

SOUTHEASTERN BIOLOGY



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ASB **ASB 73RD ANNUAL MEETING** *ASB*

ASB **APRIL 4-7, 2012** *ASB*

The University of Georgia
Athens, Georgia

ASB *ASB*

Abstracts of Papers and Posters
Presented at the Annual Meeting



The Ecology Building

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PURPOSE

The purpose of this association shall be to promote the advancement of biology as a science by encouraging research, the imparting of knowledge, the application of knowledge to the solution of biological problems, and the preservation of biological resources. The ASB has representation in Section G Committee of the AAAS. Varying types of membership are available to individuals and institutions. See inside back cover.

TIME AND PLACE OF FUTURE MEETINGS

2013 April 10-13: Hosted by Marshall University, Huntington, WV. Meeting site is the Charleston Convention Center, Charleston, WV.
2014 April 2-5: Spartanburg, SC (TBA); 2015 April: Alabama (TBA); 2016 April: TBA; 2017 April: Spartanburg, SC (TBA).

**ASSOCIATION OF SOUTHEASTERN BIOLOGISTS
INTERIM EXECUTIVE COMMITTEE MEETING
SATURDAY, 1 OCTOBER 2011
CHATTANOOGA, TENNESSEE**

ATTENDANCE: 15 persons attended the meeting.

NAME	CAPACITY
Don Roush	President
Zack Murrell	Vice President
Pat Cox	Past President
Conley McMullen	Secretary
Tim Atkinson	Treasurer
Terry Richardson	Membership Officer
John Herr	Archivist
Joey Shaw	EC Member-at-Large
James Costa	EC Member-at-Large
Ashley Morris	EC Member-at-Large
Irene Kokkala	EC Member-at-Large
Roland Roberts	EC Member-at-Large
Scott Jewell	Meetings Coordinator
James Caponetti	Journal Editor
Nicole Welch	Program Committee

I. Call to Order and Welcome - Don Roush called the Executive Committee (EC) Meeting to order at 9:05 A.M. Don welcomed all in attendance, and each person was introduced for the benefit of new EC members. Don announced that long-time member, Dr. Jim Fralish had passed, and a sympathy card was circulated for comments and signatures. The card will be delivered to Jim's wife to express our condolences.

II. Approval of the Executive Committee Meeting Minutes

Conley McMullen pointed out that the minutes from the 16 April 2011EC Meeting, as circulated, required one correction, that the last name of Kim Rogers be added.

Motion 1. Roland Roberts made a motion that the minutes of the 13 April 2011 EC Meeting, and the minutes of the 16 April 2011 EC Meeting (as corrected) be approved. Tim Atkinson seconded the motion. The motion carried.

III. Officer's and Executive Committee Reports

- A) President - Donald Roush reported that some of his activities since the April 2011 meetings included filling out committee rosters and making appointments. Most of his society activities were "standard fare." Don mentioned that he has been contacted by convention planners hoping to

represent ASB, but he assured them that we are very satisfied with our current Meetings Coordinator (Scott Jewell, a2z Convention Services).

- B) President-Elect - Position Vacant
- C) Vice President - Zack Murrell reported that David Schimel (Chief Science Officer and Principle Investigator, National Ecological Observatory Network) has agreed to be the plenary speaker at the upcoming meeting in Athens, Georgia.
- D) Secretary - Conley McMullen reported that his main activities since the April 2011 meetings involved putting together the minutes of the two EC meetings (13 and 16 April 2011) and the annual Business meeting (15 April 2011), and circulating them for review.
- E) Treasurer, Business Manager (include Finance committee and Enrichment fund) - Tim Atkinson reported that ASB finances remain stable. He further reported that the April 2011 meeting had proven successful without the input of a Local Arrangements Committee.
- F) Archivist - John Herr began his report by showing EC members a wooden box (complete with brass plaque) that he had made to house the official ASB Enrichment Fund 'enhancement tool.' The plaque explained how the tool was meant to be used, and John suggested that the box be kept with other items in the ASB archive. A rather animated discussion followed. John's other activities have included working on a written history of ASB for the archives. John passed out a copy of the table of contents for EC members to review. The complete history will be published as a supplement to the April issue. John's wife, Lucrecia, suggested to him that a PowerPoint presentation might be developed from his ASB history, which could be used as the basis for future talks at other venues. Such talks could help get the word out about ASB to nonmembers. John suggested that Kim Marie Tolson might be an appropriate person to do this. Discussion followed. Patricia Cox volunteered to work with Kim Marie on this project. Don Roush formed an *ad hoc* committee comprised of John, Kim Marie, and Pat to work on a presentation, and charged them to bring it to the Wednesday EC meeting in Athens, Georgia in April 2012.
- G) Journal Editor - Jim Caponetti reported that the October issue of *Southeastern Biology* (SEB) is now online, and that the 75th anniversary meeting is mentioned on the front cover. Jim also mentioned that a new membership page will be generated, and that the October issue will be edited when new membership information is available. Future information on the *Southeastern Naturalist* (SENA) will be sent out as a broadcast email when available. Discussion followed.
- H) Web Editor - Ashley Morris updated the EC on visits to the ASB website. Ashley reported that since the April 2011 meeting, there had been half as

many visits as prior to the spring meeting. The average visit was very short. Discussion followed. Ashley mentioned that a member had contacted her about the possibility of an interactive membership database. Don Roush stated that some members don't want this, and Scott Jewell suggested that we could simply set up subgroups on Facebook. Patricia Cox added that anything where members must choose to join would be better. Ashley advised that having a professional company involved would be prohibitively expensive. She asked that a web committee be established to help with the upkeep of the ASB website, as preparing material for addition to the website is quite time consuming. Ashley mentioned that she has someone in mind who wants to get more involved in the society. Don allowed that it is within Ashley's discretion to get whatever assistance she deems necessary, and that no official committee is needed. Ashley also reported that the look of the website will change a bit over the next couple of weeks. For example, the membership form will be easier to find. Moving on, Ashley reported that the ASB Facebook page has been a huge success. The photo contest has been quite popular, and has increased the ASB "likes" on Facebook. Visitors are definitely checking out the page and sharing information. It was suggested that an email to members directing them to Facebook will help even more with participation. Discussion followed. Examples of subpages that could be included were ecology and taxonomy. Roland Roberts inquired as to what can be added to entice even more students to join? Roland suggested that information on graduate schools might be useful. Don suggested information on industry, conservation, etc. Ashley mentioned that a blog on these and other topics might be appropriate. Roland mentioned that we could have a blog on undergraduate research projects. Conley McMullen, Terry Richardson, and Tim Atkinson reiterated that we need young, enthusiastic individuals involved in society. John Herr suggested that a special communication should be sent to Tri-Beta members.

- I) Book Editors - Melissa Pilgrim - No report was given. However, Jim Caponetti stated that Melissa sent him two book reviews that are published in the October, 2011 issue of *Southeastern Biology*.
- J) News Editor- Ricky Fiorillo – no report.
- K) Past President's Council - Patricia Cox clarified her support role for newly elected Vice-President Zack Murrell. Patricia also reported that work on the nominating committee is going well, and that nominee information will be sent to Jim Caponetti for publication in the April issue of SEB.
- L) Membership Officer - Terry Richardson stated that he is optimistic that the ASB website and Facebook are helping with membership. Terry will make a follow-up report at the Wednesday EC meeting in April 2012 in Athens, Georgia. Terry recommended that Jim Caponetti contact Joerg-Henner Lotze (Publisher, SENA) to see about an archival copy of SEB.

Scott Jewell suggested that FedEx/Kinkos could make an archival copy, as we would simply need to send an email with the file attached. Jim Costa suggested that university printing shops might be another option, but Scott stated that FedEx/Kinko's is less expensive. Volume 58 of SEB will cost approximately \$5 per copy. The final cost depends on the number of pages in the issue.

- M) Meetings Coordinator - Scott Jewell handed out copies of the 2011 Operating Plan. Scott explained that ASB made money on the April 2011 meeting because the income for the meeting was \$133,341, whereas the expenses totaled \$118,347. Scott suggested that it would be wise to consult Terry Richardson's member survey when selecting future meeting sites. Scott pointed out that despite relatively low attendance we made money, without a Local Arrangements Committee. Discussion followed. Scott shared that he was recently in Athens, Georgia, and things are looking good. Scott expects a high attendance due to the 75th anniversary.

Break

IV. Committee Reports

- A) Member Benefit Committee Report - Terry Richardson made no report at this time.
- B) Local Arrangement Committee Reports
1. ASB 2012 - Athens, GA – Scott Jewell reported that he visited the meeting site two weeks ago. There have been some renovations at the conference center, and things are looking good. Scott further stated that there will be a shuttle service to the secondary hotel throughout the day. Scott mentioned that there will be a good band.
 2. ASB 2013 - Charleston, WV – Don Roush stated that due to the economic situation, we may need to consider cancelling WV as the site of the 2013 meeting and look elsewhere. Concern about the finances dealt primarily with the fact that West Virginia is on the outer range of ASB member states, and many individuals might decide to pass on that meeting. Discussion followed. It was decided that we need to look into the economics of switching the meeting location.
- C) Place of Meeting Committee
1. ASB 2013 - Charleston, West Virginia - Discussion continued regarding the location of the 2013 meeting. Patricia Cox reminded members of the EC that we need to make money on these meetings in order to repay the enrichment fund. Scott Jewell mentioned that the more symposia we have, the more members will attend. Ashley Morris suggested that Murfreesboro, Tennessee might be possibility

for a future meeting. Don Roush reminded members of the EC that we will need to check the West Virginia contract before going further.

2. ASB 2014 - Mobile, AL or Spartanburg SC - Discussion continued regarding future meeting sites.
- D) Publication Committee - Joey Shaw shared the opinion of many EC members that the October issue of SEB (online) looks great. Appreciation and congratulations were extended to Jim Caponetti. The transition to an electronic format has been going well. There was nothing new to report on *Southeastern Naturalist* at this time. It was decided that a report on the new journal would take place under new business.
 - E) Education Committee - Zack Felix - no report.
 - F) Program Committee - Nicole Welch reported that a call for papers has gone out for the April 2012 meeting. She asked that the announcement needs to be put front and center on the website. Nicole also mentioned that she and co-chair Howie Neufeld are considering putting the meeting program and abstracts on thumb drives or make it so that they are downloadable to ipads, etc. Folks will need to be aware to include italics fonts, etc.
 - G) Bioinformatics - Zack Murrell reminded members of the EC that last year he requested a letter of support for the bioinformatics project. Although the project was not funded, the proposal will be resubmitted, so Zack once again requested a letter of support. Discussion followed. The EC voted to support this project.
 - H) Tri-Beta - Christi McGrath communicated that a letter was mailed to all chapters regarding the upcoming meeting in Athens, a call for papers, etc.
 - I) Other committees - During this time, Scott Jewell initiated discussion on the site location for the 2013 meeting. Scott reported that if we cancel the meeting at Charleston, West Virginia, we will have to pay a penalty of \$2500. Discussion followed. Terry Richardson asked for Scott's opinion on what to do. Patricia Cox inquired as to the overall potential for a financial loss. John Herr suggested we leave the decision up to Scott. Don Roush proposed that Scott look into changing venue and report back at the Wednesday EC meeting in April 2012. There were no objections, so Don charged Scott to look further into changing the venue for the 2013 meeting.

Lunch Provided by the Convention and Visitor's Bureau

V. Old Business

- A) Designation of Fellow - John Herr reminded members of the EC that he had previously proposed that Peter Raven be designated our next Fellow. John reiterated that he believed this would be appropriate. Don Roush asked if the EC makes that decision, and John replied in the affirmative. John Herr made a motion that Peter Raven be selected as the next Fellow of ASB. Patricia Cox seconded the motion. Discussion followed. Terry Richardson agreed with John that Peter Raven is a worthy recipient. However, he further stated that there other individuals, in the southeast, who are also worthy to be made Fellows. Joey Shaw agreed with Terry's views on this. John pointed out that, technically, Missouri is in the southeast. Jim Caponetti inquired as to whether we are restricted to only one Fellow honored per year, and was informed that more than one individual can be honored. Terry Richardson suggested that John's motion be amended so that we make Howard Odum and Elsie Quarterman Fellows in 2012, with Peter Raven following in 2013. Discussion followed.

Motion 2. Terry Richardson made a motion that John's original motion, as amended, be passed. The motion was seconded and carried.

Zack Murrell and Roland Roberts suggested that perhaps one or both of the 2012 honorees could give a presentation. Don Roush suggested that an appropriate time might be after the plenary session. Discussion followed. Tim Atkinson suggested that we should invite Peter Raven as soon as possible.

- B) Flora of Virginia – Conley McMullen inquired as to whether a box had been added to last year's meeting registration form allowing a \$3 donation to the Flora of Virginia Project. Tim Atkinson replied that the box had been included, and a small amount of money had been donated.

VI. New Business

- A) New ASB Journal - Joey Shaw and Ashley Morris reported on the new ASB journal. Don Roush mentioned that Joerg-Henner Lotze (Publisher, SENA) is very positive about the new journal, believing that it should fill a definite niche between higher powered journals and state-level journals. Don said that persons are being consulted who might be editors, and that we will need to come up with a journal title. Members will then be allowed to choose to receive either the new journal or the Southeastern Naturalist. If a member so chooses, he/she may receive both at extra cost. Ashley and Joey suggested that perhaps there should be a contest to select a name for the new journal. Discussion followed.

Motion 3. Don Roush moved that we ask for journal title suggestions via Facebook, and require that submissions be in by November 1st. The best titles, as selected by the Publications Committee will be sent to the

membership via survey monkey. This information will be used by the EC to make the final name selection. The member whose journal name suggestion is selected will receive a one year membership in ASB and a one-year subscription to the new journal. The motion was seconded and carried.

- B) AMAC Committee replacing POM and LAC Committees - John Herr circulated two handouts dealing with the topic of a proposed Annual Meeting Arrangements Committee (AMAC), which would replace the Place of Meeting Committee and the Local Arrangements Committee. John pointed out that, ultimately, this gives Scott Jewell the authority to pick the best venue for the annual meetings. The host institution could then select two persons to help Scott on site. In addition, there would be three appointed committee members. John mentioned that making this decision would require a bylaws revision. Discussion followed on where our core group of locations would be.

Motion 4. John Herr moved to replace the Place of Meeting Committee and the Local Arrangements Committee with an Annual Meeting Arrangements Committee. Terry Richardson seconded the motion, and the motion carried.

John Herr reiterated that the bylaws will need to be revised, as well as the Leadership Guide. John asked that updated version of Leadership Guide be placed on website. The bylaws revision will be voted on at the April 2012 meeting.

- C) Winners of ASB Photo Contest – Ashley Morris presented a slideshow of photos that had been submitted online for the first ASB photo contest. Members of the EC selected the winners under the categories of people, places, and things.
- D) Proposals for Workshops and Symposia at 2012 meeting in Athens, GA
1. Gulf Oil Spill Symposium – Don Roush reported that this symposium proposal never materialized.
 2. SE ESA Symposium - Lakes as Sentinels – Alan Covich submitted a proposal for this symposium, which was reviewed by members of the EC.

Motion 5. Patricia Cox made a motion to accept the symposium. Irene Kokkala seconded the motion. The motion carried.

3. SE Phylogenetics and Phylogeography – Ashley Morris and Joey Shaw discussed their proposal for this symposium. Roland Roberts will be joining Ashley and Joey on developing this symposium. It was suggested that this symposium will focus on a “next-generation” approach to phylogeography (new approaches to phylogeography).

Ashley suggested that Zack Murrell and Emily Gillespi might be willing to make presentations during the half-day symposium. Ashley is the contact person for this symposium.

Motion 6. Patricia Cox made a motion to accept the symposium. Jim Costa seconded the motion. The motion carried.

4. A New Vision for Undergraduate Biology Education - Nicole Welsh presented the proposal for this half-day symposium, which encourages educators to help their students achieve success in six core competency areas: ability to apply the process of science, ability to use quantitative reasoning, ability to use modeling and simulation, ability to tap into the interdisciplinary nature of science, ability to communicate and collaborate with other disciplines, and ability to understand the relationship between science and society. This symposium will share teaching strategies aligned with these six core competency areas and employed by faculty at a variety of Southeastern institutions of higher education. Nicole is contact person.

Motion 7. Roland Roberts made a motion to accept the symposium. Jim Caponetti seconded the motion. The motion carried.

VII. Announcements

There were no additional announcements.

VIII. Adjournment

Being no further business, Don Roush thanked everyone for attending and adjourned the meeting at 3:40 P.M.

Respectfully submitted,

Conley K. McMullen
4 October 2011

ASSOCIATION OF SOUTHEASTERN BIOLOGISTS
73rd ANNUAL BUSINESS MEETING
FRIDAY, 6 APRIL 2012
ATHENS, GEORGIA

1. Call to Order and Welcome – President Donald Roush called the meeting to order at 12:10 P.M. and welcomed all members. Approximately 86 persons attended.

2. Approval of the Minutes – On behalf of Secretary Conley McMullen, President Donald Roush presented the minutes of the 2011 Business Meeting as published in the July 2011 issue of *Southeastern Biology*. A motion to accept the minutes as published was made, seconded, and approved.

3. Election of Officers – Past President Patricia Cox, Chair of the Nominating Committee, presented the 2012 candidates. These included: President-Elect – Zack Murrell and David Whetstone; Vice President – Rebecca Cook and Joey Shaw; and Members at Large – Judy Awong-Taylor, Anisha Campbell, William Ensign, and Danny Gustafson. There was a call for further nominations from the floor and, being none, it was moved that the nominations close. Tellers distributed the ballots and members voted. Tellers were asked to count the ballots and announce the results at the Friday evening Awards Banquet.

4. Recognition of Members Who Passed in 2011-2012 – President Donald Roush shared with the members that Hal De Selm, Steve Dial, James Fralish, Joe Ann Lever, and Donald Windler passed away this past year. President Roush asked for a minute of silence to pay our respects to them.

5. Treasurer's Report – Tim Atkinson, Treasurer, reported that the Enrichment Fund for 2012 increased by \$3,925. There were no disbursements. There was an ending balance of \$32,095. For ASB as a whole, Tim reported that there was a beginning balance of \$28,170. Receipts totaled \$163,732. At the end of FY 2011 (31 December 2011), the Association showed a new increase of \$28,385, with an ending balance of \$56,555. Major differences this year were due to changing from a print to online journal format, which has been very beneficial to our balance. Tim mentioned that meeting expenses from 2011 (\$94,847) are still being paid, but that we should soon be able to pay back to Enrichment Fund what is owed.

Mike Baranski inquired about whether the books are checked by an outside auditor. Tim Atkinson replied in the affirmative, and Mike suggested that it might be good to make this information public. Susan Farmer asked about different options for paying dues and registration fees, and suggested a PayPal option. Dean Cocking stated that the program booklet this year was to be complimented, being much easier to use than in the past. President Donald Roush mentioned that Patricia Cox, Howie Neufeld, and he had taken care of the printing cost for the program booklet. The Program Committee was recognized for its efforts this year.

Kim Marie Tolson moved to accept the Treasurer's Report. The motion was seconded. Discussion followed. The motion to accept the Treasurer's Report as submitted passed.

6. Proposed Changes to the Bylaws and Constitution – Archivist John Herr outlined the proposed changes to the Bylaws and Constitution, which were published in *Southeastern Biology* 59(1). A motion to accept the changes as presented was made, seconded, and passed.

7. Members Requesting Emeritus Status – President Donald Roush announced, as conveyed to him by the Membership Officer, Terry Richardson, that David Ault, Katherine Gregg, Ken Marion, Rebecca Sharitz, and Joe Winstead seek emeritus status. A motion to grant these members emeritus status was made, seconded, and passed.

8. Resolutions – Past President Patricia Cox, Chair of the Resolutions Committee, read the Resolution of Appreciation to the University of Georgia at Athens, the organizers of the 73rd meeting of the Association of Southeastern Biologists, and the City of Athens, Georgia. A motion by the Resolutions Committee to accept this resolution was passed.

9. Announcements – President Donald Roush congratulated the individuals who coordinated this year's silent auction (Patricia Cox, Kim Marie Tolson, Pat Parr, Eloise Carter, Bonnie Kelley, and Diane Nelson).

10. Adjournment – President Donald Roush thanked everyone for attending and the Business Meeting was adjourned.

11. Election Results – Announced at the Friday night awards banquet.

President-Elect – Zack Murrell

Vice President – Rebecca Cook

Members-at-Large – Judy Awong-Taylor and William Ensign

Respectfully submitted,

Conley K. McMullen, Secretary

23 April 2012

**CALL FOR NON-COMMERCIAL WORKSHOP AND
SYMPOSIUM PROPOSALS FOR THE
2013 ANNUAL MEETING OF THE
ASSOCIATION OF SOUTHEASTERN BIOLOGISTS**

Deadline for Receipt of Proposals: August 31, 2012

Proposals for non-commercial Workshops (hereafter referred to as Workshops) and Symposia to be offered at annual meetings of the Association of Southeastern Biologists must be prepared and submitted for review as described in this Call for Proposals; the same criteria for proposal preparation, submission, and review apply to proposals originating from internal leadership bodies within ASB (such as standing committees) and from individuals or groups outside of ASB. **Commercial workshops are arranged through the Meetings Coordinator, and they are subject to separate guidelines that can be obtained from the Meetings Coordinator.** Written proposals for Workshops and Symposia must be submitted to the Chair of the Program Committee, the ASB Meetings Coordinator, and the ASB President no later than two weeks prior to the fall interim meeting of the ASB Executive Committee. Proposals for Workshops must clearly describe their structure (including maximum number of participants) and concept, as well as prerequisites, space and other facilities requirements, and request for funding from ASB (if any). Proposals for Symposia must clearly address all five of the criteria listed below and be accompanied by letters of endorsement (if any). All proposals will be peer-reviewed and ranked by the Program Chair of the LAC and the ASB Executive Committee. Decisions to accept or reject proposals will be made at the fall interim meeting of the ASB Executive Committee, and proposers will be contacted shortly thereafter.

Workshops

Structure & Concept: Workshops are flexible in their structure. They can be a half-day, full day, or two days in length. Lunchtime Workshops are also offered. Workshop structure is determined by the organizers. Workshops typically have maximum enrollments, and they may specify prerequisites for participation (Workshops should be open to all meeting attendees, first-come first-served, who meet these prerequisites). Workshops often have a registration fee to cover A/V equipment and preparation. Workshops are intended to convey specific knowledge or skills; they are not intended for the presentation of research papers. Workshops are frequently more interactive and informal than sessions within the formal scientific program, and they are not scheduled concurrently with Symposia, contributed oral sessions, or poster sessions. Workshops may involve one or several teachers/presenters, and they may include computer-based or other 'hands-on' training. Weekend Workshops may be linked with a scientific field trip. A Workshop proposal should make clear what participants might expect to gain, and how the Workshop furthers the overall goals of the Association of Southeastern Biologists (these two aspects are the major criteria for Workshop acceptance). Limits of space and time may make it impossible to accommodate all worthy submissions.

Symposia

Structure & Concept: Symposia are a half-day or a full day in length. The number of speakers and the length of each talk are determined by the session organizers; talks should be between 15 and 30 minutes long, and presentation times can vary between speakers. Each session should include at least one 30 minute break that will be synchronized with the coffee break of all concurrent sessions. Generally, Symposia should be focused, integrated presentations assessing current understanding regarding a particular research problem, concept, application, or educational theme. Symposia should have broad appeal to members of ASB or involve integration across sub-disciplines.

Symposium proposals will be assessed under the following criteria. Weighting of particular criteria may vary depending on the nature of proposals, but proposals should explicitly address these criteria, as appropriate. There is typically room for only three Symposia at the annual ASB meeting.

Criteria for Evaluation of Symposium Proposals

1. **Scientific strength:** Symposia are the scientific centerpieces of the meeting, and should:
 - offer significant contributions to biological understanding,
 - present innovative or interdisciplinary approaches, including novel collaborations or syntheses across subdisciplines, and
 - have broad enough appeal to generate large audiences (>100 people) at the meeting.
2. **Structure and organization:** Symposia should be more explicitly integrated than other sessions, and should be structured to:
 - provide overall synthesis or overview; they should not be simply a set of related case studies,
 - avoid taking a narrow perspective on the Symposium topic; organizers should carefully avoid appearance of biases toward their own perspectives, and
 - build a well-integrated whole; each talk should have clear relevance to overall synthesis.
3. **Speakers:** Invited speakers should bring new contributions to the session, not simply reviews of previous work. Inclusion of experienced or particularly engaging speakers can strengthen a proposal, but new voices are also important. Proposals with a larger proportion of confirmed speakers will be favored.
4. **Funding:** Workshop and Symposium proposers must certify that they have sufficient funding available to cover all costs of the program as proposed, including expenses (travel, meals, lodging, honoraria) for all invited speakers. If additional funds are needed beyond those available to the proposers, such funds must be identified and may be requested from the ASB Executive Committee (EC), which has some funding available for Symposium proposals, usually reserved for proposals that come from ASB standing committees. If requesting funds from the EC, the Symposium proposers must specify an amount and justify that amount. If the EC provides funds

requested by the Symposium proposers, it is assumed that the Symposium is fully funded as described. If partial funding is offered by the EC, the Symposium proposers must subsequently secure the additional funds required to cover all costs.

5. **Integration:** Proposals may receive higher priority if they are clearly linked to the meeting's overall theme, or if they offer particular value or insight in the context of other sessions proposed for the meeting or of Symposia at recent ASB meetings.

Endorsements

Workshops and Symposia are often endorsed by various groups, agencies, and organizations including international societies, private non-governmental organizations, governmental agencies, or internal leadership bodies within ASB, such as standing committees. These endorsements will be considered in review of proposals, particularly if they emphasize why the group finds merit (in terms of evaluation criteria above) in the proposal. **Each of these groups, organizations, or agencies is allowed to endorse only one Symposium proposal.** If a group submits a proposal, that group is considered to be endorsing its own proposal, and it cannot endorse another. Symposium proposers, in requesting endorsements, should make this policy clear. There is NO guarantee that a proposal endorsed by any group or organization will be accepted. Individuals preparing letters of endorsement should send them directly to those preparing the proposal for inclusion as part of the proposal package.

If Your Proposal Is Accepted

After proposals are accepted and the scheduling for the meeting is underway, cancellations and schedule changes are very disruptive to meeting planning. Hence, organizers of Workshops should obtain firm commitments from their teachers/presenters and organizers of Symposia should obtain firm commitments from as many of their invited speakers as possible before submitting their proposals. **Requests for additional funding will not be considered by the ASB Executive Committee.**

If a proposal is accepted, the organizers must submit a final summary description of the Workshop or Symposium to the Program Committee Chair at the same time abstracts are due. This summary will appear on the meeting website and should be written so as to stimulate interest and promote attendance. This description must include a complete and current listing of organizers' names and their affiliations, addresses, telephone and fax numbers, and email addresses; a 400-word narrative description of the session; a 50-word sentence description of the session; and a final, confirmed speaker list.

It is the responsibility of Symposium organizer(s) to see that each speaker submits an individual abstract of his/her talk using ASB's abstract submission criteria by the abstract submission deadline. It is not permissible to submit abstracts by any other means. Contact the Program Committee Chair if your situation precludes use of the abstract submission website.

It is suggested and encouraged that a written summary of the Workshop or Symposium be submitted to *Southeastern Biology* for publication.☺

Non-Commercial Workshop/Symposium Proposal Submission Form

Title:

Submitters' Contact Information (address, phone, and e-mail address):

Session Description: In 400 words or less and in sentence form, describe the theme and purpose of this session.

Session Justification: In 250 words or less and in sentence form, provide the justification for this session.

One-sentence Summary: Summarize your proposal in 50 words or less.

Speakers and Titles: List all teachers/presenters (Workshops) or speakers and their titles (Symposia). Next to each participant, indicate if they are confirmed or only contacted and have not yet decided (unconfirmed). Do not list individuals who have not yet been contacted.

Funding: Explain how the Workshop or Symposium as proposed is to be funded. Symposium proposers may request needed funds from the ASB Executive Committee.

This form must be submitted to the following individuals no later than two weeks prior to the fall interim meeting of the ASB Executive Committee (deadline is August 31, 2012).

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ASB

Paper and Poster Abstracts

From the 73rd Annual Meeting

Hosted by

The University of Georgia

Athens, Georgia

April 4-7, 2012

Papers of the 2012 Annual Meeting

- 1 **Stephen J. Murphy.** Compositional shifts in the vegetation of an old-growth forest (Dysart Woods, Ohio) over a fifteen year period. Ohio University, OH.

Understanding the natural dynamics of plant communities remains a fundamental goal of ecology. Here, we describe fifteen-year changes in community composition and structure in the woody and herbaceous vegetation of Dysart Woods, an old-growth, mixed mesophytic forest in southeastern Ohio, USA. In 1996, two permanent 50x70 m plots were established, and all stems >2.5 cm diameter at breast height were measured, tagged, and mapped. In addition, 35 5-m² circular subplots were placed evenly throughout each plot to sample the seedling stratum. At these same locations, 2-m² circular subplots were used to sample the herbaceous stratum at three separate periods: spring, early summer, and late summer. All vegetation sampling was repeated in 2011. Mortality and regeneration patterns were highly asymmetric, with *Fagus Grandifolia* and *Acer* spp. comprising ~95% of new stems. While some seedlings of *Quercus* spp. were originally sampled, none grew into the 2.5 cm size-class over fifteen years, confirming that oaks are not regenerating at Dysart Woods. We also found a near 100% mortality of *Cornus florida*, likely due to Dogwood Anthracnose. The herbaceous stratum also showed significant change over the study period. The most striking was an increase of the invasive *Alliaria petiolata*, being present in zero plots in 1996 and in fifteen plots in 2011. To conclude, our results strongly suggest that a shift in overstory composition from *Quercus* spp. to *Acer-Fagus* dominance is occurring at Dysart Woods, and future immigration from non-native species is likely to occur.

- 2 **Amanda L. Ecker, Clinton S. Major and Kelly M. Major.** Effects of historical land use and environmental variation on vegetation patterns in Weeks Bay, AL: implications for invasion. University of South Alabama, AL.

Weeks Bay is an ecologically sensitive and economically important resource for the Gulf Coast, and provides an excellent case study for how land use and environmental variation influence invasive species occurrence in linked terrestrial and aquatic systems. Specifically, the Swift Tract region of the Weeks Bay reserve is comprised of Southern Flood Plain and mixed hard wood forest cover types that include *Pinus palustris*/*Pinus elliotii*-dominated communities that are notably in decline. Fifteen paired permanent sampling sites were stratified throughout the study area to accurately represent all cover types. Percent cover for all species rooted in each 50 X 20 m nested plot was recorded monthly from Summer 2010 through Fall 2011, along with canopy/subcanopy percent cover, DBH, and seedling/sapling measurements. Lysimeters were placed between paired sites; environmental parameters that include salinity, pH, dissolved oxygen (DO), and soil organics were measured from March-November 2011. To date, 58 representatives from 34 plant families have been recorded. Several general/species (e.g., *Polygonum* sp., *Rumex* sp., *Boehmeria cylindrica*, *Toxicodendron radicans*) are widely distributed across ~75% of the sites. Additionally, two invasive species, *Triadica sebiferum* (*Sapium sebiferum*; popcorn tree) and *Alternanthera philoxeroides* (alligator weed), also commonly occur among sites. Environmental data indicate that salinity and DO are low, while organic content is generally high, regardless of location. Vegetation and habitat data will be used, together with spatial imagery, to develop a land classification scheme that will allow reserve managers to monitor shifts in composition and identify those communities likely to be susceptible to invasion upon disturbance.

- 3 **David C. Merriman and Wade B. Worthen.** Comparing biodiversity across taxonomic groups; carabid beetle communities and local tree size and diversity. Biology Department, Furman University, SC.

Ground beetles are a highly diverse group of organisms that are important arthropod predators in many ecosystems. We conducted a survey of carabid diversity at the Furman Forest in the northeast corner of Greenville Co. SC, and described the relationships

between carbid communities and the diversity, abundance, and size of local tree communities. Beetles were collected by pitfall trap, one night/week at 24 sites that varied in tree diversity, richness, and stand density. Carabid abundance was negatively correlated with tree species richness, and was positively correlated with mean tree diameter at breast height (DBH). Carabid richness and abundance was positively correlated with Tulip Poplar abundance, and negatively correlated with White Oak and Virginia Pine abundance, suggesting that carabids prefer mesic hardwood habitats over dry ridge (oak /pine) or successional (pine) stands. *Carabus*, *Dicaelus*, and *Cyclotrachelus* beetles were the most abundant genera in the preserve. *Carabus* and *Dicaelus* beetle abundances were both positively correlated with tree DBH. Additionally, the proportion of *Carabus* beetles per site was also correlated with average DBH per site. The relationship between carabid abundance and average stand DBH is most likely due to the preference of carabid prey species—such as xylophagous beetles and their larvae—for large trees and dead wood. The factors influencing the carabid populations in this study seem to be consistent with the structural heterogeneity hypothesis of bottom up control of community structure and ecosystem function.

- 4 **Keith E. Gilland and Brian C. McCarthy.** Performance of American chestnut (*Castanea dentata*) and its hybrids on reclaimed mine sites in unglaciated Ohio. Ohio University, OH.

American Chestnut (*Castanea dentata*) once accounted for a large portion of the Eastern Deciduous Forest overstory until the introduction of Chestnut blight (*Cryphonectria parasitica*). The American Chestnut Foundation has bred a putatively blight-resistant Chinese-American hybrid for reintroduction. Chestnut has been proposed as a candidate species for reclamation of previously mined lands, especially those being reclaimed with the newly developed Forestry Reclamation Approach—early studies have shown promising results. This study compared the performance of chestnut under field conditions at a reclaimed strip mine in eastern Ohio. Seeds (660) were planted on a two-year-old reclaimed mine site in March 2008. The seeds were pure American, pure Chinese and three hybrid genetic lines. The seeds were planted in 132 experimental blocks, each containing one individual of each genetic type. Survival and growth over three growing seasons was monitored, leaves were collected at the end of the 2011 growing season to compare morphological differences that were expected to differ between lines, but also may have ecological significance under the conditions found on reclaimed mine sites (i.e., low moisture, high light). Pure American seedlings had significantly lower survival rates compared with hybrid and pure Chinese seedlings (Cox proportional hazard ratio = 36.16, $df = 4$, $P < 0.01$). Annual growth rates differed significantly between genetic lines and between years but showed no overly clear trends. Leaf morphological characters (e.g., SLA, pubescence) also had a significant effect on survival. These differences may be important for selection consideration as the American chestnut restoration program moves forward.

- 5 **Dominic J. Graziani and Frank P. Day.** Thresholds of change in decomposition rates along a dune/swale transect on Virginia's barrier islands. Old Dominion University, VA.

Aboveground and belowground decomposition rates were determined along a barrier island dune/swale transect located on the Virginia Coast Reserve-Long Term Ecological Research Site in Virginia using litterbags and wooden dowels. The objective was to determine the influence of fine scale changes in the environment on decomposition. Wax myrtle (*Morella cerifera*) leaves and dowels of a southern yellow pine were used as standard substrates to evaluate environmental influences on decay. Aboveground decomposition was highest in the shrub-dominated swale (44% leaf mass lost after 185 days) and at the edge of the fresh water marsh (48% leaf mass lost after 185 days); and was lowest at high dune elevations (21% leaf mass lost after 185 days). Belowground decomposition was highest just below the peak of the dune on the shrub-dominated swale

side (22% woody mass lost after 185 days) and lowest in the marsh itself (9% woody mass lost after 185 days). Aboveground decomposition increased with decreasing elevations toward both the shrubby and marshy swales; while belowground decomposition decreased toward the shrubby swale, but increased toward the marshy swale up to the marsh edge. Elevation, groundwater level, vegetation composition and soil N-content are being analyzed for correlations with spatial patterns in decomposition rates. The fine scale dynamics of ecosystem processes, like decomposition, merit further investigation in order to determine areas where these processes would be enhanced or restricted and where thresholds of change occur.

- 6 **Richard Pickens and Travis Perry.** The puma (*Puma concolor*) as a potential top down agent of community structure and ecosystem function. Furman University, SC.

The disappearance of large apex predators around the globe has resulted in dramatic cascade effects impacting biodiversity and ecosystem function. Large predators may exert top-down effects on communities through alterations in the abundance and distribution of prey species, including both herbivores and smaller predators. In a few relatively large regions of the continental U.S. apex predators still exist, notably puma (*Puma concolor*). We used GPS collar data from puma and fecal pellet plots from elk (*Cervus elaphus*) and mule deer (*Odocoileus hemionus*) to assess habitat segregation of puma and their large ungulate prey. We found that habitat selection differed dramatically between the two groups, suggesting a causal effect of predation risk in determining ungulate distributions, a possible landscape of fear effect. If this pattern of ungulate distribution is the result of predator avoidance, then management of puma populations has significant implications for biodiversity and ecosystem management.

- 7 **Alex Viere and Travis Perry.** Top down effects of puma (*Puma concolor*) on herbivore and mesocarnivore communities in New Mexico. Furman University, SC.

Large carnivores may exert top down effects on ecological communities, at times directly by affecting the abundance and distribution of herbivores through predation and predator avoidance, or indirectly by affecting herbivores through similar effects on mesocarnivores. Impacts on the abundance and distribution of herbivores may have a corresponding effect on vegetation. Through the use of remote camera data we previously found significant relationships between puma (*Puma concolor*) and mesocarnivore species in New Mexico. Here we present an expanded and updated investigation of these relationships, adding a third study site as well as data on large and small herbivores. Our data suggest that puma may have top-down community level effects actuated through the avoidance of 'good' puma habitat by prey species, both herbivores and mesocarnivores.

- 8 **Jessica Carrier¹, Eric Sparks², Mark Woodrey³, Just Cebrian² and Anne Boettcher¹.** Variations in herbivore pressure across the northern Gulf of Mexico salt marshes. ¹Department of Biology, University of South Alabama, Mobile, AL, Dauphin Island Sea Lab and Department of Marine Sciences, University of South Alabama, ²Coastal Research and Extension Center, Mississippi State University and ³Grand Bay National Estuarine Research Center, MS.

Herbivore-plant interactions have been shown to play central roles in determining the structure of salt marsh communities, and it has been shown that there is a latitudinal gradient with increased herbivory and plant defense in lower latitude marshes. However, relatively little is known about how marsh herbivory varies within a single geographic region and potential driving forces. Interestingly, it has been observed that along the northern Gulf coast, *Juncus Roemerianus* marshes in Mississippi are heavily impacted by insect herbivores, while similar sites in Florida remain relatively untouched. To address these observed differences and examine potential reasons for differences, we have quantified the extent of herbivory at three *Juncus* marsh sites in the Grand Bay National

Estuarine Research Reserve, Jackson Co., Mississippi and one site at Big Lagoon State Park in Escambia Co., Florida. We will present results comparing differences in abundance of insect herbivores, plant densities, plant nutrient content, and intensity of herbivory across our study sites. Preliminary data suggests that in our marsh systems, the primary driving force for observed herbivory differences can be attributed to varying landscape patterns among sites. Results of our research will provide a better understanding of factors controlling spatial variation in herbivory within a latitude and will contribute to data important to the development of coastal marsh modeling efforts investigating functioning of salt marsh food webs.

- 9 **Matthew S. Swain, Derrick B. Poindexter and Ray S. Williams.** Effects of biological control of the invasive weed *Persicaria perfoliata* on vegetative community composition. Appalachian State University, NC.

Mile-a-minute weed (MAM), *Persicaria perfoliata* (L.) H. Gross (Polygonaceae), is an annual vine from Asia that has invaded the eastern US where it can form dense monocultures and outcompete other vegetation in a variety of habitats. *P. perfoliata* was discovered in several disturbed habitats in Alleghany County, North Carolina in 2010. The Asian weevil *Rhinoncomimus latipes* Korotyaev (Coleoptera: Curculionidae) was released in May 2011 as part of a classical biological control program. The weevil and plant community were monitored for a full growing season in 2011 to determine what effect insect control had on MAM cover, fecundity and phenology and to ascertain what if any changes occurred in the extant (or native) plant community. Two release and two control (no weevil release) transects were established. *Rhinoncomimus latipes* successfully established in 17 of 20 release quadrats. For the plant community, 97 plant taxa were identified within study quadrats, with 8 taxa showing an ability to compete with *P. perfoliata*. Release transect 2 had significantly higher plant diversity than transect 1 and the Control transect. All transects had similar ratios of exotic to native taxa. In the release transects *P. perfoliata* plants had a significantly lower fecundity than those in control transects. Transects with weevils also had earlier time of MAM senescence than controls. The ability of the weevil to affect *P. perfoliata* performance, along with demonstrated differences in species richness among treatments, suggests that biological control effects of MAM in year one of this multi-year study are emerging.

- 10 **Clinton S. Major¹, Bradley R. Cooper¹, Dudgeon R. Steven², Joel A. Borden¹, Janet E. Kubler² and Kelly M. Major¹.** Influences of habitat variability and disturbance on aquatic plant community structure in the Mobile-Tensaw delta. ¹University of South Alabama, AL, ²California State University-Northridge, CA.

As an ecotonal bridge, the Mobile-Tensaw Delta (MTD) is characterized by high biodiversity as well as anthropogenic (e.g., eutrophication, development, and industrial pollution) and natural (e.g., flooding, tropical storms, and drought) disturbances varying in periodicity, intensity, and duration. Thus, biodiversity is likely linked to disturbance in the MTD. Following the deep-water Horizon (DWH) oil spill, 16 sampling sites were established throughout the MTD to capture the Delta's broad geographical and biological variation. Sites 1-12 are aligned along a north-south gradient; an additional four sites were established along an east-west gradient from Grand Bay to Weeks Bay, serving as positive and negative controls, respectively (i.e., areas exposed to DWH contaminants and unexposed at the time of the spill). A plant list was compiled that includes 72 species from 44 families. Vegetation patterns indicate that few species (e.g., *Smilax rotundifolia*, roundleaf greenbrier) are members of plant communities across a wide range of habitats. Rather, species occurrences are predictable according to habitat variables that include: salinity, temperature, and redox potential. Moreover, plant distribution varies among four sub-regions of the Delta (Upper, Upper Middle, Lower Middle, and Lower). Species richness varied with season across all regions, but was greatest in the UM and LM Delta, with α -diversity being greatest in the UM Delta. To our knowledge, this is one of few detailed descriptions of the aquatic plant communities of the MTD and will serve as a

baseline for future studies focused on the temporal and spatial variations in community structure and function upon disturbance.

- 11 **Sarah Kooy and Travis Perry.** A description of seasonal variation in diel cycle activity patterns of New Mexican mammals. Furman University, SC.

We know that ecological communities may be structured along resource niche axes of food and space. The temporal axis has been less studied and there are sound theoretical arguments for why the temporal axis may not exert the same structuring pressure, particularly for competitors. However, temporal structuring has been demonstrated for raptors, lizards, ants, bats, and rodents. Elucidating the diel activity patterns of larger mammals with large sample sizes, particularly carnivores, has presented a significant challenge to ecologists. The use of remote cameras to collect these sorts of data has increased exponentially in the last decade. We describe the seasonal variation in diel cycle activity for medium to large mammals, including large carnivores, using remote camera data from 45 remote cameras arranged in three disparate arrays across the state of New Mexico. Further, we investigate whether potential competitors and predators and prey demonstrate significant temporal separation in activity.

- 12 **Christopher J. Paradie, Meagan Madden, Lucy Hedley, Romina Clemente and Jackie Kim.** Assessment of beetle and bug diversity in low input cattle farms of varying cattle density and surrounding land use. Davidson College, NC.

Insects and the services they provide are important to agroecosystems. Low input farms depend on high biodiversity for ecosystem services, whereas high input farms have been linked to decreased biodiversity and habitat degradation. However, all farms are vulnerable to degradation and alteration of the surrounding landscape, which may affect biodiversity even if a farm uses sustainable practices. We monitored insects to determine the effects of farming practices, cattle densities and land use patterns on biodiversity. We measured diversity and abundance of beetles and bugs on five grass-fed cattle farms near Davidson, North Carolina using pitfall trapping and sweep-netting. For each farm, we determined the acreage, cattle density, average grass height, and the surrounding landscape as percentages of forest, pasture, and developed land. We predicted that farms with lower cattle densities would support greater biodiversity. We hypothesized that a greater percentage of less developed land would positively correlate with greater diversity and density. There were differences among farms in density of several beetle families and beetle diversity, but beetle diversity and abundance were unrelated to cattle density. Hemipteran abundance increased with increases in grass height. Family-level beetle diversity declined with increases in utility right-of-ways, weevil abundance declined with increases in roads, and scarab abundance increased with increases in percent developed land. Hemipteran diversity increased with increases in size of the study pasture, and abundance of Alydidae increased with total pasture surrounding farms. These preliminary results suggest that maintenance of diversity on farms is not solely related to agricultural practices on farms.

- 13 **Jesse M. Wood and Travis W. Perry.** Camera trap assessment of habitat correlates of mammal diversity in New Mexico. Furman University, SC.

Many species of medium to large mammal are notoriously difficult to survey, being nocturnal, shy, and often occurring at low population densities. In response, the last two decades have seen an exponential increase in the use of remote cameras for work on elusive species. We employed 45 remote cameras arranged in three disparate arrays across the state of New Mexico to (1) measure camera trap effort needed to produce survey data of these species based on rarefaction curves; (2) determine detection probabilities as they vary with body size; and (3) elucidate habitat features that are correlated with increased mammalian diversity across the New Mexico landscape. Our results may be of particular interest to land managers seeking to inventory mammal species on a broad scale or identify potential biodiversity hotspots within the Southwest.

- 14 **Lora L. Sigmon and David Vandermast.** Composition of the soil seedbank in a highly altered riparian forest in the central piedmont of North Carolina. Elon University, NC.

Riparian forest buffers are important landscape features which maintain the health of the water bodies they adjoin. In an earlier study we reported that, despite being heavily altered in the past, Haw River riparian forests appear healthy and are in the accreting stage of structural development with very few invasive tree species. As a follow-up to our forest canopy work, we conducted a seedbank study to understand the degree to which it resembles the canopy composition and to examine propagule pressure. Soil samples from five sites were collected at 25m intervals up to 75m from the river. The soils were placed in a greenhouse in order to germinate the seedbank. Only 4 of 29 species in the seedbank were trees and two of these were invasive (*Ailanthus altissima* and *Paulownia tomentosa*). Overall, 110 of 817 germinations (13.5%) were invasive, as were 5 of 29 species (17.2%). Invasive species germinated in 13.9% of soil samples. There was no correlation between the presence of invasives and the distance from the river. Our results indicate that, while invasive species make up meaningful proportions of plant diversity and of saplings in the herbaceous layer, germinable seeds tend to be found in strong concentrations in some areas while being absent from others. Furthermore, the success of invasive woody species in depositing seed in Haw River riparian forests has not resulted in similar proportions of those species in the canopy.

- 15 **John A. Barone¹ and JoVonn G. Hill².** Effect of habitat specialization and dispersal abilities on the metacommunity structure of plant, ants and grasshoppers in black belt prairies. ¹Columbus State University, ²Mississippi State University, MS.

The structure of a metacommunity can be influenced by a variety of species-level traits, including habitat specialization and dispersal abilities. For habitat generalists, which are able to persist in a wide range of environments, each species persists (or goes extinct) according to a variety of uncorrelated factors. This should lead to a Gleasonian community structure. In contrast, specialist species will tend to respond to habitat differences in a similar way—rising or falling together. For them, communities should be Clementsian in structure. Good dispersal abilities can also alter metacommunity structure, by reducing dispersal limitation. Consequently, communities composed of taxa that disperse well are more likely to be affected by site variables than geographic distance. We tested these hypotheses by collecting data on the plant, grasshopper and ant communities for 21 Black Belt prairies in Mississippi and Alabama. Community structure was analyzed using three measures: coherence, turnover, and degree of boundary clumping. We found that that for plants, grasshoppers and ants, the communities were largely Clementsian in structure, displaying significant coherence and clumped boundaries. This was true for generalists and specialists, providing little support for the first hypothesis. For the second hypothesis, the composition differences across plant communities (the group with the poorest dispersal abilities) were significantly affected by latitude (a measure of distance). In contrast, ant and grasshopper communities were most affected by soil variables. The results suggest that in prairies habitat specialization may be trumped by other variables, such as dispersal ability, in determining metacommunity structure.

- 16 **Michael E. Dorcas¹, John D. Willson², Robert N. Reed³, Ray W. Snow⁴, Michael R. Rochford⁵, Melissa A. Miller⁶, Walter E. Meshaka⁷, Paul T. Andreadis⁸, Frank J. Mazzotti⁵, Christina M. Romagosa⁶ and Kristen M. Hart³.** Severe mammal declines coincide with proliferation of invasive burmese pythons in Everglades National Park. ¹Davidson College, NC, ²Virginia Tech, VA, ³US Geological Survey, ⁴National Park Service, ⁵University of Florida, FL, ⁶Auburn University, AL, ⁷State Museum of Pennsylvania, PA, ⁸Denison University, OH.

Invasive species represent a significant threat to global biodiversity and a substantial economic burden. Burmese pythons, giant constricting snakes native to Asia, are now found throughout much of southern Florida, USA, including all of Everglades National Park (ENP). Pythons have increased dramatically in both abundance and geographic range since 2000 and consume a wide variety of mammals and birds. Here we report severe, apparent declines in mammal populations that coincide temporally and spatially with the proliferation of pythons in ENP. Before 2000, mammals were frequently encountered during nocturnal road surveys within ENP. In contrast, road surveys totaling 56,971 km from 2003-2011 documented a 99.3% decrease in frequency of raccoon observations and decreases of 98.9% and 87.5% for opossum and bobcat observations, respectively and failed to detect rabbits. Road surveys also revealed that these species are more common in areas where pythons have only recently been discovered and are most abundant outside of the python's current introduced range. These findings suggest that predation by pythons has resulted in dramatic declines in mammals within ENP and that introduced apex predators, such as giant constrictors, can exert significant top-down pressure on prey populations. Severe declines in easily observed and/or common mammals, such as raccoons and bobcats, bode poorly for species of conservation concern, which are often more difficult to sample and occur at lower densities.

- 17 **Daniel E. Wright and Robert Carter.** Population status of Bachman's sparrow in the Coleman lake region of the Talladega National Forest, Alabama. Jacksonville State University, AL.

The purpose of this research is to determine the population status of Bachman's sparrow (*Aimophila aestivalis*) and other grassland dependent species on the Talladega National Forest in northeastern Alabama. The study area consisted of 24 sites with 12 in frequently burned stand and 12 in unburned stands near Coleman Lake. Point surveys for breeding birds were conducted at each site in late May when breeding males are most active. Forty-five species were detected. The burned and unburned stands had a similar species diversity, but Jaccard's similarity index was 0.39 indicating a distinct suite of species in each habitat type. Species common in burned areas were prairie warbler (*Dendroica discolor*), yellow-breasted chat (*Icteria virens*), and indigo bunting (*Passerina cyanea*). Present but uncommon was Bachman's sparrow. Two blue-headed vireos were detected and it is assumed they were attempting to acquire a mate. In the unburned stands, common species included yellow-throated vireo (*Dendroica dominica*), summer tanager (*Piranga rubra*), and Eastern wood peewee (*Contopus sordidulus*). The open grassy habitat in the burned sites should support larger populations of Bachman's sparrow. The study area is surrounded by closed canopy forest possibly reducing the likelihood of Bachman's sparrow recruitment.

- 18 **Jennifer M. Cruse-Sanders¹, Jason A. Smith², Ron Determann¹, Tova Spector³, Michael Wenzel¹, Hilary Hart¹ and Gerald S. Pullman⁴.** *In situ* and *ex situ* methods for conservation of the critically endangered conifer, *Torreya taxifolia* Arn. ¹Atlanta Botanical Garden, GA ²University of Florida, FL, ³Florida Park Service, FL, ⁴Georgia Institute of Technology, GA.

Torreya taxifolia, at the center of the debate on assistant migration, is one of the rarest conifers in the world. Until recently, *Torreya* was a large canopy tree endemic to ravine forests along the Apalachicola River that twists through the Florida panhandle in eastern North America. In the mid-Twentieth Century this species suffered a catastrophic decline as all reproductive age trees died leaving only the remaining seedlings in the forest. In the decades that followed, this species did not recover and was subjected to changes in hydrology, forest structure, heavy browsing by deer, loss of reproduction capability, as well as disease. Since the late 1980s efforts have developed to address conservation needs of this critically endangered species. In 1990, the Atlanta Botanical Garden received 155 clones of *T. taxifolia* from the remaining natural population that have been propagated for more than 20 years. Current efforts include evaluation of the current status

of the species, determination of disease, estimation of remaining genetic variability and efforts to reintroduce the species into areas where it has been lost. We present the ongoing research to meet recovery objectives for this species, as well as how they relate to other rare species conservation and evolution under predicted climate change.

- 19 **M. Richards¹, R. Rossmann², M. Wenzel², J. Cruse-Sanders¹, J. Determann², C. Denhof², R. Gagliardo² and S. Tallman².** Integrated conservation efforts for an endangered Florida orchid; *Tolumnia bahamensis*.
¹Atlanta Botanical Garden, GA, ²Jonathan Dickson State Park, FL.

Tolumnia bahamensis (Nash ex Britton & Millsp.) G.J. Braem, is a critically endangered orchid of a rare and restricted coastal scrub habitat along the Atlantic coast of southeast Florida. Plant conservation staff at the Atlanta Botanic Garden partnered with Florida State Park officials to embark on a population augmentation program for this species within Jonathan Dickinson State Park. Critical observations of their native habitats were performed, and a recovery strategy formulated. Native populations of *Tolumnia bahamensis* were out crossed and seed capsules harvested post 100 days fertilization. Tissue culture techniques were utilized at Atlanta Botanical Garden to optimize germination and growth of the species *In vitro*. Additional horticultural protocols were developed and refined for production. The result was that thousands of these plants have been produced by the garden for reintroduction. Three consecutive years of recovery work has resulted in the reintroduction of more than 2000 plants in several sub-groups. Many challenges have been presented through the conservation of this endangered orchid. For instance; it will succumb to wildfire, but also requires infrequent fire to maintain narrow strips of rosemary scrub habitat. Careful habitat management, propagation, and out planting has resulted in the successful augmentation and further protection of scarce populations of this endangered orchid native to the southeast United States.

- 20 **Gerald S. Pullman¹, Xiaoye Ma¹, Ronald O. Determann², Jennifer M. Cruse-Sanders² and Kylie Bucalo¹.** Somatic embryogenesis, plant regeneration and culture cryopreservation for *Torreya taxifolia*, a highly endangered coniferous species. ¹Georgia Institute of Technology, GA, ²Atlanta Botanical Gardens, GA.

Torreya taxifolia Arn., an ancient evergreen tree, is on the brink of extinction from attack by a fungal disease. We report a somatic embryogenesis tissue culture system that is able to initiate cultures, produce somatic seedlings and cryogenically store cultures of *T. taxifolia*. Initiation of embryogenic tissue occurred on a medium with salt formulation originally developed for Douglas fir and with 0.25% activated carbon (AC), maltose (41.6 mM), 2,4-D (0.5 mM) BAP (0.2 mM), Kinetin (0.2 mM), brassinolide (0.1 µM), ABA (3.8 µM), biotin (20.5 µM), folic acid (1.13 µM), MES (1.28 mM) and pyruvic acid (0.69 mM). Initiation from immature embryos ranged from 60% to 100% across six seed sources tested over two years, and the initiation medium was able to maintain all started cultures. Cotyledonary somatic embryo yields of approximately 20 per ml or g of embryogenic tissue developed on medium containing the same salts, maltose (41.6 mM), 1% AC, ABA (37.8 µM), biotin (20.5 µM), brassinolide (0.1 µM), folic acid (0.205 mM), MES (1.28 mM) and pyruvic acid (0.69 mM). Germination for two genotypes tested ranged from 64 to 82%. Embryogenic tissue cultures from 30 genotypes representing seed from six mother trees have been cryopreserved and their recovery was demonstrated after retrieval from liquid nitrogen. The measured water potential (-MPa) of *T. taxifolia* megagametophyte tissue rises greatly, in contrast to many other coniferous tree seeds, during seed after-ripening. Mimicry of this rise *In vitro* was necessary to continue development of somatic embryos to a cotyledonary stage.

- 21 **Katie L. Burke.** The effects of white-tailed deer on growth and mortality of two understory dominants, American chestnut (*Castanea dentata*) and striped maple (*Acer pensylvanicum*). Hampden-Sydney College, VA.

White-tailed deer (*Odocoileus virginiana*) are selective browsers that have increased across eastern North America, and their effects on forest ecosystems were studied in fenced exclosures monitored for four years from 2006-2009 and compared to unfenced plots. Effects of white-tailed deer browsing on the growth and mortality of two co-dominant understory trees are reported: American chestnut (*Castanea dentata*), a palatable species of conservation concern due to decline caused by an invasive pathogen chestnut blight (*Cryphonectria parasitica*); and striped maple (*Acer pensylvanicum*), a less palatable, browse-resilient species. Diameter, height, number of stems, mortality rate, and blight prevalence were measured annually over the four-year period. Results showed that in chestnut, stem number and survival rate increased significantly in the fencing treatment, while in striped maple stem number decreased slightly and mortality rates were not different between fenced and control plots. Proportional change in basal area and mean height over the four-year period were not significantly affected by fencing treatment for either species. While it was surprising that change in chestnut mean height was not different between fencing treatments, this result is due to large stems dying similarly across all plots, but small chestnut sprouts increasing in number in fenced plots only. This study suggests that deer exacerbate decline in chestnut populations through preferential browsing, facilitating an increase in striped maple. Deer are a major concern for chestnut conservation and restoration.

- 22 **Eva B. Gonzales and Patrick C. Sullins.** Taxonomic and conservation implications of species circumscription of *Liatris helleri*. Appalachian State University, NC.

Ecological, distributional, and genetic characteristics can provide alternative evidence for taxonomic distinctions of two closely related taxa when morphological characters are ambiguous. This has been the case for *Liatris helleri* Porter (Asteraceae) and its more common congener, *L. turgida*. *Liatris helleri* has been regarded as a narrowly distributed endemic perennial, restricted to nine populations in rock outcrops of Western North Carolina; its distinction from *L. turgida* is based on a single morphological character (pappus length) that has been shown to be variable and is no longer considered to be a diagnostic character. Consequently, a broadened concept has been proposed to include both species in the same taxon, potentially expanding the distribution and invalidating legal protections for *L. helleri*. We sequenced 20 chloroplast DNA loci from *L. helleri*, *L. turgida* and several other *Liatris* species to clarify taxonomic distinctiveness between *L. helleri* and its more common congeners. Preliminary results show a number of fixed genetic differences in chloroplast DNA sequences between *L. helleri* and *L. turgida*, demonstrating that the populations identified as *L. helleri* represent a distinct lineage within the *Liatris* genus. Taken together with ecological and distributional data, it appears that the *L. helleri* populations share a common evolutionary history and adaptations to their unique habitat, and is distinct from the otherwise morphologically indistinguishable *L. turgida*. Our findings are relevant to conservation management in order to make informed decisions about the protections of these populations under the Endangered Species Act.

- 23 **Andrea R. Benson, Joey Shaw and Jennifer Boyd.** Impacts of large mammal herbivory on *Scutellaria montana* Chapm. in the Tennessee army national guard volunteer training site, Catoosa County, Georgia. University of Tennessee at Chattanooga, TN.

Scutellaria montana Chapm. (large-flowered skullcap) is a locally endemic herbaceous perennial protected under the U.S. Endangered Species Act. Currently, known populations exist in Tennessee and Georgia, one of which is within the Tennessee Army National Guard Volunteer Training Site (VTS), Catoosa County, GA. To investigate the impacts of deer and feral hog herbivory on *S. montana* at the VTS, we designed and implemented a field experiment consisting of four herbivore exclosure treatments: small and large herbivore exclosures, large herbivore exclosures, open exclosure frames, and non-exclosures. Preliminary results show that throughout the growing season, the

mean number of leaves per individual plant decreased in all treatments, but the greatest reduction in leaf number was observed when herbivores could access plants. Specifically, plants in open enclosure frames and control treatments experienced ~38% and ~31% reductions in mean leaf number respectively, while plants protected from small and large herbivores and plants protected from large herbivores only exhibited ~21% and ~23% reductions in this factor, respectively. In contrast, mean stem height of plants decreased ~9% during the growing season in our control treatment, while this factor increased ~2% in plants protected from small and large herbivores and ~7% in plants protected from large herbivores only. Collectively, our findings suggest that large mammal herbivores negatively impact *S. montana* individuals at the VTS, and small mammal herbivores may potentially offset this negative impact to some extent through the positive effects of selectively thinning surrounding vegetation.

- 24 **Morgan L. Schweigert and Troy Mutchler.** Seagrass (*Thalassia testudinum*) tissue analysis indicates significant herbivory-enrichment interaction. Kennesaw State University, GA.

Efforts to protect coastal ecosystem services against the threat of eutrophication require effective means for detecting nutrient pollution. To this end, seagrasses have been used as bioindicators because tissue nutrient content may reflect changes in nutrient availability to the system. However, tissue nutrient levels are subject to other factors, such as grazing, that have the potential to confound interpretation. A field experiment was conducted in Big Lagoon, FL to investigate the hypothesis that grazing and eutrophication have comparable effects on tissue nutrient content (C:N:P ratios) of *Thalassia testudinum*. Fertilizer additions were used to simulate eutrophication, and manual clipping of seagrass blades mimicked vertebrate herbivory. Fertilizer additions successfully elevated water column concentrations of NH_4^+ in fertilized beds, although concentrations diminished over time. Sediment NH_4^+ concentrations were significantly higher in fertilized beds ($p = 0.04$), and uniquely elevated in the beds exposed to combination (Fertilized + Clipped) treatments ($p < 0.05$). Tissue N content increased in response to fertilizer treatments, but grazing had little effect on CN ratios. Fertilized + Clipped seagrasses exhibited a mean tissue %P of 0.18 ± 0.05 , which deviated significantly from all other treatments ($p = 0.009$). The mean tissue nutrient content ratios (Control 709:39:1, Fertilized 573:41:1, Clipped 567:35:1, Fertilized + Clipped 472:32:1) suggest that P may be a limiting factor in Big Lagoon. While grazing and fertilization, as independent variables, did not impact seagrasses similarly, their interactive effect suggested intense grazing may confound interpretation of P content as a bioindicator of nutrient loading.

- 25 **Elizabeth L. Stephens, Matthew R. Tye and Pedro F. Quintana-Ascencio.** Do habitat and microsite type affect recruitment limitation in native scrubland and scrub undergoing restoration? University of Central Florida, FL.

Recruitment success of native plant species is central to restoration of imperiled habitat. The restoration of an agricultural property adjacent to Archbold Biological Station on the Lake Wales Ridge has provided a unique opportunity to compare factors influencing the establishment of Florida scrub plants in intact and degraded scrub. We evaluated effects of habitat and microsite type on life history stages in the annual scrub species *Chamaecrista fasciculata*. Because habitat characteristics in the degraded scrub may reduce competition with shrubs and provide larger habitat for recruitment, we expected that the study species would have higher seed production and seedling establishment in the degraded scrub. We hypothesized that seed removal would differ in the two habitats and among microsites due to potentially different suites of predators. Seed production per individual was not significantly different between habitats. Seed removal was predicted by habitat, microsite, enclosure treatment, and deposited seed density in logistic regression analyses, and was greatest in bare sand. Emergence was greater in intact habitat and was significantly different in litter microsites in degraded habitat; the fewest *C. fasciculata* plants established in bare sand. Using demographic matrix models, we found that

population growth was greatest in degraded habitat and under shrubs. Vital rate elasticities showed that seed to seed survival (intact scrub) and reproductive to reproductive adult survival (degraded scrub) were the most important factors influencing population growth rate. Our results suggest that habitat heterogeneity and seed availability influence recruitment with potential consequences for species persistence and successful reintroduction of scrub species.

- 26 **Constance L. Rogers-Lowery.** Respiration and photosynthesis in larval and newly-settled coral exposed to different levels of carbon dioxide. Catawba College, NC.

It is projected that as the levels of atmospheric CO₂ increase the pH of the oceans will become more acidic, resulting in decreased aragonite saturation of seawater. As a consequence, the growth and survival of coral may be negatively affected. While much research has been dedicated to the impact of CO₂ levels on calcification, skeletogenesis, and other physiological mechanisms of adult coral, little has dealt with early developmental stages. In the current study, planula larvae of the coral *Favia fragum* were exposed to different levels of atmospheric CO₂ (ambient = 390ppm, 700ppm, and 1300ppm) for 24 hours and 1 week. After 24 h exposure to elevated CO₂, oxygen consumption (dark respiration) was reduced; however, oxygen production (due to photosynthesis of symbiotic zooxanthellae) was elevated. After 1 week exposure, dark respiration was depressed; however, rate of photosynthesis was similar between treatments. Additionally, newly-settled primary polyps were exposed to different levels of atmospheric CO₂. Six-week old polyps had increased rates of dark respiration and photosynthesis after 24h exposure to elevated CO₂. After 1 week exposure, rates of respiration remained elevated, but photosynthesis was similar between treatments. This data may indicate an adaption response of the coral planulae and polyps to elevated CO₂ after exposure for 1 week. However, it should be noted that, in a parallel study, decreased rates of growth and bleaching were observed in primary polyps of *Favia fragum* when exposed to elevated CO₂.

- 27 **Bijay B. Niraula, Jonathan M. Miller, Evelyn G. Reategui-Zirena and Paul M. Stewart.** Life history study and morphological variations of primary burrowing crayfish *Cambarus lacunicambarus diogenes* and *C. tubericambarus*. Troy University, AL.

Primary burrowing crayfishes make up 15% of total crayfish species but account for 32% of imperiled crayfishes (Eversole 2006); yet, primary burrowers are much less studied as compared to secondary and tertiary burrowers. The main objective of this study was to observe the life cycles of two primary burrowing crayfish species *Cambarus (Lacunicambarus) Diogenes* and *C. (Tubericambarus) sp. 'B'*. Sampling was done near Persimmon Branch and under Hwy 29 Bridge on the Conecuh River, Troy, AL. Digging, plunging, and hand excavation techniques were applied to capture the crayfish. For *C. diogenes* (N = 158), and *C. sp. 'B'* (N = 147) form I males were found throughout the year but more towards the end of the year. Females of *C. diogenes* with active glair glands were collected throughout the year, but least in September and October. An ovigerous female of *C. diogenes* was collected in March and juveniles were collected in March and November. Females of *C. sp. 'B'* with active glair glands were collected throughout the year except for November and the number was highest in June, August, and December. Juveniles of the same species were collected in June, August, November, and December.

- 28 **Megan Pitman¹ and Travis Perry².** Comparison of photographic rate population estimates to mark-resight population estimates for puma (*Puma concolor*) across three study sites. ¹Clemson University, ²Furman University.

Cost effective techniques for estimating population levels of puma (*Puma concolor*) are sorely needed for responsible management and conservation. Our previous work suggests that photographic rates combined with empirically derived detection probabilities

hold promise for providing puma population estimates that are comparable to traditional mark-resight estimates. However, this previous work was based on detection probabilities calculated only for two puma at a single study site. Here we expand on this work to include additional puma and two additional study sites.

- 29 **Wesley M. Knapp and Richard H. Wiegand.** Orchid decline in the Catoctin Mountains, Frederick Co., Maryland as documented by a 25+ year dataset. Maryland Natural Heritage Program.

Of all the land plants the orchids are among the most speciose and charismatic. The Catoctin Mountains of Maryland are reported to support 27 species of orchids including 25 native and 2 non-native. Over 25+ years annual counts have been conducted at 163 sites for 21 of these species (20 native and 1 non-native). These counts have documented a shocking decline in all species of orchids except for *Platanthera ciliaris* and *P. flava*. The reasons for *Platanthera ciliaris*' continued population success is largely due to site specific habitat management at two sites with all other sites for this species showing an overall decline in individuals. Of all the orchids known from the Catoctin Mountains the most significant declines are documented and discussed. Alarming trends are documented for common species such as *Galearis spectabilis*, which has declined at 21 sites from 1319 individuals in 1985 to 257 individuals in 2008 and *Cypripedium aculalie* which has declined at twenty four sites from 1168 individuals in 1984 to 160 in 2008. An additional four species known from 35 sites in the study area have been lost. Of all 21 species surveyed during this long-term study 10 have seen a decline of at least 90% while the remaining species have undergone similar but less severe declines. This loss of orchid diversity is likely caused by a number of factors including a large deer population.

- 30 **Jennifer R. Mandel¹, Ethan F. Milton¹, Lisa A. Donovan¹, Steven J. Knapp² and John M. Burke¹.** Genetic diversity and population structure in the rare algodones sunflower (*Helianthus niveus* ssp. *tephrodes*) and comparison to related sunflowers. ¹University of Georgia, ²Monsanto Vegetable Seeds.

Assessing levels and patterns of standing genetic variation is an important step for evaluating rare or endangered species and determining appropriate conservation strategies. These strategies are particularly important for ensuring the preservation of rare genetic material in wild relatives of crops, which could provide beneficial alleles for plant breeding and improvement. In this study, we evaluate the population genetics of *Helianthus niveus* ssp. *Tephrodes* (the Algodones sunflower), which is an endangered, wild relative of cultivated sunflower (*H. annuus* L.). This rare sunflower species is native to the sand dunes of the Sonoran Desert in southern California, southwestern Arizona, and northern Mexico and is thought to harbor beneficial alleles for traits related to drought resistance. We genotyped nine populations of this species with a set of expressed sequence tag simple-sequence repeat (EST-SSR) markers and investigated levels of genetic diversity and population structure within *H. niveus* ssp. *Tephrodes*. We also compared our results to findings from five related sunflower species that have been analyzed with these same markers, including annuals and perennials that range from rare to widespread. The Algodones sunflower harbors lower levels of population genetic diversity, but similar levels of population structure, as compared to other sunflower species. We also discovered that a population from northern Mexico was genetically quite distinct from populations elsewhere in the range. Given the occurrence of such a genetically unique population, we recommend a conservation strategy that includes searching for additional populations in the southern portion of the range of this species in hopes of bolstering the existing germplasm collection.

- 31 **CANCELLED**

- 32 **William H. Dees¹, Kaleigh A. Helo¹ and Jill Hightower².** Caged mosquitoes: observations of unusual mosquito oviposition behavior. ¹McNeese State University, LA, ²Calcasieu Parish Mosquito and Rodent Control Department, LA.

During tests to determine mosquito oviposition preferences to botanical extracts, we detected noticeable oviposition behaviors by mosquitoes in cage experiments that influenced test results. There appeared to be some inherent cage factor(s) influencing egg deposition. *Aedes aegypti* mosquitoes deposited their eggs into oviposition cups in specific sections of 45.7cm cube (18" cube) cages having tubular/sleeve stockinettes. The stockinette is the part of the cage through which mosquitoes or laboratory materials are introduced/placed into the cage. We investigated this oviposition behavior by altering the number and placement of cups containing distilled water. In cage tests using approximately 100 mixed gravid female and male mosquitoes, more than 1.5x more eggs were deposited into cups placed in the two corners opposite the stockinette, and into cups placed in the center, along the side perpendicular and farther away from the stockinette. Placement of oviposition cups must be considered when conducting cage oviposition tests with mosquitoes. In addition, placement of oviposition containers in specific sections of a cage may yield more mosquito eggs when conducting routine mosquito colony maintenance.

- 33 **William H. Dees¹, Irvin J. Louque¹, Linda D. Canning¹, J. T. Guidry¹, Camille F. Abshire-Degrado¹ and Sandra A. Allan².** Collecting mosquitoes in the field: light trap covers can make a difference. ¹McNeese State University, LA, ²USDA/ARS Center for Medical, Agricultural and Veterinary Entomology, LA.

In the mid-1980's, silver metal covers on commercially made Centers for Disease Control (CDC) mosquito light traps were replaced with black plastic covers. We conducted field tests to determine if this change in the material and color of the cover (i.e. silver metal vs. black plastic) affected the number and species of mosquitoes collected. Eighteen comparison tests using non-CO₂-baited CDC light traps were conducted. More mosquitoes were collected in traps with silver covers (n=560; mean=31) than in traps with black covers (n=437; mean=24). More females also were collected in traps with silver covers (n=504; mean=28) than in traps with black covers (n=367; mean=20). However, more males were collected in traps with black covers (n=70; mean=4) than in traps with silver covers (n=56; mean=3). More than twice as many female *Aedes taeniorhynchus* and *Ps. columbiae* were collected in traps with silver covers than in traps with black covers (n=28 and n=18 vs. n=11 and n=5, respectively). Thirteen mosquito species in six genera (*Aedes*, *Anopheles*, *Coquillettidia*, *Culex*, *Psorophora* and *Uranotaenia*) were collected during this investigation.

- 34 **Daria Monaenkova, Matthew S. Lehnert, Taras Andrukh, Charles E. Beard, Binyamin Rubin, Alexander Tokarev, Wah-Keat Lee, Peter H. Adler and Konstantin G. Kornev.** Dual functionality of the lepidopteran proboscis allows exploitation of vast nutritive sources. Clemson University, SC.

Butterflies and moths use a tube-like proboscis to feed from a variety of nutritive sources including pools of nectar in floral corollas and films on porous substrates such as rotting fruits. The proboscis is composed of two modified maxillary galeae joined together by dorsal- and ventral-linking structures to form an internal food canal, thus resembling, and historically assumed to function like, a drinking straw. The drinking-straw model, however, requires that Lepidoptera feed from pools of liquid; the ability to feed from porous substrates has not been explained until now. Using scanning electron microscopy and a series of feeding experiments involving X-ray phase-contrast imaging, we discovered that fluid acquisition from porous substrates is a two-step process: capillary action induced by spaces between the dorsal-linking structures pulls liquid into the food canal, forming liquid bridges, which are then carried to the gut by action of the sucking pump in the head. The dual functionality of the proboscis represents a key innovation that allows the use of a

wide range of nutritive sources, and might have fostered the diversification of Lepidoptera, especially during the angiosperm radiation.

- 35 **Charles E. Beard, Matthew S. Lehnert, Peter H. Adler and Konstantin G. Kornev.** Structure of the butterfly proboscis relates to feeding guilds. Clemson University, SC.

We examined the structure of the butterfly proboscis for relationships to feeding guilds — nectar feeding versus non-nectar feeding. The butterfly proboscis is formed of two elongated, conjoined maxillary galeae. We have determined structural landmarks that denote three proboscis zones for structural and functional comparisons among species. We tested three hypotheses, using light and scanning electron microscopy: (1) Structural features within the zones are consistent within feeding guilds, regardless of phylogeny. (2) Sexual dimorphism exists in species in which the sexes use different food sources. (3) Species differ in the shape, size, and arrangement of the dorsal linking structures of the proboscis. Butterflies that feed on nectar have relatively smooth proboscises with fewer large sensilla. Butterflies that do not feed on nectar have larger, more numerous sensilla forming a brushy tip. We did not find sexually dimorphic structures; thus, feeding differences between genders probably are not related to proboscis structural dimorphism. The bilayered dorsal linking structures differ among species and feeding guilds. In the guild of butterflies that do not feed on nectar, the upper linkage branch enlarges distally and to a greater extent than in the butterflies that do feed on nectar. Our results suggest a convergence of structures among species in relation to feeding habits, regardless of phylogenetic relationships.

- 36 **Tom J. Fink.** The role of the stridulatory organ hairs in stridulation in fire ants (Hymenoptera: *Solenopsis* spp.) as studied with scanning electron microscopy (SEM) and acoustics. East Carolina University, NC.

The stridulatory organ (SO) in Fire Ants and other ants consists of a raised central area with parallel raised ridges. Laterally these ridges become fragmented to form a rough cuticular area. In all fire ant castes there are mid to posterior hairs from about 7 on each side of the SO in minor workers to over 20 in the large SO in male alates. Hairs are usually simple and range in length from 8 – 36 μ m. Present in most specimens in all castes, are some small bifid hairs with the width between forks of about 1.7 μ m. Stereo SEM anaglyphs of the SO reveal that the hairs project strongly away from the SO so that the postpetiole posterior edge or scraper probably contacts these hairs. Thus these hairs may form a feedback sensor for the fire ant that indicates the postpetiole travel on the SO. A minor worker of *S. invicta* with about 38 SO ridges was acoustically recorded with about 19-22 waveform peaks, and the first SO hair appears adjacent to ridge 22. Similarly: major worker (57, 19-31, 32), female alate (87, 35-44, 64), male alate (87, 47, 59). Many posterior SO ridges are clearly not scraped during stridulation (up to 37 more specimens are currently being examined both morphologically and acoustically). *S. richteri/solenopsis* hybrids in the laboratory and the field did not show stridulation during mound excavation either after rain events or in a constructed narrow ant farm with a 100 mv/g accelerometer attached and recorded along with video.

- 37 **CANCELLED**

- 38 **Zachary J. Loughman¹, Kinsy L. Skalican¹ and Nate Taylor².** Determination of daily of movements and macrohabitat preference of the invasive crayfish *Orconectes virilis* through use of telemetry. ¹West Liberty University, WV, ²West Virginia University Fisheries Graduate Program, WV.

In an effort to better understand the daily activity and microhabitat preference of invasive *Orconectes virilis* populations, a study was performed in Anthony Creek, West Virginia utilizing telemetry. Eight *O. virilis* (3M/4F/1 F) were fitted with 0.8 g transmitters and released at their initial point of capture. Animals were tracked for six consecutive days,

after which a 20 day latent period was initiated, followed by six days of tracking. Proceeding the location of each individual, water depth and velocity, substrate type, and distance travelled were noted. *Orconectes virilis* utilized two distinct movement patterns. "Residents" made up 62% of crayfish and either did not move from their point of capture or made initial long distance movements, followed by little to no movement. "Adventives" (38 % of crayfish) moved on average 41 m/day, and rarely used the same retreat more than one day. The longest recorded daily movement for a single individual was 210 m; one individual moved 1.62 kilometers upstream over 28 days. *Orconectes virilis* preferred depositional habitats with an abundance of detritus and macrophytes, and avoided habitats dominated by boulders. Habitats *O. virilis* were associated with were allied with anthropogenic disturbances and not indicative of pristine stream conditions.

- 39 **Raquel A. Fagundo, Michael J. Lucero and Zachary J. Loughman.** Epigeal crayfish of West Virginia's lower Kanawha river system: conservation and natural history. West Liberty University, WV.

The Lower Kanawha River system's epigeal crayfish fauna was surveyed during the summer of 2010. Goals of this project included determining the native fauna of the basin and identification of conservation concerns. Thirty seven random sites were chosen for sampling through use of GIS. Site coverage accounted for all stream orders conducive to crayfishes. Physiochemical and biotic data were collected at each site, as well as crayfish vouchers for identification in the laboratory. The native epigeal crayfish fauna of the Lower Kanawha River system consists of three species: *Cambarus b. cavatus*, *Cambarus robustus*, and *Orconectes sanbornii*. The invasive crayfish, *Orconectes virilis*, was collected in every sub-basin within the system. This species has competitively excluded crayfishes in other West Virginia basins, and represents the most important conservation concern in the Lower Kanawha River system. Siltation associated with development and agriculture was another important cause of imperilment. Crayfish conservation efforts in the Lower Kanawha should focus on limiting the expansion of *O. virilis* and controlling siltation impacts throughout the watershed.

- 40 **Martha E. Perry¹, Stephen C. Landers¹ and Rachel N. Jones².** Larval settlement of two invertebrates at Dauphin Island Sea Lab, Alabama following the Deepwater Horizon oil spill. ¹Troy University, AL, ²Dauphin Island Sea Lab, AL.

Barnacles and bryozoans are sessile animals that permanently attach to substrates in the marine environment. These animals are filter feeders and produce larvae responsible for colonizing a new location. The barnacle *Balanus* sp. and the bryozoan *Membranipora tenuis* were the two animals examined in this study. Two sites at Dauphin Island Sea Lab were sampled using slide traps, which provided the settlement substrate for the organisms. Each month, starting in August 2010, slide traps were submerged into the Mississippi Sound for one week and then recovered. After 15 months of collection, our results indicate that *Balanus* settlement occurred primarily in June-September. Barnacle densities reached a peak of 9.5 animals/cm² in September 2010. This value is lower than the peak values reported for *Balanus* at the same location during a 1999-2000 study. Additionally, an anticipated February-March spawning event did not occur for *Balanus* in this study. *Membranipora* densities peaked at 0.83-0.97 colonies/ cm² in June 2011. Further investigation of settlement and abiotic factors that may relate to colonization is underway.

- 41 **David A. Foltz II¹, Stuart A. Welsh² and Zachary J. Loughman³.** Baited lines, a nondestructive burrowing crayfish collecting technique. ¹Marshall University, WV, ²West Virginia University, WV, ³West Liberty University, WV.

Collection methods for organisms are constantly being improved upon to reach the highest capture rate with the least amount of effort. Excavation is the primary method used for collecting primary burrowing crayfish. This method is physically demanding, time

consuming, and difficult in certain habitats. Recently, burrowing crayfish nets (BCN) have been used to collect crayfishes without excavating burrows. Unfortunately, success rates with a BCN is directly correlated to weather events, making use of this method temperamental. Baited lines are fishing hooks baited with earthworms, tied to 20-30 cm long monofilament leaders, and require investigators to engage crayfishes resting at the entrances of burrows. Crayfish when observed, are tempted with baited lines from their portals, and then captured. The focus of this study was to compare the baited line method against burrowing crayfish nets and excavation in a variety of habitats with different crayfish species to determine the success of the baited line. Four study areas were selected throughout West Virginia to ensure broad coverage of primary burrowing crayfishes. We used model selection criteria to elucidate the best fit model associated with our data. The additive model (taxa + sampling method) was the best approximating model to the data (AIC weight = 0.71), and provided evidence for differences in capture rates among taxa and sampling methods. In all instances, baited lines were the most successful method used to collect burrowing crayfishes.

- 42 **Zachary J. Loughman¹ and Stuart A. Welsh²**. Burrowing crayfish occupancy rates at natural and disturbed sites along West Virginia's Ohio and Kanawha River floodplains. ¹West Liberty University, WV, ²USGS Cooperative Research Unit, WV.

Many primary burrowing crayfish inhabit floodplains, where forested landscapes have been fragmented by agricultural, industrial, or residential uses. The impact these practices have on burrowing crayfishes occupying floodplains is poorly understood. In order to elucidate burrowing crayfish conservation concerns associated with these land use types, site occupancy rates (ψ) were modeled for *Fallicambarus fodiens* and *Cambarus thomai*, from Ohio and Kanawha river floodplains in West Virginia. Occupancy rate modeling incorporated four environmental covariates (forest age, soil type, tree frequency, and land use). Based on presence/absence data, forests with tree ages > 100 years ($\Delta\text{QAICc} = 0$) and sites with loam soils ($\Delta\text{QAICc} = 1.80$) were most likely to harbor *F. fodiens* populations. For *C. thomai*, several models were supported owing to model selection uncertainty, however land use had more total model weight (total $w_i = 0.55$) than all other covariate models. *Cambarus thomai* rarely occupied industrial/agricultural sites, but were often present in forested and residential sites. Although the influence of covariates on site occupancy differed between species, forested habitats were important for *F. fodiens* and *C. thomai*.

- 43 **Hillary Doyle and Michael S. Bodri**. Effects of heat shock protein 90 (hsp90) inhibitors on regeneration and behavior in the planarian *Dugesia tigrina* (Platyhelminthes: Turbellaria). North Georgia College & State University, GA.

There are no published studies that examine if heat shock proteins play any role in the regeneration of animal tissues. This study was performed to determine if inhibitors of heat shock protein 90 (HSP90) have any effect on the behavior and ability to regenerate heads in the model organism *Dugesia tigrina* (Girard) (Platyhelminthes: Turbellaria). Serial dilutions of the geldanamycin analogs 17-AEP, 17-DMAG, 17-DMAP (500 μM , 50 μM , 5 μM , 0.5 μM , 0.05 μM) and radicicol (80 μM , 40 μM , 20 μM , 10 μM , 5 μM) were used to establish toxicity concentrations ($n=5-10/\text{treatment}$). All inhibitors were lethal at the highest concentrations. Ten groups of 10 randomly selected planaria were then exposed individually to 0.5 μM or 1.0 μM concentrations of the geldanamycin analogs or 5 μM or 10 μM radicicol. Locomotor behavior was evaluated by counting the number of 0.5 x 0.5 cm gridlines crossed by the planarian during a 5-minute time span once transferred to the test solution in a 100 x 15 mm Petri plate. No atypical behaviors were observed and locomotion of treatment groups compared to controls was not significantly different (ANOVA). At the end of the behavioral evaluation, the original groups were reconstituted in identical test solutions following head amputation. Head regeneration in experimental

groups and controls was ascertained on day 10. DMAG and radicol (5 μ M) differed significantly from their respective controls (Fisher Exact Probability Test, $P < 0.05$).

- 44 **Gabriel J. Langford, Brent Willobee and Luiz Isidoro.** Life cycle, host specificity, and seasonal occurrence of *Cyrtosomum penneri* (Nematoda: Atractidae) from lizards in Polk County, Florida. Florida Southern College, FL.

The nematode *Cyrtosomum penneri* is a commonly encountered gastrointestinal parasite of the Brown Anole (*Anolis sagrei*). The life cycle of *Cyrtosomum penneri* has not been elucidated, and no experimental infections have been conducted on this nematode to establish its host specificity. Therefore, we conducted experimental infections to fully elucidate the life cycle of *C. penneri* and determine the ability of the nematode to establish infections in sympatric lizards from Polk County, Florida. In addition, we collected nematodes from Brown Anoles on the campus of Florida Southern College from 2010-11 to establish seasonal occurrence of *C. penneri*. Our experimental infection experiments strongly suggest *C. penneri* was only transmitted during copulation, which was supported by our seasonal occurrence data; Brown Anoles with a snout-vent length ≤ 34 mm (i.e., non-reproductive individuals) were never infected. Our host specificity experiments yielded unexpected results; for example, we found *C. penneri* obtained from *A. sagrei* were unable to infect *Anolis carolinensis* (a closely related lizard), yet successfully and consistently infected *Hemidactylus turcicus* (a distantly related lizard).

- 45 **Kate L. Sheehan and Ron J. Johnson.** Intestinal parasites of resident and migratory double-crested cormorants (*Phalacrocorax auritus*). Clemson University, SC.

There is a potential for the use of parasites as biomarkers for the movement of hosts across large geographic areas. Here, we attempt to document the distribution of helminthic communities with a single host species in North America, the Double-crested cormorant (*Phalacrocorax auritus*). The intestines of over 200 *P. auritus* collected from Alabama, Mississippi, Minnesota, and Vermont, U.S.A. were assessed for disease and parasitic infection. Abnormal appearance of tissues, fat content (for body condition assessment), and eukaryotic parasites were documented for immature and adult male and female birds. Platyhelminthes (digenean trematodes) and nematodes (Anisakidae and Capillariidae) were found in nearly all birds assessed. Cestodes were also commonly documented. Parasite community parameters (abundance, richness, and relative biomass) and host body condition (assessed as percent body fat) are compared among different locations, ages, and sexes. In addition, we address seasonality of parasitic infections for resident and migrant *P. auritus* in breeding and wintering colonies. Understanding of changes (and the lack thereof) of parasitic communities could indicate shifts in the geographic distribution associated with migration of waterbirds.

- 46 **Michael J. Cherry¹, L. M. Conner², Jessica C. Rutledge², Lora L. Smith² and Robert J. Warren¹.** White-tailed deer site selection in response to predator exclusion. ¹University of Georgia, GA, ²Joseph W. Jones Ecological Research Center, GA.

Predation risk influences foraging behavior and movement of prey. For example, white-tailed deer (*Odocoileus virginianus*) abundance is greater in the margins of wolf (*Canis lupus*) pack territories where wolf use is less. However, it is unknown whether the spatial organization of white-tailed deer is caused directly by predation, indirectly by predator avoidance, or their combined effects. Therefore, we conducted a study on the Joseph W. Jones Ecological Research Center, Newton, Georgia, USA to determine effects of predator exclusion on aspects of white-tailed deer behavior. Coyotes (*Canis latrans*) were the primary predator of white-tailed deer on this site and fluctuations in coyote abundance and habitat selection may impact white-tailed deer movement. To test this hypothesis, we identified 8, ~ 104-acre plots with similar habitats, and excluded coyotes and other mesomammal predators from 4 plots using an electric fence; remaining plots served as

controls. White-tailed deer freely crossed the 4 foot fences. Within all 8 plots, we monitored relative abundance of white-tailed deer using thermal camera surveys (3 times seasonally, 2004-2007), and monthly track count surveys (2004-2011). White-tailed deer were detected by thermal camera surveys and track counts more frequently in enclosure plots than in control plots (106 versus 51, and 404 versus 101, detections respectively $P < 0.001$ for both analyses). We suggest that white-tailed deer preferred predator enclosures because of reduced predation risk. White-tailed deer select for areas of reduced predation risk based on predator abundance rather than habitat associations.

- 47 **Scarlet L. Sellers and Travis W. Perry.** Puma predation, medium to large mammal activity, and lunar phase. Furman University, SC.

Lunar cycles have been shown to influence the behavior of a wide variety of organisms, from marine fish to rodents to birds and large carnivores. We investigated the relationship between lunar phase, puma movement, puma predation, and the activity of potential prey species. We used data from GPS collared puma to assess puma movement and predation. We used remote cameras to assess the activity levels of potential prey species. Further, we asked whether puma activity, as revealed by GPS collars was reflected by remote camera data. We used 45 remote cameras in three disparate arrays across New Mexico that corresponded to home-ranges of GPS collared puma. Our results have significant implications for the temporal variation in top down effects of predators.

- 48 **Elizabeth A. Miller¹, Bradley S. Cohen¹, David A. Osborn¹, George R. Gallagher², Robert J. Warren¹ and Karl V. Miller¹.** An automated device for training deer for behavior-based experiments. ¹University of Georgia, GA, ²Berry College, GA.

Understanding an animal's sensory capabilities is paramount to manipulating its behavior. Although research on deer anatomy and physiology has enhanced our understanding of deer perception, few behavior-based experiments have been conducted to provide direct evidence of sensory perception. This lack of behavior research is partially attributed to the difficulty of efficiently training adequate numbers of deer to participate in experimental trials. We present a system that trains white-tailed deer (*Odocoileus virginianus*) to associate visual stimuli with a food reward through operant condition techniques. This "deer-training-apparatus" (DTA) automatically dispenses food, rings a start buzzer, randomly assigns a positive stimulus over 1 of 2 food troughs, and registers a deer's interaction with the stimulus. When a deer approaches the food trough associated with the positive stimulus, a correct choice is registered. A pilot study in which deer were trained to respond to a supra-threshold, white-light stimulus resulted in all 6 test deer meeting successful training criteria by Day 19 with performance of $88.2\% \pm 3.9\%$ by Day 25. The DTA eliminates common hindrances of animal training such as experimenter effort and time, thus providing an effective and efficient platform for training white-tailed deer for research on behavior, perception, and preference.

- 49 **Emily C. Alberto, Kelli M. Slunt and Abbie M. Tomba.** Characterization of the alarm cues present in the hemolymph of the crayfish *Orconectes rusticus*. University of Mary Washington, VA.

Alarm cues are damage released chemicals that signal a threat to conspecifics and are imperative to the survival of many aquatic animals including crayfish. This alarm response has been studied in several species of crayfish where it has been found that exposure to the alarm cue will elicit behavioral changes in order to avoid predation. Behavioral changes include a decrease in time spent feeding, changes in posture, and a decrease in locomotion or non-locomotory movement after exposure to an alarm cue. Though the response to alarm cues has been well documented, the identity of the alarm-causing chemical is unknown. Previous research on the crayfish *Procambarus clarkii* suggests that hemolymph contains an alarm cue that is most likely a peptide smaller than 5 kDa. In our previous research with *Orconectes rusticus*, crayfish were found to respond to hemolymph

fractions smaller than 50 kDa. To further characterize the size of the alarm cue we continued our behavioral assay. Crayfish were first exposed to food odor for the purpose of stimulation. After stimulation crayfish were exposed to a water control or a treatment of hemolymph that was fractionally centrifuged using filters for the desired particle size. Behaviors such as feeding and movement were monitored. The change in behavior between food odor and treatment was calculated and compared across treatments to determine which fraction contained the alarm chemical. Preliminary results indicate that the alarm cue is smaller than 30 kDa in size. Tests with 0-≤10 kDa, >10-≤30 kDa, and >30 kDa hemolymph are ongoing.

- 50 **Richard G. Hodel¹ and Eva B. Gonzales².** Phylogeography of sea oats (*Uniola paniculata* L., Poaceae), an ecologically important coastal dune grass in the southeastern United States. ¹University of Florida, FL, ²Appalachian State University, NC.

Sea oats (*Uniola paniculata*) are a coastal dune grass native to the southeastern United States that are valuable for preventing dune erosion and protecting the health of coastal ecosystems. We tested the hypothesis that *U. paniculata* populations are divided into eastern and western lineages, with the southern tip of Florida acting as the primary geographic break, as observed in co-distributed animal taxa. Additionally, we asked whether the geographic distribution of chloroplast DNA (cpDNA) variation in *U. paniculata* corresponds to 1) genetic structure in nuclear variation reported in previous studies, and 2) the geographic distribution of morphological adaptive traits reported in previous studies. We sampled 66 populations of *U. paniculata* throughout its range in the United States and performed phylogeographical analyses using sequence variations in maternally inherited cpDNA. We used TCS software to reconstruct the intraspecific phylogenetic network and Monmonier's algorithm to identify phylogeographic breaks in the species. We found six cpDNA haplotypes and two major lineages: eastern (Atlantic) and western (Gulf), with a phylogeographic break at the southern tip of Florida. The phylogeographic analysis suggests that *U. Paniculata* survived the last glacial maximum (LGM) in southern refugia. Following the LGM, vicariance and dispersal explain the current distribution of haplotypes into eastern and western lineages. Most populations that contain a haplotype from outside its native range are likely due to human-mediated translocation. The genetic structure of cpDNA sequence variations has a weak correlation with nuclear DNA variation, and there is partial concordance between the geographic distribution of cpDNA and morphological variation.

- 51 **Bryan A. Strelow and Gregory J. Haenel.** Exploring species boundaries: a genetic study of interactions between North American cricket frogs, *Acris crepitans* and *A. gryllus*. Elon University, NC.

The failure of reproductive barriers has been well documented in many different systems and results in the mixing of genetic characters between previously independent populations. In this study, we investigate interactions across the species boundaries of two closely related species of North American cricket frogs, *Acris crepitans* and *A. gryllus*. These species have distinct calls and morphological characters in allopatry, and are therefore expected to show strong reproductive isolation. We surveyed *Acris* populations surrounding a region of range overlap in North Carolina to quantify genetic differences. We used our genetic information, in conjunction with previously cataloged morphological and acoustic data, to examine the historic gene-flow and present genetic interactions of these two species. We demonstrate the presence of hybrid individuals using mtDNA haplotype discordance of cytochrome B gene sequences with morphology and call type. We report the sequence haplotype (220 bp) for 140 individuals in 24 populations, representing both allopatric and sympatric populations. Twenty-seven percent of samples show evidence of hybridization in locations currently inhabited by both species. Historically syntopic populations, determined by past sampling and records, had a 48% occurrence of hybrid individuals. Population genetics models (Tajima's D, Fu's F, and AMOVA) support

a hypothesis of rapid range expansion in *A. crepitans* but not *A. gryllus*. This study documents a system of interspecific gene-flow between closely related species with the rapid range expansion of one species and demonstrates a lasting genetic signature of interaction.

- 52 **Kathlina Alford¹, Anna George², Dave Neely² and Joey Shaw³**. Population status and conservation genetics of the flame chub, *Hemitemia flammea*.
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The Flame Chub, *Hemitemia flammea*, is an imperiled Cyprinid native to spring runs of the Coosa, Cumberland and Tennessee rivers. Due to habitat fragmentation and destruction, this monotypic spring endemic is becoming increasingly rare and in need of a conservation strategy. Currently the species is listed as threatened in Georgia but is of special concern in Tennessee and Alabama, providing little to no protection. This species was believed to be extirpated from Kentucky until its rediscovery in August of 2011. In Middle Tennessee, *H. flammea* often co-inhabits springs with Barrens Topminnow (*Fundulus julisia*), and likely has benefited from habitat restoration projects for *F. julisia*. However, there are no conservation projects currently underway for *Hemitemia* specifically. The purpose of this study is to examine the genetic diversity and spatial distribution of genetic variation in *H. flammea* in order to evaluate its current conservation status and provide recommendations on delineation of management units. For this study, individuals from more than twenty populations have been sampled and analyzed using the cytochrome *B* mitochondrial gene. Preliminary analysis recovered two unconnected haplotype networks: 1) individuals from the Caney Fork; 2) individuals from the Barren Fork, Elk River, Sequatchie River, South Chickamauga Creek and Upper Tennessee River. Results from this study will give insight into genetic diversity both within and among populations, additional data on presence and absence of the species at various localities across its range, and suggested management actions for the Flame Chub.

- 53 **Danielle E. Peters and Thomas K. Pauley**. Characterization of the *posterior hox* regions in amphibians and reptiles. Marshall University, WV.

Hox genes are major regulators in developmental and dimensional organization in tetrapods and other metazoans. Even though these genes are clustered and have highly conserved homeobox regions, their number, organization, and expression patterns are highly diversified. Due to the axial integration of *Hox* in limb formation, there is a significant correlation between *Hox* expression domains and morphological evolution. As the proposed cause of formation in the terminal limb, further analysis of the *Hox-11*, *Hox-12*, and *Hox-13* gene regions, also known as the posterior *Hox* clusters will reveal patterns of morphological evolution in reptiles and amphibians. Using samples from each of the following species: *Hemidactylum Scutatatum*, *Plethodon Cinereus*, *Psudacris crucifer*, *Anaxyrus a. americanus*, *Pantherophis g. guttatus*, *Python regius*, *Boa c. constrictor*, *Eublepharis macularius*, *Eumeces Fasciatus*, *Acontias percivali* and *Psedopus apodus*, posterior *Hox* clusters will be amplified using long-range PCR. As the outgroup, prior published sequences from *Mus musculus* will be compared to these clade representatives. We expect to observe differentiation in sequence presence and content between clades in amphibians and reptiles in the posterior *Hox* clusters. Specifically, we expect differentiation in *Hoxd* and *Hoxa*, due to the extensive variability in digit number and structure. In the case of evolutionary limb loss, however, it has not yet been established if either posterior *Hox* clusters or translation of these areas into protein could drive limb dissimilarity.

- 54 **Sarah J. Pate¹, Jason A. Clement², Joe-Ann H. McCoy³, Stacey L. Lance⁴ and Katherine G. Mathews¹.** Development and characterization of microsatellite markers for *Actaea racemosa* (black cohosh, Ranunculaceae). ¹Department of Biology, Western Carolina University, ²Department of Chemistry and Physics, Western Carolina University, ³Bent Creek Germplasm Repository, The North Carolina Arboretum, ⁴Savannah River Ecology Laboratory, University of Georgia, GA.

Actaea racemosa (black cohosh) is one of the top ten selling herbal drugs internationally and is used to treat menopausal symptoms. It is distributed throughout the Appalachian range in the U.S. and Canada and west into the Ozarks. Due to extensive wild harvesting of plant rhizomes, the sustainability of this species in the wild is of concern. We developed nine polymorphic microsatellite markers in *A. racemosa* to analyze population genetic structure, compare genetic diversity across the species' geographic range, and provide a genetic context for studies of phytochemical variation. We screened 60 individuals from 12 original collection localities that are maintained in a common garden living collection at Bent Creek Germplasm Repository in Asheville, NC. The number of alleles per locus ranged from three to six, and observed heterozygosity ranged from 0.133 to 0.900. Such high levels of heterozygosity are typical of long-lived, outcrossing perennials. Genetic structure analyses also demonstrated high admixture among populations and no geographic structuring, indicating widespread gene flow. Variation found in concentrations of total saponins and actein + deoxyactein isolated from rhizomes of the same plant accessions also showed a lack of geographic structuring. Accessions showing peak growth and high phytochemical production may be selected for cultivar development. Most of our microsatellite loci cross-amplified in the related southeastern U.S. species, *A. pachypoda*, *A. podocarpa* and *A. rubra*, indicating the broader utility of these markers in the genus. We also identified multiple single nucleotide polymorphisms in the internal transcribed spacer (ITS) region of nrDNA among *A. racemosa*, other eastern U.S. *Actaea* species, and Asian *Actaea* species, which could be used to identify common adulterants in medicinal preparations of black cohosh.

- 55 **Laura E. Heflin¹, Victoria K. Gibbs², Mickie L. Powell¹, Robert Makowsky³, Addison L. Lawrence⁴, John M. Lawrence⁵ and Stephen A. Watts¹.** Effect of diet quality on nutrient allocation to the test and Aristotle's lantern in the sea urchin *Lytechinus variegatus*. ¹University of Alabama at Birmingham, AL, ²Villanova University, PA, ³U.S. Food and Drug Administration, ⁴Texas A & M University, TX, ⁵University of South Florida, FL.

Small adult (19.50 ± 2.01 g wet weight) *Lytechinus variegatus* were fed eight formulated diets with different protein (12 to 36% dry weight as fed) and carbohydrate (21 to 39 % dry weight) levels. Each sea urchin ($n = 8$ per treatment) was fed a daily ration of 1.5% of the average body weight of all individuals for 9 weeks. For each physical growth response, different mathematical models representing *A priori* hypotheses were compared using the Akaike Information Criterion (AIC) score (Burnham and Anderson, 2002). The AIC is one of many information-theoretic approaches that allows for direct comparison of non-nested models with varying number of parameters. Dietary protein level and protein: energy ratio were the best models for prediction of test diameter increase. Dietary protein level was the best model of test with spines wet weight gain and test with spines dry matter production. When the Aristotle's lantern was corrected for size of the test, there was an inverse relationship with dietary protein level. Log transformed lantern to test with spines index was also best associated with the dietary protein model. Dietary carbohydrate level was a poor predictor for growth parameters. However, the protein x carbohydrate interaction model was the best model of organic content (% dry weight) of the test without spines. These data suggest that there is a differential allocation of resources when dietary protein is limiting and the test, but not the Aristotle's lantern, is affected by availability of dietary nutrients.

- 56 **Rebecca Y. Shirk¹, J. L. Hamrick¹, Chaobin Zhang² and Sheng Qiang².** Inferring the invasion history of *Geranium carolinianum* using population genetics. ¹University of Georgia, GA, ²Nanjing Agricultural University, China.

The genetic diversity of invasive species may be markedly different between native and invasive ranges as a result of evolutionary and demographic factors associated with the colonization process. Theory suggests that colonizing populations should be genetically depauperate, but this is often not the case with biological invasions due to human involvement during introduction and establishment. As global trade continues to rise, countries such as China are under increasing threat of accidental introductions, and understanding how invasive species are introduced and spread can be crucial to preventing future invasions. Comparing patterns in genetic diversity between the invasive and native ranges can be used to reconstruct the introduction and colonization history of invasive populations and make inferences about their evolutionary potential. Here, we report on a comparative biogeographical study of genetic diversity in the annual plant *Geranium carolinianum*, which is invasive to eastern China and native to the US. Populations in the native range have higher genetic diversity and lower genetic structure compared to similar species, suggesting high levels of gene flow, likely due to human-mediated long-distance dispersal. Patterns of diversity in invasive populations suggest a single entry point near Nanjing, Jiangsu province, which is corroborated by historical records. While Chinese populations are less diverse than US populations, consistent with colonization theory, this may be due to successive bottlenecks during range expansion rather than a severe loss of genetic variation in the initial colonization phase.

- 57 **Ciara M. Lockstadt¹, Eva B. Gonzales¹ and John Young².** Reconstructing the phylogeography of American ginseng (*Panax quinquefolius*, Araliaceae). ¹Appalachian State University, NC, ²United States Geological Survey.

Historical climate change has impacted species by causing shifts in their distribution. In eastern North America glacial periods affected species' distributions by shrinking their ranges to warm southern refugia, wherefrom they later spread north following recession of the glaciers. We analyzed the phylogeographical history of the native medicinal forest understory species American ginseng (*Panax quinquefolius*, Araliaceae). We sequenced sixteen regions of chloroplast DNA from 157 populations across ginseng's eastern North American range to identify six haplotypes. We identified two main lineages whose ranges partially overlap but are primarily distributed on either side of the Appalachian mountains. This mountain range may have served as a barrier to seed dispersal. The southern Appalachian foothills harbor the oldest haplotypes and this region most likely functioned as a region of glacial refugia. We discovered that the southern portion of the species' range is most diverse. Results reveal that ginseng has a complex migration history that has been further complicated by humans transplanting plants. The outcome of our study is useful for developing informed conservation strategies for management of ginseng.

- 58 **Emily K. Copeland.** Terminal investment and the potential for dishonest signals in the ground cricket, *Allonemobius socius*. University of Central Florida, FL.

Life history theory predicts that organisms should be able to alter their investment in energetically costly traits in order to minimize the effects of parasitic infection. Upon infection, organisms can either increase investment in immune defense, often at the expense of reproduction, or they can increase reproductive effort, often at the expense of immune defense. The former strategy is what is generally predicted from life history theory. The latter strategy, however, is a special case of life history theory termed terminal investment. According to the terminal investment hypothesis, if an individual's residual reproductive value is low they should increase reproductive effort in order to maximize fitness. A low residual reproductive value is typically expected for individuals of advanced reproductive age, but may also be expected if an individual is suffering from a detrimental parasitic infection. There is ample evidence for the first infection strategy. However, evidence for terminal investment has been mixed. Here we assess the potential for

terminal investment and a dishonest signal in the southern ground cricket, *Allonemobius socius*. To this end, we manipulated the pathogen load received by an individual, the pathogen type, and the individual's age. We found that older males who were immune challenged with LPS invested more in their sexual signal and therefore dishonestly signaled their condition. We also found that males treated with a low dose of LPS had a longer mating duration than control males.

59 **Stephanie A. Pearl, John E. Bowers and John M. Burke.** The genetics of safflower domestication. University of Georgia, GA.

Carthamus tinctorius L. (safflower) is a drought tolerant crop that is cultivated throughout the world for its flowers and high quality seed oil, especially in third world countries. It is believed to have had a single origin of domestication from its wild progenitor, *Carthamus palaestinus* Eig., dating to ca. 4000 years ago. Safflower shares a most recent common ancestor with *Helianthus annuus* L. (sunflower) dating back to approximately 40 million years ago. These two members of the Compositae have been independently domesticated for similar purposes and can thus serve as parallel systems for studying the accelerated evolution of domestication-related traits. The genetic architecture of domestication-related traits has been investigated in sunflower, but virtually nothing has been known about these traits in safflower. Through genetic mapping, QTL mapping, and comparative mapping with other important crops within the Compositae, I describe the genetics of safflower domestication, illustrate localized patterns of macrosynteny throughout the Compositae, and provide preliminary insight into whether parallel phenotypic evolution in both sunflower and safflower was driven by selection on homologous genomic regions.

60 **Tom Diggs.** Tracing the evolution of glade-endemic prairie clovers (*Dalea* spp.). University of Alabama at Birmingham, AL.

Dalea cahaba J. Allison is a prairie clover endemic to one set of dolomitic glades in Bibb County, Alabama. Its total distribution is over less than 400 acres. *Dalea gattingeri* (A. Heller) Barneby is endemic to limestone glades east of the Mississippi River, with ranges in Alabama, Georgia, Tennessee, Missouri, and Arkansas. Given that most *Dalea* species are restricted to areas west of the Mississippi River, and that *D. cahaba* and *D. gattingeri* occur mostly east of the river, the question of their evolutionary origin naturally arises. It is hypothesized that *D. cahaba* and *D. gattingeri* speciated from a widespread congener (hypothesized to be *D. candida* Michx. ex Willd. or *D. purpurea* Vent.) during a period of climatic change, when the widespread congener expanded its range to include the present sites of the glades, and was subsequently isolated there. All four of these species are morphologically similar to each other. The internal transcribed spacer (ITS) regions of *D. cahaba* and *D. gattingeri* were amplified and compared to published data for *D. purpurea* and *D. candida* using a Bayesian phylogenetic approach. Results indicate that *D. cahaba* and *D. gattingeri* are, in fact, directly descended from *D. purpurea*.

61 **Robert M. Shepard, Clea F. Klagstad and Dwayne Estes.** *Symphyotrichum pilosum* var. *pringlei* (Asteraceae) new to Tennessee from a unique riparian limestone glade community at Rock Island State Park. Austin Peay State University, TN.

Symphyotrichum pilosum var. *pringlei* is reported as new to the flora of Tennessee. This taxon was discovered at Rock Island State Park on the Eastern Highland Rim in Warren County. Vouchers were collected and compared to specimens at the University of Tennessee Herbarium (TENN). Maps were created to display the current and potential distribution of the species. Community ecology data and associated flora were recorded during 2010 and 2011. A review of specimens at TENN indicated that this taxon was previously collected from the same locality ca. 30 years ago and was identified as *Aster demotus*, a synonym of *S. pilosum* var. *pringlei*. This voucher was later annotated to *S. priceae* and mapped as that species in the *Atlas of Tennessee Vascular Plants* project.

Our fieldwork confirms that Rock Island plants differ from *S. priceae* in white (vs. lavender) rays and smaller heads. They differ from *S. pilosum* var. *pilosum*, another close relative, in their smooth herbage (vs. hairy), smaller heads, and presence of well developed rhizomes with basal offshoots. The population consisted of several hundred individuals from one large limestone glade adjacent to the periodically flood-scoured Caney Fork River. Notable rare vascular plant associates included *Amsonia illustris*, *Cornus obliqua*, *Dalea candida*, *Phyllanthopsis phyllanthoides*, *Spiranthes lucida*, *Ulmus thomasi*, and *Vitis rupestris* as well as undescribed species of *Clematis* and *Andropogon*. The phytogeographic significance of Rock Island is discussed along with its exceedingly rare riparian glade community that merits further study as it appears to represent an undescribed plant community.

62 **Amelia Harris, J. Hill Craddock and Joey Shaw.** A floral survey and census of *Castanea dentata* (Marsh.) Borkh. (American chestnut, Fagaceae) at Bendabout Farm, Bradley County, Tennessee. University of Tennessee at Chattanooga, TN. Bendabout Farm is a 1,486 ha privately-owned farm in Bradley County, Tennessee. It lies in the Southern Ridge and Valley physiographic province, and natural habitats include Allegheny-Cumberland Dry Oak Forest and Woodland, Appalachian Riparian System and three riparian zones. Altered habitats include pine plantation, horse pasture, agricultural fields, and man-made wetlands. The goal of this study is to inventory the flora of Bendabout Farm, with a special focus on the American chestnut. A census of American chestnut is being conducted in areas of suitable habitat. Thirty-two collection trips have been made since June 2010, with 304 species from 175 genera in 95 families. Two special concern species, *Panax quinquefolius* and *Castanea dentata*, have been documented and 40 species are non-native. Chestnut surveys using the "dead-body sweep" method were begun in August 2011. Currently, 147 hectares of the hardwood forest have been surveyed and 69 American chestnuts have been documented. This research will offer insight into the dynamic flora of an area that is currently undergoing rapid urban development. It will also enable comparisons between nearby floras and enhance our knowledge of vegetation and American chestnut distribution in the Southern Ridge and Valley.

63 **Sunny A. Hart¹, Dwayne Estes², B. E. Wofford³, Dawn York², Emily Blyveis¹, Clea Klagstad², Rob Shephard², Courtney Gorman², Aaron J. Floden³ and Joey Shaw¹.** Floristic inventory and vegetation mapping of the Ocoee River Gorge, Polk County, Tennessee. ¹University of Tennessee at Chattanooga, TN, ²Austin Peay State University, TN, ³University of Tennessee at Knoxville, TN.

The Ocoee River Gorge (ORG) lies entirely within the Cherokee National Forest and is bisected by US Hwy 64. This highway is a major east-west corridor through the southern Appalachian Mountains. During the fall of 2009, rockslides blocked US 64 and it remained closed until April, 2010. The blockage of this major corridor resulted in adverse impacts of approximately \$197 million to local economies. This resulted in new road construction being proposed to bypass this rockslide-prone area. Our research is focused on documenting the plant communities and the flora, including rare plant species populations and non-native plant species populations. During the 2010 and 2011 growing seasons, 83 trips were made to the ORG and more than 120 sites were surveyed for collecting vegetation data. Eight ecological systems were observed and we estimate between 35-45 associations. Some of these associations are rare and are tracked as G1, G2, or G3 ranked communities by NatureServe. One association, within the Appalachian Shale Barren system is potentially new to science. A geographic information system of the ecological systems was also constructed. Approximately 1000 voucher specimens representing 738 species were documented in one year of floristic study. Sixteen endangered, threatened or special concern species were documented including the rediscovery of *Agalinis plukenetii* in the state. Ninety-four non-native plant species were documented, 14 of which are listed as severe threat species. Three introduced species,

Lathyrus sylvestris, *Parthenocissus triscuspidata*, and *Scandix pecten-veneris*, are new to Tennessee.

- 64 **Clea F. Klagstad and Dwayne L. Estes.** The vascular flora and vegetation classification of the Cheatham Wildlife Management Area, Cheatham County, Tennessee. Austin Peay State University, TN.

The Cheatham Wildlife Management Area (CWMA) comprises 8,422 ha in Cheatham County, Tennessee and is owned and managed by the Tennessee Wildlife Resources Agency (TWRA). It is the second largest public land unit on the Western Highland Rim and is located in the south-central part of the county ca. 64 km west of Nashville. A total of 30 collection trips from August 2010 to December 2011 yielded an inventory of 530 species representing 103 families and 339 genera. Thus far, 156 county records have been documented, as well as 4 species with a state or federal listing, including *Helianthus eggertii*, *Hydrastis canadensis*, *Juglans cinerea*, and *Panax quinquefolius*. Numerous additional rare species have been discovered within close proximity of the refuge. Fifteen percent of the flora is introduced, of which the most problematic are *Elaeagnus umbellata* and *Lespedeza cuneata*. Analyses were performed using BONAP's Floristic Synthesis of North America software in order to understand range extensions and phytogeographic patterns. Vegetation types were classified using NatureServe and SEGAP data in order to prepare a map of the habitat types within the refuge. Noteworthy systems include the Western Highland Rim Prairie and Barrens, Central Interior Highlands and Appalachian Sinkhole and Depression Ponds, South-Central Interior/Upper Coastal Plain Flatwoods, Interior Low Plateau Seepage Fens, South Central Interior Large Floodplain, and Southern Appalachian Low-Elevation Pine communities. Conclusions from the study may be used by TWRA as baseline data for further research and management decisions.

- 65 **Sarah A. Hoopes and David Vandermast.** The effect of geographic range and seasonality on concentration of podophyllotoxin in *Podophyllum peltatum*. Elon University, NC.

This study was conducted to determine if the concentration of podophyllotoxin varies seasonally, geographically, and within the different plant tissues in *Podophyllum peltatum*. Plants were collected from six different plots: five along the Haw River in North Carolina and one in southeastern Pennsylvania. Podophyllotoxin was extracted using an aqueous extraction and separated using HPLC with previously recorded methods from Canel et al. 2001. Concentrations were compared using paired t-tests and ANOVA. Podophyllotoxin appeared to vary seasonally with the highest concentration gathered at the beginning of the season with the exception of one sample. Podophyllotoxin also varied geographically with the highest concentrations being further south but no strong correlation overall. Podophyllotoxin was extracted at the highest concentration in the leaf with no significant difference seen in the interior and exterior of the leaf. Concentrations in the leaf were higher than the in the stem. These results support the use of *Podophyllum peltatum* as a cash crop grown under specific conditions for use in cancer treatments.

- 66 **Alan S. Weakley.** Aliens: how do we define them, and which ones should we include in floras? University of North Carolina at Chapel Hill, NC.

Floras have generally treated the native flora of an area, along with alien species considered to have become a part of the flora. But the criteria of which alien species to include (and in what manner) have been dealt with in very different ways. In a world where additional aliens are ever more rapidly becoming established, how should floras deal with old waifs, persistent woody plants and long-lived perennial herbs, potential invasives with sparse documentation as naturalized, and aggressive invasives likely to enter the region soon? While floras should serve as an "early detection system" for the establishment and spread of non-natives, the additional complication of keys represents a cost to users (most of whom are unlikely to encounter exotics new to their area), so a balancing of costs and benefits is needed. Moreover, the question of which species are native or alien in a

particular area or jurisdiction (such as a state) is a surprisingly difficult one to assess, but an issue with significant conservation repercussions: is the one occurrence of species A in jurisdiction B the last remnant population of a native species driven to near-extirpation, to be coddled and favored, or is it a recently adventive alien to be despised and perhaps even suppressed?

67 **Wayne Barger and Brian Holt.** Introducing "ALNHS": Alabama's newest herbarium. Natural Heritage Section, State Lands Division, ALDCNR, AL.

Alabama's plant biodiversity is well documented. However, due to consolidation of herbarium collections, decreased funding, emphasis on molecular analysis, and lack of student/public interest, the number of repositories and plant research facilities has been shrinking. The fundamental mission of this herbarium is to offer an outlet for plant research and to become a holding site for every plant taxa in the state. Emphasis will be placed on collecting plants from Forever Wild land tracts. Current herbarium holdings, ongoing floral projects and future plans will be discussed.

68 **Alan S. Weakley.** Go find 'em: where are the undescribed vascular plants of the eastern United States? University of North Carolina at Chapel Hill, NC.

The eastern United States has been subject to many centuries of botanical exploration and taxonomic work, and one might expect that taxonomic novelties should now be becoming few and far between. However, an analysis of taxonomic novelties named in recent decades in the eastern United States suggests that many new taxa remain undiscovered and undescribed, especially habitat specialists and narrow endemics. Their discernment is in part because of a resurgence of good, old-fashioned field work and application of traditional taxonomic techniques, as well as the use of modern approaches, including DNA sequencing and phylogenetic analyses. The probability of the discovery of new taxa is not randomly distributed geographically or ecologically; the geography of new endemics is related both to inherent phylogeographic patterns, as well as the overlay of differential taxonomic effort applied to various areas and habitats. Where to go to discover a new species? Try sandhill or scrub habitats in Florida or other coastal states from North Carolina to Texas; longleaf pine savannas or embedded seepage bog, seasonally ponded wetlands, or prairies from North Carolina to Texas; sedimentary rock glades or barrens of the Interior Highlands of Arkansas (or Oklahoma or Missouri), or of the Interior Low Plateau and southern Ridge and Valley of Alabama, Georgia, and Tennessee, metamorphic glades or barrens of the Piedmont or southern Blue Ridge (of Virginia, the Carolinas, and Georgia), or seepages or fens of the Southern Appalachians (Virginia, Tennessee, North Carolina, and Georgia).

69 **Alan S. Weakley.** A progress report on the Flora of the Southeastern and Mid-Atlantic States. University of North Carolina at Chapel Hill, NC.

The first edition of a new flora covering the Southeastern and mid-Atlantic states of the United States is nearing completion. The area involved includes the states of Mississippi, Alabama, Georgia, South Carolina, North Carolina, Virginia, Maryland, Delaware, Tennessee, Kentucky, and West Virginia, the District of Columbia, and portions of New Jersey (the Coastal Plain), Florida (northern Florida and the Panhandle, excluding the peninsula), and Louisiana (the Florida parishes, east of the Mississippi River). The flora consists of approximately 7000 taxa. I will present an update on progress towards publication of the new flora, emphasizing various aspects of the work on this flora, including taxonomic philosophy, decision-making about inclusion and exclusion of alien taxa, treatment of sub-regionally adventive taxa, open access and community crowd-sourcing, construction of keys, and development of maps. Several of these topics will be discussed in greater detail in additional talks about 1) aliens and the criteria for their inclusion in floras, 2) the potential development of digital flora applications, and 3) a discussion of Where the New Species Are.

- 70 **Wayne Barger¹, Brian Holt¹, Dwayne Estes², Howard Horne³ and Daniel Spaulding⁴.** New and noteworthy records for the flora of Alabama. ¹Natural Heritage Section, State Lands Division, L-DCNR, AL, ²Austin Peay State University, TN, ³Barry A Vittor & Associates, AL, ⁴Anniston Museum of Natural History, AL.

While performing plant surveys across the state of Alabama, 56 state records and/or noteworthy taxa have been observed by the above authors. Collection information, along with a brief account of observations will be provided for some of the species that were collected.

- 71 **Lisa Kelly and Elizabeth Workman.** The vascular flora of Sampson's Landing, Robeson County, North Carolina. University of North Carolina at Pembroke, NC.

Natural area inventories inform studies of biodiversity and ecological distributions. The vascular flora of Sampson's Landing was inventoried from late May to late July 2010 and during the growing season of 2011. Sampson's Landing (16.5 ha) is located on the Lumber River in Robeson County, North Carolina. The Lumber River Conservancy acquired the site to protect the biological resources and water quality of the Lumber River, a National Wild and Scenic River. We documented ≈182 taxa in the first year, of which ≈90% were perennial, 36% were trees/shrubs, 33% forbs, and 6% were non-natives. Among the 80 families present, the five largest were Asteraceae, Cyperaceae, Poaceae, Fabaceae, and Fagaceae. A preliminary analysis indicates >40 additional taxa for the 2011 inventory. This small, but relatively diverse site supports several plant communities, including blackwater cypress--gum swamp, blackwater bottomland hardwoods, pine oak-hickory forest, pond shoreline vegetation, and open-disturbed communities. Our distribution data can direct management activities aimed at promoting the native flora.

- 72 **Alan S. Weakley.** Customized digital flora "apps": are we ready? University of North Carolina at Chapel Hill, NC.

The widespread and rapid advent of tablets, smartphones, and digital readers suggests the possibility that floras can be presented in mobile digital forms that are more practical and functional than the traditional paper flora (often well over a thousand pages and weighing in at a kilo or more). Digital devices offer a variety of potential advantages, including the flexible exclusion by the user from the keys of various groups of species: alien taxa, marginally naturalized alien taxa, taxa not known from the county, taxa not known from the state X physiographic province combination, taxa not known from the state, taxa not documented as flowering at a particular time, etc. Such choices, used smartly, would greatly simplify and enhance plant identification.

- 73 **Richard Stalter and Patrick Lynch.** Vascular flora of Delaware Water Gap National Recreation Area, New Jersey and Pennsylvania. St. Johns University, NY.

Delaware Water Gap National Recreation Area composed of over 27,200 ha, is located in northeastern Pennsylvania and northwestern New Jersey. A survey of the vascular plants was conducted from September 2003 to August 2006, and also included species identified by additional investigators. A total of 147 families, 550 genera, and 1280 species have been identified. Native to the region were 1080 species. Largest families in the flora were the Cyperaceae (123 species) Asteraceae (117 species) and Poaceae (98 species), comprising 26% of the flora. The largest genera were *Carex* (91 species), *Aster* (22 species) and *Salix* (15 species). Non-native taxa composed 23% of the park's flora. Ten habitats exist here: OSF, old upland fields, successional fields, meadows; R, ruderal, roadsides, disturbed sites, old home sites; SUF, slopes, upland forests, woodlands; LS, lowlands, swamps; LPM, lakes, ponds, marshes, bogs; RIF, river banks, islands, floodplain forests; RB, ravine banks, ravines; SOB, scrub oak barrens; C, cliffs, ridges; TS talus slopes. The greatest number of vascular plant species was observed in slopes, upland forests and woodlands, old upland fields, successional fields, meadows and

ruderal (disturbed) roadsides and old home sites. The unstable talus slopes support the fewest vascular plant species. The vascular flora at the ten sites may vary in number and kind as conditions (drought, insect damage, fire, wind-throw, succession) vary at each site from year to year. One hundred seventy three listed species of management concern exist throughout the national park.

74 **Aaron Floden.** A floristically unique and new habitat for Tennessee. University of Tennessee, TN.

Dolomite seepage fens with a unique flora are a new habitat for the state of Tennessee. This habitat is described from the lower part of the Powell River in Campbell, Claiborne, and Union Counties. The junction of two geological formations, the underlying less permeable Conasauga Group and the overlying Copper Ridge Dolomite Series creates conditions facilitating permanent seepage slopes. This habitat in Tennessee supports a flora with affinities to northern fen habitats. Though floristically limited in species number, the presence of numerous rare taxa in the state, seven taxa new to the state, a species rediscovered extant, and a taxon new to science endemic to the habitat indicates the habitat to be a significant addition to the flora to the state and to North America. Of the additional members of the flora four taxa present are Tennessee special concern and six are Tennessee endangered.

75 **Zack E. Murrell.** The future of plant systematics. Appalachian State University NC.

Evidence suggests that the oldest science, taxonomy, is eroding, resulting in a taxonomic impediment that could have significant negative consequences. Recent analyses suggest that 86% of the species on Earth have not been described. Yet if we trace the post-Linnaean history of taxonomy, we discern that the science surrounding the discovery, description and classification of new species has undergone tremendous change as technological and theoretical innovations have redefined the role of the taxonomist, with accompanying name changes for the science, from taxonomy to systematics, biosystematics and most recently phylogenetics. On the horizon we see next generation sequencing bringing enormous increases in comparative data, coupled with maturing analytical tools and a robust "tree of life" that revolutionize our view of biodiversity. Progress in biodiversity informatics is joining specimen-based resolution with remotely sensed data layers, providing novel views from bio/phylo-geographic studies. Recent strides in genomics and developmental biology show the potential for these areas of inquiry to inform our understanding of evolution and new sources of paleobiological and paleoecological data provide opportunities for more stringent dating of cladogenic events. Contrary to dire predictions, evidence from a revival within the museum community suggests that there is potential for growth. Instead of lamenting the demise of taxonomy, it is time to examine how we train the next generation of taxonomists to take advantage of available tools and innovations to move beyond traditional naming practices, to make the field of taxonomy/systematics more relevant to population biologists, ecologists and society.

76 **Emily L. Gillespie.** A molecular phylogenetics primer for 21st century taxonomy. Wake Forest University, NC.

The toolkit for taxonomists is ever-increasing. We now have the ability to produce large amounts of molecular data to complement morphological data at relatively low cost. Multiple distinct analytical approaches are available to aid our efforts to reconstruct evolutionary history using various kinds of data, and software is rapidly being developed that allow us to visualize evolutionary processes. By taking full advantage of this entire tool kit, we can now produce robust, rigorous phylogenetic hypotheses to aid our understanding of the evolution of Southeastern taxa. Here, we review these tools and discuss 'best practices' with the primary goal that taxonomists who have not used these tools in the past will begin incorporating them into future research projects, and a

secondary goal of having those already exploring their utility begin integrating the newest ideas about the best use of these tools. We will discuss DNA marker selection, options for DNA sequence alignment, the pros and cons of the major analytical approaches to tree building (Parsimony, Likelihood, and Bayesian), approaches to statistical support for each, and arguments for and against various strategies of model selection. We will also examine the available software to conduct phylogenetic analyses and their downstream applications, including a brief discussion of options for using the outputs of these programs to prepare publication-quality trees.

77 **Kevin S. Burgess.** Barcoding local floras: potential challenges and future applications. Columbus State University, GA.

Considerable effort has been focused on the performance of barcoding regions across diverse collections of land plants, medicinal floras and biodiversity hotspots. Species resolution for the *rbcl*+*matK* barcode, in particular, has been shown to plateau around 70% across a broad sampling of land plants. With the recent consensus of this two-locus DNA barcode by the Consortium for the Barcode of Life (CBOL) Plant Working Group (2009), barcoding efforts have begun to focus on building the barcode library for land plants. One of the goals of DNA barcoding is to identify species in local floras and ecological communities. Recently, we establish a barcoding database for a temperate flora of moderate taxonomic breadth based on the *rbcl*+*matK* barcode. We evaluated the performance of this combination in comparison with three other potential supplementary regions (the coding region *rpoC1* and two non-coding intergenic spacers *trnH-psbA* and *atpF-atpH*). Using *rbcl*+*matK*, were able to correctly identify 93.1% of the species sampled and found a weak relation between the number of species per genus and identification success rate. Furthermore, identification success was higher for gymnosperms, bryophytes, lycophytes and monilophytes, compared with angiosperms. Our results indicate that the *rbcl*+*matK* barcode can provide an acceptably high rate of species resolution in the context of this and other local northern temperate floras. The application of barcoding data bases to provide novel insights into plant community structure, resolve taxonomically complex groups, confirm the identity of medicinal plants, and facilitate future hypothesis testing in ecology, conservation and evolution will be discussed.

78 **Joey Shaw, Hayden Shafer and Peggy Kovach.** Chloroplast DNA sequence utility for inference of low-level or phylogeographic relationships among plants. University of Tennessee at Chattanooga, TN.

Plant researchers have used cpDNA sequences as a primary source of data for studies of plant phylogeny and phylogeography. Early work provided the this research community with a few primer pairs; therefore, a few gene regions dominated early research. Shaw et al. (2005) compared the genetic mutation accumulation rate between all previously employed noncoding cpDNA regions and showed that these different regions evolve at different, yet predictable, rates across plant lineages. An extension of this work (Shaw et al., 2007) compared the entire chloroplast genomes of three related pairs of plants (*Atropa/Nicotiana*, *Lotus/Medicago*, and *Saccharum/Oryza*) in the search for other regions that might accumulate mutations faster than those of the 2005 study. This work suggested that nine gene regions evolve quicker than any previously studied. It is these most quickly evolving regions that are of interest to systematists working at low levels or plant phylogeographers. In 2007 only three confamilial pairs of species were published on GenBank; therefore, screening the genome was limited. Presently, there are 255 published chloroplast genomes and over 20 congeneric pairs. We are comparing the sequence divergence between congeneric pairs to test the conclusions of earlier studies and to search for the fastest evolving portions of the genome. To date, we have assessed all of the noncoding portions of the small single copy region for the congeneric pairs and preliminary results suggest that the *NdhF-rpl32-trnL* region is the most variable region of this portion of the cpDNA genome. We will ultimately report on the entire genome.

- 79 **Matthew Hansen and Roland P. Roberts.** A demonstration of software packages used for data analysis in population genetics: unraveling population genetic structure and patterns of gene flow in the exotic invasive *Ailanthus altissima* along the I-95 corridor. Towson University, MD.

The boundary between the fields of phylogenetics and population genetics continues to fade. Phylogeographical investigations now bridged what used to be a chasm between the two fields of study. However, the methodologies utilized in population genetics still, at times, seem foreboding. However, application of these methodologies facilitates our understanding of both native and exotic taxa and the results inform conservation decisions. Biologists interested in population genetics have numerous software packages available for data analysis as they seek to elucidate and evaluate, allelic composition, genetic variation, gene flow and their impact on the population structure of their species of interest. In fact, multiple programs can be used to assess similar or the same population parameters. Thus, like for phylogenetic analysis, some practitioners recommend utilization of multiple methods of analyses to corroborate population substructuring and assessments of the effects of migration and gene flow among subpopulations. The combined results from such approaches can inform conservation efforts and the management of both native and exotic species. Using the ruderal, invasive tree *Ailanthus altissima* as a model, we will address issues of project design, data/marker selection, and methodological approaches discussed and illustrated through the use of multiple data analysis software packages (*Structure*, *GenAlEx*, *Genepop*) at both local and landscape scales. We will also address the biological meaning of resulting parameters and their effectiveness in helping us to understand factors influencing population distribution and substructure caused by contemporary and historical patterns of gene flow.

- 80 **Ashley B. Morris.** Plant phylogeography 2.0: innovative approaches for a stagnating field. Middle Tennessee State University, TN.

Phylogeographic researchers continue to expand the scope of the field through new experimental and analytical approaches. However, the most innovative work is largely published in animal systems, while botanical papers remain somewhat traditional in their methodologies. The rise of population genomics and the increasing sophistication of ecological niche models provide new opportunities for addressing old questions in the phylogeographic realm. Additionally, a limited number of studies have successfully used fossil-based calibration of intraspecific data sets to highlight the importance of time: not all observed phylogeographic patterns can be attributed to the Pleistocene, as is often assumed. Finally, we as botanists are missing a potentially significant piece of the phylogeographic puzzle by ignoring the soil seed bank. Many plant species are known to maintain long-term, viable, soil seed banks, but few if any publications report sampling these potential sources of genetic variation for phylogeographic studies. Traditional population genetic approaches in some plant species have shown greater genetic diversity in seeds from the soil seed bank relative to standing vegetation. Considering that the occurrence of single unusual haplotypes can strongly influence how we interpret a phylogeographic data set, the soil seed bank seems like a logical next step for advancing the field. The application of any one of these approaches in a given phylogeographic study is not necessarily novel. The inclusion of most or all of the approaches, however, could lead to some true revelations with respect to how we interpret phylogeographic patterns in plant communities.

- 81 **Jessica M. Howells and Ray S. Williams.** Effects of prior herbivory and plant genotype on aphid colonization of *Solidago altissima*. Appalachian State University, NC.

Variation of plant defenses, such as constitutive and induced levels of terpenoids and other plant adaptations, between genotypes within plant species may affect colonization of insect herbivores. To investigate this, four genotypes of *Solidago altissima* collected from

eastern Tennessee were propagated at the Appalachian State University (ASU) greenhouse and maintained in insect cages to minimize herbivory. Larvae of the leaf beetle *Trirhabda* sp. were placed on 12 plants of each genotype and allowed to feed for four days; an additional 12 plants were left undamaged as controls. In May 2011, seedlings were transferred to a randomly designed common garden at the ASU Gilley Research Station. After 10 weeks, levels of aphid abundance were visually quantified and leaves collected to determine foliar carbon and nitrogen (C:N), leaf area and water concentration, specific leaf weight, and foliar terpenes. A non-destructive estimate of plant biomass was determined to express aphid abundance/g plant biomass. Leaf area was significantly higher for plants subjected to herbivory ($p=0.001$), which could have been an adaptive response by *S. altissima*, while leaf water varied significantly between genotypes ($p<0.0001$). Specific leaf weight was significantly related to both herbivory ($p=0.017$) and genotype ($p<0.0001$). Differences in amount of foliar water and leaf area likely contributed to the variation seen in specific leaf weight. Aphid abundance/g biomass was significantly different between genotypes ($p=0.003$). These results suggest that differences in plant nutritive and chemical allocation could be a mechanism by which plant genotypic diversity impacts the abundance of colonizing insects such as aphids

82 **Megan A. Avakian and Ray S. Williams.** Effects of genotypic and environmental variation within *Solidago altissima* on associated arthropod communities. Appalachian State University, NC.

Intraspecific genetic diversity within host-plant populations is known to alter the structure of associated arthropod communities, though the mechanisms are not well understood. Furthermore, because phenotype is a function of both genotype and environment, environmental variation (e.g. elevation) between plant populations may influence insect host-plant selection. In this study populations (presumed genotypes hereafter) of *Solidago altissima* were collected from four elevations ranging from 260 - 1126 m in Tennessee. Clones of each genotype were propagated from rhizomes and grown at the Appalachian State University (ASU) greenhouse. Four genotypes from each elevation were planted in a common garden at the ASU Gilley Research Station. There were three replicate plots for each genotype/elevation combination (N =48 plots). Visual and vacuum sampling methods were used to quantify the insect community, with individuals identified to morphospecies. Plot level biomass, foliar C:N, fresh and dry weights, water content and specific leaf weight were also determined. Elevation affected certain foliar measures, including fresh weight, dry weight, and water content, with plants from a mid-elevation site (885m) having significantly higher values for these three variables. Plant genotype had a significant effect on mean aphid abundance ($p=0.0226$) and plant biomass ($p=0.0003$). To correct for differences in aboveground biomass between plots, average aphid abundance per average plot level biomass (aphids/g) was determined. Aphids/g was significantly different between genotypes ($p=0.0023$). These results suggest that aphids preferentially select host plants based primarily on genotype, though environmental variation between plant populations could play a role in structuring associated insect communities.

83 **Jacqueline M. White and Robert K. Peet.** The interactive effects of growing season flood duration and timing on bottomland hardwood tree species regeneration patterns. UNC Chapel Hill, NC.

Most large rivers in the Southeast are regulated by dams that alter the frequency, duration, and timing of floods. Because bottomland hardwood tree species' distributions are determined primarily by their tolerance to flooding, river regulation can result in shifts in composition, structure, and diversity of vegetation on the floodplain in part by inhibiting or enhancing regeneration. Previous studies have linked regeneration strategy of bottomland species to the duration and frequency of floods. However in a recent meta-analysis, Latzel et al (2011) noted only a few studies of a limited number of species that have assessed the effects of flood timing on regeneration. To investigate the spatial and temporal effect of flooding on bottomland hardwood regeneration, we biannually

monitored seedlings of bottomland tree species across floodplain gradient on the lower Roanoke River in 118 permanent plots from 2007-2011. We characterized the flooding regime each year at each plot using well data and a hydrologic model. Overall there was an interaction between flood timing and duration and regeneration patterns. Long duration floods late in the growing season were associated with reduced germination, recruitment, and survivorship. Early, long duration floods and late, short floods resulted in higher germination rates, but only later floods were followed by higher recruitment the next season. There were important difference between species, age class, and position along the floodplain gradient. These results illustrate the influence of flood timing and duration on regeneration patterns, knowledge critical for adaptive management of flows.

- 84 **Alexander K. Anning and Brian C. McCarthy.** Long-term growth response of trees to prescribed fire and thinning treatments in the mixed oak forests of southeastern Ohio. Ohio University, OH.

Tree growth analysis is necessary for a better understanding of the influence of prescribed fire and thinning on forest community structure and dynamics. However, only a few studies have focused on this subject despite the preponderance of studies on these treatments in the ecological literature. To understand the long-term effects of these management strategies in the mixed oak forests of southeastern Ohio, we analyzed tree ring widths of white oak (*Quercus Alba*), chestnut oak (*Q. prinus*), black oak (*Q. velutina*) and hickory (*Carya* spp.), spanning a 20-year period including 10 years pre-treatment (1991-2000) and 10 years post-treatment (2001-2010). The study was conducted in the mixed oak forest of Ohio and consisted of two sites with four treatments (control, thin, thin/burn, burn) each. In each stand, there were ten 20 × 50 m permanent plots. A total of 620 increment cores (two per tree, dbh ≥ 25 cm) of the four species were extracted from the two sites. Increment cores were prepared according to standard dendrochronological procedures, cross-dated and measured with the Measure J2X program at 0.01mm precision. Ring widths were converted to five-year periodic basal area increments. Results were pooled for all species and also analyzed separately for each species. Linear mixed effects models (LMM) conducted using the *Lme* function (R package "nlme) showed that post-treatment growth rates of trees were significantly increased by the thin ($P < 0.001$), thin/burn ($P = 0.0014$) and burn ($P = 0.001$) treatments relative to the control, with species varying in the growth response.

- 85 **Kyle A. Palmquist, Robert K. Peet and Alan S. Weakley.** Dramatic declines in small-scale species richness in longleaf pine (*Pinus palustris*) savannas. University of North Carolina at Chapel Hill, NC.

Until recently, longleaf pine savannas of North Carolina's Green Swamp Preserve were the most species-rich plant communities at small scales in North America. Frequent fire is essential for the maintenance of biodiversity in longleaf savannas, and many species go locally extinct after a few years of fire suppression. In the last 15 years, the fire regime in the Green Swamp Preserve has shifted from nearly annual burns for over half a century to fires every two or three years. We re-sampled permanent vegetation plots after 25 years to investigate how changes in the fire regime have impacted biodiversity over time. Species richness across all spatial scales examined (.001 - 2.5 m²) was significantly lower in 2011 compared to all other sampling years (1985-1994). In 2011, almost all plant species had become less frequent, particularly herbs, including orchids and insectivores. These declines are exceptional and represent a loss of 33% to 48% of the flora, depending on the spatial scale, suggesting that reduced fire frequency has caused local extinction and reduced species packing. However, several severe drought events have occurred since 1997, making it difficult to attribute these declines solely to changes in the fire regime. Continued monitoring is necessary to determine if the change in fire regime is responsible for these declines; if so, we recommend that nearly annual fire be returned to prevent additional species loss in one of the most famous longleaf pine savannas.

- 86 **Casey L. Carpenter.** Phylogeography of short-tailed shrews (genus *Blarina*) of southeast Tennessee. University of Tennessee – Chattanooga, TN.

Shrews of the genus *Blarina* are among the most common small mammals of the southeastern United States. Two species are found in the area surrounding Chattanooga, TN: *Blarina brevicauda*, the northern short-tailed shrew and *Blarina carolinensis*, the southern short-tailed shrew. In an effort to clarify geographic ranges of the two species in southeast Tennessee, *Blarina* vouchers were collected and mitochondrial DNA cytochrome *B* genes were isolated and sequenced. These sequences were then compared to GenBank data and phylogenetic relationships were determined for the vouchers. Results indicate *Blarina brevicauda* is found in areas north and west of the Tennessee River and *Blarina carolinensis* is found in areas south and east of the Tennessee River. Most *B. brevicauda* specimens from the study area were similar to haplotypes classified as either 'Appalachian' or 'East-Central' as defined by previous publications. *Blarina carolinensis* specimens were monophyletic, and more similar to *B. carolinensis* from Arkansas, Illinois and Louisiana rather than those from Georgia, Florida and Virginia.

- 87 **Jarvis E. Hudson.** Thirty-one years of change in a midwestern hardwood forest. University of North Carolina - Asheville, NC.

In order to observe population dynamics of trees and record changes in tree species composition in a 0.5 ha plot of hardwood forest in Indiana, density and basal area of canopy trees (those with DBH of at least 10.2 cm) were measured at intervals between 1980 and 2011 and density of saplings was monitored from 1988 to 2011. Density of saplings varied from 3093/ha in 1999 to 6667/ha in 2010, and density of canopy trees declined from 282/ha in 1980 to 248/ha in 2011. Relative density of *Acer saccharum* saplings varied between 46% in 1991 and 12% in 2011. Relative density of *Ostrya virginiana* saplings varied from 10% in 1994 to 30% in 2011 and for *Prunus serotina* saplings it varied between 8% in 1992 and 37% in 2011. From 1980 to 2011 among the 13 species represented by canopy trees relative density of *Quercus alba* declined from 27.0% to 22.6% and relative density of *Acer saccharum* increased from 31.2% to 51.6%. In the same time interval relative density of canopy oak species as a group decreased from 38.3% to 28.2%. Relative density of *Carya glabra* in the canopy varied between 15.6% in 1985 and 13.7% in 2011. In the absence of fire or other major disturbances *Quercus* and *Carya* are expected to continue to decrease in abundance and *Acer saccharum* is expected to increase.

- 88 **Matthew L. Reid¹, Davis W. Pritchett² and Joydeep Bhattacharjee¹.** Twenty-seven years of bottomland hardwood forest succession. ¹University of Louisiana at Monroe, ²University of Arkansas at Fort Smith, AR.

Our project is aimed at analyzing the status of the plant community in a bottomland hardwood forest 27 years into secondary succession. We present data on the historical plant communities from the first three years of succession and data on the current composition of the plant community. Our results indicate no significant differences in the species richness of plants during any of the years in which data were collected. In these years, species richness varied between 53 and 68 in the 32000 m² study site. However, the presence/absence data reveals that many species which were present early in succession are now absent. Currently, *Carex*, *Campsis radicans*, and *Brunnichia ovata* are found with the highest frequency in the site, at 0.99, 0.89, and 0.86, respectively. Each of these taxa was present within the first two years of succession and has since increased in frequency. Other woody species, including *Acer rubrum*, *Liquidambar styraciflua*, and *Ulmus americana* have been recruited sometime after the first three years. The herbaceous community has also experienced some changes; some annuals, such as *Iva annua*, have increased in frequency (0.05 in 1985 to 0.75 in 2011). Overall, our results indicate that although the species richness has not changed much, there has been a change in the species composition. This change is a reflection of the transition from an

open field to a more mature forest. However, data indicate continued dominance of herbaceous vegetation, which can impede the recruitment of woody seedlings through competition – yielding support for arrested succession.

- 89 **Monika B. Hayleck.** Impact of beech bark disease on epiphyte diversity and cover in high elevation beech gaps in the Great Smoky Mountains National Park. Elon University, NC.

Beech bark disease is an introduced insect-fungal pathogen complex that has been killing beech trees in Great Smoky Mountains National Park (GRSM) since 1993. Successional processes following the death of beech in GRSM are not fully understood but it is apparent that new tree species, such as red spruce (*Picea rubens*), are able to establish themselves in the diseased areas. Little is known about how epiphyte (lichens and mosses) species are impacted by beech tree mortality. This study investigated how beech mortality has impacted bark (found on the main trunk of the tree) epiphyte cover and richness in high elevation (>4,500') beech gaps in GRSM. Bark epiphytes were surveyed in diseased (high beech mortality) and non-diseased (low to no beech mortality) plots throughout the eastern region of GRSM. Various tree species, including American beech (*Fagus grandifolia*) and red spruce, were sampled using transects. Information on tree diameter at breast height, lichen color and structural form (crustose, foliose, or fruticose), and percent of trunk covered by epiphytes was collected. The results indicate that there is no correlation between tree diameter at breast height and epiphyte cover and richness. Overall, red spruce had a significantly lower average percent epiphyte cover (9.7%), lichen cover (8.2%) and richness (2.5 species) than all other tree species, including beech. In contrast, beech had significantly higher epiphyte richness than all other species. Average epiphyte cover for beech was 46.9% ($P < 0.0001$), average lichen cover was 26.9% ($P < 0.0001$), and average number of species was 3.1 ($P = 0.04$). It was observed that red spruce bark seems to peel frequently, which probably keeps epiphytes from becoming established on them. These results indicate that as red spruce becomes established in diseased beech gaps where beech is no longer the dominant species, epiphyte richness and cover could decrease.

- 90 **Lindsay D. Leverett and Claudia L. Jolls.** Defining cryptic seed heteromorphism in *Packera tomentosa* (Asteraceae) using seed mass characteristics and germination. East Carolina University, NC.

Seed heteromorphism in plants is the production of two or more seed types with dissimilar forms and behaviors. This heteromorphism is termed "cryptic" when seed types have different behaviors but similar morphologies. Although rarely documented, cryptic seed heteromorphism may be widespread, particularly in taxa with floral dimorphism. We investigated the possibility of seed heteromorphism in a North Carolina population of *Packera tomentosa* (Asteraceae), a native of shallow soils in the southeastern Coastal Plain. We compared size and germination behavior of central and peripheral seeds produced by disc and ray florets, respectively. While seed types lacked obvious morphological differences, they differed in mass and germination behavior. Central seeds were 11% heavier with nearly 80% larger embryos than peripheral seeds. Peripheral seeds allocated 17% more of total mass to the fruit coat than did central seeds. After one month of storage, central seeds showed higher germinability than peripheral seeds (75 vs. 36% germination, respectively). Central seeds also germinated faster, possibly related to thicker fruit coats. Seed types differed in response to watering frequency (every 1, 2 or 4 days), with central seeds usually showing higher and faster germination than peripheral seeds. Germinability in peripheral seeds increased following vernalization; peripheral seeds may be dormant at dispersal. Both seed types germinated faster following an aging period, suggesting an after-ripening effect. In *Packera tomentosa*, variation in germination behavior due to cryptic seed heteromorphism extends the germination period, potentially promoting establishment and persistence in unpredictable habitats.

- 91 **Eric South and William Ensign.** Life history of largescale stoneroller (*Camptostoma oligolepis*) in urban and rural streams. Kennesaw State University, GA.

The persistence of tolerant fish species in degraded stream environments reflects their adaptability. This study was a year-long investigation of the effect of watershed urbanization on the life history of *Camptostoma oligolepis* (largescale stoneroller). Life history characteristics of two separate populations of *C. oligolepis* were compared by sampling two stream systems that differ in the level of urbanization in their upstream catchments. Both stream systems have similarly sized watersheds and are located in the Etowah River drainage basin within the Piedmont ecoregion. Each stream system was sampled once a month during the spawning period and once every other month during the remainder of the year. Standard lengths, tuberculation, total weight and gonadal weight were recorded for all retained specimens. Relative urbanization was determined by estimating the percent area of impervious catchment surfaces using ArcGIS and stream temperatures recorded with continuous monitor probes. Gonadosomatic Index (GSI) values from the impacted system showed reproductively active individuals present in January. Also, GSI calculations suggested that reproductive maturity occurs at a smaller size for females and males in the less urbanized system than in the more impacted system.

- 92 **Tabitha N. Williford, Lissa M. Leege and Cassandra M. Plank.** The effects of fire and dormancy on population dynamics of endangered *Trillium persistens*. Georgia Southern University, GA.

The endangered herb, *Trillium persistens* occurs in only a ~5 mile radius near the Georgia-South Carolina border (USA), including one population in a fire-dependent ecosystem. The response of *T. persistens* to fire is not known, nor is the role of dormancy in its population dynamics. Therefore, the objectives of this study were to determine the impact of fire and the role of dormancy on *T. persistens* populations. We censused three sites in 2009-2011, including one site with a fire-dependent ecosystem, and recorded life stage, survivorship, and transition through dormancy for each individual. To determine the effect of prescribed fire, forty plots with *Trillium persistens* were established in the fire-dependent ecosystem. Half the plots were burned in February 2009. For all sites, life stage transitions of individuals from the previous season were calculated and used to build matrix models to determine the annual rate of increase of the population, λ , and predict future population dynamics. Population projections ranged from decreasing to slightly increasing, depending on site ($\lambda = 0.935 - 1.065$). 14% of all individuals went dormant after 2009, and 39% of dormant individuals re-emerged in 2011, but 59% regressed to a smaller life stage. Re-emergence from dormancy was lower for control than burn sites (10% vs. 7%), but sites did not differ in percent of plants regressing. This study indicated that an early season burn had no negative impact on *Trillium persistens* populations in the 2 years following a prescribed burn, but increased the proportion of individuals returning from dormancy.

- 93 **Stephen Hutchinson, Will deGravelles and William H. Conner.** Suppressed baldcypress growth response to artificial canopy gap creation in a North Carolina, USA swamp. Baruch Institute of Coastal Ecology and Forest Science, SC.

Baldcypress (*Taxodium distichum* [L.] Rich.) is commonly a dominant species in southeastern U.S. wetlands. However, past logging practices and changes in natural flooding patterns in many floodplain systems have resulted in a species shift towards a more water tupelo (*Nyssa aquatica* L.) dominated forest. In areas like the lower Roanoke River floodplain in eastern North Carolina, clusters of baldcypress saplings are found growing beneath a well-established water tupelo canopy. This study was designed to test whether suppressed baldcypress saplings would respond to increased light from the creation of artificial canopy gaps. Gaps were created by killing all water tupelo trees in areas where baldcypress saplings existed. Sapling diameters were monitored for three

years. A steadily significant positive growth trend was evident, with mean sapling growth in artificial gaps expanding from 2.5 cm² in year one (4 times that of control saplings) to 8.5 cm² in year three (20 times that of control saplings). Among treatment saplings, a strongly significant positive trend between growth and initial sapling diameter was evident, while such a trend among controls was non-existent. Mortality levels were similar between gap and control saplings after one year, but by year three, gap sapling mortality had declined to 4%, while control mortality increased to 16%. It is clear that long suppressed baldcypress are able to respond vigorously to an increase in light with decreased mortality and increased growth. This has important implications for wetlands requiring restoration or for baldcypress management within the framework of two-age or uneven-aged silvicultural systems.

- 94 **Ariel Firebaugh¹, Jonathan Walter² and Kyle Haynes².** *Lymantria* disperse! Using forest fragmentation and host quality to describe male gypsy moth densities at the local and regional levels. ¹Roanoke College, VA, ²University of Virginia, VA.

Populations are vulnerable to a suite of fitness penalties (Allee effects) at low densities. For the exotic gypsy moth (*Lymantria dispar*), male moth density is strongly correlated with mating success and may anticipate future outbreaks. We evaluated the strength of forest fragmentation and host quality as predictors of male gypsy moth densities at both the local and regional levels. We captured male moths in forests and mid-successional fields at Blandy Experimental Farm in Clarke County, VA using pheromone-baited traps. Plots were characterized in terms of forest fragmentation (distance to and area of nearest forest patch) and host quality (basal area of preferred hosts). Both forest fragmentation ($p = 0.917$, $r^2 = 0.2$) and host quality ($p = 0.096$, $r^2 = 0.39$) were poor predictors of moth capture at the local level. In a GIS-based study at the regional level, we delineated three discrete zones along the invasion front based on national trap capture data. Both forest fragmentation ($r^2 = 0.73$) and host basal area ($r^2 = 0.75$) were strong predictors of moth abundance in high-density populations (10-30 moths) well behind the invasion front. These findings suggest a complex, scale-dependent relationship between Allee effect strength, host quality, and forest fragmentation. The control of problem populations can be resource-intensive. Using landscape features (at the appropriate scale) to identify vulnerable populations may enhance management programs for the gypsy moth and other insect pests.

- 95 **Patrick T. Ma, David Vandermast and Ryan Kirk.** Land-use history and the composition and structure of Elon University forest, a successional hardwood forest in the North Carolina piedmont. Elon University, NC.

Elon University Forest (EUF) is a 22.5 ha forest preserve on a former farmstead in the central Piedmont of North Carolina. During the summer of 2011 it was sampled via CVS-style permanent plots and prism cruising to quantify total basal area, species richness, relative abundance, and diversity. Additionally, ESRI ArcGIS 3.1 software was used to track land cover changes from aerial photographs dating to 1950. Results of this effort indicate that EUF is a mixture of forest patches of widely varying age and structure. Virginia pine (*Pinus virginiana*) dominates areas most recently in cultivation (as recently as the 1970s) and early-successional trees are most abundant throughout the forest. However, EUF also contains mature mixed hardwood forests with an average basal area of 36.1 m²/ha. On an east-facing slope, a patch of large, old oak trees, approximately 6 ha in area, has a structure consistent with that of an old-growth forest and may represent a "forest of continuity". Like old-growth forests (and unlike the younger forests that surround them), this patch has trees that are large and old (in excess of 200 years) for their species, tip-mound topography and standing dead trees. Forests of continuity (FOC) are often relatively small patches of old-growth-type forests typically found on sites that were not desirable for agriculture and that, while perhaps utilized by farmers for firewood collection or grazing, were never clearcut. FOCs represent an under-recognized and

under-utilized ecological resource in a human-dominated landscape such as the North Carolina Piedmont.

- 96 **Kileigh D. Browning and David B. Vandermast.** An interaction between the European wild boar (*Sus scrofa*) and beech bark disease in the high elevation beech gaps of Great Smoky Mountains National Park. Elon University, NC.

The interaction between non-native species is a concept that has not been thoroughly explored in the field of ecology. Throughout the past century, high elevation beech forests (>4500 ft) of Great Smoky Mountains National Park have been affected by both European wild boars (*Sus scrofa*) and Beech Bark Disease (BBD: a non-native insect-fungal pathogen complex killing mature beech trees (*Fagus grandifolia*)). Without mature beech trees composing the forest canopy, a dense shrub layer develops which limits boar rooting. This study examined the effect of BBD on boar rooting in beech gaps. Data were collected in 11 plots within beech-dominated forests. Estimates of tree and shrub coverage were made for each stratum (canopy, shrub, herb) at each plot. Furthermore, species identified by Bratton (1974) as threatened by boar rooting were re-evaluated using data collected in 2008. Our results indicate that BBD-caused mortality of beech trees and the consequent growth of a dense shrub layer significantly reduced hog rooting in beech gaps ($R^2 = 0.31$). We found that herbs are affected by both hogs and by the dense shrub cover that follows BBD-caused overstory beech mortality. However, results also indicate that some species proposed by Bratton to be endangered by hog rooting such as *Carex sp.*, *Viola sp.*, and *Trillium erectum* have increased in frequency, possibly due to their "protection" in the dense shrub layer. Our study represents a unique attempt to understand the interactions between two non-native species (European wild boars and BBD) in a unique ecosystem.

- 97 **Paul H. Scott and Richard E. Baird.** An ecological comparison of anamorphic Ascomycota taxa within the *Pestalotia* complex of the southeastern United States. Mississippi State University, MS.

Recent interest in the *Pestalotia* complex, within the Xylariales has been stimulated by the discovery that several species of *Pestalotiopsis* can produce the important chemotherapy drug Taxol as a secondary metabolite. In the Southeastern United States, *Pestalotiopsis microspora* growing on *Taxodium distichum* can produce Taxol but is also associated with the decline of the endangered tree *Torreya taxifolia*. The pharmaceutical importance has lead to further evaluation and discovery of these taxa of fungi on a broader ecological scale as endophytes, saprophytes or parasites on a wide variety of plants (eg. lichens) and macrofungi. These include *Pestalotia*, *Monochaetia*, *Seiridium*, *Pestalotiopsis* and *Truncatella*. Eighty five species have been reported in the Southeastern United States. Unfortunately, many of these species originally thought to be distinct based on occurrences on different hosts are now being shown to be the same. Preliminary ITS molecular data supports the concern that traditional taxonomic determinations based on host species are possibly incorrect. Therefore, a taxonomic study was conducted using herbarium and live specimens from the southeast region. This research was preceded by a thorough type study for the species from the region using traditional morphological investigations. The results from this ecological portion of the study will be presented comparing several examples of *Pestalotia* complex taxa based on host comparisons, preliminary ITS and morphological data.

- 98 **Danny J. Gustafson¹, John Synovec¹, Dewitt Jones¹, Charles Major¹, David J. Gibson² and Sara G. Baer².** *Chamaecrista fasciculata*, *Silphium integrifolium*, and *Sorghastrum nutans* show divergence in genetic structure when grown in a background of wild collected versus cultivars of the dominant grasses. ¹The Citadel, SC, ²Southern Illinois University, IL.

There is a long running debate regarding the appropriateness of using grass cultivars that have been selected for traits or wild collected seed to restoring or augment native

grasslands. A field study was established in March 2006 to test whether differences within multiple dominant species widely used in community re-assembly acts as a filter on community assembly and scales to affect ecosystem function in restored tallgrass prairie. This experimental design contained replicated experimental community assemblages that differ in wild collected or cultivar sources of the dominant grasses (*Andropogon gerardii*, *Sorghastrum nutans*, and *Panicum virgatum*). Two years following establishment we used this experiment to determine whether population source of the dominant grasses affects the genetic structure of subordinate species. Inter-simple sequence repeats (ISSR) DNA markers were used to characterize differences in population genetic structure of two subordinate forbs (*Chamaecrista fasciculata*, *Silphium integrifolium*) and one dominant grass (*Sorghastrum nutans*) growing in the matrix of wild collected or cultivars of the dominant prairie grasses. Multiple response permutation procedure (MRPP) analysis indicated differences between *C. fasciculata* ($T=-3.13$, $A=0.05$, $P=0.01$) and *S. integrifolium* ($T=-2.55$, $A=0.01$, $P=0.01$) growing with cultivar grasses versus with wild collected grasses. There was a difference between *S. nutans* wild collected and the 'Rumsey' cultivar that was planted ($T=-1.86$, $A=0.004$, $P=0.05$). Genetic differences in subordinate species as a function of dominant species source may reflect genetic sorting in these developing tallgrass communities.

99 **Courtney B. Mandeville.** A comparison of total nitrogen and water quality recommendations for the Cache River basin. Guilford College, NC.

The USEPA has strongly encouraged states to define nutrient criteria for inland water ways and has released guides for recommended nutrient levels. This study examines total nitrogen (TN) levels in the Cache River Basin in Northeastern Arkansas and compares the findings to both, others areas of the country and to the EPA recommended nutrient levels. We found that nutrient levels in the Cache River Basin are similar to those observed by the USEPA for the entire ecoregion with a similar 25th percentile value and with 75% of sites exceeding the TN recommended criteria of 0.86mg/L. The methods of using the 25th percentile to determine the recommended value automatically puts 75% of the observed values above the 0.86mg/L recommended level. Though there were a large number of sites were above the recommended value, TN at those sites was lower than observed TN in other river basins with equal densities of agriculture.

100 **Diane De Steven¹ and Joel M. Gramling².** Conservation effects of wetland restoration practices in the southeastern wetlands reserve program. ¹U.S. Forest Service Southern Research Station, ²The Citadel, SC.

Wetland degradation causes loss of ecosystem services such as water storage, water-quality improvement, and habitat support. The Wetlands Reserve Program (WRP) offers financial incentives to restore converted or degraded wetlands on working lands; however, the nature and outcomes of these restorations in the Southeast are largely unstudied. Because ecological functions differ among wetland hydrogeomorphic (HGM) types, knowledge of wetland types is a necessary foundation for identifying the possible trade-offs in ecosystem services that may result from program implementations. We characterized >100 WRP projects in the Piedmont and Coastal Plains of South Carolina, Georgia, and Mississippi to identify the wetland types restored and to assess how choice of restoration practices influenced functional outcomes. The projects encompassed diverse wetland types including depressions, flats, low-order riverine headwaters, and large-river floodplains. Pre-restoration habitats varied from agricultural sites to drained vegetated wetlands and timber-harvested bottomlands. Hydrology-restoration methods interacted with wetland type and prior habitat to yield different functional outcomes. Restoration of depressions and flats generally favored original hydrodynamic functions. Restoration of low-order riverine sites and prior-agriculture floodplains tended to alter hydrodynamics in favor of water retention and managed impoundments for waterbirds, at probable trade-offs with some natural riverine functions. Conversely, restoration of timber-harvested floodplains favored the removal of barriers to hydrologic and biotic connectivity.

Rapid field surveys suggested that most restorations achieved positive indicators of functional wetland conditions.

- 101 **Ruel Michelin¹, Cynthia Johnson², Wolfgang Leitner³, Lafayette Frederick⁴, Imad Shureiqi⁵, Joseph Whittaker² and Mary-Lou Gutierrez¹.** Effects of climate change on *Aspergillus* species and consequences for agriculture and human health: a meta-analysis. ¹Walden University, ²IUHS School of Medicine, ³Morgan State University, MD, ⁴NCI/NIH3 Tuskegee University, ⁵MD Anderson Cancer Clinic University of Texas, TX.

Climate change has been implicated in influencing environmental biodiversity, parasitic disease and vector dispersal, and the change in insect habitats. However, its influence on microbial species and their response to varying environmental pressures is apparently still lacking rigorous examination. Issues such as genus or species response, that could initiate the fermentation of novel microbial metabolites is certainly deserving of more extensive examination. Species survival is also an important component that could benefit from further in-depth investigation. Examples from published studies were selected from both human and plant applications. This study examined the influence of climatic change on *Aspergillus* species and investigated how these factors have influenced survival and disease causing capacity. Information regarding the impact of climate change was obtained through meta-analysis of secondary data which was employed to determine and present evidence on the true effect of this phenomenon on *Aspergillus* species. The analysis clearly implicates climate change as important in the complex yet challenging situation regarding microbial life and the biological changes that have been uncovered. While the issue is a reflection of extremely complex set of events affecting ecosystems and various life forms, it clearly implicates climate change as an issue of serious environmental concern. We hope that the results will encourage and influence even more extensive research into the impact of climate change and importantly the biological response now seen in species of *Aspergillus* and other genus such as *Fusarium* and *Penicillium*. Such studies could unearth invaluable scientific information.

- 102 **Jane L. Guentzel and Julie W. Murphy.** Mercury concentrations in surface water, sediments and water hyacinth (*Eichhornia crassipes*) from a South Carolina coastal plain river. Coastal Carolina University, SC.

Mercury exists in many different physical and chemical forms in the environment and it is the interconversions between these species that mediate its distribution patterns and biogeochemical cycling. The most widely known conversion is the biological transformation of inorganic Hg (II) to methyl Hg and its subsequent biomagnification in piscivorous fish, which poses a risk to higher trophic level organisms and humans who consume these fish. The discovery of high levels of Hg (>0.25 ppm) in fish from water bodies in South Carolina (SC) has resulted in the issuance of many fish consumption advisories throughout the state. Some of the highest fish tissue concentrations have been found in unregulated blackwater rivers in the Southeastern Plain and the Middle Atlantic Coastal Plain ecoregions. The Waccamaw River is a blackwater river located along the eastern coastline of South Carolina. Large areas of the shoreline contain floating mats of water hyacinths during the warmer months. These mats can block light and oxygen penetration thus creating low to no oxygen environments in the surface waters that are conducive to the formation of methyl Hg. The purpose of this study was to quantify the chemical and biological parameters of the water column and sediments near and under these mats that may promote the formation of methyl Hg and to quantify the amount of total and methyl Hg in these plants as they mature.

- 103 **Maynard H. Schaus¹, Wanda W. Morris¹ and Ken C. Mattes².** Nutrient uptake by mangroves adjacent to a wastewater treatment plant on Ambergris Caye, Belize. ¹Virginia Wesleyan College, ²Belize Marine TREC.

The town of San Pedro, Ambergris Caye, Belize utilizes a series of three treatment lagoons to treat a substantial portion of its municipal sewage. This wastewater treatment process has a mean retention time of 10 days before the effluent is discharged into the mangroves on the leeward side of the island. We examined the horizontal transport of nutrients by sampling the leaves of four species of mangroves at varying distances from the treatment lagoons during Jan 2009- Dec. 2011. Leaf samples were analyzed for %C, %N, %P, and %S, for isotopic composition ($\delta^{13}\text{C}$, $\delta^{15}\text{N}$ and $\delta^{34}\text{S}$) and elemental ratios (C:N:P). Leaf samples on the treatment site were higher in %N and %P and had lower C:N and C:P ratios, relative to mangrove leaves from control sites and from other sites >250m from the treatment lagoons. This indicates that mangroves near the treatment site are able to take up the vast majority of the N and P released from the site, whereas mangroves further away show strong evidence of nutrient limitation. This is also reflected in the typical plant height, as plant height declines with increasing distance from the treatment facility. Recent urban development and the dredging of a canal near the treatment plant could short circuit the treatment process and potentially impact the effectiveness of nutrient uptake by mangroves. However, our data indicate that at the present time nutrients do not travel to the end of the canal and into the lagoon.

- 104 **Jamie A. Duberstein¹, Ken W. Krauss² and William H. Conner¹**. Site salinity affects fertility and forest structure in coastal swamp forests. ¹Baruch Institute, Clemson University, SC, ²National Wetlands Research Center, U.S. Geological Survey.

Changes in community structure occurring in estuarine and near-estuarine environments have been reported for many states in the southeastern United States, with active conversion of coastal swamp forest to oligohaline marsh occurring at mean annual salinities of approximately 2.0 ppt. We monitored incremental growth (in basal area) of codominant baldcypress (*Taxodium distichum*) trees, water levels, and interstitial salinity at each site monthly between August 2004 - July 2007, to examine the inter-relationships among tree height, growth, site fertility, and soil physico-chemical characteristics. We found that forest height and growth are logistically related to site salinity; sites with interstitial salinities less than 0.7 ppt had basal areas as high as 87 square m/ha, whereas sites with salinity concentrations of 1.3 ppt or greater supported a basal area of less than 40 square m/ha. Stand height was also negatively affected by higher salinity. Though a variety of hydrologic and edaphic characteristics were analyzed, salinity related only to soil TN concentrations or to the relative balance between soil TN and total phosphorus (TP), which reached a maximum concentration between 1.2 and 2.0 ppt salinity. Persistent drought conditions prevailed at most sites subsequent to 2007, and we discuss how salinity and forest structure has responded since 2007. We also discuss our expanded scope, which includes re-measurement of soil physio-chemical characteristics in coastal swamps, as well as neighboring oligohaline marshes.

- 105 **Rachel H. Ruttley**. Spatial ecology of preimaginal black flies (Diptera: Simuliidae) in the *Simulium jenningsi* species group. University of South Alabama, AL.

The family Simuliidae is currently one of the most well-known taxonomic groups of aquatic insects at the species level. The *Simulium jenningsi* species group is ecologically unrivaled among simuliids of the southeastern United States and is an excellent candidate for creating a model. It exists in abundant numbers in diverse habitats. The goals of this study are to determine how species richness and distribution of larval black flies varies over large geographic landscapes and ecoregions and whether species richness and distribution can be predicted by stream variables and landscape features. Data obtained from field specimens will be used to create a GIS model of species richness and distribution of the *Jenningsi* species group. GIS (Geographic Information Systems) technologies are enabling scientists to analyze spatially extensive communities, gain insights on genetic diversity and population dynamics, and also for modeling geographical

distances of organisms. Accordingly, data from this study will also aid in the identification of morphological features that could separate adult sibling (cryptic) species. Over 130 sites from Texas, Louisiana, Mississippi, Alabama, Florida and Arkansas have been sampled for all members of the *Simulium jenningsi* group. The methodology for field collections is in accordance with McCreddie and Adler (1998). All samples have been sent to Dr. Peter Adler at Clemson University for genetic analysis.

- 106 **Jackie C. Guzy, Steven J. Price and Michael E. Dorcas.** An assessment of the spatial configuration of greenspace: factors influencing semi-aquatic turtle occupancy in a suburban landscape. Davidson College, NC.

Within urban areas, the importance of greenspaces for supporting wildlife has been widely investigated for some groups of species, but studies of reptiles have generally been neglected. To assess the importance of the amount, spatial distribution, and composition of greenspaces, we examined semi-aquatic turtle species richness in urban areas. In this study, we sampled turtles from 2010-2011 at 20 suburban ponds classified as rural, urban, or golf. We used a hierarchical Bayesian species-richness model to estimate species richness and species-specific responses to four landscape measurements of greenspace, generated in FRAGSTATS (Euclidean nearest neighbor, interspersions juxtaposition index, percent of landscape, and connectance). We found that occupancy of four species, *Kinosternon subrubrum*, *Trachemys scripta*, *Chelydra serpentina*, and *Pseudemys concinna* increased substantially with an increase in connectance of greenspace within 500 m of each pond. On golf courses, the occupancy of *Sternotherus odoratus* increased with an increase in the percent of landscape comprised of ponds and also when ponds were closer together. We found no effects of pond type (rural, urban, or golf) on turtle occupancy or estimated species richness. Our results indicate that in suburban areas, semi-aquatic turtles benefit from increased connectivity of greenspace. As landcover becomes increasingly urbanized, it is important to understand mechanisms which promote biodiversity and conservation in these systems.

- 107 **April L. Conway, Sonia M. Hernandez and John P. Carroll.** Camera trapping the pygmy hippopotamus (*Choeropsis liberiensis*) on Tiwai Island, Sierra Leone. University of Georgia, GA.

Techniques for monitoring rare or cryptic species have developed rapidly since the introduction of remote monitoring devices. The pygmy hippopotamus *Choeropsis liberiensis* is an endangered species endemic to the Upper Guinea Forests of West Africa. There are challenges to studying pygmy hippos in the field; they are solitary, nocturnal and *In situ* ecological data is scarce. The objective of this study was to develop and implement a camera trap study of pygmy hippos on and around Tiwai Island, Sierra Leone. During 2008-2011, we conducted repeated surveys with near-infrared motion detecting cameras. Cameras were placed randomly within a grid system on multiple islands on the Moa River (total 3,211 trap nights). Hippos were detected 28 times on camera within the survey periods. However, when assessing locations for pit traps and platforms, pygmy hippos were detected an additional 49 occasions. Along with pygmy hippos, we recorded other rare and threatened species, some never before documented in this area. Results from this study will aid in describing activity patterns, determining occupancy, and designing future camera trap studies. This basic data on pygmy hippopotamus life history can lead to improved conservation planning.

- 108 **Sam R. Watkins, Erin M. Coughlin and Martin L. Cipollini.** Trapping and monitoring ambrosia beetles for the implementation of integrated pest management in Georgia chestnut orchards. Berry College, GA.

Within the past two growing seasons, stem-boring Ambrosia beetles (Coleoptera: Scolytidae) have become an unpredictable and highly damaging pest in Georgia chestnut (*Castanea* spp.) orchards. Ambrosia beetles are generally active from early spring to fall, and peak in their activity at the beginning of the period. Very little is known, however,

about the exact species and patterns of attack in the state of GA. Often, once chestnut trees are attacked they die, especially in the case of attacks on young trees by the non-native Granulate ambrosia beetle (*Xylosandrus crassiusculus*). Monitoring programs are essential for understanding regional species, and their life cycles and patterns of attack. Preliminary monitoring took place at Berry College (GA) in a 4 yr old chestnut orchard associated with The American Chestnut Foundation (TACF). Following an infestation of dozens of trees in April 2011, infested trees were removed and destroyed, and ethanol-baited traps were used to capture beetles on a weekly basis through August 2011. Data from this monitoring period indicated a variable but constant presence of Ambrosia beetles across the season, declining from a peak in May (just after the initial tree infestation). No additional infested trees were observed during this monitoring period. We will also report on a second monitoring period from January 2012 through March 2012. This latter monitoring period will provide more information on early season patterns of attack and will help inform a pest management strategy designed to prevent attacks while minimizing insecticide use.

- 109 **Alicia M. Garcia.** Assessing the effect of restoration on phenological progression and reproductive success of the rare Georgia rockress (*Arabis georgiana* Harper). Columbus State University, Ga.

Understanding the effects of restoration efforts on the phenological progression and reproductive success of rare plants can help land managers more efficiently navigate conservation challenges. *Arabis georgiana* Harper (Georgia Rockress) is a rare, short-lived perennial endemic to Georgia and Alabama. To date, *A. georgiana* exists in 17 populations that range in size from 15 to 1000 plants. Due to habitat degradation attempts have been made to augment remaining populations with plants grown *Ex situ* from seeds collected at home sites. To evaluate the efficacy of these restoration efforts, we investigated a series of phenological and reproductive traits between three native and three restored plots within the largest known population of *A. georgiana*. We also assessed each plot for nine soil attributes as possible sources of variation. Although results indicate only marginal delays in phenological progression (the timing of flowering and fruit dehiscence), traits associated with reproductive success (plant size, fruit production, and seed output) were significantly lower in plots comprised of restored plants compared to their native cohorts. In restored plots, plants were on average, 2.7 and 10.8 days later to flower and dehisce seeds, respectively. Furthermore, restored plants were 9.3 % shorter, produced 44% less fruit and had 14.4% fewer seeds compared to native plants. These results not only provide a valuable assessment of the reproductive biology of this rare plant species, but also contribute to the future management of remaining *A. georgiana* populations where genetic bottlenecks due to *Ex situ* restoration efforts may negatively impact persistence.

- 110 **Jennifer M. Torgerson and Laura E. DeWald.** Genetic variation in *Hydrastis canadensis* populations in western North Carolina. Western Carolina University, NC.

Goldenseal (*Hydrastis canadensis* L.) has a patchy distribution throughout eastern deciduous forests. The small, dense and highly isolated patches are becoming more rare and smaller in size due to habitat loss and over-harvesting for the herbal market. These population declines could be affecting the integrity of patches where genetic diversity is likely already low due to clonal reproduction by the species via rhizomes. However, knowledge of amount and distribution of genetic diversity within versus between patches is unknown. In addition, relationships between alkaloid production (medicinal product of interest) and genetic versus environmental controls are also unknown. Knowledge of genetic diversity patterns is important for the development of management strategies to effectively conserve goldenseal, and for the development of harvesting and breeding strategies that minimize impacts on natural populations while maximizing products useful to growers. The objective of our research was to quantify genetic variation and alkaloid

concentration among and within six natural populations of goldenseal located within the Pisgah and Nantahala National Forests, and on private land in western North Carolina. Preliminary results showed high genetic variation within populations indicating that sexual reproduction is creating within-population genetic diversity in this clonal species. Results of a common garden showed there was genetic variation among populations in adaptive traits such as spring emergence and fall dormancy. This suggests plants and/or seeds should not be moved into different populations to ensure the genetic integrity of natural populations is protected. More comprehensive results will be available in the spring of 2012.

- 111 **Jill E. Bourdon.** Location and simulated harvest/disturbance on the medicinal herb *Chamaelirium luteum* L. Western Carolina University, NC.

Recently, there has been concern about the sustainability of wild-harvested medicinal plants such as fairy wand, *Chamaelirium luteum*. Not just important to the herbal medicine market, *C. luteum* also adds to biodiversity of the forest understory in the western North Carolina region. Harvesting individual plants can change population structure, reduce flowering and seed set, and potentially reduce population size to under the threshold of viability. There are no cultivated sources of *C. luteum* for the medicinal market. My research asked: Does shade exacerbate, and open canopy ameliorate, harvest effects? Does harvesting decrease plant growth, flowering and seed set, and pollinator activity? In a field experiment, eight plots were established in a split-split plot design with canopy openness as the upper level (plot) factor and simulated harvest as the sub-plot factor, further split into fall and spring harvest. Plant survival did not differ between harvest times. The odds that a plant survived did not differ between plots beneath closed vs. open canopy or between disturbed and undisturbed plots. Neither flowering nor plant growth differed with canopy condition or plot disturbance. Animal activity and drought likely affected survival, flowering and seed set. While this experiment provides baseline information, the sustainability of wild-harvested *Chamaelirium luteum* needs to be further investigated.

- 112 **Rebecca A. Cook¹ and Patricia D. Parr².** Long term monitoring of a population of *Delphinium exaltatum* Ait.: observed trends and future plans. ¹University of Memphis Lambuth Campus, TN, ²Oak Ridge National Laboratory, TN.

Monitoring of a population of *Delphinium exaltatum* Ait. (tall larkspur) was begun in 1985 at Oak Ridge National Laboratory. Permanent plots (100) were established on a grid 0.25 km² in area. Plots were identified as one of five habitat types. All individuals in a plot were classified as juvenile, immature or adult and the total number in each class was recorded. Plots were revisited annually, excluding 1992, 1996 and 2007, with individuals being classified and counted. Total individuals in the permanent plots varied from a high of 299 in 1990 to a low of 40 in 1988 with an average of 116. In addition to changes in size, the study also considers the effects of habitat maintenance on the population. The habitat was maintained by mowing from 1989 to 2010. In 2011 maintenance by a fire regime was initiated.

- 113 **Jane L. Guentzel, Jennifer L. Aldershoff, Julie W. Murphy and Samuel H. DeMint.** Mercury concentrations in loggerhead shrike (*Lanius ludovicianus*) feathers from South Carolina. Coastal Carolina University, SC.

The increased anthropogenic usage and mobilization of mercury in the environment poses a toxicological risk to fish and wildlife. Many studies concerning the fate and transport of mercury in the environment have focused on aquatic species and seabirds, but there is growing interest in mercury cycling and bioaccumulation in terrestrial ecosystems. Loggerhead Shrikes are predatory songbirds that breed in grasslands and shrub-steppe areas. These birds feed on grasshoppers, small lizards, snakes, rodents, and other small birds. Loggerhead shrike populations have experienced significant declines throughout their North American breeding range and are listed as a U.S. Fish and Wildlife Service migratory bird of conservation concern in the northeast. A previous study by deMent et al.,

2008 reports that Loggerhead Shrikes in South Carolina are non-migratory residents. Outer rectrices were collected from 29 Loggerhead Shrikes throughout 5 counties in South Carolina from 2005-2010 (U.S. Dept of Interior banding permit # 22771). The counties are located in the Piedmont Ecoregion (Abbeville), Southeastern Plain Ecoregion (Calhoun, Clarendon, Lexington) and Middle Atlantic Coastal Plain Ecoregion (Williamsburg). A recent aquatic ecosystem study by Glover et al., 2010 reported that the highest freshwater fish tissue Hg concentrations have been found in the Southeastern Plain and the Middle Atlantic Coastal Plain Ecoregions, with lower fish Hg concentrations found in the Piedmont Ecoregion. The objective of this study is to determine levels of total Hg in outer rectrices from these birds and to examine how the mercury levels in these non-migratory terrestrial birds may vary with ecoregion.

114 **Anthony W. Willsea and Timothy O. Menzel.** The relationship between soil characteristics and presence or absence of *Echinacea laevigata* (smooth coneflower) along roadsides in the Tugaloo Basin. Piedmont College, GA.

Echinacea laevigata Blake, or smooth coneflower, was listed federally as an endangered species in 1992. Wild populations are found in open woods or human maintained clearings which would include roadsides and utility right of ways. They are typically associated with calcium and magnesium rich soils that are often shallow and have poor moisture retention. Wild populations in Georgia are in decline due to natural succession, habitat fragmentation, habitat destruction, and a lack of naturally occurring fires. This research was designed to determine if there is an association between soil characteristics and occurrence of *Echinacea laevigata* along roadsides in the Tugaloo Basin. Soil samples were collected from sites along roadsides with known populations and from arbitrarily selected sites without *Echinacea laevigata* along the same roadsides. Multiple response permutation procedure (MRPP) found a non-random relationship between soil characteristics and the occurrence of *E. laevigata*. Ordination demonstrated that soil at locations with *Echinacea laevigata* had lower pH, higher base saturation and CEC, and higher levels of Mg and Ca. The ordination also showed higher levels Fe associated with sites not containing *Echinacea laevigata*.

115 **Claudia L. Jolls¹, Julie E. Marik¹, Kayri Havens², Pati Vitt², A. K. McEachern³ and Darcy Kind⁴.** An adventive biocontrol weevil, *Larinus planus*, and other emerging threats to populations of the federally threatened pitcher's thistle, *Cirsium pitcheri*. ¹East Carolina University, NC, ²Chicago Botanic Garden, IL, ³US Geological Survey, ⁴Wisconsin Department of Natural Resources, WI.

Cirsium pitcheri, Pitcher's thistle, is a federally threatened monocarpic perennial of the open dunes and shorelines of the upper Great Lakes. This taxon lacks vegetative reproduction; seed and seedling success are critical for population persistence. *Larinus planus* Frabicius (Curculionidae), is a seed-eating weevil that adventively appeared in the US and was later distributed for the control of noxious thistle species of rangeland. We report the first detection of this weevil in *Cirsium pitcheri*, in Wisconsin. We assayed weevil damage in a natural population of Pitcher's thistle at Whitefish Dunes State Park, Door County and estimated the reduction of fecundity. We then estimated impact of this weevil on natural, uninvaded populations of Pitcher's thistle for which we have long-term demographic monitoring for 14 yr (Wilderness State Park, Emmet County, MI) and 21 yr (Miller High Dunes, Indiana National Lakeshore, Porter County, IN). We used transition matrices to determine growth rates (λ) and the effects of weevil damage and reductions in fecundity from other seed predators, inbreeding and natural succession on thistle populations. Weevil seed predation reduced population growth rates by 11-12%, enough to increase the 5% risk of extinction from 24 yr to 13 yr and 8 yr to 5 yr in the MI and IN population, respectively. This impact is particularly severe, given most populations of Pitcher's thistle hover near or below replacement. This is yet another cautionary tale reporting unanticipated ecological impacts from a biocontrol agent and the first such report for *Cirsium pitcheri*.

- 116 **Steven J. Price¹, Robert A. Browne² and Michael E. Dorcas¹**. Resistance and resilience of a stream salamander to supra-seasonal drought. ¹Davidson College, NC, ²Wake Forest University, NC.

Drought represents a significant stressor to aquatic animals, yet empirical data on population response to drought is limited. The Southeastern USA experienced a supra-seasonal drought in 2007-2008, which provided an opportunity to examine the resistance and resilience of salamanders to drought. We used 5 years of presence-absence data at 17 first-order streams and 61 months of mark-recapture data at one stream to examine the effects of drought on occupancy and vital rates of the salamander *Desmognathus fuscus* (Northern Dusky Salamander). We tested three hypotheses regarding the effects of drought: i) larvae would decrease in occupancy during drought conditions, but adult occupancy would remain stable and ii) adult temporary emigration rates would be greater during severe drought conditions and iii) adult survivorship would be equal or nearly equal during non-drought conditions and drought conditions due to temporary emigration. We found that adult salamander occupancy remained stable through the five years of sampling, however larval salamander occupancy decreased by 30% during the supra-seasonal drought. We found that adult temporary emigration probabilities were twice as high during supra-seasonal drought conditions than during non-drought or typical drought conditions. Monthly survival of adults was relatively high during non-drought ($S = 0.89 \pm 0.02$), typical drought ($S = 0.97 \pm 0.02$), and severe drought conditions ($S = 0.90 \pm 0.01$). Our findings suggest that high survivorship of adult *D. fuscus* likely buffers the negative effects of drought on larvae and high rates of temporary emigration allow adult salamanders to be resilient to supra-seasonal drought conditions.

- 117 **Elizabeth E. Hieb, Thomas G. Jackson, David H. Nelson and Ashley B. Morris**. A population genetic analysis of the Alabama red-bellied turtle (*Pseudemys alabamensis* Baur). University of South Alabama, AL.

The federally endangered Alabama red-bellied turtle (ARBT; *Pseudemys alabamensis* Baur) occurs in an isolated range in southern Alabama and Mississippi. Little is currently known about the population structure of the ARBT, and no genetic analyses on the reproductive ecology of this species currently exist in the literature. Several distinct nesting populations are known to occur across the species range. Here we identify eight microsatellite markers to be used for a genetic comparison of members of these populations. Previously isolated microsatellite loci in the related species *Pseudemys floridana* amplified cleanly from DNA extracted from ARBT tissue samples. Alleles at all eight loci were polymorphic with the total number of alleles at each locus ranging from 2 to 11. Microsatellite loci were also used to examine the reproductive success of the largest ARBT nesting population, the Blakely River population, over a multi-year period. Microsatellite markers were tested for amplification in various sample types: egg shells, egg membranes, egg yolk/developing embryos, and tail tissue from hatchlings and adult females. The long-term goals of this study are to use microsatellite markers to determine the number of breeding pairs contributing to clutch production and the number of clutches produced within the largest known *P. alabamensis* population over a three to five year period. Information gathered will be used to meet objectives of the current Alabama Red-bellied Turtle Recovery Plan by determining reproductive trends and the success of current conservation measures for the species.

- 118 **Madeleine M. Kern, Adriana A. Nassar, Jackie C. Guzy and Michael E. Dorcas**. Oviposition site selection by spotted salamanders (*Ambystoma maculatum*) in an isolated wetland. Davidson College, NC.

Oviposition-site selection is an important aspect of reproduction for species such as amphibians that breed in dynamic environments. We examined predictors of oviposition-site selection of Spotted Salamanders (*Ambystoma maculatum*) at Cowan's Ford Wildlife Refuge in Mecklenburg County, North Carolina. We conducted egg mass surveys and

checked 40 minnow traps for potential predators every two days along transects, sampling a subset of all representative habitat within the wetland. Random points were generated for each egg mass to compare microhabitat conditions in areas where egg masses were present versus absent. We constructed a paired logistic regression model and used Akaike Information Criterion to rank the associations between oviposition site and water depth, temperature, predator density, and vegetation. *A. maculatum* egg mass location was best predicted by deeper water and dense submergent vegetation. Our study suggests that *A. maculatum* actively select oviposition sites, rather than ovipositing in all available microhabitat implying that vegetation structure and hydrology of ephemeral wetlands are important for the successful reproductive efforts of this species.

- 119 **Stephanie D. Hunt¹, Jackie C. Guzy¹, Steven J. Price¹, Brian J. Halstead² and Evan A. Eskew³**. Response of riparian reptile communities to anthropogenic habitat alteration. ¹Davidson College, NC, ²US Geological Survey, ³University of California, Davis, CA.

Various pressures, including habitat loss, pose a dramatic threat to reptile populations around the world. Riparian zones are critical habitat for many reptile species, but these zones are also frequently modified by anthropogenic activity. Our study investigated the effects of two riparian habitat modifications – damming and urbanization – on overall and species-specific reptile occupancy patterns. We used time-constrained search techniques to compile encounter histories for 28 reptile species at 21 different sites along the Broad and Pacolet Rivers of South Carolina. Using a hierarchical Bayesian analysis executed in WINBUGS we modeled reptile occupancy responses to a site's distance upstream from dam, its distance downstream from dam, and its percent urban land use. Positive mean responses to each of the three covariates indicated that reptile occupancy was maximized when sites were more urbanized, farther downstream from dams, and farther upstream from dams. Of these three covariate responses, however, distance upstream from a dam was the most consistent predictor of overall reptile occupancy. Mean model estimates for each species showed similar trends of lower occupancy immediately upstream from dams, and our model also estimated reptile species richness to increase at sites farther upstream from dams. Our results indicate that the reservoir conditions characteristic of riparian zones upstream from dams may not provide suitable habitat for a number of reptile species.

- 120 **Jacob B. Campbell and Vincent A. Cobb**. Comparing the effects of hypoxia/hypercapnia on the metabolic rates of fossorial and terrestrial snakes. Middle Tennessee State University, TN.

Subterranean animals are generally exposed to different environmental conditions than their terrestrial counterparts. Because of enclosed surroundings with little air space and reduced air flow, low levels of oxygen and high levels of carbon dioxide would be expected and animals that frequent such environments could exhibit physiological adaptations (e.g., reduced metabolic rates). As the early evolutionary history of snakes likely involved fossorial conditions but extant species exhibit great diversity in habitat selection and lifestyle, we hypothesized corresponding respiratory metabolic variation. We addressed this question by using closed-system respirometry to measure oxygen consumption on two fossorial and two terrestrial snake species under normal and simulated hypoxic/hypercapnic environments at three temperatures (15, 25, 30 °C). Basal metabolic rate (BMR) was calculated by placing individuals in a respirometry chamber and measuring VO₂ every hour for 24 hours using normoxic air; hypoxic/hypercapnic simulations were performed by flowing air from pre-filled gas tanks (15% O₂ and 5% CO₂) through the respirometry setup and measuring VO₂ every hour for 12 hours. At normoxic conditions, the terrestrial species had higher BMRs than the fossorial species, particularly at the warmer temperature treatments. At hypoxic/hypercapnic conditions, both groups show an increase in VO₂, with the fossorial group exhibiting a less pronounced increase. We suggest fossorial snakes may exhibit reduced metabolic rates as well as mechanisms

to handle hypoxic/hypercapnic conditions that their more terrestrial species may have lost. Understanding such physiological variation may help strengthen the evolutionary lineages of snakes as well as provide insights into the plasticity of physiological systems.

- 121 **David A. Beamer¹ and Trip Lamb².** River drainages, ecoregions and twisted tales of *Desmognathus* systematics. ¹Nash Community College, NC, ²East Carolina University, NC.

The dusky salamanders (*Desmognathus*) constitute a large, species-rich group, and while a considerable body of literature addressing systematic relationships and adaptive trends exists, these issues have heretofore been approached in piecemeal fashion. A few recent, seminal papers have substantially revised our understanding of the diversity contained within this lineage and its tempo and direction of adaptive divergence. Tilley & Mahoney (1996) revealed considerable cryptic species level divergence within mountain dusksies; Titus & Larson (1996) presented data which completely reversed former hypotheses regarding the direction of adaptive trends in the genus; Chippindale et al. (2004) provided strong evidence for a reversal in reproductive mode within the *Desmognathus* lineage; and most recently, the work of Kozak et al. (2005), which has highlighted that *Desmognathus* is more lineage rich than previously believed. All of these have served to demonstrate how complex the evolutionary history of *Desmognathus* is, and taken together, these works manifest a need for more sampling in areas and within lineages that have thus far been sparsely evaluated. We designed and carried out a sampling regimen that focuses on level iv ecoregion X independent river drainages. We sampled over 600 populations across the distribution of all described dusky salamander (*Desmognathus*) species and DNA sequence data was collected for each population. A Bayesian phylogenetic reconstruction of mtDNA reveals more than fifty independent evolutionary lineages; for exemplars of each mtDNA lineage we sequenced three nuclear-encoded regions. We analyzed this dataset with several methods that accommodate gene-tree heterogeneity to produce a *Desmognathus* species tree.

- 122 **Danté B. Fenolio¹, Matthew L. Niemiller² and Ronald M. Bonett³.** A review of the obligate subterranean salamanders of North America with emphasis on new work with the Georgia blind salamander, *Haideotriton wallacei*. ¹Atlanta Botanical Garden, GA, ²Yale University, CT, ³University of Tulsa, OK.

Organisms inhabiting extreme environments teach us about the flexibility of life through adaptation in morphology, ecology, and behavior that often demonstrate unique and unusual phenotypes. Salamanders have successfully exploited the extreme environments of subterranean waters (groundwater inhabitants are known as stygobites). Subterranean habitats lack light and are often limited in food and nutrient resources. Biologists are just beginning to unravel the complexities in biodiversity, adaptation, and population ecology of stygobitic salamanders. Technological advancements, intensified cave exploration, and contemporary genetic analyses have produced a rapidly expanding list of species that are adapted and restricted to subterranean habitats, with at least 11 species occurring in North America. Little is currently known about the life history strategies or population ecology of many subterranean salamanders. Perhaps the most enigmatic of the groundwater salamanders is the Georgia Blind Salamander, *Haideotriton wallacei*. Almost nothing is known of the amphibian's biology or ecology; in fact, the limits of its subterranean range are not even clearly defined owing to the inaccessibility of the habitat within which the Georgia Blind Salamander lives (the Floridan Aquifer below Georgia, Florida, and Alabama). Because these salamanders inhabit groundwater, any study of them will be a challenge; a team of biologists aims to decipher some of the questions surrounding this species. A facility to maintain captive individuals has been established at the Atlanta Botanical Garden with the intent to reproduce this species in captivity. Additional studies are also underway including genetic analyses and testing for emergent infectious amphibian disease.

- 124 **Rachel L. King¹, Lora L. Smith² and Alan P. Covich¹.** Spatial and diet analysis of freshwater aquatic turtles in coastal plain of Georgia. ¹University of Georgia, GA, ²Joseph W. Jones Ecological Research Center, GA.

The Southeastern United States is a global hot spot for freshwater turtles, with many species inhabiting isolated wetlands and streams in the Coastal Plain of Southwest Georgia. Previous studies have shown that there are significant movements in many species of freshwater turtles, but other species have been little studied in this context. I propose to investigate the overland and aquatic movements of freshwater turtles at the Joseph W. Jones Ecological Research Center in Southwest Georgia. The Jones Center is a 30,000 acre tract with multiple isolated wetlands and is bordered by the Ichawaynochaway Creek and the Flint River. I will be using mark-recapture, radio telemetry, and stable isotope analysis to investigate where *Trachemys scripta*, *Graptemys barbouri*, *Pseudemys concinna*, *Chelydra serpentina*, *Macrolemys temminckii* and other species are spending much of their lives. The long term goal of this project is to demonstrate the importance of lands between isolated wetlands and riparian zones for habitat conservation efforts.

- 125 **Benjamin O. Koester and Thomas K. Pauley.** Hibernacula site selection in the eastern box turtle, *Terrapene c. carolina* (Linnaeus, 1758) in West Virginia. Marshall University, WV.

In temperate regions, understanding how an organism responds to cold winter conditions is necessary for a full understanding of their natural history. For Eastern Box Turtles (*Terrapene c. carolina*), winter can result in high mortality rates which may cause drastic population fluctuations, especially due to variable environmental conditions. This threat to an already rapidly decreasing species necessitates the study of their winter ecology. In order to study conditions experienced and behaviors expressed by overwintering Eastern Box Turtles, I followed 15 radio-tagged turtles into hibernation. Weather stations, temperature probes, and on-site surveys recorded key environmental conditions including wind, precipitation, ground temperature, air temperature, soil moisture, soil pH, soil texture and ground cover at each hibernaculum. I conducted surveys every 48 hours to examine box turtle movements (position, direction, vertical angle in hibernacula, and depth), behavioral changes, and hibernacula conditions. I then compared collected environmental conditions with an environmental map covering a 10,000 square meter area around each hibernaculum, which I used in an attempt to determine if Eastern Box Turtles preferentially select hibernacula locations, and if they do, what site characteristics they select. I hope this study will increase knowledge of Eastern Box Turtles and provide a basis for further conservation of this declining species.

- 126 **Whitney Kroschel and Tom Pauley.** Revisiting the ecological status of the Cheat Mountain Salamander (*Plethodon nettingi*) after 32 years. Marshall University, WV.

The ecological impacts of anthropogenic climate and environment changes are exacerbated in high elevation regions due to the localized nature of montane species and their habitats. The Cheat Mountain Salamander (*Plethodon nettingi*) is endemic to the high elevations of the Allegheny Mountains in West Virginia and is listed by the U.S. Fish and Wildlife Service as a threatened species. Their limited range and habitat requirements increase their vulnerability to environmental changes. The purpose of this study was to provide an updated evaluation of the Cheat Mountain Salamander's status using methods from a 1979 study, which first documented this species' ecological state. At each of four sites within their known range, surface abundance of Cheat Mountain Salamanders was surveyed twice between June and September 2011 by use of quadrats placed along a transect at regular 12.2 m elevation intervals. Surface abundance of competitive salamander species was also documented to compare abundance between species. Habitat properties measured included: temperature, relative humidity, soil and leaf litter percent moisture, soil pH, tree density, basal area, and tree species richness. The habitat

change that is most pronounced compared to 1979 is an increased tree density at half of the sites. Salamander abundance data were compared to the 1979 Cheat Mountain Salamander study with preliminary results suggesting a decline in the surface abundance of Cheat Mountain Salamanders and an increase in competitive salamander species.

127 **Ryan Seddon and Matthew Klukowski.** The effects of acute stress on corticosterone, prostaglandin e2, and testosterone in male southeastern five-lined skinks (*Plestiodon inexpectatus*). Middle Tennessee State University, TN.

Corticosterone (CORT), the major glucocorticoid in reptiles, induces physiological and behavioral changes thought to help an individual overcome the immediate stressor and perhaps prepare for future stressors. During stress, CORT increases while testosterone levels are typically suppressed. Increases in CORT may also alter prostaglandin levels which are important mediators of fever and inflammation. We tested whether male lizards subjected to an acute confinement stress of one hour had increased plasma CORT and PGE₂ levels. While confinement did not have a significant effect on plasma PGE₂ levels, PGE₂ and CORT levels were positively correlated. In mammals, PGE₂ has a very short half-life; thus in experiment two; we determined the effects of shorter periods of confinement on plasma PGE₂ levels and CORT. In our final experiment, we tested whether male skinks exposed to confinement stress had increased CORT and decreased testosterone levels. While CORT levels were elevated, confinement stress had no effect on plasma testosterone levels. This latter result may indicate that maintenance of high testosterone levels is especially important for reproductive success in this species. During the mating season male skinks express a bright orange head coloration thought to be important in sexual selection. The skinks may be keeping their testosterone levels high to maintain the expression of this trait. Consistent with this hypothesis, we found that more brightly colored skinks had significantly higher testosterone levels than duller males.

128 **Derek A. Bozell and Thomas K. Pauley.** The effect of auditory call playback on anuran detectability, catch probability and visual encounter survey efficiency. Marshall University, WV.

With current threats to amphibian biodiversity, it has become increasingly important for surveys to maximize data collection. One of the most striking features of frogs (Order Anura) is the auditory calls that males emit to attract mates and ward off conspecific predators during the breeding season. These calls have been studied extensively because they are species specific and useful identification tools. The established methods of anuran surveying include auditory surveys and visual encounter surveys (VESs). One historical difficulty with surveying anurans is that males cease calling after any disturbance in the area, including those made by researchers. I have proposed a variation on current methods that attempts to reduce the period after a researcher-created disturbance where males cease to call by utilizing the propensity of male frogs to compete with one another. To test this, I surveyed 14 breeding sites of varying characteristics in Cabell and Wayne counties in West Virginia monthly during the springs and summers of 2010 and 2011. I first surveyed sites using a traditional VES. I then used automated recording devices to create site specific playlists of the calls of all species at each site. By playing these recordings over a loudspeaker while conducting secondary experimental surveys, I expected to increase the efficiency of visual encounter surveys, as well as anuran detectability and capture probability when compared to traditional survey methods. Only one of the eight species detected, *Pseudacris c. crucifer*, showed a statistically significant increase in detection and capture rates when surveyed using callbacks.

129 **Kefyn M. Catley¹ and Laura R. Novick².** Does studying natural selection provide students sufficient knowledge to understand macroevolution? Data from the classroom. ¹Western Carolina University, NC, ²Vanderbilt University, TN.

Evolution encompasses a broad range of processes from variation in the genome of organisms to cladogenesis and extinction of higher taxa. Learners' conceptual problems

understanding microevolution have been well studied, however only recently has research begun to document issues of understanding surrounding macroevolution. Does studying natural selection provide students with sufficient background knowledge to understand macroevolutionary concepts and processes? College students (N =124) participated in a study in which half received instruction in tree thinking and half did not. All students completed both the Conceptual Inventory of Natural Selection (CINS) and an assessment of skill at tree thinking (a test of understanding of a significant part of macroevolution). To evaluate the relationship between performance on our tree-thinking assessment and both (a) knowledge of microevolution and (b) instruction in tree thinking, we conducted a multiple regression analysis in which CINS score and experimental condition were used to predict scores on the composite tree-thinking measure. While both instruction in tree thinking and prior knowledge of microevolution were associated with better performance on the tree-thinking assessment, just as critical is the fact that the control condition students (no instruction in tree thinking) with a mean CINS score answered less than 50% correct on the tree thinking assessment. Clearly, we still have much to do to help students translate microevolutionary knowledge into macroevolutionary understanding. We argue for a paradigm shift in evolution education such that curricula present evolution as a broad hierarchical continuum integrating the processes of natural selection with those of macroevolution.

130 **Debby R. Hanmer.** Maximizing study abroad experiences for college students in Costa Rica. University of North Carolina at Pembroke, NC.

Study abroad experiences enrich student learning by connecting experience and content, thereby fostering a wider world view. Careful planning is required to maximize learning over the short but intense time abroad. Costa Rica offers a unique experience for this type of place-based education that interweaves the themes of ecology, conservation, and related studies. It also provides a rich cultural experience for students. Resources are available to assist in planning and implementing a successful student experience. Utilization of campus study abroad departments and Costa Rican educational institutions can facilitate the development of excellent courses that require reasonable amounts of faculty input and time. During this presentation information will be shared about the planning and implementation of two successful trips, taking students to study first-hand the biological complexities of the tropics.

131 **Candace Timpte and Alexandra M. Kurtz.** Evolution from a campus wiki to Wikipedia. ¹Georgia Gwinnett College, GA.

Students in our different classes have designed and developed wiki pages for assigned research topics, such as characterizing a particular microorganism, a human genetic disease or fungal plant disease, instead of writing a paper-based document. Previously students would use a campus based wiki page to disseminate their information. Students were provided with a template and tutorial instruction, as well as grading rubrics. We found that providing a template page gave students some structured direction and promoted some uniformity among the student-developed sites. We have now taken the wiki projects a step further and joined the Wikipedia: United States Education Program. Students in fall semester 2011 disseminated their research on Wikipedia rather than the campus wiki page. By building or adding to a Wikipedia site, students must perform the same research, writing and citation skills they would use for a research paper but they benefit from honing their technology skills. Students must consider logical organization, inclusion of figures in layout design and determine which topics require additional links. The strength of the wiki is the ease of collaborative efforts, which could include answering questions from other students, or resolving peer critiques of student work. Further, these web pages also serve as visual aids for peer-to-peer teaching presentations about individual research topics. Using this technique, we continue to develop students who learn to become active participants in the scientific community and participating citizens of the digital age.

- 132 **Pearl R. Fernandes and Kajal B. Ghoshroy.** Integrative learning in biology courses. University of South Carolina Sumter, SC.

Fostering integrative learning helps students see the connections between the science they study and the world around them and opens up the possibilities for enhanced and fun learning. Real-world examples, collaborative learning, group discussions and YouTube videos were used to engage students and stimulate interest in content. Reading, reflecting and writing allowed students time to think and formulate ideas, synchronize communication, engage and interact with each other as well as with course content. Beyond-the-classroom activities and projects such as "Water Quality Testing" and "Effective Hand Washing" were used to help students relate the lecture content to context making science more real and applicable. Pre and post assessments were used to gather information on change in student interest and knowledge. Our results indicated that the combination of in-class and beyond-the-classroom activities stimulated student learning, knowledge and application of science to real-life situations.

- 133 **Judy Awong-Taylor, Latanya Hammonds-Odie, Lee Kurtz, Michael Erwin and Lorina Boomhower.** Old dogs, new tricks: modifying standard labs for teaching the nature of science through an inquiry-based approach. Georgia Gwinnett College, GA.

The presentation describes a model lab that was developed and introduced for our freshmen, introductory biology course for science majors (Principles of Biology I). The lab was specifically designed for students to gain a better understanding of the Nature of Science and the Scientific Method. The lab also introduces students to the basic components of research methods and focuses on an inquiry-based approach. The lab is the first lab of the semester and is designed in such a way that students actually design their own experiments, perform the experiments, and submit a short paper on their results. The experiments are based on a simple enzymatic reaction which is commonly used in many labs, simple to conduct, and can be easily modified by individual faculty teaching the course. Since instituting these labs, students have shown a better understanding of the nature of science, perform better in later labs, show increased confidence in designing experiments, have a better understanding of labs in general, and show improvement in their lab report writing skills. Additionally, this activity fosters discussion, collaboration, and comradeship among students. Feedback from students suggests that the majority of students gain a better appreciation of the nature of science and scientific inquiry.

- 134 **Chris J. Paradise, A. M. Campbell, Laurie J. Heyer, Pat J. Sellers and Mark J. Barsoum.** Improving critical thinking in introductory college biology courses. Davidson College, NC.

We redesigned the first year college biology course (*Integrating Concepts in Biology*) using first principles of learning: students learn best when they construct their own knowledge and when new material is related to what they already know. We emphasized data interpretation, the utility of mathematics in biology and de-emphasized memorization of facts. We divide biology into five big ideas (information, evolution, cells, emergent properties, and homeostasis) and address each idea at five levels (molecules, cells, organisms, populations, and ecological systems). We compared the first semester of our course with sections using traditional textbooks taught by different instructors. We hypothesized our students would: 1) score as well as other students on content questions; 2) perform better on data interpretation questions; and 3) show significant changes in perceptions of biology in pre- and post-semester assessments. Our students performed significantly better on the data interpretation assessment than those in traditional sections ($p = 0.046$) and demonstrated no significant difference in performance on content assessment ($p = 0.737$). Our students exhibited significant improvement in ability to interpret experimental data over the course of the semester ($p = 0.015$), while traditional students did not ($p = 0.320$). Several aspects of perceptions were significantly different,

indicating that students acquired a more realistic perception of biology and may have developed a more accurate evaluation of their abilities ($p < 0.05$). We are currently conducting assessments for the second half of the year-long course. *Integrating Concepts in Biology* improved critical thinking and disciplinary perceptions without compromising content knowledge.

- 135 **W. E. Grossman and Christine M. Fleet.** Does confronting scientific misconception in an inquiry based general education course yield concept change? Emory & Henry College, VA.

Beginning fall, 2010 all sophomores have been required to take the course "Becoming Modern" to facilitate student inquiry on questions about the natural world, especially those that – like evolution – have generated misconceptions. While there is evidence that confronting misconceptions helps move students toward scientifically accepted positions, many American adults reject the concept of evolution. We surveyed students at the start and end of the fall, 2011 Becoming Modern course to test the hypothesis that an inquiry approach, and explicit confrontation of misconception, yields favorable concept change. We also considered the alternate hypothesis that misconceptions may become more entrenched among some individuals who are confronted with scientific evidence contradicting held beliefs. The results did not show any large scale pattern in concept change across the course. Regarding evolution, however, a significant and favorable concept change was reported among students in sections that dealt most explicitly with evolutionary concepts. Most strikingly, we found no difference in concept change related to the religious or political activity of the student.

- 136 **Andrew N. Ash¹, Catherine E. Matthews², Ann B. Somers² and Terry M. Tomasek³.** Herps – an informal science education curriculum to promote herpetological education, conservation and public engagement in underserved communities in North Carolina. ¹UNC Pembroke, NC, ²UNC Greensboro, NC, ³Elon University, NC.

HERPS (Herpetological Education in Rural Places and Spaces), funded by the National Science Foundation, is a collaboration between UNC Greensboro, Elon University and UNC Pembroke to provide informal herpetological educational opportunities to selected underserved communities in North Carolina. Our target audience is rural, ethnically diverse populations who are often marginalized in the sciences. HERPS engages diverse participants in conservation and field ecology experiences along trajectories ranging from highly accessible experiences for newcomers to increasingly intensive, sustained experiences for budding experts and enthusiasts. HERPS provides a coherent curriculum of four integrated programs: Herpetological Research Experiences (HREs), Celebrations, Cyberhub and Studies. HREs are residential science research experiences for high school-aged participants and selected high school teachers where participants engage in herpetology inquiry projects. Celebrations are single day community gatherings associated with HRE locales designed to provide participants opportunities for science education, interaction with reptiles and amphibians, and to hear Native American stories celebrating nature. Participants can tell and record their own nature stories in our Nature Chronicles, modeled on StoryCorps. Cyberhub is an internet-based portal allowing citizens to provide and receive information concerning reptiles and amphibians in their locale. Innovative species identification software and other resources will be available for free download. Studies provide interested citizens an opportunity to perform research with trained professionals. This curriculum should result in enhanced awareness and public support of education and conservation efforts in traditionally underserved communities. Science educators involved with HERPS are conducting research on how participants form and develop an affinity for science.

- 137 **Diana S. Ivankovic¹, Frank A. Norris¹, Cynthia C. Deaton² and Benjamin E. Deaton¹.** Students' use of mobile learning devices to support science content understanding in an introductory biology course. ¹Anderson University, SC, ²Clemson University, SC.

This study examines the use of iPads to support undergraduate student learning in introductory biology. We examined three biology courses that encouraged iPad use in the laboratory and lecture meetings. Research questions guiding our qualitative case study (Patton, 2002) are: 1) How did students use iPads to support their learning of biology concepts? ,and 2) What are students beliefs about the integration of iPad to support their learning of biology? Data collected for this study were video of lecture and lab meetings, pre and post- assessments, mid-point surveys, focus group interviews, and student products. Open coding (Strauss & Corbin, 1990), and cross case analysis (Merriam, 1998; Patton, 2002) were used to analyze the findings. Student iPad use was categorized as being either teacher-encouraged or student-initiated. For example, teacher-encouraged use was illustrated through the use of Proscopes and development of stop motion animation. Examples of student-initiated use are social media sharing and note-taking apps. Students believed iPad integration, especially collaborative iPad activities, resulted in an increased understanding of biology content, engagement in effective learning strategies, and ability to access resources. Students also noted issues that interfered with the effective use of their iPad during biology class. Our presentation will discuss the theoretical framework grounding our study and the findings and implication of our research in detail.

- 138 **Judy Awong-Taylor, Latanya Hammonds-Odie and Michael Erwin.** Enhancing biotechnology research skills in an introductory biology lab curriculum. Georgia Gwinnett College, GA.

The School of Science and Technology at Georgia Gwinnett College recently implemented an initiative to enhance STEM instruction and STEM education by implementing a 4-year Undergraduate Research Experience (4-yr URE) for all SST students. Undergraduate research is one of the ten High-Impact Educational Practices for student engagement and learning listed by the American Association of Colleges and Universities. While many colleges and universities provide research experiences for some students, these experiences occur more prominently in the senior or junior years. Scientists and faculty now recognize the importance and need to introduce systemic investigation and research experiences much earlier in a student's educational career. As part of this initiative, modules of the introductory biology lab curriculum were modified to include activities designed to provide students with basic research skills commonly utilized in biotechnology labs. Although the new modules included traditional micro-pipetting techniques, gel preparation, gel electrophoresis, DNA restriction digestion, and DNA restriction mapping procedures, they were designed to be research-based and taught with an inquiry-based approach. The research-based lab modules were designed to incorporate and utilize actual research data and research experiences, to provide opportunities for students to make empirical observations, and to provide students with basic research skills. The presenters will discuss the research-based aspects of the modules, implementation, and assessment.

- 139 **Louis J. Gross.** The vision of *Vision and Change*. University of Tennessee, Knoxville, TN.

Discussions of the need to reconsider undergraduate life science education from the perspective of advances in understanding of student learning and progress in fields of modern biology have been ongoing for decades. Congruence between various reports sponsored by the major federal agencies supporting life science research and biological organizations has led to a consistent set of themes that are appropriate for higher education institutions to build upon in considering their biology programs of study.

Consistent themes include: the interdisciplinary nature of modern biology, the benefit of broad exposure to conceptual foundations of biology rather than attempting to cram extensive detail about different organizational levels into every student's exposure, utilizing research experiences to develop biological intuition in at least one area, and a focus on educational methods that have been consistently documented as enhancing student learning. I will present a set of procedures that institutions might utilize to build their own curriculum around these themes, with particular emphasis on quantitative education for life science undergraduates.

- 140 **Paula P. Lemons¹ and Luanna B. Prevost²**. What type of multiple-choice questions help students practice the process of science? A study of student cognition during multiple-choice testing.¹The University of Georgia, GA, ²Michigan State University, MI.

Multiple-choice testing, a time-saving and student-preferred method of assessment is a standard part of most large introductory biology courses. However, multiple-choice testing may pose problems. Observations from student work in a large, non-majors introductory biology class suggested that performance on multiple-choice testing was not a good measure of student higher-level thinking skills. We undertook a qualitative study to determine what cognitive steps are prompted by multiple-choice questions of different Bloom's levels. We used documented problem solving (DPS), a classic classroom assessment technique, in an introductory biology course with 230 students to collect data about student cognitive processes as they solve multiple-choice problems. After teaching DPS in class, we asked students to document their solutions to multiple-choice homework and exam questions that were pre-judged to be Bloom's level understanding, applying, or analyzing. We also collected student responses to the Learning and Studying Questionnaire (adapted from Enhancing Teaching-Learning Project Hounsell and Entwistle). To analyze student DPS work, we use a qualitative method known as Grounded Theory, whose central question is: What theory emerges from systematic comparative analysis and is grounded in fieldwork so as to explain what has been and is observed? Based on our preliminary observations from student DPS work, we have found that students (1) do not always approach questions at the Bloom's level predicted by the authors; (2) exhibit both high-quality and low-quality problem-solving strategies, (3) tend to approach problems either sequentially or globally; (4) sometimes arrive at the correct answer without understanding the concept and with major misconceptions about the concept. Our analysis of student DPS work is still in progress. We will also be using statistical methods to study the relationships among students' problem-solving methods, their survey responses, and their performance on course exams and assignments.

- 141 **Peggy Brickman**. Media-savvy scientific literacy: developing critical evaluation skills by investigating scientific claims. University of Georgia, GA.

Students must learn content knowledge and develop scientific literacy skills to evaluate and use scientific information in real-world situations. Recognizing the accessibility of scientific information to the average citizen, we developed an instructional approach to help students learn how to judge the quality of claims. We describe a Project-based Applied Learning approach (PAL) utilizing engaging questions about biological issues relevant to students. Working through these projects, students are challenged to evaluate sources of information and communicate their understanding of scientific claims. We discuss challenges students encounter and offer suggestions for enacting this approach in a general education college classroom.

- 142 **J. S. Oliver, Georgia W. Hodges, James N. Moore and Tom P. Robertson**. Teaching cellular processes to high school students using modules based on 3-d computer animations. University of Georgia, GA.

Many high school students experience difficulties when learning how the organs and tissues of the body function. This session will demonstrate three interactive case studies

that combine dynamic 3-D animations and inquiry-based learning. In addition, we will examine evaluation results which have been attempting to document the impact of these modules on student learning. Our development team has aimed to create interactive 3-D models and environments with which students can explore basic cellular processes such as osmosis, diffusion and filtration. Each animated curriculum module includes a case study that directs the student's attention to an animal or human, a specific disease state, and a biological process. Students are placed in a scenario in which an animal is afflicted by a health condition linked to some fundamental process of biology such as osmosis. The students' goal is to determine the underlying cause and to solve the problem using medical diagnostic tools and treatments available through the module. This presentation will show examples of the animations, discuss issues related to teachers' implementation as well as student learning.

143 **Kathrin F. Stanger-Hall.** Interdisciplinary thinking in biology. University of Georgia, GA.

Biology is based on physical and chemical processes, and students are expected to integrate this information when they learn biology. However, this integration is made difficult by discipline-specific terminology and thinking, which not always translates easily. With an increasing emphasis on interdisciplinary research in the sciences, and on an interdisciplinary approach to science education, this communication problem can no longer be ignored. Instead we need to find common ground and agree on an interdisciplinary frame of reference when communicating with colleagues from other disciplines and when teaching our students. I will use the example of osmosis to illustrate (1) communication problems between faculty from physics, biology, veterinary medicine and science education, (2) confusing or incorrect use of terminology and illustrations by introductory biology textbooks, and (3) a resulting superficial understanding of osmosis by introductory biology students. Finally, I will report on the current progress of our interdisciplinary working group towards generating a common framework for the teaching of osmosis and other interdisciplinary processes and concepts in biology.

144 **Nicole T. Welch¹, Nancy J. Pelaez², Charlene D'Avanzo³ and Charles W. Anderson⁴.** Helping faculty embrace the vision of *Vision and Change*. ¹Mississippi University for Women, MS, ²Purdue University, IN, ³Hampshire College, MA, ⁴Michigan State University, MI.

Reforming the college science classroom experience from passive lectures to active-learning, with emphasis on scientific reasoning, communication, and applicability to societal issues, is the focus of the *Vision and Change* initiative proposed by AAAS in 2011. Student understanding of biological concepts increases when instructors employ active-learning methods, demonstrate the process by which textbook content is generated, and permit students to discover how and why course content is important to them. Yet, with the constraints of workload demands, most instructors use passive lectures. This work surveyed a group of fifteen motivated biology faculty who voluntarily participated in a three-year, NSF-funded project designed to help faculty implement diagnostic assessments and active teaching to transform their courses. The faculty received guidance, teaching activities, diagnostic assessments, and monetary support to share their experiences at workshops and scientific meetings. Ninety-three percent of the project participants completed the 20-question survey via Survey Monkey in late Spring 2011. Respondents identified easily-accessible teaching and assessment tools, work with other motivated colleagues, and increased awareness of the value of students' incorrect answers as the most useful components of the project. They admitted continued use of lectures, but reported that active-learning exercises were incorporated into those lectures. Lastly, respondents shared that their confidence in the content and effectiveness of their courses increased thanks to having assessment data to confirm student understanding. Course reform is not an overnight process, but, given time and support, instructors appreciate the benefits of informed, active teaching and slowly transform their courses.

- 145 **Daniel V. Rhiner.** Using cyclomorphosis to assess predation of zooplankton in wetlands. Kennesaw State University, GA.

Macrophytes have the potential to provide a refuge for zooplankton from predators. Alternatively, macrophytes may provide refuge for these predators, thereby increasing predation intensity on zooplankton. This study assesses the influence of macrophytes on predation of zooplankton by comparing body size and spine length of the zooplankton *Bosmina longirostris* within a beaver created wetland to nearby open water areas (Lake Acworth, Cobb Co, GA). Frequency distributions of body size differed between the wetland and the open water area. Total length, carapace length, and carapace height were significantly greater in the wetland, while spine length was significantly shorter in the wetlands, with the largest spines found in the smallest open water individuals. The spine length to carapace length ratio was significantly lower in the wetland than the open water. These results suggested that visual predation is more intense in the open water than in the wetland leading to smaller body sizes in the open water. Non-visual predation may also be more intense in the open water than the wetland leading to longer spines in the open water. Macrophytes in the wetlands appear to provide some sort of refuge from predators for zooplankton.

- 146 **Keri M. Goodman¹ and Mark E. Hay².** Activated chemical defenses suppress herbivory on freshwater red algae. ¹University of Georgia, GA, ²Georgia Institute of Technology, GA.

Chemical defenses have rarely been investigated in freshwater macrophytes and never before in freshwater red algae. The rapid life cycles of freshwater algae are hypothesized to suppress selection for chemical defenses against herbivores. Until now, this prediction has remained untested. We present the first evidence for anti-grazer chemical defenses in freshwater macroalgae. Structural, nutritional, and chemical traits of five species of red algae were assessed for their role in reducing algal susceptibility to crayfish grazers. *Boldia Erythrosiphon* was palatable, while the cartilaginous structure of *Paralemanea annulata* reduced its susceptibility to grazing. *Batrachospermum helminthosum*, *Kumanoa Sp.*, and *Tuomeya americana* showed evidence of enzymatically activated chemical defenses, which are produced immediately from available precursors upon tissue damage. Their activated chemical extracts suppressed crayfish feeding by 30-60%. Activation is thought to reduce ecological costs of chemical defenses and might be favored in freshwater red algae, whose short-lived gametophytes must grow and reproduce rapidly. The frequency of activated chemical defenses found here (3 of 5 species) is 3-20x higher than for surveys of marine algae or freshwater plants. If typical, this suggests that 1) freshwater algal chemical defenses may be missed if investigators do not consider chemical activation in their methodologies and 2) herbivory may be a stronger selective force than previously believed in freshwater streams. Investigations of defenses in freshwater algae, such as this, can contribute to among-system comparisons and provide insights into the generality of plant-herbivore interactions and their evolution.

- 147 **James B. Deemy and Edward R. Crawford.** Vegetative recruitment patterns in a recently restored mixed tidal regime wetland: seed bank to standing cover. Virginia Commonwealth University, VA.

Ecological restoration of a prior converted wetland was characterized within a recently drained impoundment along the James River, Virginia. We quantified the recruitment and colonization of native and non-native wetland vegetation within a former impoundment using GPS/GIS technology. Colonizing vegetation was assessed over three growing seasons in both tidal and non-tidal environments. Objectives for this study were (1) to examine geospatial relations of recruitment patterns among colonizing species over three growing seasons, (2) assess geospatial distribution of invasive species, (3) quantify species composition in the extant seed bank and (4) assess geospatial patterns in recruitment of *Taxodium distichum* and use these patterns to identify areas where

restoration efforts may be most effective. The two most common native colonizing species during 2009, 2010 and 2011 growing seasons were *Typha angustifolia* L. and *Leersia oryzoides* L. The two most common exotic invasive species were *Murdannia keisak* Hassk. and *Microstegium vimineum* Trin. We determined that *T. angustifolia* L. and *M. keisak* Hassk. were the most dominant species in tidal portions of the basin. In non-tidal portions of the basin *L. oryzoides* L. tended to dominate vegetative communities and there were fewer invasive species present. The two most abundant species in the seed bank were *L. oryzoides* and *Ludwigia palustris*. Approximately 250 *Taxodium distichum* individuals have been located within the restored wetland. Over 75% of the individuals found were seedlings or saplings. Based on geospatial relations of these recruits we have identified potential areas within the restored wetland for natural and facilitated recruitment.

148 **Jason H. O'Connor and Betsie B. Rothermel.** Factors influencing the distribution and abundance of exotic fish in modified wetlands in peninsular Florida. Archbold Biological Station, FL.

Invasion by non-native species represents one of the greatest threats to biodiversity. Negative effects of freshwater fish invasions are particularly well documented, and Florida is home to at least 30 established exotic fish. One such species, the African Jewelfish (*Hemichromis letourneuxi*) has been spreading northward from Miami, Florida, and the Everglades since 2000. Jewelfish were first recorded in ditches and ponds on the Archbold Reserve in the central part of peninsular Florida in 2008. Jewelfish are opportunistic predators and, like many other members of the Family Cichlidae, they possess many of the characteristics of successful invasive species. The primary goals of my study were to determine the distribution, abundance, and length-weight relationship of the African Jewelfish and other exotic fish species on the Archbold Reserve, and to identify which factors predict their occurrence and abundance. I sampled 45 wetlands on the Reserve using minnow traps in September-October 2011. *H. letourneuxi* occupied only 22% of sampled ponds, and its distribution was limited to wetlands in close proximity to streams. However, *H. letourneuxi* was the second-most abundant fish species, comprising 33% of the total fish captures. *H. letourneuxi* on the Reserve grow isometrically. Pond size correlated positively with exotic fish abundance, and the maximum depth of ditches within 30 m correlated positively with *H. letourneuxi* abundance. *H. letourneuxi* warrants concern because it is a novel tadpole predator and there is potential for future spread. More research is needed to investigate its effects on native communities.

149 **William Ensign.** Fish species richness and stream network topology. Kennesaw State University, GA.

Increased fish species richness with increasing watershed area is a well-established phenomenon in stream fish ecology, serving as the basis for biomonitoring metrics used in assessment of stream biological integrity. A less well documented phenomenon is the influence of stream network topology on richness. This study assesses the role of tributary network position and proximity of sample sites to stream confluences on species richness in Chattahoochee and Etowah River tributaries. Fish species richness was estimated using backpack electrofishing at 84 sites with catchment areas from 1.4 km² to 303.3 km². For each site, catchment area above the site, distance from the site to the nearest downstream confluence with a stream of greater catchment area, and the area of the receiving catchment were estimated using ArcGIS. Catchment area above the site was divided by the catchment area of the receiving tributary to establish a catchment area ratio. Sites were categorized by catchment ratio (low < 10%, moderate 10% - 30% and high >30%) and distance to confluence (near < 5 km and far >= 5 km). Expected species richness as a function of catchment area was estimated using linear regression and residuals from the regression used as the dependent variable in an ANOVA with catchment ratio and distance to confluence as independent variables. Sites with low catchment ratios near the confluence had significantly higher species richness than

expected. The results indicate that assessments of biotic integrity using fish communities that fail to include corrections for stream network topology may be biased.

- 150 **Derek J. Turner¹, Jeff Steinmetz¹, Ann Stoeckmann¹ and John Ludlam².** The relationship between water quality, phytoplankton and zooplankton in a South Carolina lake. ¹Francis Marion University, SC, ²Fitchburg State University, MA.

The purpose of the experiment was to see if there was a relationship between water quality parameters, phytoplankton, and the concentrations of freshwater Zooplankton, especially the invasive *Daphnia lumholtzi*. Lake Marion was sampled approximately every two weeks from May 2012 to August 2012. Samples were collected around Lake Wateree at different depths while the characteristics, such as depth, secchi depth, temperature, etc., were measured in the field. Zooplankton samples were collected with an 80 micron net and preserved in ethanol. Water samples were collected and returned to the lab for chlorophyll a, nitrite, nitrate and phosphorous analysis. Abundant zooplankton species included copepods, *Daphnia ambigua*, *Daphnia lumholtzi*, *Bosmina longirostris*, and *Diaphanosoma* spp. Preliminary analysis shows a weak positive relationship between chlorophyll a and *D. lumholtzi* abundance. We are continuing to analyze the other water quality parameters.

- 151 **Robert L. Hopkins II¹ and Jordan C. Roush².** Species-specific responses of stream fish to surface coal mining in eastern Kentucky. ¹University of Rio Grande, OH, ²USDA, Natural Resources Conservation Services.

North America is experiencing a rapid decline in freshwater fish diversity, with human-driven landscape changes being implicated as the primary cause. In eastern Kentucky, surface coal mining is responsible for broad scale shifts in landscape composition. While the local effects of surface coal mining on stream chemistry and biota have been fairly well-studied, how the effects are manifested at the watershed scale remains elusive. In this study, we evaluate the distributional responses of six fish species with contrasting ecologies to surface coal mining within the watershed. Of particular concern are the relative effects of the areal composition versus the spatial pattern of surface mining. Our results indicate that species distributions are mainly controlled by watershed area (> 12% relative influence) and measures of forest cover (> 20% relative influence) – reflecting differences in preferred hydrologic regimes. Surface coal mining appears to markedly affect the distribution of only two of the studied species, Southern Redbelly Dace and Sharpnose Darter. In each of these two cases, the relative influence of surface mining is 10.7 and 10.1%, respectively. The Southern Redbelly Dace is the only obligate headwater species under examination, and it is likely that direct habitat destruction (e.g. the covering of headwater streams via valley fills) is the root cause of decline. The response of the Sharpnose Darter may be attributable to the habit of burying eggs during spawning; thus, increasing sensitivity to increased sediment loading. In each case, the spatial pattern of surface mining was more influential than the areal composition.

- 152 **Dwayne Estes¹, Chris A. Fleming², Angelina Fowler¹ and Nathan Parker¹.** Distribution, abundance, and habitat preference of monoecious *Hydrilla verticillata* in Tennessee's Emory River Watershed. ¹Austin Peay State University, TN, ²BDY Environmental Inc., TN.

The Emory River Watershed (ERW) is a high-gradient river system located within the Cumberland Plateau of eastern Tennessee. This system includes several cool, clear rocky streams that cut down into the Plateau forming deep and hard-to-access gorges. Portions of four major streams in the ERW, the Obed and Emory rivers and Clear and Daddy's creeks, are part of the U.S. National Park Service's (NPS) National Wild and Scenic River System. In 2004, the invasive submersed macrophyte, *Hydrilla verticillata*, was discovered in the ERW. In 2010, a study was initiated to determine the origin of the *Hydrilla* infestation and the distribution, relative abundance, and habitat preferences of the species within the watershed. Fieldwork was conducted from July to September 2010. The source for

Hydrilla was found to be a private lake that feeds into Daddy's Creek in Cumberland County. From the source it has expanded downstream at least to Harriman in Roane County, a distance of more than 80 km. A systematic survey of 47.5 km of the ERW, from Devil's Breakfast Table on Daddy's Creek to Camp Austin on the Emory River, revealed that *Hydrilla* covers 26% of this portion of the ERW. Within the watershed, *Hydrilla* prefers slow-moving pool and run habitats.

- 153 **Gina Botello¹, Stephen Golladay¹, Alan Covich², Darold Batzer³ and Mark Blackmore⁴**. Larval mosquito assemblages in agricultural wetlands of southwestern Georgia: investigating the influence of surrounding land use. ¹Odum School of Ecology, University of Georgia, GA, ²J.W. Jones Ecological Research Center, GA, ³Department of Entomology, University of Georgia, GA, ⁴Valdosta State University, GA.

Isolated wetlands are extensively drained and altered by urbanization, forestry and agriculture. These landscape changes could affect the assemblages of larval mosquitoes that occupy these wetland habitats. Most mosquito surveillance is concentrated in urban areas and little observational data of mosquito assemblages are available from rural areas of the southeastern U.S. The expansion of mosquito-borne disease has increased the need to determine how altered wetland conditions influence mosquito ecology. This research used wetland surveys during extreme drought conditions in January-December of 2011 to test how surrounding land use influences larval mosquito assemblages in agricultural and reference wetlands typical of southwestern Georgia. For nearly all sample dates, mosquito abundance was greater in agricultural wetlands compared with reference wetlands. Preliminary results using an Indicator Species Analysis revealed that *Anopheles quadrimaculatus* and *Psorophora columbiae* are indicators of sites dominated by row-crop agriculture and pasture land, *Culex erraticus* and *Uranotaenia sapphirina* are indicators of sites dominated by pecan orchards, and *Culex territans* is an indicator of reference wetlands dominated by upland forest. These results suggest distinct habitat preferences for mosquito species, which could make mosquitoes useful bioindicators of wetland condition. This research may also be important in predicting hotspots of disease risk at the landscape scale.

- 154 **Brian C. Reeder**. Primary productivity limitations in low-alkalinity eastern Kentucky reservoirs. Morehead State University, KY.

Some eastern Kentucky reservoirs do not have chlorophyll *A* concentrations commensurate with their total P. We added nitrogen, phosphorus, and carbon to 4 L cubitainers containing water from three reservoirs with possible nitrogen or carbon limitations. We allowed these to incubate in the photic zone 1-2 weeks. Despite relatively low N:P ratios and alkalinities, we found that P was still the limiting nutrient for algal productivity if the water was clear and warm. We observed a secondary N limitation at high P loading, and a carbon limitation at high N and P loading. Low alkalinity Eastern Kentucky reservoirs are limited by temperature, light-penetration (turbidity), and phosphorus. Some lake fertilization recommendations, such as liming, may not be advisable unless hypereutrophication is desirable.

- 155 **CANCELLED**

- 156 **Evelyn G. Reategui-Zirena¹, Jonathan M. Miller¹ and Paul M. Stewart¹**. Growth rates and age estimations of *Pleurobema strodeanum* and *Fusconaia burkei*, species proposed to be listed under the Endangered Species Act. Troy University, AL.

The United States has the greatest freshwater mussel diversity in the world. However, about 70% are extinct, endangered, or in need of special protection. There is a great need for the assessment and restoration of mussels and their habitats. *Pleurobema strodeanum* (Fuzzy pigtoe) and *Fusconaia burkei* (Tapered pigtoe) are species proposed to be listed

under the Endangered Species Act. The purpose of this study was to estimate their growth rate and age. Samples were collected, tagged, and measured in a study in 2004 in Eightmile Creek, Walton County, Florida. Mussels were surveyed and measured again in the summer of 2011. Twenty eight *P. strodeanum*, of 161, and four *F. burkei*, of 32, were recaptured and assessed. Growth rate percentages were determined based on length, width, height and volume. Age estimations were done for *Pleurobema strodeanum* using the von Bertalanffy growth equation. Results showed that *P. strodeanum* grew 7.84% (3.37 mm) in length over a period of seven years and *F. burkei* grew 6.80% (2.94 mm). The growth rate decreased in width ($R^2 = 0.626$, $p < 0.001$) and volume ($R^2 = 0.528$, $p < 0.001$) when individuals were larger. The age estimations for *P. strodeanum* in this study ranged from 48.67 to 74.50 years old in 2011. This study suggests that growth and age estimates are needed to assess the risk of extinction of rare and endangered species.

157 **Chelsea Daniel, John McCreadie and Jason Coym.** Black flies: a proposed entry point for mercury into the food web. University of South Alabama, AL.

Black fly larvae (Diptera: Simuliidae) are an ideal candidate as a mercury entry point into the aquatic food web. As filter feeders, they ingest what is found in the water column and are limited only by particle size. Through this method, mercury is ingested mainly as a dissolved organic material/mercury (DOM-Hg) compound. Few studies have been conducted to examine the relationship between the mercury levels in the larval black fly population compared to stream mercury levels. Accordingly, an empirical investigation of mercury levels among the stream water column, the streambed, and black fly larvae is the first priority to understanding how mercury enters the food web through black flies specifically and aquatic insects in general. In addition, in order to understand potential spatial-temporal variation in mercury levels, a variety of streams are assessed over different seasons.

158 **Samantha Hardwick, Leland Stoddard, Kelly Bickle, Reed Jacobs, Evan Meadows, Scott Miller¹, Colleen Milstead, William Shipes, Rachael Wheeler and John Hains.** Ecological studies of *Bellamya japonica* (Japanese mystery snail) a new invasive snail in Lake Hartwell, SC (Savannah River Basin). Clemson University, SC.

The freshwater snail, *Bellamya japonica*, native to Asia and Japan, is invading much of North America. This exotic species was recently discovered in Lake Hartwell (2006), the first occurrence in the Savannah River Basin. Concurrent to its discovery, its negative impact on the facilities of Clemson University indicated the potential for similar industrial costs when it arrives in other aquatic systems. Because little is known about the invasion ecology of this and similar organisms and because of its potential industrial impact, our team is investigating its behavior, substrate preferences, fecundity, and dispersal in Lake Hartwell using a variety of laboratory and field methods. Because of differences in field observations, our early experiments tested phototactic behavior. Laboratory experiments showed a measurable negative phototactic response in excess of any geotactic effect. Because it is viviparous, we have begun field underwater video surveys to attempt to document its dispersal in a newly-invaded habitat. Moreover, *In situ* studies are underway to measure its fecundity and any effect of seasonality on fecundity. Finally, differences in field observations also led us to question the preference for different substrates by *B. japonica*. We are designing laboratory experiments to attempt to identify such preferences, if present. Our studies will contribute to the basic knowledge of this invasive species, greater understanding of it and similar species' ecology in newly-invaded habitats, and potentially identify ways to eliminate or mitigate the costs to industry as these and similar organisms invade additional aquatic systems.

159 **Robert U. Fischer¹ and Steve S. Warner².** Evaluating the Illinois stream valley segment model as an effective management tool. ¹University of Alabama at Birmingham, AL, ²Wisconsin Department of Natural Resources, WI.

Stream habitat assessments are conducted to evaluate biological potential, determine anthropogenic impacts, and guide restoration projects. Utilizing these procedures, managers must first select a representative stream reach which is typically selected based on several criteria. To develop a consistent and unbiased procedure for choosing sampling locations, the Illinois Department of Natural Resources has proposed a technique by which watersheds are divided into homogeneous stream segments called valley segments. Valley segments are determined by GIS parameters including surficial geology, predicted flow, slope, and drainage area. To date, no research has been conducted to determine if the stream habitat within a valley segment is homogeneous and if different valley segments have varying habitat variables. Two abutting valley segments were randomly selected within thirteen streams in the Embarras River watershed, located in east-central Illinois. One hundred meter reaches were randomly selected within each valley segment, and a transect method was used to quantify habitat characteristics of the stream channel. Habitat variables for each stream were combined through a principle components analysis (PCA) to measure environmental variation between abutting valley segments. A multivariate analysis of variance (MANOVA) was performed on PCA axes 1-3. The majority of abutting valley segments were significantly different from each other indicating that habitat variability within each valley segment was less than variability between valley segments ($5.37 < F < 245.13$; $p < 0.002$). This comparison supports the use of the valley segment model as an effective management tool for identifying representative sampling locations and extrapolating reach-specific information.

160 **Carlos D. Camp.** North Georgia: a potential salamander hotspot. Piedmont College, GA.

Biodiversity hotspots are regions characterized by significant levels of both species richness and endemism. The Southern Appalachian Mountains represent a hotspot for a number of both aquatic and terrestrial taxa. The region is particularly well known for its diversity of salamanders because of the high number of lungless salamanders of the family Plethodontidae. This group is known for its cryptic diversity, which has only recently begun to be uncovered through the use of modern molecular techniques. Morphologically distinct species, especially local endemics, also continue to be discovered. Plethodontid species richness is positively correlated to both topographic diversity and rainfall and is highest in regions of intermediate elevation. Genetic diversity within species also correlates positively with rainfall. Northern Georgia is topographically diverse and is characterized by mountains of intermediate elevation. Moreover, the greatest amount of rainfall in the eastern US occurs along the mountainous border between Georgia and North Carolina. It is no surprise, then, that Georgia ranks among the most robust states in salamander species richness and has been the locality of relatively recent discoveries of new species in the plethodontid genera *Desmognathus*, *Plethodon*, and *Urspelerpes*. Georgia's highlands, however, remain poorly surveyed relative to some of its Appalachian neighbors (e.g., North Carolina), and species as yet unknown likely await discovery. Candidate regions for the possibility of housing undescribed species include the Rich Mountains, the Cohutta Mountains, and the Talladega Uplands.

161 **Lisa D. Brown and John L. Carr.** Aquatic herpetofaunal communities in a regenerating bottomland hardwood forest at upper Ouachita National Wildlife Refuge, Louisiana. University of Louisiana at Monroe, LA.

Loss of ecologically valuable habitats has prompted protection of native flora and fauna; however, despite such endeavors, biological diversity is in decline. Due to conversion of land for agriculture and hydrological changes associated with flood control, one such habitat that has been disappearing at unprecedented rates is bottomland hardwood forest (BHF). Upper Ouachita National Wildlife Refuge (UONWR) has been the site of the largest BHF restoration effort in the nation's history. In addition to the major reforestation initiatives, the refuge is restoring the natural hydrology of the area. Herpetofaunal communities are significantly impacted by hydrology in BHF; therefore, monitoring this

community, in both altered and unaltered refuge habitat, is vital as the restoration work progresses. Total species richness as of 15 November 2011 at UONWR was 35 species, of which 12 were amphibian species and 23 were reptile species. Species diversity indices for the refuge resulted in an exponential form of the Shannon-Wiener function (E^H) value of 2.85 for altered habitat and 2.32 for unaltered habitat, and Buzas and Gibson's evenness value of 0.189 for altered habitat and 0.118 for unaltered habitat. Akaike's Information Criterion was used to evaluate the effectiveness of habitat models in predicting species richness.

- 162 **Kevin R. Messenger and Yong Wang.** Herpetofauna of Shennongjia National Nature Reserve and effects of elevation on diversity, Hubei Province, China. Alabama A & M University, AL.

Shennongjia National Nature Reserve is a recently established reserve (1986) in central China, on the western border of Hubei Province. We conducted the first formal, comprehensive herpetological survey of the area. The reserve was surveyed from May to August 2006, July 2008, late May and early June 2011, and mid-July 2011. Forty-seven species were documented within the reserve. Three snakes and one frog were new provincial records for Hubei Province: *Amphiesma optata*, *Lycodon liuchengchaoi*, *Oligodon ningshaanensis*, and *Amolops chunganensis*. Work from this study has contributed to the reclassification of *Oligodon ningshaanensis*. Several other specimens were new records for the reserve (*Ranodon tsinpaensis*, *Megophrys minor*, *Pareas boulengeri*, *Protobothrops mucrosquamata*, and *Oocatochus rufodorsata*). In addition, notes were taken on a potential new subspecies of *Zaocys dumnades*. The immense size and elevational changes present in Shennongjia offer many research opportunities. Between the upper and lower elevations, in any given month, temperature differences can range upwards to 25°C. This results in interesting distributions and emergence periods of the local herpetofauna. Shennongjia is home to several threatened and endangered species, including *Andrias davidianus*, *Azemiops feae*, and *Oligodon ningshaanensis*. Continued monitoring of the area should be a high priority for future studies.

- 163 **Carrie A. Straight¹, Marcia N. Snyder¹, Mary C. Freeman² and Byron J. Freeman³.** Characterization of landscape-scale and microhabitat-scale sites used by spawning robust redhorse, *Moxostoma robustum*, in the Broad River, Georgia. ¹University of Georgia, GA, ²US Geological Survey, Patuxent Wildlife Research Center, MD, ³Georgia Museum of Natural History, GA.

Robust redhorse, *Moxostoma robustum* (Cope), are large imperiled catostomid fish native to southeastern Atlantic slope drainages from the Altamaha River drainage in Georgia northward to and including the Pee Dee River drainage in North Carolina and South Carolina. Robust redhorse are migratory, and historically they likely wintered in the Coastal Plain and migrated upstream above the Fall Line to spawn in gravel shoals that are more abundant in that region. Population estimates for robust redhorse have been declining and they are considered a species of conservation concern in the southeastern United States by the U.S. Fish and Wildlife Service. A reintroduction effort to establish robust redhorse in the Broad River system (Savannah River drainage) led to the release of almost 40,000 juveniles at various locations from 1995 to 1998. This population of robust redhorse is the only one that has access to its historical spawning habitat above the Fall Line. Since the mid-90's researcher studying this species have learned some about its life history, however one question that has not been addressed is what factors lead an individual or group of fish to choose a specific location to spawn. In this presentation, we will address large-scale (landscape) and small-scale (microhabitat) features of areas robust redhorse use to spawn in the Broad River system.

- 164 **Neil Billington, Jayesh Patel and Janet Gaston.** Hybridization between Mid-West and Great Plains sauger and walleye determined by protein electrophoresis. Troy University, AL.

Sauger (*Sander canadensis*) and walleye (*S. vitreus*) are large predatory North American percid fishes that are valued in both sports and commercial fisheries. These species hybridize naturally, usually at low frequency. In addition, their F₁ hybrid the saugeye (male sauger x female walleye) is propagated and stocked by fisheries managers as it performs well in impoundments. Sauger and walleye F₁ hybrids can backcross with both parental species resulting in introgression. Protein electrophoresis has been shown to be more reliable than morphological examination in several studies for identifying hybrid and introgressed fish. Cellulose acetate gel electrophoresis at four diagnostic loci was used to examine 2255 fish collected by gill-netting or electrofishing from 23 populations from the mid-west and great plains regions to document hybridization and introgression between sauger and walleye: one population each from Saskatchewan and Alberta, Canada, and 21 U.S. populations from Iowa (1), Montana (14), North Dakota (1), South Dakota (3), and Wyoming (2). No hybridization was found in Wyoming and in three Montana populations. Low rates (4%) were found in Lake Sharpe and Lake Francis Case, SD, 5.5% of sauger in the upper Milk River, Alberta, and 3-6% in six Montana populations. Rates of 9-10% were found in three Montana sauger populations, 17% in Lake Diefenbaker, Saskatchewan, while rates of 20-25% were found in two Montana sauger populations, North Dakota, Lewis and Clark Lake, SD, and Mississippi River Pool 13, Iowa. Protein electrophoresis was superior to morphological analysis for separating sauger, walleye, and their hybrids.

165 **Zachary Anglin and Gary D. Grossman.** Microhabitat use and movements of southern brook trout in a southern Appalachian stream. University of Georgia, GA.

The southern brook trout is native to the southern Appalachian Mountains, yet little is known about its ecology. Most pure populations of southern brook trout currently are restricted to isolated headwaters with physical barriers to upstream movement of invasive rainbow trout or stocked northern brook trout. Hence the survival of this sub-species is affected not only by a lack of information but also by fragmentation, species invasions, and climate change. We compared microhabitat availability to microhabitat use by this species as well as monitored fish movement in Ball Creek NC. We conducted microhabitat studies during July and September 2010 and April, July and October 2011; tagging and movement studies were conducted from March to October 2011. In general trout preferentially occupied deeper microhabitats with lower mean velocities and higher amounts of small cobble, sand, and silt. Older trout occupied deeper microhabitats with lower velocities than yearling trout. Movement by older trout was varied, but the majority of trout displayed small scale movements (< 10m) during the study. Recaptures in the spring showed that between March and May fish displayed limited movements, but by October trout had moved an average of 13 meters upstream. Microhabitat and movement information will be useful for quantifying the continued probability of survival of these isolated populations in the face of environmental challenges.

166 **Avery Scherer and Nicholas Santangelo.** Reproductive habitat requirements of the federally threatened blackside dace, *Chrosomus cumberlandensis*. Eastern Kentucky University, KY.

The blackside dace, *Chrosomus cumberlandensis*, is a federally threatened fish species endemic to the Cumberland River system. Previous work done on this species has consisted of population surveys and one attempt at captive breeding with limited success. As a result, general, qualitative stream characteristics for blackside dace habitat are well understood: the species prefers cool (<70°C), moderate gradient streams and areas with healthy riparian zones, undercut banks and rocks, and at least 70% canopy cover. Canopy cover and intact riparian zones maintain cool temperatures while riparian also reduces silt and runoff. However, we observed within these streams that these fish spawn in gravel pits which are generally clustered in certain areas. This suggests that there are specific reproductive microhabitat requirements for which no quantitative characteristics are known. Thus, we assessed the physical habitat of these reproductive nests and the immediate surrounding areas by measuring depth, stream flow, nest temperature, and

nest structure. Nest quality was assessed by degree of male use. These data suggest that, amongst the factors measured, flow is most important in determining nest location while depth is most important in determining nest quality. Overall, these data are a critical component to current habitat restoration that will not only enable survival but also support reproduction, as well as aid any future attempts at captive breeding.

- 167 **Diane R. Nelson¹ and Eugenie Clark²**. Behavior of *Trichonotus elegans* (Family Trichonotidae) and its cohabitation with the garden eel, *Gorgasia maculata* (Family Congridae). ¹East Tennessee State University, TN, ²Mote Marine Laboratory, FL.

The behavior of the protogynous hermaphroditic sand-diver, *Trichonotus elegans*, was studied off the central west coast of the volcanic island of Sangeang, Indonesia, where their territories overlapped with colonies of the garden eel, *Gorgasia maculata*. Each sexually mature *Trichonotus* male mated almost every morning with the 2 to 5 females in his harem shortly after sunrise. Males with adjacent harems often skirmished at their territorial boundaries, raising their filamentous dorsal fins and chasing each other. Mating took place on the sand, with the male pressing his quivering body on the female as she laid eggs on top of the sand. Once the male left, she buried the eggs into the sand with her mouth. After mating, *Trichonotus* left the sand area and formed swarms that fed on plankton, whereas *Gorgasia* fed on plankton only within reach of its permanent burrow. No competition between *Trichonotus* and *Gorgasia* was observed. When potential predators or divers approached the fishes' territory, *Trichonotus* dove into the nearest sand, whereas *Gorgasia* retreated into their burrows, easily recognized by the presence of the burrow entrance. At sunset, *Trichonotus* males with their harems dove into the sand in their territories where they remained until dawn. We collected *Trichonotus* eggs by scooping sand from the mating areas and placing the sample in containers with sea water. The pelagic larvae hatched out at approximately sunset.

- 168 **Jingjing Yin, Hazel Y. Wetzstein and Robert O. Teskey**. Root and shoot hydraulic conductivity and growth of one-year-old loblolly pine seedlings under two levels of atmospheric CO₂ and fertility. University of Georgia, GA.

In this study, we examined the influence of ambient and elevated [CO₂] and low and high fertility on hydraulic conductivity (K_h) in main stems, taproots, and fine roots of loblolly pine (*Pinus taeda* L.) seedlings. We found stem K_h was more affected by fertility than either taproots or fine roots, while taproot K_h was more sensitive to [CO₂] than stems or fine roots. Changes in K_h were correlated with needle gas exchange and tree growth, and the variations in xylem anatomy. Xylem radius and area in stems were stimulated by enhanced fertility, which appeared to be the cause of high K_h in stems of seedlings grown under high fertility. Tracheid lumen diameter in fine roots increased with enhanced fertility, whereas the effect of enhanced fertility on tracheid lumen diameter in taproots and stems was not significant. Fine root radius and root cross-sectional area were lower under elevated [CO₂] compared to ambient [CO₂]. This suggests that the main way for fine roots to increase hydraulic efficiency is to increase tracheid lumen diameter and root density rather than by simply increasing single root diameter.

- 169 **Bradley S. Cohen¹, David A. Osborn¹, George R. Gallagher², Karl V. Miller¹ and Robert J. Warren¹**. Visual sensitivity of white-tailed deer as determined by behavioral assay. ¹University of Georgia, GA, ²Berry College, GA.

Although many aspects of white-tailed deer (*Odocoileus virginianus*) biology and physiology have been studied thoroughly, few studies have confirmed deer cognitive perception, partly because of the difficulty of training deer to respond behaviorally in controlled experiments. We obtained a behavioral measure of relative visual sensitivity by comparing intensity thresholds based on performance of deer in forced-choice discrimination tests conducted at the short and long wavelengths of their purported visual spectrum. By using an automated training device, we taught deer to associate a food

reward with a light stimulus. We recorded deer responses across a series of decreasing intensities for each wavelength until deer could no longer discriminate the stimulus light from an unlit light. When deer performed at chance percentages we assumed they could no longer perceive the light. We regressed a best fit line to each deer's performance as intensity decreased at a single wavelength, which was used to demarcate the sensitivity threshold to that wavelength. We compared thresholds across wavelengths and delineated sensitivity measurements best fitting previous cone template functions. Our results confirm white-tailed deer's relative spectral sensitivity, which agreed with previously measured cellular sensitivity and deer's visual perception. Deer are dichromats with much greater sensitivity to shorter wavelengths and much lower sensitivity to longer wavelengths when compared to humans. For example, deer are about eight times more sensitive than humans to lights of wavelengths around 430 - 440 nm, which is the peak emission of most UV-brighteners.

- 170 **Adam B. Lyon, J. H. Craddock and Jennifer Boyd.** Using leaf-level gas-exchange characteristics to investigate the shade tolerance of *Castanea dentata* and *C. mollis*. University of Tennessee at Chattanooga, TN.

American chestnut restoration efforts include the production of hybrid chestnuts that retain the morphology of *Castanea dentata* (American chestnut) with the blight resistance of *C. mollissima* (Chinese chestnut). Although this process provides a potential solution to the blight susceptibility of *C. dentata*, *C. mollissima* does differ in some potentially significant ways from its American congener that could impact proposed restoration efforts. In particular, the short stature and sunny habitats associated with *C. mollissima* suggest it may tolerate shade less well than *C. dentata*, which could impact hybrid success in deciduous forests. We investigated shade tolerance of potted saplings of these chestnut types as determined by leaf-level photosynthetic light responses. Contrary to our predictions, *C. mollissima* exhibited greater maximum light-saturated photosynthetic rate (A_{max}) than *C. dentata* and hybrid chestnuts at relatively low light levels, but was photoinhibited at higher light levels, suggesting it is comparatively shade tolerant. In contrast, both *C. dentata* and hybrid chestnuts responded positively to increased light availability, exhibiting greater A_{max} than *C. mollissima* at relatively high light levels. Proposed efforts to restore *C. dentata* to deciduous forest systems partially hinge on the assumption that blight resistant hybrid chestnuts will function similarly to their American ancestors. Our findings suggest that *C. dentata* and hybrid chestnuts should respond similarly to shaded and open sites (i.e. gaps) in forest systems and that hybrid chestnuts should be successful across a range of light availability in deciduous forest systems.

- 171 **Alyssa L. Teat, Eva Gonzales, Michael D. Madritch and Howard S. Neufeld.** Influence of biochar on soil properties and physiological responses of corn, *Zea mays*. Appalachian State University, NC.

Atmospheric greenhouse gas concentrations are rapidly rising, with CO₂ concentrations at 392 ppm. Most mitigation strategies focus on either eliminating new greenhouse gases by using alternative fuel sources or reducing greenhouse gases already present in the atmosphere. Biochar, a black carbon compound produced through pyrolysis during the burning of biofuels, has emerged as a potential way to sequester CO₂ from the atmosphere into the soil due to its long-term recalcitrance. However, the effects of biochar on the environment are not yet fully understood. We investigated how varying amounts of biochar soil amendment can affect plant physiology and soil properties. A greenhouse study was conducted with corn (*Zea mays*) using three levels of biochar (0, 2.5%, 5% v/v). Additionally, soil analyses were performed using soil only, biochar only, and a mixture at a rate of 100 t ha⁻¹. While biochar did not change net photosynthetic rates or stomatal conductance in corn, the Ci/Ca ratio in corn decreased. Root and shoot biomass significantly increased in the 2.5% biochar treatment. Biochar also significantly increased cation exchange capacity of the soil as well as the percent carbon and nitrogen. Though improvements in soil quality were observed, there may have been a decreased amount of

nutrients available to plants over the short term with the addition of biochar. Recent studies also suggest a need to fertilize for greater plant growth. Biochar may be a useful soil amendment if applied in combination with fertilizer and may play an important role in carbon sequestration in the future.

- 172 **Maraih C. Clements and Jeff Kovatch.** Responses of the freshwater mussel *Pyganodon grandis* to alterations in temperature and photoperiod. Marshall University, WV.

Metabolic rate determines how much energy input is required for organismal maintenance, growth and reproduction. On a larger scale, metabolic rate also influences an organism's environment by removing and returning resources through uptake of nutrients and excretion of wastes. Due to their role as filter feeders, the metabolic rates of freshwater mussels may have a strong impact on water quality, as suggested by studies on invasive bivalves such as zebra mussels (*Dreissena polymorpha*) and Asian clams (*Corbicula spp.*). Metabolic rates in all taxa are directly influenced by both body mass and temperature. In mussels, a number of other factors, such as population density, reproductive status, suspended solid load and hypoxia have been shown to affect metabolic rate. The effects of photoperiod, however, have largely been ignored, resulting in a potential gap in understanding of mussel metabolic rate and, possibly water quality in response to both natural, seasonal cycles and certain environmental alterations caused by human activity. This experiment is designed to explore the combined effects of temperature and photoperiod on metabolic rate in the freshwater mussel *Pyganodon grandis* by acclimating mussels to one of nine temperature-photoperiod combinations in a 3x3 experimental design with a sample size of 5 mussels to a treatment. Metabolic rates are measured individually after two weeks of acclimation using fully-automated intermittent flow respirometry. Data are then normalized for soft tissue mass, and differences in metabolic rates in response to temperature and photoperiod are analyzed using ANOVA.

- 173 **Robin J. Van Meter and Christopher M. Swan.** Tolerance to road salt deicers in chronically exposed urban pond communities. University of Maryland, Baltimore County, MD.

Freshwater salinization is a concern in urban aquatic ecosystems that receive road salt runoff from vast expanses of impervious surface cover. Our study was designed to evaluate the effects of chloride contamination on urban stormwater pond food webs and to assess the tolerance of pond dwelling organisms that are chronically exposed. From May – July 2009, we employed a 2x2x2 full-factorial design to manipulate chloride concentration (low = 177 mg L⁻¹ Cl⁻ / high = 1067 mg L⁻¹ Cl⁻), gray treefrog (*Hyla versicolor*) tadpoles (presence/absence) and source of stormwater pond algae and zooplankton inoculum (low conductance/high conductance urban ponds) in 40, 600-L mesocosms. Phytoplankton biomass (chlorophyll [a] µg L⁻¹) was 53% greater in mesocosms receiving high conductance inoculum and high chloride as compared to the low conductance inoculum and low chloride treatment. High chloride reduced periphyton biomass by 15% and increased total zooplankton density by 80%, although different zooplankton taxa showed varied responses to chloride exposure. Tadpoles reared in high chloride that reached metamorphosis in fewer days than the average were also 18% greater in mass at metamorphosis relative to tadpoles in the low chloride treatment. Our results indicate differential susceptibility to chloride salts among algal resources and zooplankton taxa and suggest that phytoplankton, adult copepod zooplankton and gray treefrog larvae may be more tolerant of the high salt loads often present in urban stormwater ponds. Changes in ecosystem structure in urban ponds receiving and retaining chloride can be anticipated with predominance toward salt tolerant taxa.

- 174 **Alexandra J. Weiser, Kaitlin Everidge and Timothy M. Griffith.** Will northern range shifts impact photosynthetic capacity? A study of longer daylengths on leaf architecture in a common weedy annual. Georgetown College, KY.

Global warming may cause plant species to shift their geographic ranges towards higher latitudes to remain within a similar climate envelope. However, shifting species will experience longer day length cycles during spring and summer growing periods. For plant species, this may be problematic because specific day lengths provide cues for many developmental processes. While the deleterious effects of day length shifts on reproductive timing have been extensively studied, almost no attention has been given to how such changes affect vegetative development and resulting photosynthetic capacity. Populations of Cocklebur (*Xanthium strumarium*), obtained from three latitudes along a transect within the species' range were grown under three different day lengths corresponding to a 4° northward shift from each of the collection locations. Day length differences induced several changes in leaf architecture. Among all populations, there was a significant increase in leaf area and a corresponding decrease in specific leaf area (i.e. leaf thickness) under the northernmost day lengths. Under northern day lengths stomatal index values (stomata per epidermal cell) increased significantly for northern populations but decreased for southern populations. Moreover, for all traits, there were significant differences between populations from the three latitudinal regions, suggesting that leaf architecture is locally evolved. Therefore a northward range shift could potentially create a mismatch between the newly induced leaf architecture and the leaf architecture needed to maximize photosynthetic capacity in that climate. Ultimately, global warming could have deleterious consequences for photosynthetic capabilities of Cocklebur populations.

- 175 **Groves B. Dixon and Laura E. DeWald.** Clonal dynamics and decline of trembling aspen *Populus tremuloides* (Michx.) in the Kaibab National Forest, Arizona. Western Carolina University, NC.

Sudden aspen decline is distinguished from the typical gradual successional decline by rapid reduction of aspen coverage associated with high rates of crown dieback and stem mortality incurred from a combination of environmental stress factors (Worrall 2008). Adding to the complexity of sudden aspen decline is that single genets (genetically distinct individuals) that can comprise entire groves of ramets (physiologically distinct stems) might have varied degrees of resilience or susceptibility to different stresses. To improve our understanding of aspen clonal dynamics as it might relate to aspen decline, leaf and cambial tissues were collected from 15 sites within aspen groves in the Kaibab National Forest, AZ. Five microsatellite loci were used to determine the number of distinct genets and this information was used to infer the relative frequency of sexual reproduction at these sites. Preliminary results indicate the presence of 19 distinct genets among the 15 sites. This presentation will discuss the relationship(s) between the molecular data with previously collected data on the health (degree of crown dieback and percent stem mortality) and environmental conditions (elevation, slope, and aspect) of each site. Evidence for disparate health responses between genets that share similar environmental conditions will also be discussed.

- 176 **Thomas F. Bohrmann¹ and Mary C. Christman².** Robust abundance estimation in animal abundance surveys with imperfect detection. ¹US Environmental Protection Agency, ²University of Florida, FL.

Surveys of animal abundance are central to the conservation and management of living natural resources. However, detection uncertainty complicates the sampling process of many species. One sampling method employed to deal with this problem is depletion (or removal) surveys in which animals are sequentially removed (and not replaced) from a closed subunit of the population. Information obtained in such a survey is translated into estimates of total population abundance via a statistical abundance estimator, of which there are many choices. However, any reasonable abundance estimator deals explicitly or implicitly with the issue of imperfect animal detection. Generally speaking, abundance estimators are either from the class of "design-based" estimators or "model-based" estimators, each having strengths and weaknesses. In this talk, we describe those strengths and weaknesses in terms of abundance estimation, and further present a new

hybrid abundance estimator which draws from the strengths of both model-based and design-based estimators. We show that the coherent combination of these two frameworks yields a useful, flexible and yet robust total abundance estimator. We apply the estimator in the context of a simulation study based on annual depletion surveys of Chesapeake Bay blue crab abundance, and we compare the performance of our hybrid estimator with a typical fully model-based estimator. Although applied to a depletion data set, we discuss the utility of our estimator for other surveys in which animal detection rates are estimated, such as mark-recapture surveys.

- 177 **Mary M. Williams¹, Christina M. Perez¹, James A. Ruttinger¹, Derek S. Colbert¹, Michael J. Chamberlain¹, L. M. Conner² and Robert J. Warren¹.** The effects of growing-season prescribed fire on eastern wild turkey nesting ecology and poult survival in southwestern Georgia. ¹University of Georgia, GA, ²Joseph W. Jones Ecological Research Center, GA.

Increased use of growing-season prescribed burning in the southeastern United States has led to concern among biologists and hunters about potential impacts of these fires on ground-nesting game bird populations. Our objective was to investigate effects of growing-season prescribed burning on nest success and poult survival of eastern wild turkeys (*Meleagris gallopavo silvestris*) using radio telemetry. We conducted this research at 2 sites in southwestern Georgia that have similar habitat conditions—the Joseph W. Jones Ecological Research Center and Silver Lake Wildlife Management Area (WMA). To determine nest initiation date and location, we took multiple daily locations for radio-tagged females prior to and throughout the 2011 nesting season. Females with nests or poults near or within an active growing-season burn were located every hour. Poult survival data were determined using flush counts and incidental sightings until poults were indistinguishable in size from the females. At the Jones Center, 7 females began incubating 10 nests, 60% of which were successful. At Silver Lake WMA, 5 females began incubating 6 nests, 50% of which were successful. Only one nest was lost to prescribed fire on either study site, despite some nests being located immediately adjacent to or within prescribed burns. Predation was the major cause of poult mortality—only 1 of 9 broods on both sites survived to 40 days. Our results suggest that nest success and poult survival on these sites are similar to other studies, but the effects of growing-season burns on nest success and poult survival are minimal.

- 178 **David R. Brown and Gail Miller.** Increased frequency of year-round residency as an explanation for winter range shifts in a partial migrant songbird. Eastern Kentucky University, KY.

Recent work suggests that some migratory bird species are responding to climate change by shifting winter distributions northward; however, it remains unclear what population processes underlie these shifts. The general assumption is that fall migration distances have shortened resulting in a northward shift in average winter distribution. For obligate migrants, this Shortened-Migration Hypothesis has few obvious alternatives. For partial migrants, species in which some individuals migrate and others are year-round residents, the northward shift in winter distributions could also be explained by an increased frequency of non-migrant individuals—the Increased Residency Hypothesis. We tested these alternative hypotheses using band-recovery and geolocator data for American Robins. Band recovery analysis revealed no detectable change over time in migration distance; however we did detect an increased frequency in non-migrant individuals during the last two decades. Geolocator and band-resight data confirm that some individuals choose to remain resident year-round, in some cases defending breeding territories. These results suggest that short-distance migrants such as American Robin may adopt year-round residency as an alternative winter strategy to migration. For individual birds, the choice of strategies is likely a response to winter weather conditions; however, long-term climate warming could be causing increased numbers of residents thus leading to the observed population-level northward shifts in winter distribution.

179 **Gary D. Grossman and Robert E. Ratajczak Jr.** Population regulation in several southern Appalachian mountain stream fishes. University of Georgia, GA. We quantified the importance of density and environmental factors on the per-capita rate of increase and mean length of longnose dace (*Rhinichthys cataractae*), rosieside dace (*Clinostomus funduloides*) and rainbow trout (*Oncorhynchus mykiss*) in the Coweeta Creek NC drainage. We sampled fishes in spring and fall in three 30m and two 100m long sites between 1984 and 1995 and 1991 and 2004 respectively. The study period included high flow years and two droughts (1985-1988 and 1999-2002). PCA demonstrated that habitat availability and flow varied in the sites among years (high flow years with erosional substrata vs. low flow years and increasing amounts of depositional substrata). Similar results were noted in all 6 sites. Using regression analysis and AIC, we found evidence of density- dependence on the per capita rate of increase for all species. Rainbow trout displayed the strongest effects of density-dependence and rosieside dace the least. Density-independent forces were most important for rosieside dace. Variation in standard length of both adults and YOY for all three species was primarily explained by both density-dependent and density-independent forces (i.e. flow variation). These results indicate that these populations have the capability to recover from forces that depress population size and that flow variation is an important aspect of their population dynamics.

180 **Dwayne Estes.** Kral's beardtongue, a narrowly-endemic new species of penstemon (Plantaginaceae) from the Cumberland Plateau of Alabama and Tennessee. Austin Peay State University, TN.

Penstemon is a large, taxonomically complex genus of 270+ species endemic to North America. Approximately 20 species are native to the southeastern U.S. In spring 2011, an undescribed species of *Penstemon* was discovered while studying herbarium specimens and conducting field work in the southern Cumberland Plateau of Alabama and Tennessee. This new species is thought to be related to *Penstemon smallii* of the Appalachians and *P. tenuis* of the southern Mississippi River Valley. Like these, the new species shares closely eglandular-puberulent stems, ovate-lanceolate, subcordate, conspicuously serrated leaves, prominently bearded staminodia, and corolla throats which are strongly 2-ridged within. It is distinguished from both *P. smallii* and *P. tenuis* by its combination of small, pale-lavender to whitish corollas, spreading-recurved, linear-attenuate sepals, preference for rocky, limestone-derived soils on mountain slopes, and allopatric distribution. This species joins *Blephilia subnuda*, *Clematis morefieldii*, *Polymnia johnbeckii*, *Silphium brachiatum*, and *Vernonia flaccidifolia* as the latest addition to the endemic flora of rocky limestone woods of the southwestern escarpment of the Cumberland Plateau. It is known from less than a dozen populations in Blount, Jackson, Madison, and Morgan counties, Alabama, and Franklin County, Tennessee. The new species, to be known as Kral's beardtongue, will be named in honor of one of the preeminent taxonomists of the 20th and 21st centuries, Dr. Robert Kral (1926-), professor emeritus of Vanderbilt University, curator of the VDB herbarium, and research associate at the Botanical Research Institute of Texas in Ft. Worth.

181 **Jesse W. Jamison and Jimmy K. Triplett.** Introgressive hybridization and the evolution of North American cane bamboos as revealed by nuclear and chloroplast DNA. Jacksonville State University, AL.

The North American cane bamboos (Poaceae: Bambusoideae: *Arundinaria sensu stricto*) are an ecologically important but taxonomically difficult group of forest grasses in the Southeastern US. Recent phylogenetic research supported the recognition of three species (*A. appalachiana*, *A. gigantea*, and *A. tecta*) and implicated hybridization as a source of taxonomic confusion. The studies also identified East Asian bamboos (*Pleioblastus sensu lato*, *Sasa*, and *Sasamorpha*) as the closest relatives of the cane bamboos, while highlighting divergent lineages for *A. gigantea* (the river cane clade) and *A. appalachiana* + *A. tecta* (the switch cane clade). The current study utilized DNA

sequences from three nuclear genes and multiple chloroplast gene regions to investigate the origin and evolution of *Arundinaria*. Each of the nuclear gene trees confirmed hybridization among cane bamboos. Moreover, chloroplast DNA haplotypes revealed that hybridization has been bidirectional and, in combination with nuclear data, provided evidence of introgression and chloroplast capture. Consistent with previous studies, the new data failed to support the monophyly of *Arundinaria*; in contrast, analyses suggested a new hypothesis that river cane and switch cane lineages arose independently in East Asia and hybridized with Asiatic species prior to migration. Due to limited population-level sampling, a more conclusive insight into the phylogeographic history is still impossible, but these new observations form the basis of our future studies.

182 **John M. Herr, Jr.** The hydro-microtome: a new instrument for sectioning fresh or paraffin embedded plant tissue. University of South Carolina, SC.

This instrument differs from other microtomes in that the only portion of the specimen not in contact with the metal base that holds it in place is the portion to be removed as a section. Depression of the specimen as the result of the downward movement of the blade is thus eliminated. Section thickness is determined by use of a special gage that consists of a standard glass slide onto which two 0 cover glasses or strips of thick to thin aluminum foil are attached on either side of a central space. The slide is placed against the surface over which the cutting blade will pass and the tissue specimen is advanced forward to contact the central portion of the slide. The distance between the central space surface and the blade pathway is equal to the thickness of the mounts on either side of that space. The gage is then removed, and the blade is passed through the specimen to cut a section the same thickness of the mounts on the gage. The microtome is immersed in water for sectioning fresh tissue so to reduce friction as the blade passes through the tissue. Immersion of the instrument is not necessary for preparing paraffin sections. Stem cross sections from *Coleus blumei* Benth. and *Sinningia sellovii* (C. Mart.) Wiehler serve to illustrate the application of this instrument.

183 **Emily L. Gillespie and Kathleen A. Kron.** Phylogenetic analysis reveals reticulate evolution in the arctic/alpine genus *Cassiope* (Ericaceae). Wake Forest University, NC.

The genus *Cassiope* (Ericaceae) is comprised of approximately 17 species of mat-forming dwarf shrubs distributed circumboreally in the Northern Hemisphere, with greater species diversity in both the Pacific Northwest and the Himalayas. Although overall similar in their habits and general morphology, a phylogenetic study was undertaken in order to produce a species-level phylogeny suitable for interpretation of morphological evolution and biogeographic history. Bayesian, Maximum Likelihood and Maximum Parsimony analyses were conducted on a three-gene (chloroplast and nuclear) dataset. The combined analysis showed diminished support and resolution compared to analyses of individual genes and genomes, suggesting a negative interaction of some taxa in the combined analysis. Closer examination revealed three taxa whose positions were most unstable. A series of smaller analyses were conducted in order to evaluate the interactions of each of these three taxa alone and in combination. Results indicate that the three problematic taxa are likely to be hybrids. Re-analyses in light of these results are congruent with some morphological and ecological data, demonstrating likely evolutionary scenarios in this enigmatic group.

184 **Tina Davis¹, Melanie DeVore¹ and Kathleen Pigg².** Deciphering the *Prunus* fossil leaf record: delimiting leaf types from the Eocene of Washington State.

¹Georgia College & State University, GA, ²Arizona State University, AZ.

The latest early Eocene Republic flora of northeastern Washington State provides an unusual glimpse of one of the oldest warm temperate floras of the Tertiary. One family that is well represented at Republic and the other floras of the Okanogan Highlands of northeastern Washington State and British Columbia, Canada, is the Rosaceae. The first

documented occurrence of fossil *Prunus* flowers is from Republic, and not surprisingly, there is a large representation of the genus in the leaf record. Untangling the diversity of leaf types present is a challenge. Glands have often been used as an important feature for delimiting species of *Prunus*. However, damage pattern and preservation must be carefully considered when interpreting *Prunus* leaf types. Although glands are important, other features such as tooth types and higher order venation are useful when describing these fossil leaf types. Gland type, as well as basal venation leading to the glands, suggests that the fossil *Prunus* leaves are most similar to the living *P. serotina* Ehrh. ("Black Cherry") and *P. virginiana* L. ("Chokecherry"). Another interesting aspect of the fossil leaves is the array of damage patterns they exhibit. Some patterns are clearly attributed to insects but others are quite similar to patterns produced by modern pathogens of extant *Prunus*. The fossil *Prunus* leaves serve as valuable means of understanding both the evolutionary history of the genus and its ecological interactions.

185 **Tanja M. Schuster.** Recircumscription of *Polygonum* L. to include *Polygonella* Michx. East Carolina University, NC.

Polygonella belongs to the buckwheat family Polygonaceae and is an endemic of the southeastern U.S. It is included in Polygoneae along with *Atraphaxis* L., *Duma* T.M.Schust., *Fallopia* Adans., *Muehlenbeckia* Meisn., *Polygonum* and *Reynoutria* Houtt. Morphological data support the inclusion of *Polygonella* within *Polygonum* and the recognition of three sections in *Polygonum* (*Duravia*, *Polygonum*, *Pseudomollia*). *Polygonella* shares several floral characters, fruit morphology and petiole anatomy with *Polygonum*, and in particular members of sect. *Duravia*. In this study, the evolutionary relationships among genera of Polygoneae and the circumscription of *Polygonum* are investigated with Maximum Likelihood and Maximum Parsimony methods in a molecular framework. Genetic markers used include one nuclear (nrITS) and three chloroplast (*MatK*, *NdhF* and *TrnL-TrnF*) regions. Results confirm that tribe Polygoneae is composed of three clades with *Knorringia* sister to all other genera within Polygoneae. A second clade is formed by *Reynoutria* and *Fallopia* + *Muehlenbeckia* and the third by their sister clade comprising *Atraphaxis*, *Duma* and *Polygonum*. In particular, results show that *Polygonella* is included in *Polygonum* as indicated by morphological characters. The eight species of *Polygonella* sampled (of a total 11) form a strongly supported clade that is embedded among species of *Polygonum* sect. *Duravia*, also with strong support. The currently accepted sections within *Polygonum* were also recovered with these molecular data. They show that *Polygonum* sect. *Duravia* including subsect. *Polygonella* is sister to a clade formed by the sects. *Polygonum* and *Pseudomollia*. Within subsect. *Polygonella*, *Polygonum nesomii* (= *Polygonella robusta*) is sister to all other species sampled.

186 **Jason R. Comer, Wendy B. Zomlefer, Alexander Matte Santos and James H. Leebens-Mack.** A study of the genetic diversity in Georgia and Florida populations of *Veratrum woodii* (Liliales: Melanthiaceae). University of Georgia, GA.

Veratrum woodii grows in moist deciduous forests predominately on north- and east-facing slopes, ranging from as far south as northern Florida northward into Ohio, reaching its western range edge in Missouri-Iowa down to eastern Oklahoma. However, most states have only a few isolated populations, where *V. woodii* is ranked endangered, rare, or threatened. The species is locally common only in eastern Missouri. *Veratrum woodii* is a long-lived rhizomatous perennial with maroon tepals and large adaxial perigonal nectaries and is insect pollinated. Based on this pollination syndrome, this species is considered to be outcrossing. Leaf tissue was collected from 11 populations from Georgia, three in Florida, and one from Missouri. Populations ranged in size from five to more than 600 individuals, and 30 individuals were sampled from each population whenever possible. Amplified Fragment Length Polymorphism (AFLP) analyses were used for this study because prior knowledge of the genome is not required, and the AFLP data represent samples of the entire genome. The fragments generated from three primer combinations were analyzed using GenAEx software. The results imply that most of the genetic

variation is within populations, and the PhiPT value indicates that *V. woodii* has a mean expected heterozygosity comparable to other rare long-lived perennials.

- 187 **Caitlin D. Ishibashi, Tyler R. Kartzinel and Dorset W. Trapnell.** Chloroplast DNA sequencing reveals deep phylogeographic split among populations of the lady of the night orchid, *Brassavola nodosa*, in northwestern Costa Rica. University of Georgia, GA.

In biological landscapes, spatial genetic structure of species may occur as the result of historical processes. Such partitioning can influence patterns of genetic variation both within and between populations of the same species. In this study, we used chloroplast markers to measure genetic variation within and among five populations of the lady of the night orchid, *Brassavola nodosa*, in the Guanacaste province of northwestern Costa Rica. We addressed the following questions. Are there patterns of genetic structure within and among populations of *Brassavola nodosa*? If so, what do they imply about levels of gene flow: are populations in close proximity to one another fairly isolated, or do they exhibit panmixia? A haplotype network constructed from chloroplast DNA sequences revealed 8 haplotypes across 186 individuals collected from 5 locales. Within each geographic region (north/south), gene flow was found to occur between populations, with considerably less structure in the north than in the south. This distribution of the maternal lineage in these orchids indicates that seed dispersal is widespread. Notably, there was a distinct phylogeographic split of 12 mutational events between the two northern and two southern populations (about 60 km apart). The fifth, centrally located population contained haplotypes found in both the northern and southern regions. This major genetic split between north and south has been documented in other plant species in the Guanacaste region, suggesting that a common geographic influence may result in concordant phylogeographic structure.

- 188 **Matthew N. Waters¹, Stephen W. Golladay² and Chase H. Patrick¹.** The effects of land use and allochthonous inputs on primary producer community structure in a large, shallow reservoir: evidence from lake sediments. ¹Valdosta State University, GA, ²Joseph W. Jones Ecological Research Center, GA.

Lake Seminole, GA is a large, shallow reservoir formed by the joining of the Flint and Chattahoochee Rivers. The reservoir is located on the Georgia-Florida border and serves as a power supply, water supply, fishery and recreational area. The drainage basins of the two rivers are dissimilar with the Flint River draining agricultural lands and the Chattahoochee River bringing materials from more industrial areas such as Atlanta and Columbus. Currently, the primary producer community is dominated by dense stands of the invasive macrophyte, *Hydrilla*, and its associated epiphytes. Given that allochthonous materials can affect limnological characteristics, we collected a sediment core from each basin of Lake Seminole to reconstruct the relationship between allochthonous inputs and primary producer community structure since the establishment of the reservoir. Paleolimnological proxies such as organic matter, total carbon/total nitrogen, nutrients and metals were measured to infer allochthonous inputs, and photosynthetic pigments were analyzed to reconstruct primary producer community structure. Results show distinct differences between the sediment stratigraphies of the two basins. Primarily, most organic matter proxies were higher in sediments from the Flint River arm of the lake and suggest a greater impact on primary producer community structure. Implications from this study could aid the future management of Lake Seminole as well as the management of other reservoirs experiencing primary producer community change.

- 189 **Stephen W. Golladay¹, Alan P. Covich², Julie McEntire², Stephen Shivers² and Stephen Opsahl³.** Reservoirs as functional elements of rivers: Lake Seminole, GA as a case study. ¹J.W. Jones Ecological Research Center, GA, ²University of Georgia, GA, ³USGS Texas Water Science Center, TX.

Reservoirs are a common feature of North American rivers; many were constructed in the mid- to late 20th century. Reasons for construction vary but include flood control, water supply, power generation, navigation, and recreation. Reservoirs are often viewed by researchers as 'separate' from rivers, disconnecting upstream and downstream segments. Lake Seminole, in southwestern Georgia, is located at the confluence of the Flint and Chattahoochee Rivers and its' outfall is the source of the Apalachicola River. The Chattahoochee is a regulated river with a number of urban areas along its length. Water quality in the Chattahoochee shows elevated SRP and suspended sediment levels. The Flint River is unregulated, flowing through a rural landscape dominated in the lower reaches by row-crop agriculture. Water quality is characterized by elevated NO₃-N levels. Lake Seminole is shallow and the invasive aquatic macrophyte *Hydrilla verticillata* is the main primary producer, reaching nuisance levels during the summer. As water moves through the lake, nutrient and suspended sediment levels are reduced through combined water column and sediment processes. Thus, the reservoir is assimilating and transforming materials from upstream development. Like many North America rivers, the Flint and Chattahoochee have been channelized, wood removed, and otherwise altered by humans. Cumulatively, these actions reduce river complexity, lower rates of biogeochemical transformations, and diminish assimilative capacity. Reservoirs, while not strictly lotic, may restore a portion of this ability and should be viewed as functional river elements in conceptual models and river management plans.

- 190 **Stephen D. Shivers¹, Stephen P. Opsahl², Alan P. Covich¹ and Stephen W. Golladay³**. The diel and seasonal effects of submerged aquatic vegetation on nutrient dynamics, nutrient storage, and organic carbon bioavailability in a southeastern reservoir. ¹University of Georgia, GA, ²United States Geological Survey, ³Joseph W. Jones Ecological Research Center, GA.

The concentration and bioavailability of dissolved organic carbon (DOC) can be altered by the autochthonous production of macrophytes, and this alteration can influence microbial processes in aquatic ecosystems. This study evaluated the effects both spatially and temporally of submerged aquatic vegetation (SAV) upon carbon and nitrogen dynamics in a reservoir. Concentrations of DOC, carbohydrates, and NO₃ within SAV beds (*Hydrilla verticillata*) were measured in situ throughout the water column over a 24-hour period. The effects of labile DOC upon the microbial community and the resulting implications were also investigated by measuring O₂ consumption during whole water incubations. DOC concentrations exhibited the greatest variability among depths during August and September. Diurnal carbon bioavailability was higher near the sediment during September based on higher O₂ consumption rates observed during the day (1.09 μmol/h) than at night (0.52 μmol/h). Monosaccharide concentrations also followed the same pattern as DOC and could explain the increased carbon bioavailability. Therefore, it is likely that an increase in bioavailable carbon led to an increase in microbial metabolism. NO₃ concentrations were consistently lower during the growing season near the sediment (mean = 189 μg/L) compared to the surface (mean = 705 μg/L) or the intermediate depth (mean = 838 μg/L). These lower NO₃ concentrations indicate that nitrate was being removed from the system either through active uptake and storage or denitrification. These findings demonstrate that a portion of the DOC (monosaccharides) produced by SAV is labile which results in the alteration of nutrient cycling within the SAV bed.

- 191 **Joseph M. Dirnberger**. Linking climatic extremes to episodes of small-cell phytoplankton dominance in a large southeastern reservoir. Kennesaw State University, GA.

In the late summers of 1993 and 2007, phytoplankton communities in Allatoona Lake (Georgia, USA) shifted from normally diverse assemblages to near monospecific blooms of small cell-size species (a 0.5 X 2 μm cyanobacterium and a 2.5 X 15 μm diatom, respectively, comprising up to 99% of all cells). Water temperatures in the epilimnion during the late summer in each of these years were the highest measured in these two

decades, and were associated with very low inflows into the reservoir. An atypical shift to nitrogen limitation coincided with these blooms, indicating that nutrient quality rather than quantity contributed to the “blooms” (also unlike typical algal blooms, biomass did not change appreciably). Literature based on physiological studies suggests that small cells (having relatively less surface areas) may have an advantage when the limiting nutrient shifts and temperature increases, providing an explanation for these blooms of small cells consistent with the meteorological and limnological changes observed during the blooms. Other studies in recent years have attributed shifts toward smaller cell size of phytoplankton to climate change. Increasing anthropogenic disturbance in the watershed along with an observed trend of increasing thermal stratification may explain the periodic and dramatic nature of the shifts observed in Allatoona (and potentially other Southeastern lakes) where few species are pre-adapted for such changes.

- 192 **Alan E. Wilson¹, RajReni B. Kaul², Michael F. Chislock¹ and Gina L. Curvin³.** Towards an improved understanding of the factors mediating toxic cyanobacterial blooms throughout the southeast. ¹Auburn University, AL, ²University of Georgia, GA, ³Alabama Department of Environmental Management, AL.

Protecting diminishing freshwater resources is one of the most pressing global environmental issues. Bloom-forming cyanobacteria are one of the primary biological indicators of poor water quality in freshwater systems and tend to dominate algal communities under nutrient enrichment. Some cyanobacteria produce potent secondary metabolites, such as the hepatotoxin, microcystin, that can poison aquatic foodwebs. To better understand the threat that toxigenic cyanobacteria pose to the southeastern U.S., we, in collaboration with state agency collaborators, surveyed 235 waterbodies in Alabama, Florida, Georgia, Kentucky, and Tennessee during the summers of 2008-2010. Our study sites varied widely in productivity across time and space (total phosphorus concentration range: 6 – 28,320 µg/L) and 82% of the sites had detectable concentrations of microcystin. Clearly, toxic cyanobacteria are common and may be an environmental hazard throughout the Southeast. To understand the factors mediating cyanobacterial blooms throughout the Southeast, we analyzed a variety of water quality parameters using classification and regression tree (CART) analysis. Across all waterbodies, total nitrogen concentration was strongly correlated with chlorophyll and microcystin concentrations and was the most influential factor for aggregating data below and above the eutrophic threshold for these two response variables. Interestingly, Secchi depth, an easily measured parameter related to water transparency, was shown to produce similarly structured CART models relative to the models produced with the full water quality dataset. This finding has important implications for involving laypeople in the management of our freshwater resources. We are currently collaborating with our colleagues to collect additional water quality samples to test the utility of our models for forecasting algal blooms throughout the Southeast.

- 193 **Dylan C. Grippi, Stuart K. Auld and Meghan A. Duffy.** Ecological and evolutionary responses of zooplankton to parasite epidemics. Georgia Institute of Technology, GA.

Parasites can strongly influence zooplankton populations and communities. For example, parasites may regulate competitively dominant species, releasing resources to other community members, causing changes in diversity. When a community recovers from these changes, it is considered resilient. Here we explored the resilience of a pond community to perturbation from a virulent bacterial parasite. We have collected weekly zooplankton community data over a seven-month period from constructed ponds in Athens, GA. *Ceriodaphnia dubia*, a common Cladoceran species in these ponds, suffered an epidemic from the bacterial parasite, *Pasteuria ramosa*. This parasite is highly virulent, castrating its host. Preliminary analysis shows that the epidemic had a severe negative impact on host density: there was a significant negative correlation between parasite prevalence and *C. dubia* population density the following week. However, the *C. dubia*

and the zooplankton community as a whole were resilient to this perturbation. After the epidemic waned, *C. dubia* densities recovered (48 days post epidemic start). Additionally, measures of population density and growth across species as well as Shannon's diversity index show few correlations with parasite prevalence or host density change. Resilience of the host population may be explained by rapid selection for resistance to the parasite. Using clonal host lines and parasites established before and after peak epidemic prevalence, experiments this spring will determine whether the host population evolved resistance during the epidemic. These data provide evidence that communities in constructed freshwater habitats are resilient to epidemic perturbations.

- 194 **Alan P. Covich, John C. Bergstrom, Rebecca L. Moore and Douglas A. Patton.** Savannah River reservoirs are sentinels for forecasting loss of ecosystem services. University of Georgia, GA.

Ecologists are studying changes in lake levels, water temperatures, and water quality to determine how global changes are affecting regional and local freshwater ecosystem services. Increased inter-annual variability of precipitation, record floods, and prolonged droughts throughout much of the Southeast have characterized the last 10 years. Moreover, the increasing demand for freshwater resources for municipal uses as well as for irrigation, hydropower, and cooling waters, make it difficult to provide environmental flows that can sustain the aquatic biodiversity of native freshwater species. All these changes combine to increase uncertainties for maintaining populations of native freshwater species. More detailed studies of their resilience to cumulative effects of flow variability are needed. One example is the chain of three reservoirs along the Savannah River where habitats for key species are at increased risk. The current high species richness among the native mussel communities contributes to essential ecosystem processes such as nutrient cycling, detrital processing and biofiltration. However, a combination of drought, sea-level rise, and dredging of the river at the Port of Savannah will create more challenges for reservoir managers to evaluate trade-offs among alternative flow regimes that can either protect or imperil benthic invertebrates. The proposed deepening of the river channel and estuary to begin in 2012 will increase the capacity of larger cargo ships to use the harbor, but will alter the sediments and salinity that affect benthic populations and their associated ecosystem services.

- 195 **Bryan Ayres, Brian Ingram, Chris Murdock, Robert Carter and Benjie Blair.** A technique for the detection of *Borrelia burgdorferi* in various Alabama Counties via canine blood samples. Jacksonville State University, AL.

Borrelia burgdorferi is the know bacterium causing Lyme disease. The state of Alabama is currently monitoring the presence of *B. burgdorferi* by taking blood samples from canines. These blood samples are being sent to Jacksonville State University in Jacksonville, Alabama for processing. A real-time PCR assay has been developed to detect *B. burgdorferi* if it is present in the blood samples. A probe has been designed to attach to a portion of the bacterium genome before the designed forward and reverse primers set down on the same gene. The primers will separate the probe from the DNA, which causes the probe to fluoresce making detection of the bacterium DNA possible.

- 196 **Amanda C. Smith and Mijitaba Hamissou.** Comparative analysis of antioxidants and insulin-potentiating factors (IPF) in bitter melon (*Momordica charantia*) and zucchini (*Cucurbita pepo*). Jacksonville State University, AL.

Plant products have always been important tools in drug discovery. Drug discovery usually requires a thorough investigation of biologically active compounds produced by plants. Bitter melon (*Momordica charantia*) is a plant commonly consumed as a folk remedy for diabetes in India, Africa, and parts of Latin America. It contains important enzymes and antioxidants as well as an insulin-potentiating factor (IPF) that may regulate blood sugar levels in humans. Zucchini (*Cucurbita pepo*) is a cultivar of summer squash common to North America. Since both zucchini and bitter melon belong to the family Cucurbitaceae, it

is possible that zucchini may contain biologically active compounds similar to those found in bitter melon. Fresh bitter melon and zucchini fruits were extracted in buffer, and then analyzed for their antioxidant properties. Non-enzymatic and enzymatic antioxidant properties, including total phenolic content, radical scavenging activities, and superoxide dismutase activities were investigated. The presence of β -glucosidase, an enzyme indicative of medicinal potential, was analyzed using established molecular procedures. IPF activities will be investigated in the extracts by Western Blot analyses. Preliminary data indicate that bitter melon has higher enzymatic and non-enzymatic antioxidant properties and higher β -glucosidase activity than zucchini.

197 **Diana S. Ivankovic.** Obesity study case: correlation between incidence of breast cancer and BMI in women in Anderson County. Anderson University, SC.

The prevalence of obesity and breast cancer in the U.S. is creating more opportunities to prove a correlation between these two serious health threats. Research has previously focused on the relationship between obesity and cervical or uterine cancers. Obesity is a known and accepted risk factor for breast cancer in postmenopausal women. However, this study focuses on the incidence of breast cancer in both premenopausal and postmenopausal women of varying weights. A group of 183 female breast cancer patients at the Anderson medical center in Anderson, South Carolina, as well as a control group of about 200 cancer-free women of the same age were studied. Their BMI was determined, and a statistical analysis was performed to draw a final conclusion on the effect of the role that estrogen plays in breast cancer development and progression. On average, women who had breast cancer had higher BMIs, when compared to the control group. Specifically, there was a positive correlation between high BMI levels and incidence in breast cancer in women of Anderson County. There was also a significant positive correlation between obesity levels and breast cancer mortality. The correlation shown throughout this study highlights the importance of maintaining a healthy weight in women, particularly postmenopausal women. Because the rate of obesity in the United States continues to increase, more research should be done to further study the link between increased BMI with breast cancers. Obesity is a risk factor that can be modified through diet and exercise; therefore, it is an important tool in breast cancer prevention.

198 **Chris R. Gissendanner.** A novel transmembrane extracellular leucine-rich repeat protein regulates larval development and somatic gonadogenesis in *Caenorhabditis elegans*. University of Louisiana at Monroe, LA.

The identification and characterization of novel signaling pathways is an essential area of future investigation in developmental biology. Using an RNAi-based screen for genes that are required for somatic gonad development in *C. elegans* we have identified a gene encoding a novel protein belonging to the transmembrane extracellular leucine-rich repeat (tm-eLRR) protein superfamily. tm-eLRR proteins possess extracellular leucine-rich repeat domains that mediate protein-protein interactions. Studies in a variety of systems have identified functions for tm-eLRR proteins in cell-cell and cell-matrix interactions as well as receptors for various ligands. Biological functions of these proteins include cell migration, neuronal development, and innate immunity. The gene we identified, *Pan-1*, encodes a predicted tm-eLRR with structural homologs in fruit flies and humans. *Pan-1* has multiple functions during *C. elegans* development. *Pan-1* mutants arrest as larvae from an apparent molting defect and knockdown using RNAi also revealed a function in the development of adult reproductive organs. Cell-marker analyses indicate that these phenotypes are due to a failure in cell specification or differentiation. We generated nematodes that express full-length PAN-1 fused to GFP and confirmed that PAN-1 is a transmembrane protein that also exhibits a dynamic spatial and temporal expression pattern. In addition, expression of an intracellular domain-deleted PAN-1 is dominant negative, indicating that PAN-1 functions through its intracellular domain. Therefore, the genetic analysis of *Pan-1* in *C. elegans* will be instrumental in dissecting the molecular mechanisms of tm-eLRR signaling.

- 199 **Eric Craig, Koti Hanes and Miriam Segura-Totten.** Investigating the role of barrier-to-autointegration factor (BAF) in nuclear disassembly. North Georgia College & State University, GA.

Barrier-to-Autointegration Factor (BAF) is a highly conserved DNA binding protein with fundamental roles in nuclear envelope assembly. BAF binds to LEM domain proteins, which play significant roles in gene regulation, nuclear structure and integrity, and signaling pathways. These interactions are important in BAF-mediated attachment of chromatin to the nuclear periphery. Previous studies found that BAF is essential in the reassembly of the nuclear envelope at the end of mitosis, however, the role BAF plays in nuclear disassembly has not yet been explored in depth. To begin to elucidate the function of BAF during nuclear disassembly, we assembled functional nuclei with extracts from *Xenopus* oocytes. We disrupted normal BAF activity by adding anti-BAF antibodies to interphase nuclei. We then triggered nuclear disassembly by adding $\Delta 90$ cyclin. The disassembly process was monitored at key timepoints for 90 minutes to observe the extent of nuclear breakdown. Our results suggest that blocking BAF's normal function using a specific antibody impedes nuclear disassembly, and suggests that BAF completes an important task in this process.

- 200 **Kathryn M. Sinclair.** Phenotypic and molecular characterization of *Drosophila melanogaster* rhoa mutants. James Madison University, VA.

Morphogenesis is the umbrella term for various cell shape changes and rearrangements that occur during development. *RhoA* protein plays an essential role in cell shape driven morphogenetic processes. For example, *RhoA* in mice is present at the site of neural tube morphogenesis (Ybot-Gonzalez et al. 2007). In *Drosophila*, *RhoA* homozygous mutant embryos die as a result of failed head involution morphogenesis (Halsell et. al., 2000). Molecular and phenotypic characterization of five extant *Drosophila RhoA* suggests they are complete loss-of-function point mutations. In this study, two additional mutant alleles, *RhoA*^{3.5.1} and *RhoA*^{4.4.2}, are being studied. Phenotypic analysis suggests *RhoA*^{3.5.1} may be a complete loss of function allele while *RhoA*^{4.4.2} exhibits a unique partial loss of function phenotype. DNA sequencing of the mutant alleles should reveal the linkage between the molecular defects and these phenotypes.

- 201 **Erika Balogh, Soumitra Ghoshroy, Mihaly Czako and Laszlo Marton.** Ultrastructural aspects of salt tolerance in *Arundo donax* with transmission electron microscopy. University of South Carolina, SC.

The improvement of biomass crops is a research priority that supports alternative energy initiatives. One of the most promising energy crops is *Arundo donax*. Besides its outstanding biomass yield, it can remediate or prevent pollution of the soil and water by absorbing excess nutrients and pollutants and its special metabolism. As a facultative halophyte it occurs in salinity impacted ecosystems and has outstanding biomass yields when irrigated with saline wastewater. To characterize salt tolerance, the 'GT' (salt-tolerant) and the 'Blossom' ecotype (non-salt tolerant) were grown on 1% and 0% NaCl. Sodium uptake was measured by SEM outfitted with an EDS analysis system. Based on the previous sodium distribution results, the photosynthetic apparatus appears to be protected from salinity in 'GT', possibly by exclusion of the sodium ions from the stem and leaf. To test this, leaf samples were observed with a Hitachi H-8000 TEM. The chloroplasts are swollen and enlarged in the 'Blossom' but not in the 'GT' ecotype grown on 1% NaCl. The swollen and enlarged chloroplasts have severe distortions of the thylakoid membrane organization in the 'Blossom' ecotype and also have much fewer starch granules, which is a sign of disrupted photosynthesis. By understanding the mechanism of salt tolerance, genetic improvements could be devised to improve this plant with untapped breeding potential via selection or molecular techniques.

- 202 **Indrani Dey and Christi L. Magrath.** Autonomous replicating sequences of *Saccharomyces cerevisiae*: methods to assess transcription termination activity. Troy University, AL.

Saccharomyces cerevisiae has a high gene density due to having six thousand genes dispersed over its sixteen chromosomes. This may result in genes overlap (both structurally and functionally). Autonomous replicating sequences (ARS), which are origins of replication, share some similarities in structure with transcription terminators. A spatial relationship between the molecular processes of replication initiation and transcription termination has been established, while it has been maintained that they are genetically separable. However, a functional association between these two processes has been suggested. This project clarifies whether or not a functional interrelationship exists between replication initiation and transcription termination. Chromosome III is the smallest chromosome containing 19-20 ARS elements, and therefore was chosen as our model chromosome. Qualitative and quantitative assays will be used to determine the transcription termination activities of all the ARS elements by measuring their β -galactosidase activities in a transcription termination assay. This presentation highlights the efforts utilized to create the constructs needed to assess the termination activity of the ARS element. It is hypothesized that the most replicatory active ARS will be the best transcription terminators; this study will be the first assessment of the transcription termination capacity of all the ARS elements on a single chromosome.

- 203 **Tesfaye Belay.** Stress alters the levels of key immune parameters in response to genital chlamydial infection. Bluefield State College, WV.

Chlamydia trachomatis infection is the most common bacterial sexually transmitted disease worldwide. Stress is a risk factor for various infections; however, its effect on *Chlamydia* genital infection has not been defined. We recently have demonstrated that exposure of female mice to chronic cold water stress results in decreased resistance to primary or secondary *Chlamydia* genital infection. Cytokine/chemokine gene expression profile during infection of the stress model is not known. The objective of this project was to determine the levels of relative changes in cytokine/chemokine production in homogenates of the genital tract and spleen of stressed mice during genital infection. The hypothesis was that stress alters the mRNA levels and protein secretion of cytokine or chemokine proteins during *C. trachomatis* infection. Cold-stress was induced by immersing mice in cold water for 5 minutes daily for 24 days and infected intravaginally with 10^7 IFU of *C. trachomatis* while under anesthesia. After 48 hour infection, spleen and genital tract samples were collected and mRNA level or cytokines/chemokines production was determined by qPCR or multiplex assay. Exposure to stress resulted in a 2-fold or more reduction in mRNA or protein levels of interferon gamma, (interleukin) IL-12p40, IL-1b, IL-6, IP-10, and RANTES in the spleen and genital tract lysates of stressed mice. In contrast, gene expression of IL-10 was markedly increased in stressed compared to non-stressed mice. These results suggest that stress may play a critical role in the suppression of the protective immune system leading to increased susceptibility to genital infection and immunopathogenesis.

- 204 **Beck Frydenborg, Keri Goodman, Nicholas Moore, Farida Ahmadi, Tamara Misewicz, Renee Perro and Erin Lipp.** Monitoring levels of fecal indicator bacteria and salmonella upstream and downstream of a constructed wetland. University of Georgia, GA.

Constructed wetlands are considered to be a low maintenance and economical method for the treatment of stormwater. The ability to remediate incoming water depends on several factors, including residence time, the characteristics of the target pollutant, and rainfall. The wetland at the State Botanical Gardens of Georgia was constructed in 2003 to remove nutrients from an upstream swine farm and poultry feed mill before waters enter into the middle Oconee River. While the constructed wetland has successfully reduced nutrients, its ability to treat other forms of pollution is unknown. Microbial pathogens (i.e.

fecal indicator bacteria) are the primary cause for 303(d) impairment of water bodies in the United States. To assess this constructed wetland's ability to remove microbial contaminants, the fecal indicators *E. coli* and enterococci and the pathogen *Salmonella* were enumerated upstream and downstream of the wetland five times within a 30-day period. During dry conditions, outflow concentrations decreased by 17% (*E. coli*), 16% (enterococci), and 55% (*Salmonella*) compared to inflow concentrations. Storm events increased outflow concentrations by 14% (*E. coli*) and 39% (enterococci), while *Salmonella* response was mixed. Fecal indicator levels exceeded EPA impairment criteria during both dry and storm conditions despite wetland filtration, and also demonstrated a poor ability to predict *Salmonella* levels. This study highlights the challenges of designing successful wetlands, and the problems of using fecal indicators to accurately designate impairment.

- 205 **Ryan Brown, Katherine Doster and Henry Spratt.** Assessment of algae species exposed to coal ash leachate for toxicity of select toxic chemicals. University of Tennessee at Chattanooga, TN.

Coal burning power plants provide electricity for much of the United States. One byproduct of coal burning is the generation of large quantities of ash. Regulation of gaseous emissions from power plants has resulted in the incorporation of toxic chemicals into the ash. Leachates from ash piles may transport toxins into aquatic ecosystems. This study was conducted at the Tennessee Valley Authority's (TVA) Paradise Fossil Power Plant in Kentucky to assess potential impacts that toxins associated with coal ash have on algae growing in nearby aquatic ecosystems. Samples were collected from sites in the Green River upstream and downstream of the plant, and from water draining from coal ash leachate. Algae growing at the various sample sites were identified to the level of genus. LD50 tests were run on pure cultures isolated from leachate, testing an array of toxic chemicals found in leachate. For each test growth of pure algae cultures subjected to five different increasing concentrations of the target toxic chemical was determined microscopically using counting chambers. Many of the isolates appeared to have adapted to the relatively high concentrations of toxins in leachate, showing enhanced growth rates at higher concentrations than in the controls. However, most species died off rapidly as chemical concentration increased. Examples of LD50 results for toxins tested include: *Synechococcus* exposed to Aluminum = 0.08 mg/l, *Microcystis* exposed to Aluminum = 0.15 mg/l, *Microcystis* exposed to Boron = 13.8 mg/l. Potential uses for algae adapted to higher toxin concentrations may include bioremediation of leachate.

- 206 **Annette M. Golonka, Bettie Obi Johnson, Jonathan Freeman and Daniel W. Hinson.** Determination of volatile compounds produced by yeasts inhabiting the nectar of *Silene caroliniana* (Caryophyllaceae). University of South Carolina Lancaster, SC.

Plants within the genus *Silene* (Caryophyllaceae) have been well studied for pollination biology, microbe-host interactions, and scent compounds. The South Carolina plant species *Silene caroliniana* has not been as well studied. Floral scent often plays an important role in pollination of insect-pollinated plants. This insect-pollinated plant species is host to a variety of microorganisms including nectar-associated *Metschnikowia* species that may have an impact on floral scent. In this study, solid phase microextraction and gas chromatography-mass spectrometry (SPME-GC-MS) were used to characterize volatile organic compounds produced by yeasts found in *Silene caroliniana* nectar. Headspace SPME-GC-MS analysis of nectar from pollinator visited flowers indicated yeast species growing in nectar produced yeastlike volatile odor compounds including ethanol, 2-methyl-1-propanol, 2-methyl-2-propanol, 2-methyl-1-butanol, 3-methyl-1-butanol, and less common volatile compounds. These compounds have detectable scents that potentially impact floral scent. Yeast species grown in pseudoneectar and sterile nectar confirmed that yeasts associated with this plant produced scented volatile organic compounds. These results indicate a potential impact of yeasts on pollination dynamics in *S. caroliniana*.

- 207 **Ashley Newsome and Lori McGrew.** Developing a model for immunological testing in *Salmonella typhimurium*-infected *Danio rerio* treated using a traditional antibiotic and homeopathic remedy. Belmont University, TN.

Salmonella typhimurium is a common food-borne pathogen that infects millions of people worldwide. Like many bacteria, *Salmonella* strains are becoming increasingly resistant to traditional antibiotics, creating a need to develop new antimicrobial agents. Homeopathic medicines such as oregano, which has been shown to have antimicrobial effects against *S. typhimurium* in studies *In vitro*, are a potential source of new antibiotics. Studies have not yet been done *In vivo* testing this herb's effectiveness as an antibiotic. *Danio rerio* (zebrafish), a vertebrate with an innate and adaptive immune system similar to humans, have recently begun to be used in immunological studies. Zebrafish serve as a good model due to their small size and relative ease of care. This study focused on developing an experimental design that evaluates the effectiveness of homeopathic treatments in *S. typhimurium*-infected zebrafish. Based on evidence from previous experiments, it was thought that zebrafish treated with both tetracycline and oregano would have a lower death rate compared to other infected groups. Zebrafish at various stages of growth were infected using static immersion or injection, and observed for signs of infection or death. Zebrafish embryos were too susceptible to infection, and died before treatment could be administered. Conversely, the adult zebrafish were able to combat the maximum infective dose of bacteria given without ever showing clear signs of infection. The larval zebrafish infected by static immersion and tested two weeks after hatching had results similar to the expected, and they show the most promise for use in future immunological studies.

- 208 **Brian S. Burnes.** Identifying sources of pathogen contamination in the Fish River. University of West Alabama, AL.

Bacterial source tracking was conducted on the pathogen contaminated Fish River in Baldwin County, AL. Two methods were used, multiple antibiotic resistance analysis and a PCR-based technique using Enterococcus and Bacteroidetes markers for human, bovine and equine sources. Discriminant analysis compared growth patterns of Fish River *E. coli* from unknown sources to *E. coli* of human, bovine and equine sources. The total distribution of *E. coli* found in the Upper Fish River was: 16.4% of human origin, 52.8% of bovine origin, and 30.9% of equine origin. Results of the PCR-based testing supported the findings of the antibiotic resistance analysis. Identification of probable sources will aid in the development of more effective management to in turn reduce pathogen contamination in Fish River.

- 209 **David Wilson, Ryan Brown and Henry Spratt.** Resistance to triclosan in Tennessee River and Chattanooga Creek aquatic microbial communities. University of Tennessee at Chattanooga, TN.

With increasing amounts of antimicrobial substances entering our waterways from industry, medical, and residential sources, microbial resistance in aquatic communities to these substances continues to be found. The objective of this study was to determine the relative level of microbial resistance to triclosan for aquatic microbial communities in Tennessee River water compared with water from the much more heavily industrialized Chattanooga Creek. The experiment was conducted using an antimicrobial soap containing 0.10% triclosan as the antimicrobial agent. Water samples were collected, transported to the lab, and exposed to four different concentrations of the triclosan (1X, 0.1X, 0.01X, and 0.001X). Tryptic soy broth was added to each sample tube to detect bacterial growth. Controls were set up, replacing the soap with 1ml of saline. All samples were incubated at room temperature. Absorbance readings at 600nm were determined using a spectrophotometer after 19, 94, 141, and 191 hours of incubation. Concentration and time both had an effect on absorbance. There was no significant difference between Tennessee River and Chattanooga Creek water. As soap concentration increased, absorbance decreased. Growth in the 0.001X concentration samples was not statistically

different from the controls. This experiment showed that aquatic microbial communities from both Chattanooga Creek and the Tennessee River exhibit microbial resistance to this antimicrobial compound. Future studies might use higher concentrations of pure antimicrobial agents or a mixture of different antimicrobial agents. Because of the increased use of antimicrobial soaps in hospital and home settings, microbial resistance needs to be continually monitored.

- 210 **Henry Spratt, David Levine and Larry Tillman.** Physical therapy clinic therapeutic ultrasound equipment as a source for bacterial contamination. University of Tennessee at Chattanooga, TN.

Patients are often referred to physical therapy (PT) clinics as they recover from medical treatment. One tool commonly used in PT clinics is therapeutic ultrasound (US). Since this equipment and associated gel comes in contact with patient skin it may serve as a reservoir for bacterial pathogens if not properly disinfected between treatment sessions. In this study we sampled US heads and gel bottles from nine outpatient PT clinics in the Chattanooga, Tennessee area. In the clinics, samples were collected using sterile swabs. Swabs were placed on ice and returned to a lab at UTC, where within five hours of the sampling they were used to inoculate Mannitol Salt Agar or CHROMagar MRSA to scan for Staphylococcal species, and tryptic soy broth to determine non-specific bacterial contamination. US heads, gel bottle tips, and the gel itself all were contaminated to some degree. Tips of gel bottles had the highest contamination, with 72.7% testing positive for non-specific contamination, 1.8% positive for *Staphylococcus epidermidis*, 3.6% positive for methicillin sensitive *Staphylococcus aureus*, and another 3.6% testing positive for methicillin resistant *Staphylococcus aureus* (MRSA). US heads were found to have little contamination (no MRSA detected). Disinfecting the US heads after initial swabbing, followed by a second swabbing, essentially removed all bacterial contamination from the US heads. Gel from inside the bottles had the least contamination (no MRSA detected). This study demonstrates the need for an effective cleaning protocol to be established for US heads and gel bottles to reduce potential patient contamination.

- 211 **Bruce A. Sorrie.** Taxonomy and distribution of *Viburnum* section *Odontotinus* (Aoxaceae). University of North Carolina Herbarium, NC.

Herbarium and field studies of *Viburnum* section *Odontotinus* indicate that recent taxonomic concepts of the section need revision. Most notably, the *V. dentatum* complex warrants division into six distinct species plus one variety. Section *Odontotinus* ranges from southern Canada to central Florida and southeastern Texas; taxa occupy habitats as diverse as maple-gum swamps, limestone ridges, maritime heathlands, floodplain forests, montane slopes, shrubby baygalls, rock outcrops, and pine flatwoods. Range maps are provided for all taxa. As currently understood, section *Odontotinus* consists of *Viburnum acerifolium*, *V. alabamense*, *V. bracteatum*, *V. carolinianum*, *V. deamii/indianense*, *V. dentatum* var. *dentatum*, *V. dentatum* var. *lucidum*, *V. molle*, *V. rafinesquianum*, *V. scabrellum*, and *V. venosum*.

- 212 **Raymond O. Flagg and Gerald L. Smith.** The distinctive characteristics of two probable new species of sessile Mexican *Zephyranthes* (Amaryllidaceae).
¹Carolina Biological Supply Company, NC, ²High Point University, NC.

We have been studying Mexican rain-lilies intensely for several years. This work has revealed the potential for defining two new sessile *Zephyranthes* species. We are investigating the morphological characteristics and distribution of each taxon to determine the delineation and distinction of each. Our studies are primarily based on herbarium loans from MEXU, MO, and TEX plus the Blandy Experimental Farm collections made by R. O. Flagg and the late W. S. Flory. We have reasonable confidence that we can provide much definitive taxonomic information and clarification for these plants.

- 213 **Andrew S. Methven¹ and Andrew N. Miller².** *Clavariadelphus*: one genus or two. ¹Eastern Illinois University, IL, ²University of Illinois, IL.

Results of ITS and LSU analyses will be used to demonstrate that *Clavariadelphus* is not one genus but two.

- 214 **C. T. Witsell.** An ecological and floristic inventory of shale barrens in the Ouachita Mountains of Arkansas, USA. Arkansas Natural Heritage Commission, AR.

Shale glades or barrens in the Ouachita Mountains of western Arkansas and eastern Oklahoma have received relatively little attention from botanists and ecologists. These herbaceous or shrub-dominated communities occur as erosional features on several Ordovician, Silurian, and Mississippian geologic units, most notably the Womble, Mazarr, and Stanley Shale Formations. Geomorphologically these barrens can be divided into two classes: 1) those occurring on steep slopes along streams, and 2) those occurring in flat to gently sloping valleys. Inventory work from 2002 to 2010 in these communities in west-central Arkansas has documented more than 630 vascular plant taxa including more than 30 taxa of state conservation concern and 18 taxa of global conservation concern. One species, *Physaria filiformis* (Rollins) O'Kane & Al-Shehbaz is federally listed Threatened and another, *Sabatia arkansana* Pringle & Witsell, was described new to science in 2005 and is endemic to a single county. These communities support an uncommonly species-rich flora and contain significant numbers of disjunct, conservative, and endemic taxa. This inventory demonstrates that these barrens support more globally-rare and endemic taxa than any other habitat in Arkansas. Such taxa include *Amorpha ouachitensis*, *Amsonia hubrichtii*, *Carex latebracteata*, *Crataegus triflora*, *Draba aprica*, *Eleocharis wolfii*, *Eriocaulon koernickianum*, *Helianthus occidentalis* ssp. *Plantagineus*, *Houstonia ouachitana*, *Liatis compacta*, *Physaria filiformis*, *Sabatia arkansana*, *Silene regia*, *Streptanthus maculatus* ssp. *Obtusifolius*, *Streptanthus squamiformis*, *Valerianella nuttallii*, and *V. palmeri*. A summary of the flora and plant communities associated with these barrens will be presented and discussed and several apparently new-to-science species will be mentioned.

- 215 **Brinton E. Domangue and Conley K. McMullen.** Floristic survey of the vascular plants of Shenandoah County, Virginia. ¹James Madison University, VA.

The goal of this study is to create a comprehensive record of the vascular flora in Shenandoah County, Virginia. Several Virginia counties have been studied in this way, including adjacent Rockingham County, but an official survey of Shenandoah County has never been conducted. During the 2011 growing season, from March 21 to October 27, a total of 600 plant collections were made from the county. Information was recorded about the location and habitat of each plant, and all specimens were dried and preserved in the James Madison University Herbarium (JMUH). The herbarium was also searched for pre-existing county specimens that have not been formally documented. This search yielded nearly 500 specimens. Further collections and data analyses are needed to complete the project. Field collections will continue through the spring of 2012, and other local herbaria will be searched for Shenandoah County records. Personal field collections will be identified, and all additional herbarium specimens will be annotated. Completion of the floristic survey will result in a comprehensive list of species in the county, which will determine the richness of the area and bring awareness to rare or endangered species. The survey may also prove a valuable resource for updating online floristic websites.

- 216 **Herrick H. Brown¹ and John B. Nelson².** The resurgence of the Devonian landscape: whisk ferns (*Psilotum nudum*) in urban environments. ¹SC Department of Natural Resources, ²University of South Carolina, SC.

Psilotum nudum (L.) P. Beauv., a primitive, sub-tropical fern, evidently adopts anthropochory as a dispersal vector in urban environments. Exhibiting a somewhat discontinuous distribution in the Southeastern USA, this unusual plant, dependent on endophytic fungi for growth, may or may not be reproducing sexually wherever it is

encountered. The large-scale application of mulch in landscape horticultural operations may provide an effective means for its spreading sporophytes and/or gametophytes; the success of viable spores and resultant gametophytes has not been absolutely verified. The recent discovery (2008-present) of new whisk-fern (as well as other unexpected species) populations in Columbia, SC, and particularly on the University of South Carolina Campus, may suggest inadvertent introduction through interstate transport of source materials.

217 **Robert W. Thornhill, Alexander Krings, David L. Lindbo and Jon M. Stucky.** The vascular flora and soils of the wet pine savannas of Shaken Creek Preserve (Pender County, North Carolina). North Carolina State University, NC.

Shaken Creek Preserve is a 6050-acre Nationally Significant Natural Area in Pender County, North Carolina. Best known for its high-quality savanna habitat, the site supports at least 28 state-listed plant species (including three federally-endangered species) and is the only site in the state to contain four distinct Wet Pine Savanna communities, three of which are globally rare (G1). Formerly a private hunting club, the site was virtually unknown to scientists until the 1990s; consequently, few biological inventories of the site have been conducted. In particular, no systematic floristic inventories of the species-rich savannas have been undertaken, despite the fact that floristic data are critical to the effective management of any natural area. The ongoing goals of this study are to 1) document the vascular flora of each of the savanna sites with voucher specimens and tissue samples; 2) compare the vegetation and soils of the four Wet Pine Savanna communities on site; and 3) create a taxonomic manual (complete with keys, synonymy, phenology, notes on abundance, and illustrations) of the savanna flora. Besides providing the baseline data for site management, the information from this study will facilitate further biological and ecological research on site and will ultimately provide a valuable educational resource for anyone interested in the exceptional flora of these rare savannas.

218 **Ronald L. Jones.** Woody plant survey of the Playa Delfin Rainforest Reserve and Research Station, southern Costa Rica. Eastern Kentucky University, KY.

In June and July 2011 a woody plant survey was conducted of the *Playa Delfin* Rainforest Reserve and Research Station, on the eastern side of the *Golfo Dulce*. This area is known as a region of great biological diversity, but there are few remaining intact stands of primary forest in the region. *Playa Delfin* is a 115 hectare preserve privately owned by Patrick and Anne Weston, with about ¾ of the property occupied by primary forest. Elevations range from 6 meters to 145 meters. The site is bordered to the east by *Quebrada El Higo*, to the west by *Quebrada El Macho*, and to the north by the Pacific Ocean. A total of 150 sets of specimens were collected over a 2-week period, and about 75% of the specimens have been identified to genus, and about 80% of these have been identified to species. Several endangered species were documented, including *Astronium graveolens*, *Tabebuia guayacan*, *Copaifera aromatica*, *Caryocar costaricense*, *Dalbergia retusa*, *Platymiscium pinnatum*, and *Tachigali versicolor*. The lowland forest near the coast includes the following species: *Amphitectna latifolia*, *Bunchosia nitida*, *Chrysobalanus icaco*, *Cocos nucifera*, *Hibiscus pernambucensis*, *Hippomane mancinella*, *Hymenaea courbaril*, *Mangifera indica*, *Terminalia catappa*, and *Ximenia americana*. The species composition of the upland forests of *Playa Delfin*, consisting of such characteristic species as *Astrocaryum standleyanum*, *Brosimum utile*, *Castilla tunu*, *Chrysophyllum cainito*, *Cojoba arborea*, *Copaifera aromatica*, *Ficus tonduzii.*, *Hura crepitans*, *Luehea seemannii*, *Platymiscium pinnatum*, *Pseudobombax septanatum*, *Pterocarpus hayesii*, and *Virola koschnyi*, may represent an undescribed community for the region.

219 **Sarah M. Noble, Steven D. Carey and Grace D. Whatley.** A bryofloristic survey of limestone outcrops of the lower Gulf Coastal Plain of South Alabama and Mississippi. University of Mobile, AL.

Bryophytes are found in abundance on the limestone outcrops of south Alabama and Mississippi. During a twenty-four month survey, bryophytes were collected and identified from eleven sites along the limestone hills. Samples were collected from the twilight zone of caves, exposed limestone, and along streams. The most intensively sampled areas were the cave entrances and along the streams. Several taxa having tropical affinities and a few taxa having boreal affinities were noted, as were calciphiles. Results of this survey serve as the current baseline for further planned investigations of lower Gulf Coastal Plain bryophytes.

- 220 **Peter Schafran¹, Hal Wiggins² and Lytton Musselman¹.** The true identity of Tuckahoe. ¹Old Dominion University, Norfolk, VA, ²U.S. Army Corps of Engineers, VA.

Many contemporary foraging and wild edible texts written for the eastern United States feature *Peltandra virginica* (L.) Schott, roots of which are purported to have been a staple food of Native Americans. The most commonly used Native American term for this plant is tuckahoe. Authors generally trace their information to the writings of early explorers in the 16th and 17th century. However, the explorers' descriptions of plants are often incomplete and penned with spellings and grammar unfamiliar to the modern reader. As such, it takes considerable effort to align botanical features in the text with the plants as we know them. Given the inedible nature of *P. virginica* due to its oxalate raphides, it is possible that this name has been misapplied by previous workers. Or, if the plant described by early explorers is indeed *P. virginica*, then the Native Americans' preparation seems to have been lost, since all attempts at repeating their procedures do not render the plant palatable. We have identified one method that eliminates enough of the raphides to make *P. virginica* edible and would have been available to the Native Americans: soaking the roots in a lye solution made from oak ashes.

- 221 **John V. Aliff.** "Cleaning up" human anatomy and physiology case studies with soap notes. Georgia Perimeter College, GA.

When a patient is seen for the first time, the physician, nurse practitioner or nurse writes a note outlining the preliminary diagnosis or diagnoses and plan for further testing for the patient. The word for word statement of the case precedes the SOAP note. Case studies are open ended in that they are written to suggest a possibility of several outcomes. The sections of the SOAP note include: S = subjective observations that includes the symptoms stated by the patient, such as fever, sneezing, pain, et c. O = Objective – observations of the patient's signs, such as height, temperature, pulse, rashes, etc. A = Assessment – a preliminary diagnosis or other diagnoses to be pursued by further tests. The SOAP note precedes case study sections that include a Diagnosis section that includes further tests, an Anatomy and Physiology section that describes the relevant organs systems affected by the diagnosed condition, and an explanation of the Treatment, such as how insulin works for diabetes mellitus.

- 222 **Elizabeth G. Dobbins and Kristin A. Bakkegard.** How to conduct a one-semester, field-based, senior capstone course in three easy steps. Samford University, AL.

Samford University biology majors are required to take a one-semester capstone course: senior seminar. Previously, students wrote a review-of-the-literature thesis. We developed an original semester-long, self contained, field-based research project that includes a written thesis and a meeting style poster session. Our approach can be summarized by three Ps: Partnership, Preparation, and Presentation. The critical first step is to have a real world project narrow enough to provide focus but broad enough to cover a range of student interests. We use stream ecology and partner with local environmental organizations to provide background information and develop community investment. We also cultivate partnership by pairing students for data collection and safety (no one is in the field alone). Second, we scaffold data analysis and writing exercises to teach skills as

they are needed. This keeps students continually engaged in their projects, permits us to track their progress, and helps us tackle small problems before they become insurmountable. Finally, the students pre-present their posters twice for peer and faculty review before presenting at a formal poster session, open to the community. We validate our efforts, instructors and students, by using independent graders, armed with a rubric, to assess the theses and posters. This approach allows us to serve as coaches and mentors rather than the final evaluators. The ultimate attainment is the presentation of high-quality research; the best is submitted to regional scientific meetings. We have successfully used this model four times, resulting in eight meeting presentations and one journal article.

223 Virginia A. Young and Michael K. Moore. Integration of international service learning into the upper level biology curriculum. Mercer University, GA.

In the summer of 2011, we took eleven undergraduate biology students to Trinidad as part of our university's program Mercer on Mission. Our three weeks abroad were focused on service learning in two arenas. The first service learning activity of the trip was focused on assisting the conservation efforts of Nature Seekers in Matura, Trinidad, specifically as they work with sea turtles during the nesting season. Our work in Matura helped improve the lives of the citizens of Matura, while at the same time providing valuable hands-on learning experiences for our students with sea turtles and natural resource conservation issues in the tropics. The second area of service learning for our program was to provide science lessons to children at the Roman Catholic Primary School in Brasso Seco, Trinidad. Our students developed a series of 8 lesson plans covering a multitude of science topics. Using the governmental National Standards and Syllabi for Trinidad's schools as guides we developed activities for grade levels across all grade levels at the primary school. In addition to our science lessons, we held repeated literacy lessons for several of the Trinidadian children who were struggling with their reading. During our time in Trinidad, each student completed approximately 100 hours of service while also taking two upper level biology classes associated with the Mercer on Mission to Trinidad. The impact of this service learning on both the local Trinidadian communities and our Mercer students will be discussed, as well as the assessment strategies we used in our program.

224 Christopher G. Brown. Macroevolution made easy: a hands-on phylogenetics lab. Shorter University, GA.

I have developed a laboratory activity that uses modeling clay and craft items to teach college students macroevolution, phylogenetics, and taxonomy. Each group of students starts with a simple clay sphere and creates multiple "generations" by adding characters from an assortment of craft supplies. A "speciation" event occurs during each generation, thus creating a diversity of life forms both within lineages (a proxy for anagenesis) and between lineages (a proxy for cladogenesis). Students then name the results of this "macroevolution" using standard taxonomic rules. Each group is able to see how small changes added gradually over time can create diversity both within their own group and among groups. They then remove the "ancestral" species, leaving only the extant forms. Groups then switch specimens and are required to determine the evolutionary relationships of this new batch of specimens using a character matrix. This lab is effective at demonstrating many principles of these fields including evolutionary principles, like convergence and loss, and encouraging students to pay attention to characteristics of organisms. I have successfully utilized this lab in general biology as well as zoology. It usually runs about two hours in its current form.

225 Rita A. Hagevik. Preservice elementary teachers' understandings of sustainable development. University of North Carolina at Pembroke, NC.

In creating a society whose citizens have sustainable lifestyles, Education for Sustainable Development (ESD) plays a key role. However, the concept of sustainable development (SD) has developed independently from the input of educators; therefore, ESD presents current teachers with many challenges. Understanding how stakeholders in the education

sector view SD is of great importance. In order to gain an understanding of and to investigate the experiences of others, we conducted a phenomenographic study of how elementary preservice teachers think about sustainability and sustainable development. Twenty-nine preservice elementary teachers enrolled in a semester long science methods course in a large southeastern university completed Draw-a-Sustainable Development and Draw-an-Environmental Steward Tests before and after instruction on topics of food chains, populations, ecosystems, as well as societal issues related to sustainability (energy, food, etc.). An Environmental Attitudes Questionnaire indicated that the preservice teachers were overall pro-environmental before and after the course. However, participant's conceptions of SD were very narrow with a lack of understanding of the interconnectedness between the environment, energy, and technologies to the political, economic, and social concerns related to SD. Participants during their interviews identified that they felt unprepared to teach about SD in their classrooms. They were unable to explain how stewardship was connected to sustainability or how the actions of some might affect others. If we hope for a more sustainable future, then our future educational leaders will require more planned experiences related to SD throughout their school careers.

226 **Cassandra L. Quave.** Setting standards for ethnobiological curricula. Emory University, GA.

Following a four-year process involving over 500 participants, in 2011 the American Association for the Advancement of Science with support from the National Science Foundation published *Vision and Change in Undergraduate Biology Education: A Call to Action*. That document addresses how to improve college undergraduate biology education. In November of 2011 and again in February of 2012, the Open Science Network brought together over 30 participants to begin creation of an Ethnobiological Vision and Change statement and to draft standards for both ethnobiological literacy and ethnobiological curricula at the college level. Ethnobiology is the study of the biological knowledge—or of the interrelationships between plants, animals, earth, and people—of cultural groups. The Open Science Network is an NSF-funded group of educators working to share peer-reviewed educational ethnobiological materials on an open, web-based platform. We present our initial suggestions for standards and suggest ways in which ethnobiology may be incorporated into biology courses.

227 **A. D. Panvini.** The role of student lab prep workers – a key form of co-curricular science education. Belmont University, TN.

Many science departments utilize the services of undergraduate students to prepare materials for laboratories, clean up after labs, and provide feedback on lab activities. When viewed as a critical element of the biology undergraduate co-curricular education, the role as student worker can provide many of the same learning outcomes as student-centered classroom learning experiences espoused by the AAAS call for biology educational reform. As lab prep assistants, students engage in interactive, inquiry-driven, and collaborative scientific work that is both authentic and relevant. Students have an opportunity to hone practical skills, assist in curricular development, understand environmental management regulations, practice the scientific method, and engage in problem-solving. These qualities are best nurtured when students are mentored in their role as student workers and given opportunities to take responsibility for their work. This session will discuss a variety of ways in which faculty, staff, and student peers have developed our student worker program. Conference participants will have an opportunity to share how their departments mentor young scientists via the role of student worker. Results of a survey of student workers regarding their experiences, including benefits and challenges of the student worker role, will be shared. The ways in which student participation in the newly developed Environmental Management System (EMS) contributes to their professional development will also be included.

- 228 **Paula C. Jackson, Meg C. Murray and Jennifer K. Frisch.** Wikied biology: a model for student-centered, inquiry-driven instruction using WEB 2.0 technologies. Kennesaw State University, GA.

WIKled Biology is an NSF TUES (#0942085) interdisciplinary project in which we developed and implemented a model for student-centered, inquiry-driven instruction using Web 2.0 technologies to increase conceptual understanding in biology. Web 2.0 applications enhance collaboration among users to find, create, manipulate and disseminate information, and can form a relevant connection between real-world science and students' learning of content. Students use Web 2.0 technologies in their daily lives; however, there is little empirical research into its impact on education. This project addresses a significant gap in our understanding of how Web 2.0 can be used to support the teaching-learning process. Our findings thus far suggest that: 1) students require instruction and guidance to develop skill in evaluation and discrimination of information sources found on the Internet; 2) students exhibit difficulty in constructing purposed research questions and structuring an investigative process; 3) students developed projects of increasing complexity both in terms of scientific concepts and application of Web 2.0 technologies; 4) most students drew connections between the use of the Web 2.0 technologies in their daily lives and how they might apply them to their academic and professional experiences; and 5) developing teamwork skills is pre-requisite to more effective use of collaborative technologies. Critical Assessment of Thinking (CAT) tests showed a significant improvement in students' ability to separate relevant from irrelevant information when solving a real world problem after completing our course. Although implemented in a biology class, we expect this method may be easily transferred to other STEM disciplines.

- 229 **Roger Sauterer.** History of life courses: a method for promoting integrative biological understanding. Jacksonville State University, AL.

History of life courses can promote student appreciation of the evolution of life and ecosystems as well as the interactions between global and regional environments and life. They also reinforce and provide illustrative examples of evolutionary principles. These courses incorporate astrobiology, the origin of life, development and evolution of ecosystems, global carbon and nitrogen cycles, atmospheric and climatic change and their impact on life. History of life courses should emphasize the interactions between geological and atmospheric factors and the global biosphere. Topics discussed first include solar system formation and evolution, factors influencing planetary habitability, carbon and nitrogen cycles, plate tectonics and its importance, the Hadean and Archean Earth. Later topics emphasize methanogens, cyanobacteria and their impact on the global environment, the rise of eukaryotes and the Proterozoic world. Finally the origin and evolution of plants and animals are discussed, correlating changes in the global environment and mass extinctions with the evolution of life and changes in global ecosystems from the early Phanerozoic era to the present. By integrating astrobiology, the geosciences and the life sciences, history of life courses provide students with a broad perspective on life and factors influencing evolution, as well as giving them a better appreciation for the deleterious effects of rapid anthropogenic environmental changes on global ecosystems.

- 230 **Devin L. Carter, Holland M. Hendrick, Stephanie L. Simmons and C. B. Odom.** Out with the old, in with the new: converting undergraduate genetics labs from ethidium bromide to SYBR safe. Wingate University, NC.

Ethidium Bromide (EtBr) has traditionally been used to visualize DNA fragments following electrophoretic separation. Ethidium bromide is also a potent mutagenic agent requiring strict safety precautions. In 2011, the undergraduate genetics labs at Wingate University converted from using EtBr to visualize DNA to using Sybr Safe, a far less toxic alternative. The process, pros, cons, and pitfalls of this conversion will be presented and discussed.

Posters of the 2012 Annual Meeting

- P1 **Joseph McKenna, Jonathan Horton, C. R. Rossell, H. D. Clarke and Jennifer Rhode Ward.** Habitat characteristics and considerations for conservation of *Spiraea virginiana* Britton, an imperiled riparian shrub. UNC Asheville, NC.

Spiraea virginiana Britton is a rare, clonal riparian shrub, considered endangered in the state of North Carolina and federally listed as threatened. Anthropogenic alteration of habitat has been cited as one of the primary causes of the species' decline. As such, identification of habitat characteristics is a crucial step in the protection of the species. In the summer of 2011, we expanded previous research done at the Cheoah River corridor in Graham County, NC to include all known occurrences of *S. virginiana* in western NC, examining the effects of herbaceous cover, presence of vines, shrub density, tree influence, canopy openness, substrate type, slope, and aspect on the presence of *S. virginiana*. The study included populations on eight rivers total, though a reported population on a ninth was not found. We found the only factors correlated with the shrub's presence were canopy openness and the extent of boulders in the substrate. However, these characteristics were both significant only at the Cheoah site, while canopy openness alone was significant at one other river. Comparisons of the Cheoah River's characteristics vs. all other rivers pooled confirmed significant differences in nearly all habitat characteristics. These differences are likely related to differing hydrological regimes which at the Cheoah might be more representative of *S. virginiana*'s natural habitat. Failure to find significant habitat characteristics at additional rivers may reflect flaws in our sampling design at these rivers. Future studies should examine the hydrology of all rivers and repeat measurements with more representative controls.

- P2 **David Seals and Robert Carter.** Population status of the American black bear (*Ursus americanus*) in northeast Alabama. Jacksonville State University, AL.

A population survey for the American black bear (*Ursus americanus*) was conducted on the Shoal Creek Ranger District, Talladega National Forest in the spring and fall of 2011. Monitoring of individuals using non-invasive genetic sampling (NGS) of physical evidence such as hair is an economical method which does not reduce animal health due to stress. The population size can be estimated by collecting hair with hair snares baited with an attractant. Only one likely black bear sample was obtained. Although reports from landowners indicate the presence of American black bears, the population appears to be small and likely is transient. Future research will include a black bear habitat suitability survey.

- P3 **Anne B. Cubeta¹ and Joel M. Gramling².** Using species distribution modeling to develop a restoration framework for *Lindera melissifolia* in the southeastern coastal plain. ¹College of Charleston, SC, ²The Citadel, SC.

Lindera melissifolia (pondberry) is a federally endangered wetland shrub endemic to the Southeastern Coastal Plain and the Lower Mississippi Alluvial Valley. Pondeberry is known to occupy temporarily flooded habitats, but little work has been done to describe range-wide habitat profiles and species distribution in the Southeastern Coastal Plain. We developed a presence-only species distribution model (via maximum entropy modeling) for pondberry in the Francis Marion National Forest and the Woodbury Wildlife Management Area and Heritage Preserve, both in South Carolina. Results from the model suggest that physical soil properties and management techniques such as prescribed fire contribute largely to the probability of pondberry presence at a specific location. Model outputs were ground-truthed using rapid assessment techniques to check for pondberry presence and habitat suitability. Habitat suitability was determined by each site's affinity to habitat parameters observed from species and environmental data collected at 45 pondberry populations in North Carolina, South Carolina, and Georgia. Using our habitat model in conjunction with range-wide habitat descriptions and environmental data, we

provide a data-driven framework for regional land managers to assess site suitability for pondberry management activities including population discovery, restoration, and introduction.

- P4 **Scott M. Arico, H. D. Clarke and C. R. Rossell.** Browsing behavior of *Castor canadensis* on the federally threatened shrub *Spiraea virginiana* along the Cheoah River, North Carolina. University of North Carolina at Asheville, NC.

Virginia Meadowsweet (*Spiraea virginiana*, Britton) is a rare, perennial shrub that is listed as federally threatened and is endemic to the Appalachian Mountains of North America. The effects of beaver browsing on rare or endangered species, in particular plant sp, is not well understood and this study was conducted to investigate how beaver browsing affects *S. virginiana* along the Cheoah River of Western North Carolina. Forty-eight, 25 meter transects were established along the alluvial floodplain with slopes less than 17%. A modified Point Centered Quarter method was used to measure the amount of beaver browsing occurring along the river. Because of few occurrences of *Spiraea virginiana*, each of the 33 subpopulations centered on *S. virginiana* were divided up into 10 separate shrubs and examined for incisor marks indicative of browsing. A total of 72 species were recorded along the transects, with a total of 1064 individual stems counted of those species. The top ten most common species, the highest being 258 *Cornus amomum* plants and the lowest being 31 *Lindera benzoin* plants, did not include *S. virginiana*; a total of 10 individuals recorded. The top ten species with the highest proportion of browsed stems, the highest being *Calycanthus floridus* (0.3871) and the lowest being *Xanthorhiza simplicissima* (0.0185), did include *S. virginiana** (0.3000) with the third highest proportion of browsing. These data suggest that beaver are preferentially browsing *S. virginiana* in relation to other species, but because of limited availability, they do not represent a significant resource for beaver.

- P5 **Jessica Delo¹, Jennifer E. Layton¹ and Thane Wibbels².** Genetic implications of relocating loggerhead sea turtle eggs from the Alabama coast in response to the Deepwater Horizon oil spill. ¹Samford University, AL, ²University of Alabama at Birmingham, AL.

The loggerhead sea turtle (*Caretta caretta*) is an oceanic turtle that is found in temperate waters worldwide. Loggerheads nest over the broadest geographical range of any sea turtle. The greatest concentration of loggerheads is along the southeastern coast of North America and in the Gulf of Mexico. The current project evaluates the genetic implications of relocating loggerhead eggs from Alabama in response to the Deepwater Horizon Oil Spill (as well as during any future events). Specifically, we are investigating whether or not the movement of eggs from the Alabama coast to the Atlantic coast of Florida is altering the genetic composition of the loggerhead population in the southeastern United States. Over the past 3 years we have been collecting tissue samples from hatchling loggerheads in Alabama as part of a collaborative study with the Bon Secour National Wildlife Refuge. DNA sequence analysis of the 2007 tissues was conducted this summer on the mitochondrial D-loop control region of these tissues and the sequence results will be compared to previously published sequences on loggerhead sea turtles nesting along the mid-Atlantic coast of Florida where the hatchlings were released.

- P6 **Kristen K. Cecala.** The role of behavior in influencing headwater salamander responses to anthropogenic disturbance. University of Georgia, GA.

Changes in behavior can alter movement patterns of animals, which can impact patterns of occupancy among habitats and fragment populations. Evolutionary theory predicts that animals have evolved to move in response to a suite of cues that maximize animal survival and growth and minimize risk of injury or mortality. Behavioral plasticity allows these animals to adjust their behavior to appropriately respond to variable cues. When humans modify environments, new conditions can suddenly yield maladaptive responses to cues that were adaptive in the undisturbed environment. Headwater streams generally

have dense over- and mid-story canopies that limit direct light penetration and moderate values and ranges of light intensity, temperature, and humidity known to affect salamander behavior. We tested whether canopy gaps in otherwise natural systems could 1) alter salamander responses to light cues, and 2) fragment previously contiguous populations. Controlled laboratory tests indicated that salamander larvae exhibit strong, negative phototaxis that can be mediated by different stream substrates. Secondly, reciprocal transfers across a canopy gap and within forested areas demonstrated that salamanders were approximately 50% less likely to home to their capture location if a gap was present. This study demonstrates that behavioral plasticity allowed salamanders to adapt to high light environments, but the interactive effects of substrate were important to consider. Field experiments indicated that despite this plasticity, small canopy gaps (< 15 m) were capable of inhibiting homing behavior. Canopy gaps are a ubiquitous consequence of anthropogenic activity, precede more intensive development, and may yield unforeseen consequences for stream populations.

P7 **Jordan J. Sikkema, Joey Shaw and Jennifer Boyd.** Effects of invasive species on federally threatened *Scutellaria montana* Chapm. University of Tennessee Chattanooga, TN.

Scutellaria montana Chapm. (large-flowered skullcap) is an endemic herbaceous perennial located in Tennessee and Georgia. *S. montana* is a federally listed threatened species. Two common invasive species that are seen in our study sites are *Lonicera japonica* (Japanese Honeysuckle) and *Ligustrum sinense* (Chinese Privet). The design of this study will allow us to look at the effects of invasive species on a rare plant species, specifically the effects of *L. japonica* and *L. sinense* on *S. montana*. Sites have been selected that contain the endemic and invasive species. Our treatments will be a control which will contain the invasive species alongside of *S. montana* and a treatment that will include removal of the invasive species. This will allow us to look at the effects of the invasive species on *S. montana* but also determine if removal of invasive species, often a costly and labor intensive endeavor, is an effective means to help manage *S. montana*. In order to isolate and thus attribute the effects seen on *S. montana* either to the absence or the presence of invasive species an enclosure treatment will also be incorporated in order to limit the effect of herbivory. Our research should shed insight into the management of *S. montana* in the presence of invasive species in general but also specifically for our two sites, one owned by a federal entity and thus required to protect *S. montana* and the second owned by a private company that has dedicated and set aside land for conservation.

P8 **James M. Searels, Karissa D. Keen and Jonathan Horton.** The influence of abiotic and physiological factors on ginsenoside content in above and below ground tissue of American ginseng. University of North Carolina in Asheville, NC.

American ginseng, *Panax quinquefolius* L., is an herbaceous perennial species endemic to North American deciduous forests. It is a favored medicinal herb and an important economic crop harvested for its bioactive compounds called ginsenosides. The demand for this herb fosters illegal poaching and over-harvesting of belowground tissues removing individuals from a population thus reducing population viability. We studied five wild populations in western North Carolina to better understand the environmental (soil water content, light availability, sunfleck duration) and physiological (photosynthetic capacity and light responses) factors affecting the production of ginsenosides in wild populations. We will relate these parameters to the ginsenoside content (determined by HPLC analysis) in roots and shoots of field harvested plants. We will also compare the composition and concentration of ginsenosides in above and belowground tissues. Traditional ginseng harvesting collects roots and destroys individuals, negatively affecting population viability. We believe that, if ginsenoside composition in aboveground tissues is comparable to roots, these tissues might represent a sustainable source of ginsenosides for the growing western market, because these tissues can be harvested annually without destroying

plants. Our research on the influence of various factors on the production of ginsenosides in wild populations will guide future experimentation under controlled conditions in hopes of developing cultivation protocols that maximize the production of ginsenosides in both above and belowground tissues.

P9 **Kunsiri C. Grubbs.** Historical plant uses by the Catawba Tribe. Winthrop University, NC.

The Catawba Indian Nation is a federally recognized Native American tribe in South Carolina. The tribe has a long history of herbal remedies and natural uses of plant parts. Much of this information has been lost due to time. Without a written record, there is still a need to recognize and identify plants that have been used by the tribe. The purpose of this study was to examine what plants from the area did the tribe use and what those uses were. Due to changes in and overutilization of tribal land, many of the important and useful plants are now uncommon to the area in and around the reservation. This project involved examining historical research reports, interviewing local tribal elders, and searching the area for examples of the plants. A total of 85 species from 47 plant families have been applied by the tribe for 123 different uses. The most common plant families are Asteraceae, Fabaceae, Rosaceae, Lamiaceae, and Poaceae. Conventional uses of the plants include dermatological aids, gastrointestinal aids, and respiratory aids. When possible, updated photos and the Catawba name of the plants are included.

P10 **Shannon Romano and Richard M. Austin.** Effects of synthetic estrogen (17 β -estradiol) on the microbial populations of cutaneous bacteria in *Desmognathus quadramaculatus*, black-bellied salamanders. Piedmont College, GA.

Natural and synthetic estrogens are important emerging contaminants in many ecological systems. Sources of estrogen contamination include human hormone treatment, birth control, and farmwater runoff. Estrogens have been shown to induce physiological changes in reptiles, fishes, and amphibians. What is unknown is how estrogen contamination affects the cutaneous microbial flora of amphibians, which may play an important role in reproductive success and inoculation the host from emerging pathogenic strains of fungi. The purpose of this study was to determine the effects of exposure to the estrogen 17 β -Estradiol on the cutaneous microbial flora of the black-bellied salamander, *Desmognathus quadramaculatus*. Preliminary results indicate that exposure to high environmental levels of 17 β -Estradiol do affect the cutaneous microbial flora. This underscores the need to control this substance's entry into natural waters.

P11 **Justley Harston¹, Chris Holland^{1,2}, Yin Gu¹, Tommy Bohrmann¹, Robin van Meter¹, Tom Purucker².** An EPA modeling dashboard for ecological assessment of pesticides. ¹USEPA, GA, ²University of Georgia, GA.

The EPA registers pesticides for use in the US and approves imported pesticides under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). Before a pesticide can be registered, the EPA must assess whether the pesticide can be used without being harmful to humans or posing environmental risks, particularly to endangered species. To assess environmental exposures, mathematical models are used to predict pesticide concentrations in different media. We are overhauling the suite of models that the EPA uses, ranging in complexity from Fortran executables to Microsoft Excel spreadsheets, to create a web service implementation that will integrate relevant chemical property, ecological exposure information, use properties, and effects data into a decision support "dashboard" that will more efficiently conduct assessments and harmonize parameterization across the fourteen models that are currently used to assess pesticides. To accomplish this, we have developed a script-based python library that reproduces algorithms underlying the spreadsheet models and that can also access the underlying Fortran programs. This library will not have a user interface and will be accessible from multiple decision support systems. We are exposing the library to users through the use of Python/django and Google/webapp to create a web services platform that allows cloud-

based ecological pesticide models to be run over the web. We present the ecological framework used by the EPA to assess ecological risks from pesticides and illustrate the interface that allows the models to be run via a browser.

- P12 **Andrew D. Glass.** Implications of land use changes on human-wildlife conflicts and environmental conditions in the Amboseli ecosystem, Kenya. Guilford University, NC.

Agriculturists, agro-pastoralists, and pastoralists in the Kilimanjaro Foothills, Kimana Group Ranch, and Kuku Group Ranch in the Amboseli Ecosystem, Kenya, were interviewed to determine how land use is changing in the area and what implications this has for environmental and wildlife conservation. It was found that agriculturalists and agro-pastoralists vastly outnumbered pastoralists in all three areas, though pastoralists were most common in Kuku Group Ranch, which has not subdivided. Agricultural activities were found to aggregate around water sources, be in largely developed areas, decrease soil productivity, and correlate with reduced vegetation cover and tree planting, while pastoral activities were largely in scrubland environments and areas of extreme erosion. There was little difference between land use and frequency of human-wildlife conflicts. The elephant was the primary conflict animal across all land use types. Crop raiding was the most common conflict in agriculturalists and agro-pastoralists. Predation was most common for pastoralists. Pastoralists received damage in a lower range than agriculturalists or agro-pastoralists. Agro-pastoralists approved most of KWS and responded that they received benefits from wildlife more often, while agriculturalists were the least likely to approve and respond that they received benefits from wildlife. Agriculturalists were most likely to have a positive attitude toward wildlife, though this was not statistically significant. In order to protect wildlife conservation and environmental conditions in the Amboseli ecosystem policies toward agriculture and compensation for wildlife damage need to be modified.

- P13 **Clifford Bryan, Kirsten Work and Melissa Gibbs.** Nutrient leaching from fecal material of the exotic armored catfish, *Pterygoplichthys disjunctivus*. Stetson University, FL.

An algivorous organism's fecal material may contain a rich mixture of highly concentrated nutrients. In both marine and freshwater environments, nutrients from fish feces have been shown to contribute to nutrient recycling and to stimulate algal growth. *Pterygoplichthys disjunctivus*, a species armored catfish from Amazonia Brazil, has invaded springs throughout central Florida. In Volusia Blue Spring, *P. disjunctivus* produces copious feces that persistent well beyond the presence of the fish. This study examined the potential for *P. disjunctivus* feces to alter nutrient recycling in Volusia Blue Spring. We hypothesized phosphates would leach from *P. disjunctivus* feces at a rate that might produce increases in algal biomass. To measure nutrient leaching, four fecal samples were collected from recently sacrificed fish to produce a composite sample. This sample was placed into the upstream end of a 2.5 L plexiglass rectangular flume connected to a tap water flow comparable to Volusia Blue Spring. Water samples were collected from the downstream end of the flume at regular intervals and analyzed for phosphate concentration. Control flumes were connected to the same water source but missing the fecal samples. Phosphate concentrations from the experimental flumes were significantly greater than those in the control flumes in multiple trials. Furthermore, nutrient concentrations were greatest after a week, at the end of the analysis, so it is likely that the fecal samples would leach much longer. Given the high densities of feces in the system, the leaching rates measured in this study are likely to contribute to algal overgrowth.

- P14 **Tamara C. Johnson¹, Jennifer M. Cruse-Sanders² and Gerald S. Pullman¹.** Micropropagation and seed cryopreservation of the critically endangered species Tennessee yellow-eye grass, *Xyris tennesseensis* Kral. ¹Georgia Institute of Technology, GA, ²Atlanta Botanical Gardens, GA.

Xyris tennesseensis is a critically endangered species native to the southeastern USA. A micropropagation protocol was developed which may assist in the safeguarding and augmentation of dwindling natural populations of this ecologically and medically valuable plant. Four different batches of seeds were sterilized using hydrogen peroxide and germinated in vitro on modified one third-strength Murashige and Skoog medium. Shoot multiplication from seedling tissue was obtained using modified one third-strength Murashige and Skoog medium containing 1 mg/l kinetin and 0.1–0.5 mg/l α -naphthaleneacetic acid. Optimal shoot size and sustainable multiplication rates of three to five per 2-month subculture occurred on medium containing 0.3–0.4 mg/l α -naphthaleneacetic acid. Shoots rooted successfully when placed on growth regulator-free medium for 10 days followed by transfer to greenhouse soil under high humidity. Use of seed cryopreservation resulted in significant increases in germination compared to control treatments with average germination rates of 97%. Shoot tip cultures from soil-grown plants of *X. tennesseensis* and *Xyris spathifolia* were also developed using the above protocols. Plant tissue culture tools will assist in the multiplication, long-term storage, and conservation of these rare and valuable plants as well as provide a template for the micropropagation of other *Xyris* species.

P15 Suzanne G. Strait, Joseph A. Hamden and Enock Okpoti. West Virginia: where are the mammals? Marshall University, WV.

West Virginia has a rich and diverse mammalian fauna with over 60 species representing 7 out of the 10 North American orders. Many taxa are common and found throughout the state, however 4 species are now federally protected under the Endangered Species act (*Myotis grisescens*, *M. sodalis*, *Corynorhinus townsendii virginianus*, and *Glaucomys sabrinus fuscus*). Additionally, the WVDNR recognizes another 18 species which are considered rare, very rare, or vulnerable to extirpation including: *Nycticeius humeralis*, *Lasionycteris noctivagans*, *Myotis leibii*, *Corynorhinus rafinesquii*, *Condylura cristata*, *Cryptotis parva*, *Sorex palustris punctulatus*, *S. dispar*, *S. hoyi winnemana*, *Microtus chrotorrhinus carolinensis*, *M. ochrogaster*, *Reithrodontomys humulis*, *Zapus hudsonius*, *Neotoma magister*, *Synaptomys cooperi*, *Ochrotomys nUttalli*, *Sylvilagus obscurus*, and *Spilogale putorius*. Despite the fact that West Virginia has so many species whose conservation status warrants concern, there are no county-level distribution maps available. This study sought to rectify this deficiency by searching for county-level data from the 17,023 specimens of West Virginian mammals that are housed in natural history collections throughout the United States. These data come from 35 museums, with the majority of specimens (8,171) being housed in West Virginia Biological Survey Museum (Marshall University) or the Carnegie Museum of Natural History (5,970). These museum records were augmented with field data from the WV Division of Natural Resources, Wildlife Resources Section, Wildlife Diversity Unit and from the literature. County-level distribution maps were produced for all rare, threatened, and endangered taxa.

P16 Molly Atkinson and Carlos D. Camp. The effect of potential nitrate pollution on survival of larval salamanders from the southeastern United States. Piedmont College, GA.

Causes of global declines of amphibian populations have been the focus of intense conservation research in recent years. Among the identified culprits is freshwater pollution caused by the agricultural use of inorganic fertilizers such as nitrates. One study reported extreme nitrate-sensitivity and high levels of mortality in larvae of several frog (*Bufo*, *Hyla*, *Rana*) and one salamander (*Ambystoma gracile*) species from western North America. We investigated the effects of nitrates on survival in larval salamanders from the southeastern U.S., *A. maculatum* and *Eurycea cirrigera*. We tested each species independently in three separate treatments: 0 mg/L (negative control), 10 mg/L (US EPA recommended limit for drinking water), and 40 mg/L (positive control). We subjected 10 individuals to each treatment for 21 days at 16 C while feeding them *Daphnia* three times per week. We deleted from the study any individuals that underwent metamorphosis prior

to the end of the experiment. We then used Kaplan-Meier survival analysis to test for differences in survival among treatments. There were no significant differences in survival among treatments for either species. The only deaths in *A. maculatum* were four individuals that metamorphosed early. There were no deaths of *E. cirrigera* individuals. The earlier study of western species reported high rates of mortality at a nitrate concentration of 5 mg/L, which is far lower than what we used. Therefore, we conclude that different amphibian species are extremely variable in their respective sensitivities to potential nitrate pollution, which does not appear to be the universal threat suggested earlier.

- P17 **Cory J. Sperrn, K. Elizabeth Becker and C. Ross Hinkle.** Monitoring the effects of fire on the carbon cycle dynamics of a flatwoods ecosystem. University of Central Florida, FL.

Fire is an intricate element for the maintenance of pine and scrub flatwoods. However, fire can also result in alterations to the carbon (C) cycling dynamics of an ecosystem due to C released from burning biomass. Given the ever increasing levels of atmospheric carbon, it is crucial that we monitor these ecosystems for changes in C cycling. In this study, we looked at carbon storage in aboveground biomass pools (trees, shrubs, palmettos, ground cover and leaf litter) before and after a prescribed fire. The study site for this research was the Disney Wilderness Preserve (DWP) in Kissimmee, FL. Measurement surveys were conducted in 45 plots at DWP before and after fire. T-tests did not indicate that there was a significant change in the tree C pool or the shrub C pool. However, the palmetto C pool was significantly less after fire, dropping almost three-fold. Ground cover was also significantly less after fire, while leaf litter was not shown to be significantly different. C flux into and out of the ecosystem was also measured by an eddy covariance system before, during and after fire. The preliminary data from the eddy covariance system indicated a decrease in C uptake directly after fire and a recovery in C uptake within weeks of the fire. Therefore, it is likely that this ecosystem will sequester the C lost during the fire relatively rapidly. Ongoing monitoring of the survey plots and eddy covariance measurements will capture the full recovery of the system's C cycle.

- P18 **Jacob A. Kirkpatrick¹, Richard Pirkle¹, Joshua W. Campbell², Jeffrey Williams¹ and Lauren L. Harding².** The analysis of leaf breakdown rates within limestone caves in Alabama. ¹Shorter University, GA, ²High Point University, NC.

Leaf decomposition is a common function of terrestrial ecosystems; however this function has rarely been studied in cave ecosystems. In this study, the decomposition rate of six leaf species common to the southeastern United States were determined over a period of 100 days. The leaf samples were placed in the twilight and deep regions of three limestone caves in the state of Alabama, and upon collection mass loss and the C: N ratio was determined. The data collected suggests that senesced leaves that fall into caves may provide a good short term food source for cave invertebrates and could ultimately play an important role in the cave ecosystem nutrient cycle.

- P19 **Jason Harkey, Howard S. Neufeld and Michael Madritch.** Urban forest inventory and ecosystem services provided by trees on the campus of Appalachian State University. Appalachian State University, NC.

Urban forests increasingly contribute to regional biodiversity and provide valuable ecosystem services. They reduce energy costs for cooling via shading and for heating via windbreaks, as well as absorb volatile organic compounds (VOC) while sequestering atmospheric carbon dioxide. We inventoried and estimated the ecosystem services (primarily carbon storage) provided by the urban forests on the campus of Appalachian State University (ASU). This inventory involved identifying and measuring 1,754 individual trees, to date, as well as employing plot-based measurements to estimate the services provided by contiguous forests owned by the university. The data provided by the trees in ASU's natural area were collected using methods developed by the United States

Department of Agriculture (USDA) and Forest Service (FS) in support of their Urban Forest Effects (UFORE) model. The forest contains 21 different species, and is dominated by tulip poplar, black locust, black cherry, red maple, red oak, and witch hazel. Tree diameters ranged from 4cm saplings to a 79cm white oak. Over 50 percent of the trees sampled had diameters less than 15cm. We used the inventory data to estimate the carbon reduction benefits of the urban forest. ASU's urban forest contains at least 10.6 million kg of biomass and removes over 20 tons of carbon dioxide annually. Urban forests are likely often undervalued, and their ecological and economic contributions merit accurate forest inventories as well as sound management plans.

P20 **Sigurdur Greipsson.** Allelopathic effect of juglone on kudzu (*Pueraria montana* (Lour.) Merr.). Kennesaw State University, GA.

The effect of juglone on kudzu (*Pueraria montana*) was examined in three complimentary experiments under controlled and field conditions. It was observed that kudzu does not grow in black walnut (*Juglans nigra* L.) plantations due to high concentrations of juglone in the soil. The effect of juglone on mature plants was examined in a kudzu infested site in Atlanta GA where a monoculture of mature kudzu plants were climbing on nearby trees. Also, kudzu seeds were germinated and seedlings were planted into pots containing potting soil. Plants were grown under controlled condition in a growth chamber. Juglone was sprayed on the leaf or added to roots. Juglone had adverse effects on kudzu when sprayed on seedlings or mature plants and when it was added to roots. Plants receiving juglone had significantly lower number and percentages of healthy leaves and higher percentages of chlorotic leaves compared to control plants. The results are discussed in relation to control effortsof kudzu.

P21 **W. Davis, J. Holladay, M. Kral, L. Mumma, D. Saari, M. Vereen, B. Williams, Kate L. Sheehan and Ron J. Johnson.** Distribution of aquatic organisms in a restored pond system. Clemson University, SC.

Pond reclamation is a management tool often associated with mitigation processes and habitat creation. The process of restoration has the potential to evolve stochastically especially considering microhabitats that can form within heterogeneous landscapes. We assessed the spatial distribution of organisms in four reclaimed catfish ponds following pond drainage and an eight-month period without water. We obtained sediments, fishes, and waters from surrounding water sources (other fishponds and streams) to seed the system and establish the aquatic community. Eight months after seeding the system, we collected water, sediment, and fish samples to determine the community composition and distribution of benthic macro-invertebrates, planktonic organisms, and fishes. We also performed water quality assays to measure nutrient concentrations, particulate organic matter, and primary producers that use chlorophyll a. We assessed the spatial distribution of all organism and environmental parameters using ArcGIS software. The number of organisms found within the four restored ponds did not differ significantly; however, the distribution of organisms was not uniform throughout the ponds. Thus, we conclude that primary restoration on such small timescales can be achieved in such systems. Potential driving factors associated with this spatial heterogeneity (distance to neighboring ponds, access from roads, and delivery of runoff/water sources) are discussed in addition to plans for the use of this system for manipulated experiments in the future.

P22 **Eric R. Purdy, Mike Madritch and Gary L. Walker.** Using nutrient cycling as a method to refine the understanding of community. Appalachian State University, NC.

Cliff systems have significant biological and ecological importance, often acting as refugia for rare species. Previous studies in the Southern Appalachian Mountains and the Niagara Escarpment of Ontario, Canada have provided insight on the community structure of these systems. They included analysis of abiotic factors such as slope, aspect, surface heterogeneity, soil distribution, vertical position, and microsite characteristics. While these

investigations provided an increased understanding of the structure of plant communities in these environments, multivariate statistical analysis suggested that additional variables needed to be explored. In this project nutrient cycling was incorporated into developed models to increase the understanding of plant community dynamics on cliff faces. On ten cliffs near Cumberland Gap, TN and Todd, NC, vascular plants, bryophytes, and lichens were surveyed for identification and percent cover. Nutrient traps, placed to collect NH_4^+ and NO_3^- were affixed to the cliff face below each sample site and collected after three months. Biotic and abiotic data were compared. Nutrient levels on the cliff face were significantly lower than those on the cliff edge and surrounding forest. In addition, preliminary data suggests that microsite characteristics continue to be the most important factor governing community structure, and that lichens forming symbiotic relationships with nitrogen fixing cyanobacteria may play a large role in controlling nutrient levels on the cliff face.

P23 Zachary Barthel¹, Caleb Sutton¹, Doshie Smith¹, Leon Jernigan¹ and Ryan Emanuel². Assessment of secondary ecosystem succession in Hoke County, North Carolina. ¹University of North Carolina at Pembroke, NC, ²North Carolina State University, NC.

To assess ecosystem succession in the coastal plain region of North Carolina we used Lidar remote sensing combined with ground-based measurements. Our site was located on private property in Hoke County, NC. In 2010, a total of 14 permanent 20x20-m Plots were established throughout three stand types: pine, pine plantation, and deciduous wetlands. Age and height of the three largest trees in each plot were determined using an increment borer and hypsometer, respectively. Trees were identified to species and the diameter at breast height was measured, using a diameter tape, for species with a diameter > 5 cm. To learn about the productivity within stands, leaf area index (LAI) was measured using a LAI 2000 plant canopy analyzer. These measurements in combination with lidar-based stand characteristics offer an insight into how secondary succession progresses in the coastal plain. Results show that the deciduous wetland stands have greater species richness than the pine and pine plantation stands. This may be the result of moisture differences or suppression of hardwood invasion in the pine and pine plantation stands due to the regular burning and pine straw harvesting. Older stands in the pine and the deciduous wetland forests had a greater total basal area than the younger stands. Data suggests that secondary succession in the forests of this region vary according to topography and local management practices. The data from this study can be combined with data from the mountains and the piedmont to obtain a picture of succession throughout the state.

P24 Christopher Holland, Robin Van Meter and S. T. Purucker. Spatial exposure analysis for threatened and endangered species from changing pesticide use patterns in southern Georgia. US Environmental Protection Agency, Office of Research and Development, GA.

In recent decades, pesticide use patterns and crop distributions have changed; however, because there has not been a significant increase in usage disclosures, it is difficult to estimate the changes in potential exposure and ecological risk. To accomplish the goal of uncovering potential exposure zones, this analysis focuses on the intersection of agricultural pesticide usage patterns and listed endangered species distribution ranges in southern Georgia. Collectively, the thirty-eight counties in the study area are currently under significant cultivation and have relatively high pesticide usage rates. Since the available pesticide usage data is reported at the state level, and crop information is at a fine field-level resolution in openly available data sources, multiple data sets for different years were incorporated into a spatially-explicit regression relationship to scale pesticide application rates in southern Georgia. We present temporal changes in crop acreages and pesticide application rates to communicate the relative chemical quantities associated with each potential exposure category. Additionally, we present range maps for species of

interest that combine both historical and current distributions. This combination provides the best estimates of potential locations for these species. Then we integrate these elements together with spatial analysis techniques. After conducting the analysis, we discuss the results of the geographical investigation, present prioritized areas of concern for specific pesticides and endangered species exposure in southern Georgia, and identify temporal changes in the ecological risks for the time period 1991-2010.

- P25 **Eric Day¹, Clay Runck² and Michael Saum².** An inexpensive pyranometer for continuous measurement of solar irradiance. ¹Georgia Institute of Technology, GA, ²Georgia Gwinnett College, GA.

Benthic algae are an important component in the bioenergetics of small streams. *In situ* primary production of benthic algae can be estimated using photosynthesis-irradiance models and continuous measurements of ambient irradiance. Professional-grade photometers for measuring irradiance are expensive, making continuous (i.e., 24-7) measurement and logging of solar irradiance a risky venture in unsecured deployment areas. As part of a stream bioenergetics research project, this study built 2 inexpensive pyranometers (\$20 each, available as a kit), calibrated them against a professional-grade pyranometer, and deployed the devices (with relatively inexpensive data loggers, \$210 each) on the campus of Georgia Gwinnett College. Irradiance measurements were logged at 1-minute intervals continuously for several months in two habitats of contrasting light environment (kudzu patch and deciduous forest). The open-source statistical programming language R (<http://www.r-project.org>) was used to write a program script to process the pyranometer output from volts to Watts/m², integrate total solar irradiance on a daily basis, and generate X-Y graphs of the daily data with the integral. Instantaneous measurements of irradiance were highly correlated between the professional pyranometer and the kit pyranometer, making the kit pyranometer an economically-feasible and relatively accurate alternative for continuous and simultaneous measurement of irradiance in multiple habitats.

- P26 **Katherine L. Altman and Kevin S. Godwin.** A spatiotemporal assessment of Carolina Bay plant communities in South Carolina. Coastal Carolina University, SC.

Carolina bays are unique geomorphic features of the Atlantic Coastal Plain and serve as important habitat for rare/protected species, contributing greatly to biodiversity. Relaxation of wetland protection and rampant development threaten the biotic integrity of Carolina bays throughout their narrow distribution. We present ongoing research that assesses the biological condition of SC Carolina bays using GIS, field investigation, and a seed bank study. GIS was developed to identify and compare measures of bay biotic integrity (e.g., direct human impact) to the findings of Bennet and Nelson (1991). Plant community composition, seed bank emergence, and abiotic factors (e.g., soil chemistry, water level) were examined in six bays of three general types (i.e., forested, shrub and herbaceous) to quantify and statistically assess biological patterns, community expression and environmental constraints. Landscape analysis suggested that the number, size, and biotic integrity of SC bays have significantly declined since Bennet and Nelson (1991) while isolation/matrix hostility has increased. Most alarming, are the reduction of "relatively intact" (i.e. < 10% direct impact) bays from 1,000 to 436, and the extirpation of more than 200 bays since 1991. We also report significant differences in richness between plant communities ($p=0.04$). "Think globally and act locally" serves as the mantra to the environmental movement making the study and conservation of Carolina bays critically important to the biological and cultural heritage of SC. Bennett, S. & Nelson, J. Distribution and status of Carolina bays in South Carolina. (Nongame and Heritage Trust Section, South Carolina Wildlife & Marine Resource Department: 1991).

- P27 **Nettie S. Livingston.** Genes that affect the production of prodigiosin, a red pigmented antibiotic, from *Serratia marcescens*. Claflin University, SC.

Serratia marcescens are Gram-negative bacteria that are members of the *Enterobacteriaceae* family. Some strains of *S. marcescens* produce prodigiosin, a red pigment belonging to a class of compounds called prodiginines. Several genes in *S. marcescens* have been identified that are needed to synthesize or control the synthesis of prodigiosin. The purpose of this project is to use transposon mutagenesis to find additional genes involved in prodigiosin production. Transposon mutagenesis was performed using pMiniHimar RB1 carrying the *Himar1 mariner transposon*. The transposon was conjugated into *S. marcescens* by *Escherichia coli* carrying pMiniHimar RB1. Over 12,000 colonies were screened for variations in pigmentation and 45 mutants were recovered. Genomic DNA was isolated from 41 mutants. Using a NanoDrop spectrophotometer, the DNA concentration was determined for each genomic DNA sample. We are currently cloning the DNA fragments next to the transposon. The DNA will be sequenced and the information will be used to search the GenBank database to identify the genes that were interrupted by the transposon.

P28 **Eric W. Kjellmark, Kelsey A. Dunn, Kiefer J. Fortunato, Jordan C. Hutar, Rachel A. Lichter, Ashley E. Schiffmacher, Katherine C. Thousand and Elizabeth R. Webb.** Effects of local geology on the fire regime and vegetation structure of Andros Island, Bahamas. Florida Southern College, FL.

In the northern Bahamas the most widespread vegetation type is fire-maintained pinewoods. This vegetation is dominated by Bahamian pine (*Pinus caribaea* var. *Bahamensis*) with an understory of tropical hardwood species, many of which can become canopy trees, but they are kept in a low, shrub state as they are top-killed by fires. We studied the pinewoods on the eastern side of Andros Island, Bahamas. The fire frequency here is high and many areas burn annually. Embedded in the pinewoods are small to moderate sized stands of tropical hardwoods that have persisted for over 40 years, despite the high fire frequency. We developed three possible explanations for the persistence of these hardwood stands. First, the trees have reached a size that makes them resistant to surface fires. Second, the leaf litter from the hardwood trees does not carry fire well. Third, natural fire breaks, such as sinkholes, are preventing fires from overrunning the stands. We collected vegetation data and mapped and measured sinkholes, if present, in 6 tropical hardwood stands along with nearby pinewoods. Our results show that even large hardwood trees were top-killed by fires that penetrated the edges of the hardwood stands. While less combustible fuel may play a role, fire breaks, in the form of numerous karst sinkholes appear to be the primary factor protecting the embedded hardwood stands from fire. These sinkholes are common right up to the edge of the hardwood stands, but rare or absent in the nearby pinewoods.

P29 **Carson J. Kadi, Logan Joiner, Elizabeth G. Dobbins and Kristin A. Bakkegard.** Rock vanes reduce streambank erosion in Shades Creek. Samford University, AL.

Bank erosion in urban, freshwater streams contributes to sedimentation, which reduces water quality and taxa richness. One relatively new method for reducing streambank erosion is the installation of rock vanes. These vanes are believed to moderate bank erosion by shifting water flow toward midstream. In January 2011, rock vanes were installed along a portion of Shades Creek (Jefferson County, AL) that suffered detrimental streambank erosion. The goal of this study was to compare pre-construction and post-construction water velocities across the streambed to determine if the rock vanes refocused water flow. We constructed string transects across Shades Creek and measured velocities across each transect using a Global Water flow meter. Water velocity was measured in the vaned region and a non-vaned (control) region during two low-water states and one high-water state and compared to velocities in the same transects prior to the installation of vanes. After construction of the vanes, we found that mean velocity was significantly greater midstream than near the banks in high water ($F=3.27$; $P=0.040382$) and low water ($F=6.88$; $P=0.001326$). Before construction of the vanes, mean velocity was

significantly greater near the eroding south bank in both high water ($F= 10.74$, $P < 0.0001$) and low water ($F= 9.31$, $P = 0.000114$). In the control region, there were no significant differences in velocity across the stream channel. Our study suggests that the rock vanes created a significant change in the fluid dynamics of Shades Creek and appear to be a legitimate means of reducing streambank erosion.

P30 Natalie R. Grosser and David Brown. Kentucky wetland rapid assessment method is validated by avian species associations at forested ephemeral wetlands. Eastern Kentucky University, KY.

The Kentucky Wetland Rapid Assessment Method (KY WRAM) is currently being developed by the Kentucky Division of Water. We are testing the validity of the rapid assessment method by correlating it with biological indicators. We examined the effectiveness KY WRAM to predict the species richness, diversity and abundance of birds at isolated, forested wetlands in the Daniel Boone National Forest in Kentucky. Ephemeral, or seasonal pools can be located within forested areas, and provide necessary food, habitat and water sources for several wildlife and plant species. These wetlands are in decline and little is known about their function within the ecosystem, especially their role in avian life cycles. During the Fall season of 2011, we conducted point count surveys at 19 wetlands by recording all species seen and heard with vocalization playback to increase detectability. We used regression analysis of KY WRAM metrics expected to predict biological function (e.g., vegetation community characteristics) against measures of the avian community. Overall, this research showed a statistically significant positive relationship between the Shannon Diversity Index, species richness and abundance against the total KY WRAM metric for each wetland. Regressions of avian diversity and species richness were also statistically significant with the KY WRAM metric for habitat features, but were not significant with other metrics. We plan to continue research throughout winter and spring seasons to determine the overall ability of KY WRAM scores to predict avian diversity and abundance across seasons in isolated, forested wetlands.

P31 Michael Denslow¹, Christopher A. Badurek¹, P. D. Philyaw¹ and Casey Reese². Species distribution modeling of exotic plant species along the southern Appalachian Trail. ¹Appalachian State University, NC, ²National Park Service.

Addressing the impact that exotic flora and fauna have on their introduced ranges has become a worldwide issue. These species have impacted economic growth, public health, and ecological integrity on a global level. The Southern Appalachian region along the Appalachian Trail has not been immune to this. The development of spatial distribution and predictive models has been one attempt at engaging these issues. For this research we have specifically focused on predicting the range of three exotic plant species: *Microstegium vimineum*, *Ailanthus altissima*, and *Lythrum salicaria*. A species distribution model was developed using GIS and the following environmental variables: elevation, slope, aspect, climate, and distance to corridors. Following the development of the GIS, presence data was acquired online via the Early Detection and Distribution Mapping System (EDDmapS) and Global Biodiversity Information Facility (GBIF). Background data was generated inside of a GIS using a mask of the study area. The cell values which coincided with the presence/absence data were extracted and used to generate coefficients for use inside the logistic regression model. By combining cartographic modeling and logistic regression, a GIS layer of the predicted range for each species was produced. The predictive layer is used for assisting in developing preventative methods and management of invasive species in areas along the Appalachian Trail managed by the National Park Service.

- P32 **Ann G. Huyler¹, Arthur Chappelka¹, Greg Somers¹ and Steven Prior².** Soil carbon relationships with home age, yard maintenance and tree biomass in residential yards in Auburn, AL. ¹Auburn University, AL, ²USDA-Soil Dynamics Laboratory.

As urban populations increase worldwide, residential land use expands concomitantly. Research suggests that yards can sequester soil C at a high rate, possibly due to yard maintenance (fertilization, irrigation, and mulching lawn clippings) and tree biomass. At present, no research has assessed drivers of residential soil C storage in the southeastern US. In 67 yards in Auburn, AL, relationships of soil C with home age (3-87 yrs), tree biomass, and yard maintenance were determined across 0-15 cm, 15-30 cm and 30-50 cm depths. The relationship of soil C with home age was positive at 0-15 cm, ($P=0.0003$, $R^2=0.19$, slope = $0.021 \text{ kg m}^{-2} \text{ yr}^{-1}$). In 15-30 cm and 30-50 cm, soil C had positive relationships with tree biomass ($P=0.008$, $R^2=0.11$, and $P=0.011$, $R^2=0.11$, respectively). In 0-15 cm and 30-50 cm, non-watered yards had greater soil C than watered yards, ($P=0.02$, $3.40 \pm 0.22 > 2.74 \pm 0.48 \text{ kg m}^{-2}$ and $P=0.06$, $0.78 \pm 0.09 > 0.55 \pm 0.15 \text{ kg m}^{-2}$, respectively). In 0-15 cm, soil C was greater in mulched compared to bagged yards, ($P=0.06$, $3.43 \pm 0.27 > 2.96 \pm 0.30 \text{ kg m}^{-2}$). The influence of home age may be limited by unknown soil legacies. The minimal effect of tree biomass may result from low C allocation to fine roots. In this study, fertilizer applications may have been too low to significantly influence soil C sequestration. Irrigation may have boosted decomposition and/or increased shoot:root biomass ratio. Further research is needed into climate effects and the origin and turnover rate of organic soil C.

- P33 **CANCELLED**

- P34 **Anthony P. Abbate, Eleanor Russell and Joshua W. Campbell.** Parasitic beechdrops (*Epifagus virginiana*): a possible ant pollinated plant. High Point University, NC.

Beech drop (*Epifagus virginiana*) is a flowering plant that is parasitic on beech tree roots. The pollination biology of this plant is unknown. We conducted an observational study at the Piedmont Environmental Center (Guilford County, NC) to document possible pollinators of *Epifagus virginiana*. In 2011, we filmed *Epifagus* with cameras for two weeks during the flowering season (September 9-24). Only two insect species were observed to visit flowering *Epifagus*: Eastern bumble bee (*Bombus impatiens*) and the winter ant (*Prenolepis imparis*). During this study 75% of the total insect visits were accomplished by *Prenolepis imparis*. Specimens of both bumble bees and ants contained *Epifagus* pollen attached to their bodies. We counted and recorded the time an individual ant or bee spent on a flower and how many flowers they visited. We found that the average number of flowers visited by individual bumble bees was 40 and the average number of flowers visited by an individual ant was 1.2. *Bombus impatiens* spent an average of 1.5 s on individual flowers whereas *Prenolepis imparis* spent an average of 55.4 seconds on an individual flower. The preliminary results of our study suggest that *Epifagus virginiana* may be dependent on ants for pollination.

- P35 **Ashley N. Galway¹, Susan C. Loeb² and Joshua W. Campbell¹.** Comparison of two different malaise traps in forested plots within the Green River Basin, North Carolina. ¹High Point University, NC, ²USDA Forest Service-Southern Research Station, GA.

Flying insects comprise the bulk of a Chiropteran's (bat) diet, and numerous studies have used malaise traps to monitor insect abundance for bats. However, the type of malaise trap used could alter insect capture rates. We tested two different malaise traps (canopy and ground) on various 10 acre forested plots throughout the Green River Basin in North Carolina in which bat censuses were being accomplished. Forest treatments included Oak-Shelterwood, Prescribed Burn, Heavy thinning and Controls. From June-August 2009 to 2011, insects were retrieved from both types of traps every morning and night. After

collected, the insects were identified to Family level and their dry weight was recorded. Overall, the ground malaise trap caught 67.9 % of trapped insects compared to 34.2 % of insects captured by the canopy malaise trap. Diptera and Hymenoptera were captured in significantly higher numbers in the ground malaise trap ($P= 0.0001$). Coleoptera and Lepidoptera were not significantly different between the two trap types. Several very minute insects and ground dwelling arthropods (e.g. Cecidomyiidae, Acari, Opiliones and Collembola) were captured in significantly higher abundances in the ground malaise trap. Although the ground malaise trap captured higher abundances of insects, the canopy malaise trap may capture more insects related to bat diets.

- P36 **Amanda M. Starring, Gerald L. Smith and Joshua W. Campbell.** A pollination study of *Hymenocallis coronaria* in the Catawba River, SC. High Point University, NC.

As a result of human activity and river damming, much of the natural habitat of *Hymenocallis coronaria*, the rocky shoals spider-lily, also known as the cahaba-lily in Alabama, has been lost. The rocky shoals spider-lily is only found at and above the Fall Line in a few scattered populations in Alabama, Georgia, and South Carolina. One of the larger populations is located in the Catawba River at Landsford Canal State Park, South Carolina. In order to better protect and understand this species, knowledge of their pollination ecology is a priority. Throughout the peak blooming season (May-June 2011) we observed potential pollinators/insect visitors of *H. coronaria* with camera equipment from a distance of one meter away over set periods of time. We documented 282 total individual visits with 205 of those consisting of potential pollinators over a period of 51 hours. Using a Chi-square test we determined that insects were attracted to different parts of the flower bloom ($P<0.01$). Using ANOVA we determined that insects within *Hesperiidae* and *Papilionidae* spent significantly more time on the open blooms of *H. coronaria* than *Apidae* ($P<0.01$). *Papilionidae* spent significantly more time on the center of the bloom than both *Apidae* and *Hesperiidae* ($P<0.01$). The extended visits portrayed by these species may allow for a greater chance of pollination occurring. Our results indicate that numerous insect species may act as a pollinator for *H. coronaria* with some insects being potentially more efficient pollinators.

- P37 **Brian D. Holt and T. W. Barger.** A survey of the tiger beetles (Coleoptera: Carabidae: Cicindelinae) of Alabama. Natural Heritage Section, State Lands Division, AL-DCNR1.

A tiger beetle (Coleoptera: Carabidae: Cicindelinae) survey is being conducted to determine the current status of species previously reported for Alabama. This survey began in 2010 and taxa were documented through field collections and museum holdings from the Auburn University Entomology Collection (AUEM) and the H. P. Loding Collection housed at the Alabama Museum of Natural History (UAM). To date, 30 taxa of tiger beetles have been documented, including one new record for the state. Future work will include the continuation of field collections and additional inquiries into private collections and additional museum holdings.

- P38 **Holland M. Hendrick, Devin L. Carter and C. B. Odom.** Application of RAPD techniques to the genetic analysis of the invasive bean plataspid, *Megacopta cribraria*. Wingate University, NC.

Originally native to Asia, the bean plataspid, *Megacopta cribraria*, was reported in 2009 as an invasive in Oconee County, GA. Since that original sighting, it has rapidly spread to Alabama, North and South Carolina, and Virginia, in addition to significantly expanding its Georgia range. A survey of RAPD (Random Amplification of Polymorphic DNA) generated polymorphisms provide a preliminary screening for putative population markers that can be used to track the spread of separate populations of this invasive species as they expand into new ranges. Several primer sequences have been examined in the attempt to identify useful genetic markers.

P39 **Brian A. Little and Erika A. Scocco**. SEM. Wingate University, NC.
Megacopta cribraria is an invasive insect native to Southeast Asia, India, and Australia that was initially detected on the similarly invasive kudzu plant in Oconee County, GA in 2009. Since the bean plataspid's introduction into the United States, it has spread into North Carolina, South Carolina, Virginia and Alabama. Although early descriptions reported the legume kudzu as a host, the bean plataspid has also been identified feeding on legumes including soybean. Little is known about the morphology of the proboscis and the plant tissues that are damaged from feeding. This study will investigate and compare the mouthpart morphology of bean plataspids to other phytophagous Hemipteran species as well as adult and immature bean plataspids.

P40 **Brian M. McHouell, Brian A. Little and Erika A. Scocco**. An insect hitchhiker: a plausible theory of migration of the bean plataspid, *Megacopta cribraria* (Fabricius), throughout the southeastern U.S. Wingate University, NC.
Megacopta cribraria (Fabricius) is an invasive insect native to Southeast Asia, India, and Australia that was first detected in Oconee County, GA in 2009, which has since spread into North Carolina, South Carolina, Virginia and Alabama. Host plants within its native range include a wide variety of legumes; however, kudzu, lablab, and soybean are preferred by the insect. Researchers have theorized that the rapid infestation of the bean plataspid has been dispersed via weather patterns and/or by attaching onto moving substrates (i.e., automobiles). Because of the close proximity of kudzu patches to roadways, the bean plataspid may have been able to disperse abruptly. Because the bean plataspid has 2-segmented tarsi and setaceous tibiae, the latter suggesting that this insect can attach to substrates readily. The aim of this study was to determine the possibility of the insect to attach to objects that are subjected to high wind disturbance to better understand if this is theory is plausible for migration.

P41 **Elizabeth L. Mihalcik¹ and Fred G. Thompson²**. New species of Holospirid land snails of the genus *Coelostemma* from northern Mexico. ¹Contract Research Associate, ²Florida Museum of Natural History, University of Florida, FL.
 Land snails of the genus *Coelostemma* in Northern Mexico are reviewed by material collected from 1964 and 2007. *Coelostemma* are placed in the Holospiridae which is endemic to Mexico and the southern United States. The study area is confined to the States of San Luis Potosi, Coahuila, Durango and Chihuahua. Colonies of snails inhabit calcareous terrains of a few hectares or less in arid to semi-arid habitats at intermediate to high altitudes. Comparisons among species were made using shell measurements, external shell sculpture characters, teeth structures on the radula and internal anatomical features involving the reproductive tract. All species are small and cylindrical in size. Shell lengths range from 11.6 mm – 24.6 mm in length. Species variation is shown by external shell sculpture between species from being smooth to coarsely ribbed. The internal columella of the shell is completely hollow. SEMs of the radula show the marginal teeth to be bicuspid while the central tooth and lateral teeth are unicuspid. Holospirids are hermaphroditic and show very little variation among already described species in their reproductive tract. The spermathecal duct and free oviduct may unite to form a very short vagina or a vagina may be lacking all together. Six new species are described based on our findings; *Coelostemma gracile*, *C. cordylum*, *C. costatum*, *C. salpinx*, *C. scrabrum*, *C. mendax*.

P42 **Stephanie L. Simmons¹, Erika A. Scocco¹, Hal Peeler², Tracie M. Jenkins² and Wayne A. Gardner²**. Sex ratios of established and new territories of the invasive bean plataspid, *Megacopta cribraria* (Fabricius). ¹Wingate University, NC, ²University of Georgia, GA.
Megacopta cribraria is an invasive insect native to Southeast Asia, India, and Australia that was first detected in Oconee County, GA, in 2009, and has since spread into North

Carolina, South Carolina, Virginia and Alabama. Mitochondrial sequence data on specimens from diverse geographical origins indicate complete homogeneity, suggesting one initial introduction. However, parthenogenesis may be occurring due to the endosymbiont *Wolbachia sp.*, therefore, possibly causing an all female clutch in some populations. Preliminary data indicate a sex ratio difference among earlier invasive populations and populations in recently identified areas. This data indicates that in established areas that the female to male sex ratio is 1:1. In recently invaded areas, the sex ratio appears to be a 2:1, female to male ratio. This study compares reported sex ratios among different populations as well as comparing ratios between first and second year populations in newly established territories.

P43 **Hassan A. Rana and Zach I. Felix.** Preliminary work towards developing a list of land snails for Georgia. Reinhardt University, GA.

Land snails, an ecologically important group, comprise significant portion of biodiversity in some regions and reach high levels of endemism in Southern Appalachians. Our observations indicated that relatively little work had been done to document land snails in the biodiverse state of Georgia, and that many species found in adjacent states inhabit ecoregions that are also found in Georgia. Here, we have compiled a list of species documented in Georgia using distribution maps in Hubricht's 1985 monograph on the land mollusks of the eastern United States and museum records. We have also provided a preliminary estimate of which species are also likely to or possibly occur in Georgia. We developed rules to estimate species' likelihood of occurring in Georgia based on their geographic proximity and ecoregional affinity. We applied these rules to records found in Hubricht. We also compared the estimates of species likely to occur in Georgia to museum collections since publication of Hubricht's work. One hundred and fifty-one species are known to occur in Georgia; 109 of these species were found in the Upper Piedmont, Ridge and Valley, Blue Ridge and Cumberland Plateau ecoregions of north Georgia. Based on our analysis we feel that there are at least 100 snails that occur in Georgia, but have not been documented. Our eventual list of species for the state will be valuable for natural resource planners; this list currently does not exist. Moreover, the data show that more land snail surveys are needed in Georgia.

P44 **William H. Dees¹ and Matthew M. Yates².** Fish oil, undergraduates and gravid mosquito traps. ¹McNeese State University, LA, ²East Baton Rouge Mosquito Abatement and Rodent Control, LA.

Mosquito control programs continually investigate better ways to collect mosquitoes for general surveillance and virus isolation. The gravid mosquito trap is one such method. Two types of gravid traps are available. Both traps have a standard oviposition pan containing water on which the trap is placed. The standard design is equipped with a fan that pulls ovipositing mosquitoes into a collection bag; the other, an updraft trap, has a collection bag in front of the fan that prevents damage to mosquitoes. We present gravid trap attractant formulations used by different parish/regional mosquito control programs in Louisiana. Many formulations include fish oil as an additive, while others use hay infusion, lactalbumin, liver powder and yeast. The standard rate for fish oil is approximately 60 ml (2 fl oz) fish oil/3.8 L (1 gal) water. Experiments to determine gravid trap attractant formulations serve as excellent undergraduate research projects in medical entomology and have a practical, real-world utility. Persons who test different formulations of gravid trap attractants for collecting mosquitoes are encouraged to submit their gravid trap attractant formulations to the Gravid Trap Attractants Project (GTAP). One of the goals of GTAP is to compile and disseminate gravid trap attractant formulations to the operational mosquito control community. GTAP contact information: Dr. William Dees, Chair, Louisiana Mosquito Control Association (LMCA) Research Committee, Dept. of Biology and Health Sciences, Box 92000, McNeese State University, Lake Charles, LA 70609; Phone 337-475-5654, Email: wdees@mcneese.edu.

- P45 **Victor R. Townsend¹, Michael K. Moore², Daniel N. Proud³ and Virginia A. Young².** Preliminary survey of the harvestmen (Arachnida: Opiliones) of Tobago, West Indies. ¹Virginia Wesleyan College, VA, ²Mercer University, GA, ³University of Louisiana at Lafayette, LA.

Relatively little is known about the diversity, morphology or natural history of the harvestmen that occur on the Caribbean island of Tobago. In August 2010, we collected 11 species of harvestmen, primarily from along the trail connecting the Speyside overlook to Pigeon Peak on Tobago. We captured representatives of the families Agoristenidae, Cosmetidae, Cranidae, Manaosbiidae, Sclerosomatidae, and Stygnidae. The most abundant harvestmen were *Cynortula granulata* Roewer 1912 (Cosmetidae), *Paecilaemainglei* Goodnight and Goodnight 1947 (Cosmetidae), *Rhopalocranaus albilineatus* Roewer 1932 (Manaosbiidae) and *Santinezia serratotibialis* Roewer 1932 (Cranidae). We collected nymphs for multiple taxa, indicating that several species were reproductively active during our sampling period. We also examined and compared the male reproductive anatomy for each species.

- P46 **Linda D. Canning and William H. Dees.** Mosquitoes and temperature: information for mosquito-borne disease models. McNeese State University, LA.

Long-term studies of nocturnally active mosquitoes in the Sabine National Wildlife Refuge (a salt/brackish/intermediate freshwater marsh) and in Moss Bluff (a freshwater marsh) in Louisiana have been conducted for more than five years and are still underway. These studies involve collecting mosquitoes before, during and after sunset and sunrise, and throughout the night using Centers for Disease Control mosquito light traps. Traps are placed 1.5 m above ground, in areas with little to no competing light. Meteorological conditions, specifically temperature and humidity, are monitored when mosquitoes are collected. To date, mosquito species have been collected during times of low and high relative humidity (23-95+%). On a given trap night, average relative humidity ranged between 54-95+% RH. Temperature showed greater effect on the distribution of species than humidity. Mosquitoes were collected when average nightly temperatures on a given trap night ranged between 8.8°C (low -1.5°C) and 31.4°C (high 38.9°C). No mosquitoes were collected when average temperatures were at or below 8.1°C on a given trap night. *Culex* spp. and *Culiseta* spp. were more prevalent at lower temperatures while *Aedes* spp. (except *Ae. canadensis*), *Coquillettidia* spp., *Psorophora* spp. and *Uranotaenia* spp. were more prevalent at higher temperatures.

- P47 **John L. Simpson and Elizabeth V. Berkeley.** Unemployment stress on birth sex ratios in Virginia populations. James Madison University, VA.

The Trivers-Willard hypothesis proposes that parents in good condition are more likely to produce male offspring while those in poor condition are likely to produce females. As a corollary, populations under stress are likely to have birth sex ratios which skew toward females and those relatively free of stress are likely to skew toward males. We are examining a chronic stress event, unemployment, on the human sex allocation response. Specifically, this study explores the effect of local unemployment rates on birth sex ratios in Virginia counties and cities during specific years. Linked birth records including date of birth, location, sex, and gestation period are provided by the Virginia Division of Health Statistics, and unemployment rates are provided by the Bureau of Labor Statistics. Birth records from 3 months prior to and 10 months after four separate periods will be examined. Four periods with peaks in unemployment were selected: births in 1992 (very high unemployment rate in Virginia), 2000 (very low), 2008 (very low), and 2010 (very high). Monthly average birth sex ratios during these periods will be calculated for the six highest and six lowest income cities/counties in Virginia for which data is available. We are also examining how racial diversity and socioeconomic status may further influence sex allocation. Based on the Trivers-Willard hypothesis, we expect that years of high unemployment might show significant skewing toward females and that years of low unemployment might skew toward males.

- P48 **O. A. Ahmadpour¹, Cory Mullis¹, B. C. Jofre¹, Brian Keebler¹, Ashley O'Neill², William B. Cash³, LeeAnn Fishback⁴ and Thomas C. McElroy¹.** Genetic characterization of wood frogs (*Lithobates sylvaticus*) near a northern edge of their distribution. ¹Kennesaw State University, GA, ²Georgia State University, GA, ³Central Arkansas State University, AR, ⁴Churchill Northern Studies Centre, Canada.

We investigated the population genetic structure of wood frogs (*Lithobates sylvaticus*) from collection sites in boreal and tundra habitats near Churchill, Manitoba, Canada (Western Hudson Bay), which is at a northern edge of this species distribution. Previous studies in the Northern Great Plains and Northeastern USA regions on this species have revealed strong subdivision among populations at large (20 km) scales and high gene flow within small scales (5 km). We surveyed 20 microsatellite loci used in the previous studies for 160 specimens collected from 400 km² near Churchill. The previous studies indicated these loci were variable within and among sampled sites. Our initial study with 5 loci revealed no genetic diversity among all of the samples for any of the loci examined. This initial data supports significantly reduced genetic diversity of edge populations as compared to core populations. The reduced genetic variation may be the result of leading edge dispersal from glacial refuges. We are currently assaying the remaining 15 loci. The results of these analyses will be presented. Understanding the genetic composition and ecology of edge populations can provide key information to the environmental and demographic factors shaping species' geographic ranges.

- P49 **Fengjie Sun.** Rooting of the tree of life and the origins of diversified life based on phylogenetic analysis of RNA structures. Georgia Gwinnett College, GA.

The rooting of the tree of life and the origins of diversified life remain controversial, partly due to our inability to root trees and the limited phylogenetic signal in sequences. A growing tendency of applying molecular structure evidence in phylogenetic analysis provides significant insights into deep evolution of ancient molecules. The applications of RNA structures are based on three fundamental biological tendencies: (1) RNA structure is far more conserved than sequence, therefore has advantage when used to study ancient events in the history of life; (2) there is a universal tendency toward molecular order that is supported by thermodynamic, statistical, and phylogenetic arguments; and (3) successfully implemented biological designs tend to be reused in nature, generally through recruitment by takeovers or cooptions. We apply an award-winning phylogenetic approach using RNA structural information to reconstruct evolutionary history of several macromolecules (5S rRNA, tRNA, SINE, RNase P RNA). We explore the long-standing evolutionary questions, such as the origin and evolution of the genetic code, amino acid charging, and early life and viruses. The structure of an RNA molecule are decomposed into substructures (coaxial stem tracts and unpaired regions) which can be studied using features (characters) that describe their geometry ("shape" characters such as length of stems or unpaired regions) or their branching, stability, and uniqueness ("statistical" characters such as parameters describing a morphospace). These characters are coded and arranged in data matrices, which can be transposed and subjected to cladistic analyses to generate rooted phylogenetic trees of either molecules or substructures.

- P50 **William A. Cagle.** Determining the phylogeny and taxonomy of *Pueraria*. East Carolina University, NC.

Kudzu (*Pueraria montana* var. *Lobata*), is a highly invasive species and a well-known problem in the Southeastern United States. It has been responsible for engulfing and damaging 1000's of square miles of land. The genus is native to Southeast Asia and is comprised of ~20 species. Preliminary analyses suggest that the group is strongly polyphyletic with at least 4 separate clades distributed across the tribe Phaseoleae. We are performing a phylogenetic analysis of this genus in order to gain insight into its evolutionary history and the evolutionary history of invasive plants therein. We

hypothesize that the US populations of Kudzu stem from many source populations/species in SE Asia. We also test the hypothesis that *Pueraria* is not monophyletic. To test the monophyly of *Pueraria*, we are sampling across the genus as well as widely across phaseoloid legumes, including 60 of 100 genera, using a molecular based approach. Three nuclear gene regions (ITS, AS2, and Waxy) and two chloroplast gene regions, (matK, trnLF) are being examined for sequence comparison. Maximum parsimony, Bayesian inference, and maximum likelihood are being used to estimate evolutionary relationships. Our results will be used to inform taxonomic revisions and establish species relationships for future legume research. Determining the level of introgression among *Pueraria* species may provide insight into the invasive character of U.S. populations and why it is so invasive here as opposed to those of its native habitat of Southeastern Asia where it isn't considered invasive.

P51 Dipaloke Mukherjee and Walter J. Diehl. Do genetic hitchhiking, codon usage bias, mutation saturation or relaxed constraint mimic natural selection in the Mycoplasmatales? Mississippi State University, MS.

Sequences from 222 protein-coding genes common to genomes of 12 species of Mycoplasmatales were analyzed to test whether any of several populational characteristics (genetic hitchhiking, codon usage bias, mutation saturation, relaxed constraint) mimic the effects of natural selection. Genetic hitchhiking occurs when a gene is transmitted to the next generation, mimicking selection, because it is linked to a gene favored by selection. However the number of unique genes linked to genes under selection did not differ significantly ($P > 0.05$) from those not under selection. Similar results were found for the most frequently linked genes ($P > 0.05$). Codon usage bias (CBI), the uneven use of synonymous codons, can mimic natural selection favoring more frequently used codons. However, no significant correlation was found between CBI and either dN/dS ratios or neutrality indices ($P > 0.05$). Mutation saturation occurs when multiple, sequential mutations in a codon obscure signatures of original sequences, which may mimic selection randomly. Although mutation saturation was found in all clades ($P < 0.001$), genes under selection showed no greater likelihood of mutation saturation than genes not under selection ($P > 0.05$). Finally, relaxed constraint can mimic selection when a gene becomes more common if negative selection is lessened by environmental change or gene duplication. However neutrality indices increased (reduced selection) significantly ($P < 0.05$) with dN/dS ratios (increased relaxed constraint) indicating that relaxed constraint may have inhibited selection in these species. In summary, none of the above populational characteristics was found to create the patterns of natural selection of protein-coding genes previously reported in the Mycoplasmatales.

P52 Mark Z. Hu and Elizabeth Berkeley. Effect of immigration on Asian American birth sex ratio. James Madison University, VA.

Birth sex ratio can diverge from parity due to variations in environmental conditions and parental fitness. The Trivers-Willard hypothesis states that parents will invest in male offspring under favorable conditions. It is a stereotype that the United States of America has been viewed as a country of economic opportunity, whereas Asia has been viewed negatively in terms of individual economic opportunity. Furthermore, dietary changes could impact the human sex allocation response. This reasoning led us to predict that there will be a bias toward male births by first generation Asian Americans. To do this research we will compile census data on multi generation Asian Americans over a set period of time and extrapolate the birth sex ratio using data from the Inter-University Consortium for Political and Social Research. This will give us insight in the effect of different parental conditions on birth sex ratio.

P53 Leos G. Kral, Harriet N. Abbey and Summer C. Stanley. Evolutionary genomics of darters: the time is now. University of West Georgia, GA.

The family Percidae contains over 200 species, most of which are within the subfamily Etheostominae. This subfamily (the darters) represents a species rich radiation of freshwater fishes in North America and these species exhibit both allopatric and sympatric distributions. Evolutionary relationships between the various darter species have been deduced from morphological comparisons as well as comparisons of mitochondrial DNA sequences and of a sampling of a few nuclear DNA sequences. However, a thorough understanding of the evolution of the darter species will require comparisons at the whole genome level. The rapid decline in the cost of whole genome sequencing and the promise of the \$1000 genome in the next year is about to make such an approach practical. We are in the process of sequencing the genome of the Tallapoosa darter (*Etheostoma tallapoosae*) and will be in the process of annotating some of the genes. A website has been created where these genomic sequences will be made available to other darter researchers and, it is hoped, that genomic sequences of other darter species will be contributed to this site by others over time. This should create a valuable resource for the study of darter evolution and ecology.

P54 **Theresa Griffith, Richard Pirkle and Christopher G. Brown.** The inbreeding dogma: potential inbreeding depression in domesticated dogs (*Canis domesticus*). Shorter University, GA.

Inbreeding increases the homozygosity of individuals, which often increases the phenotypic frequency of deleterious recessives in the population. An increase in expression of these recessive alleles can lower the population's health and fitness (i.e., inbreeding depression). In this study, we tested for effects of inbreeding depression in domesticated dogs by comparing the health of purebred breeds with mixed breeds. As a measurement of health, we compared differences in respiratory rate and heart rate before and after brief exercise (a three-minute jog). Breed, health conditions, and diet were reported by each dog's owner.

P55A **Courtney Jenista, Rachael Peck and Cynthia Bennington.** The sexual system of *Passiflora incarnata*: it's complicated. Stetson University, FL.

Andromonoecy is a plant sexual system that allows an individual plant to plastically alter total energy investment in reproduction by adjusting its ratio of hermaphroditic to staminate flowers. We used clonal replicates of nine genotypes of *Passiflora incarnata*, an andromonoecious perennial vine, to ask whether the most plastic genotypes (i.e., those that make the biggest shift toward maleness in response to herbivory) have highest total fitness. In addition, we asked whether staminate flowers have higher male fitness than hermaphroditic ones. We grew 61 *P. incarnata* plants in individual pots within a greenhouse during the summer of 2011, half of which were exposed to simulated herbivory (50% of each leaf blade was removed) while the other half were left untreated. We recorded the sex of every flower produced between May 9 and Oct 1 (n=1740) and, for a haphazard subset of flowers, we measured the flower diameter, counted ovule number, estimated pollen grain number and measured pollen size. Although the herbivory treatment did not result in an increase in staminate flower production, we found large differences among genotypes in the proportion of male flowers (ranging from 3% to 62%). Staminate flowers did not differ from hermaphroditic ones in any of the male fitness traits we measured. There was, however, evidence that genotypes with the largest shift in gender in response to herbivory reached a greater vegetative size, suggesting that, at the whole plant level, resources saved through staminate flower production may have been allocated to vegetative growth.

P55B **Dehat M. Jalil.** The impact of Hurricane Katrina and racial and socioeconomic disparity on the human sex allocation response. James Madison University

The Trivers-Willard hypothesis states that there exists a greater investment in males by parents in good conditions and a greater investment in females by parents in poor conditions and natural selection favors this system of investment. In other words, under

stress, mothers will produce more female offspring than male offspring. Furthermore, this effect could be mediated by racial and socioeconomic disparity. The proposed study will measure birth sex outcomes of different parishes during periods before and after the hurricane. The purpose of the research is to see if the stress caused by Hurricane Katrina on women led to any bias of birth sex. Data has been obtained from the State Center for Health Statistics Louisiana's Office of Public Health. We will test for the presence of bias towards female births before and throughout the gestation period. Dehat M. Jalil. Elizabeth V. Berkeley. The Impact of Hurricane Katrina and Racial and Socioeconomic Disparity on the Human Sex Allocation Response. James Madison University.

P56 Jennifer S. Stanley, Alexander Krings, Jon M. Stucky and Richard R. Braham. Guide to the vascular flora of Picture Creek Diabase Barrens (Granville County, North Carolina). North Carolina State University, NC.

Picture Creek Diabase Barrens [PC] is a biologically unique area located in the northeastern Piedmont of North Carolina. Designated a "Nationally Significant" area by the NC Natural Heritage Program [NHP], this 407-acre site lies within the Triassic basin where diabase intrusions have given rise to mafic soils rarely found in the Piedmont. PC is a remnant Piedmont prairie, boasting a high density of rare, threatened, and endangered plant species. The NHP lists 48 taxa in Granville Co. as being rare in NC. Of these, 34 are associated with mafic soils. To date, at least 18 of these have been found at PC, of which half are threatened or endangered in NC. PC also supports the largest known population of the federally endangered *Echinacea laevigata* as well as *Marshallia* sp. 1, an undescribed Federal Species of Concern. To preserve the unique biodiversity of PC, a better understanding of its flora must be acquired. To achieve this goal, specimens are being collected weekly for identification and subsequent archiving in the herbarium of NC State University. Once a comprehensive list of species has been assembled, a guide including taxonomic keys and illustrations, will be developed to aid in the identification of plants occurring at PC. The guide will provide land managers with the tools to determine which species are growing on the site and which have been known there historically. This information will help inform precision natural resource management and aid in the effort of monitoring population changes in response to management practices.

P57 Marvin E. Brown¹ and Eran S. Kilpatrick². Distribution and habitat characteristics of the green-fly orchid (*Epidendrum magnoliae*) in four coastal plain counties of South Carolina. ¹University of South Carolina Beaufort SC, ²University of South Carolina Salkehatchie, SC.

The green-fly orchid (*Epidendrum magnoliae*) is the only epiphytic orchid found outside of Florida in the continental U.S. and is considered rare or uncommon in South Carolina. From May – August 2011 green-fly orchid searches were performed in Allendale, Bamberg, Colleton, and Jasper Counties, South Carolina within the Ashepoo, Coosawhatchie, Edisto, and Savannah River watersheds. Multiple habitat variables were measured at host trees and along transects within each study site. A total of 363 colonies were recorded on 51 different host trees. Green-fly orchids were found on eight different tree species with 94% of colonies occurring on water elm (*Planera aquatica*), water tupelo (*Nyssa aquatica*), swamp tupelo (*Nyssa biflora*), and bald cypress (*Taxodium distichum*). Host trees had an average height of 17.6m and average dbh of 47.1cm. The average colony height across sites was 6.8m with smaller heights recorded near the margins of oxbow lakes and larger heights recorded within cypress tupelo swamp forests. Bryophytes were observed in 29% of colonies with resurrection fern (*Pleopeltis polypodioides*) and Spanish moss (*Tillandsia usneoides*) observed as commensals with 19% and 14.6% of colonies, respectively. Colonies occurred at various orientations on subcanopy trees with a northward orientation observed most frequently for colonies in canopy trees. This study produced two county records (Bamberg and Jasper) for the green-fly orchid and added three locality records for Allendale and Colleton Counties. Mature stands of swamp forest

should be maintained in the Coastal Plain to sustain epiphytic orchid populations which could serve to recolonize regeneration in harvested stands.

- P58 **Andrew Dotson and Robert Carter.** Species composition of a frequently burned mountain longleaf pine forest on the Talladega National Forest, Alabama. Jacksonville State University, AL.

Portions of the Talladega National Forest near Coleman Lake are frequently burned to restore longleaf pine (*Pinus palustris*) ecosystems. The study area was inventoried to determine the understory species composition. Members of the Poaceae, Asteraceae, and Fabaceae dominated the understory. The understory shared species in common with Coastal Plain longleaf pine ecosystems including *Coreopsis major*, *Pityopsis graminifolia*, *Solidago odora*, *Sorghastrum nutans*, and *Tephrosia virginiana*. Species typically absent from Coastal Plain ecosystems include *Vaccinium pallidum*, *Krigia biflora*, *Euphorbia corollata*, and *Piptochaetium avenaceum*. This study will provide baseline data needed for the restoration of mountain longleaf pine ecosystems.

- P59 **Ryerson P. Pamplin, Elena A. Mikhailova, Christopher J. Post, Patrick D. McMillan, Julia L. Sharp and Knight S. Cox.** Multitemporal floristic analysis of the shores of Lake Issaqueena, South Carolina. Clemson University, SC.

Climate change can be reflected in phenological (first occurrence of buds, leaves, and flowers) shifts in community structure between now and 40 years ago. The floristic study of Lake Issaqueena conducted by William Pamplin in 1970-1971 was reinvestigated in 2011-2012 to determine floristic changes for this site in the forty year period. Blooming dates were recorded via photographs taken by GPS-enabled camera on a monthly basis. Photographs were downloaded and organized by sampling date in Picasa 3 web albums and stored in a project website created using Google websites. Flowering plants were identified using expert knowledge and USDA plant database. Preliminary results for the months of November and December demonstrate the presence of blooming species representative of the families Asteraceae, Ericaceae, Gentianaceae, Oxalidaceae, Polygonaceae, and Violaceae whereas the 1970-1971 data had no blooming species present during these months. There was no evidence of blooming during January for the present study and for the 1970-1971 study. There appears to be a phenological shift in blooming dates, but it unclear whether it is due to climate change or climatic variation. Further data will be collected to complete the yearly observations.

- P60 **Mark G. Winkler and Marjorie M. Holland.** Survey of the native and nonnative vascular plant species of three islands in Lake Winnepesaukee, New Hampshire. University of Mississippi, MS.

This study examined the long-term patterns in vascular plant composition on three islands in Lake Winnepesaukee, NH. It also tested the role of island biogeography in ecology as it analyzed the effectiveness of a land use plan implemented on the islands. Samplings were made on the islands in the summer of 2011 and were compared to earlier samplings in 1978, 1991, and 2001. The flora were observed and measured in 25 permanent plots selected across a grid overlain on the three islands in 1978. The understory flora was measured by presence and percent cover, and the overstory was measured by individual trees and shrubs, dominance ratings, and basal areas. This study also focused on plants of interest including certain rare (*Rhododendron maximum*), introduced (*Halesia carolina*) and potentially invasive species (*Poa compressa*). The data for this study show that the species evenness on all the islands remained relatively constant in all four years of sampling. However, species diversity and richness increased significantly from 1978 to 1991 on all three islands but remained relatively constant in the 1991, 2001, and 2011 samplings. The plants of interest mostly remained in the same areas that they were found in earlier samplings. In particular, the rare plants remained in the least disturbed areas of the islands while the introduced and potentially invasive species were found in the most disturbed areas of the islands.

- P61 **Caitlin Elam¹ and Brenda L. Wichmann²**. Who goes to scrub in February? Who fights through dense oak thickets? Who would spot such a tiny little thing? – a status survey of *Monotropsis reynoldsiae* (A. Gray) A. Heller (Florida pigmy pipes, Ericaceae).¹Cardno-Entrix, ²University of Georgia, GA.

Monotropsis reynoldsiae (A. Gray) A. Heller (Florida Pigmy Pipes, Ericaceae), a nonphotosynthetic mycoheterotrophic plant, is a Florida state endangered species that was first discovered in Florida in 1883 and not collected again for over 80 years. Although it has been circumscribed within the broader concept of *Monotropsis odorata* Schweinitz ex Elliott (Spring Pigmy Pipes) the extent of the disjunction, which ranges from the Appalachian Mountains to northeastern Florida, and morphological characters support the argument for a distinct species. Due to the diminutive size and winter flowering period of Florida Pigmy Pipes, as well as its scattered distribution, populations have not been well or regularly documented. Some of the documented populations have not been relocated for over 20 years. Population occurrence data were derived from herbarium specimens and the Florida Natural Areas Inventory (FNAI) database. A thorough survey of all documented populations was conducted in February 2012. For each occurrence, the status of the population as well as local habitat and edaphic characteristics were documented.

- P62 **Alexander Krings, Spencer Goyette and Jon Stucky**. Going mobile: new mobile plant identification resources from the North Carolina State University Herbarium. North Carolina State University, NC.

The mission of the North Carolina State University Herbarium (NCSC) is two-fold: (1) to document and understand plant diversity (Target 1 of the Global Strategy for Plant Conservation, Convention for Biological Diversity), and (2) to transfer the taxonomic expertise developed to various users that depend on the generated knowledge. Providing mobile access to taxonomic resources, through smart phones and tablets, can significantly enhance the reach of teaching and extension. Recent efforts at NCSC are focused on a number of new mobile resources, two of which are presented here: (1) a winter twig identification app and (2) a rare plant identification app. Mobile resources such as these can be used to supplement course materials and aid in learning while students are out of class. In addition, access to mobile resources can reinforce lecture material in field labs. For professionals, mobile apps provide lightweight, yet authoritative, alternatives to field manuals and thus have the potential for increasing proficiency and accuracy in field identification.

- P63 **Grace D. Whatley, Sarah M. Noble and Steven D. Carey**. Bryophytes of South Alabama and Mississippi limestone outcrops. University of Mobile, AL.

Bryophytes were inventoried from around cave entrances and along streams in the limestone outcrops associated with streams of south Alabama and Mississippi. As anticipated, a large proportion of liverwort taxa were found inhabiting the limestone outcrops. This work serves as the basis for further investigation of the bryophytes in this area.

- P64 **Ploy Kurdmongkoltham and Mijitaba Hamissou**. Molecular investigations of pokeweed, *Phytolacca americana*, extracts and their effects on prokaryotic and eukaryotic cells. Jacksonville State University, AL.

Pokeweed (*Phytolacca americana*) is a perennial herb native to the eastern United States. It belongs to the Phytolaccaceae, a small family found in Africa and the New World. The family includes several South American trees and some serpentine vines of the tropics. Pokeweed is known to contain several toxins. It is also known to contain proteinoeous toxins such as lectin. These toxins include the alkaloid phytolaccine, the resin phytolaccatoxin, and the saponin. Although most highly concentrated in the roots, all parts of pokeweed are toxic. Pokeweed may possess potential medicinal and economic values

to humanity. Can pokeweed extracts be used for biological fungicide or bactericide? These are questions that can only be answered with continued research on biologically active compounds found in the pokeweed plants. The objectives of this research are to investigate the antibacterial properties of pokeweed extracts by analyzing their inhibitory effects on bacterial growth, and to investigate the inhibitory effects of pokeweed extracts to the growth and development of Arabidopsis callus cells. Pokeweed plants were collected from different sites and separated into leaves and stems. Aqueous extracts were obtained from the different parts and analyzed for their inhibitory effects on bacterial and callus cells. Preliminary data indicated that the extracts of pokeweed are rich in proteins and alkaloids. Western blot and other molecular analyses confirmed the presence of lectin-like proteins and several organic compounds. Pokeweed extracts interfered with bacterial and callus cell growth.

P65 Samuel R. Wooten and Kellie N. Bingham. Mechanism of t-cell receptor mediated chromatin decondensation in peripheral t lymphocytes. Furman University, SC.

T-cell activation via stimulation of the T-cell receptor (TCR) is a necessary step in an immune response. In this process T-cells undergo a shift from a quiescent state in which their chromatin is tightly condensed to an active state in which their chromatin is decondensed. It has been shown that this decondensation of chromatin occurs because of TCR stimulation. In this study, we sought to determine the signaling mechanism(s) responsible for chromatin decondensation in response to TCR stimulation. We selectively activated the IP₃ and DAG signaling pathways with the use of ionomycin and phorbol 12-myristate 13-acetate (PMA), respectively. After treating cells for 1, 3, and 24 hours, histone accessibility was measured by flow-cytometry and histone solubility was measured via a Western blot. Together, these provide a surrogate measure of chromatin condensation. All treatments (PMA, ionomycin, and PMA + ionomycin) resulted in decondensation of chromatin, but with different kinetics. These findings suggest that TCR induced chromatin decondensation in T-cells can be achieved via multiple mechanisms. Future studies will focus on determining the specific contribution of each pathway to chromatin decondensation.

P66 David Bourgeois, Benjamin Hannah, Amanda D. Williams and Beth Conway. Prostate-specific membrane antigen activates integrin beta-1 in a laminin-dependent manner resulting in increased endothelial cell activation. Lipscomb University, TN.

Angiogenesis is necessary for tumor growth and disease progression in solid tumor cancers. Prostate-Specific Membrane Antigen (PSMA) is a transmembrane peptidase expressed on tumor-associated endothelial cells that positively regulates angiogenesis in a laminin-dependent manner. Previous research conducted in our lab has demonstrated that PSMA acts upon laminin peptides that have been digested upstream by matrix metalloproteases (MMPs) and activates endothelial cells. We hypothesize that these PSMA-derived laminin peptides activate integrin beta-1 resulting in increased endothelial cell adhesion and activation. Laminin was digested with recombinant MMP-2 and then digested further with recombinant PSMA to generate peptides to be used in our experiments. Laminin digested only by MMP-2 was used as a control. As previously observed, we found that laminin peptides digested by MMP-2 and PSMA increased HUVEC cell adhesion, a common indicator of endothelial cell activation. To determine if this activation was dependent on integrin beta-1, we inhibited integrin beta-1 using a neutralizing antibody. HUVEC cells exposed to our peptide with neutralized integrin beta-1 demonstrated a decrease in cell activation and adhesion. This result suggests that PSMA-generated laminin peptides activate endothelial cells in an integrin beta-1 dependent manner. Additionally, the laminin peptides generated by sequential digestion with MMP-2 and PSMA significantly increased microvessel density and hemoglobin content in Matrigel plugs implanted into C57/Bl6 mice compared to laminin

peptides generated by MMP-2 alone. Together, our findings suggest a novel mechanism for PSMA promoting angiogenesis by generating integrin β -1-activating laminin peptides.

P67 Laura M. Jackson. Investigating primordial germ cell (pgc) development using germ cell-specific genes in fish. Southeastern LA University, LA.

Primordial Germ Cell (PGC) determination is one of the most important feats of vertebrate embryonic development because it allows the continuation of life among future generations. In vertebrates, at least two different mechanisms exist that allow species to develop cells that later form the eggs and sperm. In the predetermined mechanism of PGC development, cells are specified by maternal determinants that are located within the germ plasm. In the induced mechanism, cells must be induced by external regulating factors that initiate germ cell development. Preliminary evidence suggests that different groups of fish may use different mechanisms of PGC development. The main objective of this project is to determine the mechanism of germ cell development in several fish species using conserved sequences of germ-cell genes, specifically *vasa* and *oct-4*. I will focus on the 3' untranslated region of *vasa* for localization signals, and eventually for localization of germ cells to the cytoplasm, which will allow the mechanism of germ cell development to be determined. Currently, *oct-4* has been identified only in the induced mechanism of PGC development. Therefore, using phylogenetic analysis for those species that show the expression of *oct-4* can determine a common gene mechanism for germ cell development in the presence of *oct-4*. The data will be used to test whether there is a correlation between body patterns, specifically fin position, and mechanism of germ cell determination.

P68 Sharon C. Davis¹, Pradyot Dash² and Paul G. Thomas². Effects of a mutation in the condensin II complex on tcr repertoire diversity. ¹Furman University, SC, ²St. Jude Children's Research Hospital, TN.

Proper thymocyte selection is essential for T cell development as it eliminates self-reactive T cells and those that do not recognize self-peptide MHC complexes. This selection is based upon signaling via the T cell receptor (TCR) during T cell maturation in the thymus. The result of which is a repertoire of TCRs that can distinguish self from non-self. The *Nessy* mouse has a mutation in the kleisin- β subunit of the condensin II complex, which has been shown to regulate chromatin condensation during thymocyte selection. We hypothesized that a chromatin condensation could affect the outcome of the selection process. Therefore, we elicited activated CD8+ T cell populations by influenza A infection and sequenced the antigen-specific TCR α and TCR β chains to determine if improper chromatin condensation had an effect on the overall diversity of the TCR repertoire. Our results indicated that the kleisin- β mutation did not have a dramatic effect on TCR repertoire diversity, and high or low-affinity receptors do not seem to be preferentially selected in *nessy* mice. Further studies with *nessy* mice could provide insight into the role of chromatin condensation on mechanisms of T-cell function in the periphery such as release of cytokines and mechanisms underlying autoimmune diseases arising in the periphery.

P69 Alexis Valauri-Orton and Karen Bernd. Water purification byproduct dichloroacetic acid induces stress in lung cells. Davidson College, NC.

Dichloroacetic acid (DCA) is both an environmental toxin and a molecule with promising medicinal applications. It has been found to be toxic and carcinogenic to brain and liver cells, but also has been used as a trial treatment for lactic acidosis for more than 20 years, and has promise as a potential treatment for cancer. DCA's effects vary based on cell type. Furthermore, it inhibits its own metabolism, and certain genetic dispositions inhibit its metabolism further. Thus, some patients might be more sensitive to its toxicological effects. This study is investigating its effects on lung cells through analysis of oxidative stress defense pathways. Cells were exposed for 0, 6, 16 and 24 hours to DCA in

concentrations of 0mM, 8 mM 16 mM and 24 mM. An MTT assay and cell count using trypan blue staining determined cell viability, levels of both reduced and oxidized glutathione were determined, and superoxide dismutase (SOD) and catalase activity were assayed for. Results indicate that DCA induces an increase in SOD and catalase activity, a decrease in cell viability, and no significant impacts on glutathione levels or ratios.

P70 Samantha A. Maser and Jennifer R. Ward. Genetic variation within and among populations of the invasive liana *Celastrus orbiculatus* (oriental bittersweet). UNC Asheville, NC.

Celastrus orbiculatus (oriental bittersweet) is an exotic liana from Asia that threatens native plant populations throughout the eastern United States and Canada. Asheville, NC has been proposed as the introduction nexus for this invasive species. This vine exhibits high plasticity in its morphological and physiological traits, which increases its ability to outperform native plant species. Preliminary research in North Carolina has shown that there is greater genetic diversity within than among geographically proximate populations of this liana. We hypothesized that genetic diversity would be highest near Asheville and would decrease farther away. Using Asheville, NC as the point of initial introduction, ten concentric circles were drawn 10 kilometers apart. Within each circle, ten sites were chosen randomly, and at each site, three adult plants and three juvenile plants were sampled from spots >10 m apart. DNA was extracted from each sample, and PCR is being performed using 5 microsatellite primer sets. Results to date have shown genetic differences between adults and seedlings, and both within and among sites. Since diversity is often positively correlated with plant performance, results from this experiment could reveal which populations have the highest genetic diversity and could be more important to control.

P71 Jennifer M. Preslar and Eli V. Hestermann. Effects of environmental toxicants and hormones on progesterone receptor expression in endometrial cells. Furman University, SC.

Many hormones and environmental toxicants, such as 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD), are associated with the development of endometriosis. Other results have shown that ligands of the aryl hydrocarbon receptor (AHR) can affect responses to estrogen and progesterone in these endometrial cells. Although the exact role of AHR in endometriosis is not fully understood, one way it could function is by interfering with the expression of progesterone signaling; progesterone insensitivity is believed to be a contributing factor in endometriosis. To test this hypothesis, we treated an endometrial adenocarcinoma cell line (Ishikawa) and a stromal endometrial cell line (N066), then measured expression of progesterone receptors. Cells treated with TCDD experienced down-regulation of overall PR levels; however, when treated with AHR antagonist CH-223191 (CH), or with TCDD + CH, a reversal of this trend was observed. A chromatin immunoprecipitation assay showed that while AHR bound DNA near known targets, there was no indication of binding near the PR gene. This suggests that regulation may be indirect, a hypothesis which we will explore further.

P72 Annie M. Kalinoski and Eli V. Hestermann. DNA binding by aryl hydrocarbon receptor and its repressor. Furman University, SC.

The aryl hydrocarbon receptor (AhR) is a soluble receptor that directly alters gene expression and mediates the toxic effects of compounds such as 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). The aryl hydrocarbon receptor repressor (AhRR) inhibits responses to ligand-activated AhR. However, the mechanism of AhRR action is unknown. We hypothesized that the AhRR and activated AhR compete for the same DNA binding sites. Chromatin immunoprecipitation showed that following TCDD treatment interaction of AhRR with DNA response elements rapidly declined to background levels, while AHR binding to the same elements rapidly increased. However, when RNAi was used to knock down AHR expression, AhRR binding to DNA did not increase. TCDD-

treated cells that did contain AhR actually showed less AhRR than cells without AhR. These results do not support our hypothesis, and future studies will focus on alternative mechanisms such as competition for transcriptional coactivators.

- P73 **Michael A. Anderson, Joshua R. Campbell, Alison N. Carey, Derec R. Dodge, Ryan A. Johnston, Emily R. Mattison, Ryan J. Seddon, Nathan L. Singer and Brian T. Miller.** Population survey of the streamside salamander, *Ambystoma barbouri*, in the inner and outer Nashville basins of Middle Tennessee. Middle Tennessee State University, TN.

The streamside salamander, *Ambystoma barbouri*, inhabits upland deciduous forests associated with ephemeral first- and second-order streams throughout Middle Tennessee. The geographic range of *A. barbouri* extends as far north as Indiana, and the isolated Middle Tennessee populations demarcate the southern range of the species. Historically, within the Outer Nashville Basin (ONB) breeding populations have been found in Davidson County, and juveniles have been found in Jackson County. However, the current status of these populations remains unknown, with the former presumed extirpated as a result of urbanization of metropolitan Nashville. We surveyed streams in the northern Inner Nashville Basin (INB) and the western and eastern ONB to find new breeding localities of *A. barbouri* and to connect currently known populations to historic sites. Eggs and larvae were found in a first-order stream in Wilson County. Additionally, eggs were found in a first-order stream in Trousdale County, signifying a new county record for the species.

- P74 **Charles D. Battaglia and John L. Carr.** Survey study of the herpetofauna of upper Ouachita National Wildlife Refuge in northeastern Louisiana. University of Louisiana at Monroe, LA.

Upper Ouachita National Wildlife Refuge (UONWR) is a federally owned and managed public property located in Union and Morehouse parishes in northeastern Louisiana. The major natural vegetation type is bottomland hardwood forest. The refuge is divided by the Ouachita River into two sections: the west side, a relatively undisturbed habitat, and the Mollicy Unit, a tract of land that is the site of a major reforestation and hydrological restoration project after agricultural abandonment. Reptiles and amphibians are an important part of bottomland hardwood forest food webs and are significantly impacted by hydrology making them good bio-indicators. Recent reptile and amphibian declines have been documented, and a suspected cause is the loss of habitat due to agriculture and waterway alteration. We conducted a terrestrial herpetofaunal survey at 12 sites in UONWR, 6 sites on the west side and 6 sites on the Mollicy Unit, comparing communities between the two sides. The surveys were conducted through the use of Y-shaped drift fence arrays, each with 6 funnel traps and 4 pitfall traps, time-constrained visual encounter surveys, coverboards, and PVC pipes. For all techniques combined, total species richness for the west side and the Mollicy Unit are 23 and 14, respectively. Total species richness was not significantly different between the two sides ($P = 0.0835$). Catch per unit effort was also not significantly different between the two sides ($P = 0.8932$).

- P75 **Elizabeth B. Underwood¹, Sarah C. Bowers¹, Carole Wilkes², Jeffrey E. Lovich³, J. W. Gibbons², Jackie C. Guzy¹ and Michael E. Dorcas¹.** Sexual dimorphism and feeding ecology of diamondback terrapins (*Malaclemys terrapin*). ¹Davidson College, NC, ²Savannah River Ecology Lab, SC, ³Southwest Biological Science Center.

Sexual dimorphism in animals is most commonly attributed to sexual selection. However, ecological factors such as habitat and feeding ecology can play a role in sexual dimorphism. In many species of turtles, including the diamondback terrapin (*Malaclemys terrapin*), sexual dimorphism occurs in the relative head size and shape, enabling the sexes to exploit different resources, presumably reducing intraspecific competition. Adult females are larger than adult males and have disproportionately larger skulls and jaws.

Because of these differences in skull morphology, female terrapins have a greater bite force than males, enabling them to feed on a larger, wider variety of hard-shelled prey. To better understand the connection between skull morphology and terrapin feeding ecology, we measured the in-lever to out-lever ratios of 13 terrapin skulls. Higher in-lever to out-lever ratios indicate stronger bite force. Additionally, we fed fiddler crabs (*Uca pugnax*) to 24 terrapins in captivity and measured handling times relative to body and skull size. Preliminary results indicate that females have superior bite force and considerably reduced handling times, yet smaller in-lever to out-lever ratios, suggesting that adductor muscle mass is more important in determining bite force than the in-lever to out-lever ratio. Understanding factors affecting terrapin feeding ecology is important because terrapins play an important top-down predator role in regulating the grazing habits of snails on marsh grass.

P76 Chance D. Ruder, Christiana D. Akins, Leigh Anne Harden, Steve J. Price and Michael E. Dorcas. Effects of environmental temperature variation on body temperatures and habitat use in free-ranging diamondback terrapins (*Malaclemys terrapin*). ¹Davidson College, NC, ²University of North Carolina at Wilmington, NC.

Environmental temperatures (T_e) strongly influence the body temperatures (T_b) of ectotherms. During behavioral thermoregulation, ectotherms typically select microhabitats with a T_e closest to the preferred T_b . Diamondback terrapins (*Malaclemys terrapin*) are emydid turtles inhabiting dynamic salt marsh environments, where T_e 's change both seasonally and daily in response to tides and other environmental variables. In this study, we use carapace-mounted microdataloggers to gather hourly T_b 's from free-ranging terrapins at Kiawah Island, South Carolina over the course of twelve months (Oct. 2007-08) to determine the effects of season, tide-level, and T_e on terrapin T_b . By simultaneously measuring T_e , (i.e., mud and water temperatures) we make inferences regarding seasonal variation of T_e and microhabitat use. During the winter months, terrapin T_b was nearly identical to T_e of shallow mud and was generally a few degrees cooler than the water. This trend reversed in early spring as terrapin T_b was more closely correlated with water T_e . At no time during the study did terrapin T_b strongly correlate with T_e deep mud. Basking events, shown as short periods of elevated terrapin T_b , occurred more frequently in the warmer months, beginning in later spring and continuing until early fall. Collectively, our results display significant correspondence between seasonal habitat use and terrapin T_b . Our research documents seasonal variation in terrapin microhabitat use and contributes to a fuller understanding of terrapin thermal biology. It also further supports the use of microdataloggers as a means of recording temperature variation in small, free-ranging ectotherms.

P77 Christian R. Oldham, Steven J. Price and Michael E. Dorcas. A preliminary investigation into the ecology of juvenile painted turtles (*Chrysemys picta*) in a golf course pond. Davidson College, NC.

Many aquatic habitats used by semi-aquatic turtles are threatened by urbanization. With effective management, golf course ponds have the potential to foster stable turtle populations. Adequate juvenile recruitment is necessary for population stability; however, juvenile turtles are difficult to study due to their secretive nature. Using traps and dipnetting following a robust sampling design, we conducted a mark-recapture study of juvenile painted turtles (*Chrysemys picta*) in a golf course pond from late May to mid-October of 2011. Our objectives were to estimate growth rates, determine habitat use, and estimate survivorship of juveniles. Our results indicated rapid growth rates of juveniles (mean = 0.19 mm/day, n = 7). We found that juvenile painted turtles preferentially use habitat with water deeper than 10cm. Using Program MARK to model survivorship, the model with the most support assumed season-dependent capture probability with no trap response, no temporary emigration, and constant survival. Weekly survivorship was estimated to be 82.22% \pm 13.60%, indicating low survivorship during the study period

(approximately 11.61% over the 24 weeks). Further research into the causes of mortality may provide insight into the suitability of golf courses as habitat for juvenile turtles in increasingly urbanized areas. Such research may also have implications for long-term population stability of turtle populations in these regions.

- P78 **Madeleine M. Kern¹, Jeffrey E. Lovich², Jackie C. Guzy¹, J. W. Gibbons³ and Michael E. Dorcas¹.** Potential morphological constraint on optimal egg size in the diamondback terrapin (*Malaclemys terrapin*). ¹Davidson College, NC, ²Southwest Biological Science Center, ³Savannah River Ecology Laboratory, SC.

In all organisms, available resources must be partitioned between growth, maintenance, storage, and reproduction. When investing in reproductive efforts, an organism faces further tradeoffs between what number and size of offspring will optimize fitness using the finite amount of energy available. Optimal egg size theory predicts that a relatively constant optimal egg size should be selected, while any increase in resources allocated to reproduction should result in increased clutch size. Some species may experience the additional complication of morphological constraints on egg size which could result in deviation from the predictions of traditional optimal egg size theory. We examined the relationships among body size variables (X-ray pelvic aperture width and plastron length), X-ray egg width, and clutch size of female diamondback terrapins (*Malaclemys terrapin*) from Kiawah Island, South Carolina. We examined how these parameters vary testing for isometry and allometry of clutch characteristics relative to carapace length. Our results provide new information regarding the reproduction of this species and important new data that help to evaluate the tradeoffs associated with optimal egg size theory.

- P79 **Jason H. Tant, Larry L. Cross and David A. Beamer.** A phylogeographic profile of the three-lined salamander, *Eurycea guttolineata*. Nash Community College, NC.

The three-lined salamander, *Eurycea guttolineata* is a wide-ranging lungless salamander in the southeastern United States. Considerable data has been collected on the phylogeographic structure of southeastern salamander species but to date there has not been any such data collected for this species. We have sampled over 50 populations spanning the entire distribution of the three-lined salamander. In order to reconstruct the evolutionary history of these salamanders we have amplified, purified, and sequenced 900 base pairs of the mitochondrial gene *Cty-b*. We have produced a phylogenetic reconstruction using Bayesian Inference, with separate partitions for each codon position. Our results offer a stark contrast to similar surveys with other salamander species, instead of the pattern of strong geographic partitioning uncovered for nearly every other salamander species; three-lined salamanders are characterized by extreme genetic homogeneity.

- P80 **LaShonda M. Caine, Elizabeth A. Lewis and David A. Beamer.** A phylogeographic profile of the salamander genus, *Pseudotriton*. Nash Community College, NC.

The phylogeographic evolution of the salamander genus *Pseudotriton* remains largely unexplored and undocumented. Several races of these Eastern plethodontid salamanders have been recognized, yet red salamanders (*P. ruber*) and mud salamanders (*P. montanus*) remain the only identified species of the genus. In order to reconstruct the evolutionary history and evaluate whether any of the formerly recognized races warrant species status, we have sampled fifty populations spanning the extent of this genera's distribution. For each population sampled, we extracted DNA, amplified and sequenced a 1500 base pair fragment of the mtDNA genome. Here we present the results of a Bayesian phylogenetic reconstruction for this genus.

- P81 **Gerardo Tinajero, Jr.¹, Bobbie J. Legg¹, Thomas Bridgers² and David A. Beamer¹.** The phylogenetic relationships of two-lined salamander populations along the North Carolina and Virginia borders. ¹Nash Community College, NC, ²East Carolina University, NC.

The southern two-lined salamander, *Eurycea cirrigera*, is a wide-ranging lungless salamander in the southeastern United States. The Northern Two-lined Salamander, *Eurycea bislineata*, occupies the northern United States from Fredericksburg, Virginia and then northward to eastern Canada. Recently we discovered a population of morphologically distinct two-lined salamanders in southeast Virginia. All populations in this area are currently assigned to *E. cirrigera*, but our phylogenetic reconstruction places these samples with *E. bislineata*. Additional samples from populations along the North Carolina and Virginia borders appear to consist of three distinct genetic lineages. In order to ascertain the phylogenetic position of these populations, we have amplified, purified, and sequenced 1500 base pairs of the mitochondrial gene ND2. To place our populations in a broader phylogenetic context we used exemplars from each of mtDNA lineages identified in the most recent phylogenetic treatment of two-lined salamanders and performed a phylogenetic reconstruction using Bayesian Inference, with separate partitions for each codon position. Here, we present the results of our phylogenetic reconstruction.

- P82 **Bobbie J. Legg¹, LaShonda M. Caine¹, Sean P. Graham² and David A. Beamer¹.** The phylogeography of the seepage salamander (*Desmognathus aeneus*). ¹Nash Community College, NC, ²Penn State University, PA.

The seepage salamander, *Desmognathus aeneus*, was described in 1947, based on specimens collected in Peachtree, North Carolina. Since that time little information concerning its distribution or status has been published. During the course of a range wide survey of seepage salamander, we have visited nearly every historical site from which this species has been reported; in addition we discovered many previously unknown populations. The range extent of seepage salamanders is considerable and occupies many distinct physiographic regions and several independent river drainage basins. Within this range, seepage salamander populations tend to be localized and most are apparently disjunct. The disjunct nature of these populations coupled with a complex geological and ecological history of the region occupied by these salamanders provides conditions which are conducive to lineage diversification. Here we report the first phylogeographic survey of these minute salamanders. A Bayesian phylogenetic reconstruction of both mitochondrial and nuclear DNA reveals the presence of several well supported, distinct evolutionary lineages. The presence of multiple lineages within seepage salamanders has important conservation implications since this species is often considered to be rare. The results of this survey provide a strong case for the importance of molecular systematic techniques in revealing the biodiversity of the southeastern United States.

- P83 **Cassandra Henry, Vicky Kremer, Vince Cobb, Matt Klukowski and Frank Bailey.** The effect of blood parasite load on WBC counts in cottonmouths (*Agkistrodon piscivorus*). Middle Tennessee State University, TN.

Hemogregarines are blood parasites that infect erythrocytes. They have been shown to cause liver damage in mammals and monocytosis in lizards and potentially may affect numbers of other leukocytes and cause stress to the animals. Leukocyte differentials have been used to measure stress in several types of vertebrates including reptiles. We hypothesized that numbers of different types of leukocytes would be correlated with parasite load. Cottonmouths were collected at Caddo Lake, TX in May 2011, blood samples were taken by tail clip and smears were made in the field on glass slides. Slides were fixed in ethanol and stained with Giemsa before examination by light microscope. Pictures were taken of each field of view to enable ease of counting and to keep a record of fields that were counted. Sufficient fields of view were photographed such that at least 150 leukocytes were counted and identified for each snake. RBCs and parasites were also counted in all fields. Correlations were run to examine relationships between different

WBCs and parasite load as well as between different types of leukocytes. A relationship was found between heterophils and the parasites ($r = 0.5025$; $p = 0.056$). A positive relationship was found between heterophils and lymphocytes ($r = 0.5724$; $p = 0.026$), heterophils and thrombocytes ($r = 0.6123$; $p = 0.015$), and lymphocytes and thrombocytes ($r = 0.6484$; $p = 0.009$).

- P84 **Victoria K. Kremer, Cassandra L. Henry, Matthew Klukowski, Vincent A. Cobb and Frank C. Bailey.** The effects of maternally transferred methylmercury on leukocyte differentials in northern water snake (*Nerodia sipedon*) neonates. Middle Tennessee State University, TN.

The ability to mount a response to stress is essential to the survival of any organism. Although the effects of mercury on stress in vertebrates have been well documented, little research in this area has been done on reptiles. Mercury is a common contaminant in aquatic systems, and tends to accumulate in predators at the top of the food chain, like the Northern Water Snake (*Nerodia sipedon*.) It is known that stress influences leukocyte ratios in vertebrates, and fluctuations in these ratios can be used to assess stress levels. This study examines the effects of maternally transferred methylmercury on stress in *N. sipedon* neonates using leukocyte ratios, and additionally provides baseline leukocyte parameters for *N. sipedon* neonates, which have not been previously reported. 18 gravid females were collected at Lake Erie and dosed in the laboratory at Middle Tennessee State University with one of three concentrations of methylmercury (0, .01, and 10 μ g/g body mass.) After birth, peripheral blood samples were taken from 10 neonates from each litter and smears were prepared using a Giemsa stain. The smears were analyzed using a light microscope, and leukocyte differentials were recorded for each neonate. Preliminary results suggest no significant difference in leukocyte parameters between mercury doses; however, an inverse relationship was discovered between basophil and lymphocyte ($r = -.7869$, $p = 0.002$) as well as heterophil and lymphocyte ($r = -0.5847$, $p = 0.046$) numbers in neonates.

- P85 **Paul P. Thomas¹ and Eran S. Kilpatrick².** Evaluation of anuran species detection and site occupancy in the South Carolina coastal plain using the North American amphibian monitoring program. ¹University of South Carolina Aiken, SC, ²University of South Carolina Salkehatchie, SC.

The North American Amphibian Monitoring Program (NAAMP) was established by USGS to monitor breeding anuran populations. NAAMP was implemented in South Carolina in 2008, and is a collaborative program drawing participation from a variety of public and private entities. This study investigated species detection and site occupancy along two NAAMP routes near Allendale and Grays, South Carolina. Both routes occur in the Coastal Plain, a region containing a diversity of wetlands providing breeding habitats for 26 anuran species. Calling anurans were sampled at 10 stops along each route from January 15 – February 28 (Window 1), March 15 – April 30 (Window 3), and May 15 – June 30 (Window 3). From 2008 – 2011, a total of 31 surveys were conducted along both routes, representing 310 five minute samples that detected 20 species. Eighteen species were detected on the Allendale route and 17 species were detected on the Grays route. Spring peepers (*Pseudacris crucifer*), southern cricket frogs (*Acris gryllus*), southern toads (*Anaxyrus terrestris*), and Green treefrogs (*Hyla cinerea*) were detected most often. The oak toad (*Anaxyrus quercicus*) and pig frog (*Lithobates gryllio*) were unique to the Allendale route while upland chorus frog (*Pseudacris feriarum*) and eastern spadefoot toad (*Scaphiopus holbrookii*) detections occurred only on the Grays route. The most diverse stops were proximal to open pond cypress ponds with dense herbaceous cover. Tupelo swamp forest and gum ponds were the least diverse habitats surveyed. NAAMP continues as a comprehensive statewide monitoring effort, providing an extensive database available to the public.

- P86 **CANCELLED**

- P87 **Jonathan A. Akin.** Abiotic and biotic effects on hatching rates and larval recruitment in spotted salamanders. Northwestern State University of Louisiana, LA.

In several adjacent Louisiana vernal pools with variable hydrological conditions, hatching rates of *Ambystoma maculatum* salamanders were compared with respect to water quality factors and biotic influences. Individual egg masses were isolated in floating aquaria at the ponds so that the time to hatching and hatching success rate could be quantified. In addition, relative rates of development to key Harrison stages were compared, especially with respect to determining the stage when the algal symbiont, *Oophila amblystomatis*, was first observable. Larvae were monitored through metamorphosis and body size at metamorphosis compared with respect to the hydrological period and other abiotic factors.

- P88 **James W. Stewart.** Testing subspecies delimitation of Dekay's brown snake, *Storeria dekayi*, using ecological niche modeling. Southeastern Louisiana University, LA.

Dekay's Brown snake, *Storeria dekayi*, has a widespread geographic distribution, ranging from Quebec south to eastern Mexico and an isolated population in Honduras and Guatemala. Currently, seven subspecies are recognized, varying in color patterns and morphological characteristics. These characteristics make them difficult to identify, especially in areas where these groups overlap. Subspecies designation is problematic empirically and philosophically. Using a combination of Geographic Information Systems (GIS) and Ecological Niche Modeling (ENM) the subspecies of *S. dekayi* were tested. Geographic Information Systems have led to more useful data in ecology and biogeography studies. Ecological Niche Modeling takes spatial data of a species with the known habitat and environmental requirements to form models that allow for analysis of actual or predicted range distributions. ENM previously has been used as an effective technique to learn more about an organism's habitat and to assist in species delimitation. By combining known presence data and ecological parameters, ENM will be created to test the reality of the subspecies of *Storeria dekayi*.

- P89 **Raymond C. Wright, J. Patrick, W. Cusaac, Cassandra Henry and Frank C. Bailey.** The effects of maternally transferred methylmercury on neonate performance in northern water snakes, *Nerodia sipedon*. Middle Tennessee State University, TN.

In ecotoxicology, reptiles have historically been underrepresented, with most studies focusing on the concentration of a contaminant found in an organism at a site. Fewer studies have been conducted to examine the fate or physiological/biochemical effects of contaminants on these animals. This study was designed to look at the effects of maternally-transferred MeHgCl on locomotor performance in Northern Water Snake (*Nerodia sipedon*) neonates. In the study, adult female *N. sipedon* were randomly assigned to one of three treatments: 0, 10, or 10,000 ug/Kg. Fourteen females gave birth and after a two week acclimation period the neonates were tested for average and maximum terrestrial locomotor speed in a laboratory race track. Mercury analyses of neonate livers indicated that neonates from the high dose treatment had the highest concentration of Hg. No statistical difference was found in speed of locomotion between treatments (ANOVA, $F_{2,11} = 0.021$, $p = 0.980$).

- P90 **CANCELLED**

- P91 **Ivan T. Moberly and Paul V. Cupp, Jr.** The influence of tail autonomy on the avoidance of chemical alarm cues in northern zigzag salamanders, *Plethodon dorsalis*. Eastern Kentucky University, KY.

Predator avoidance by means of chemical alarm cues was studied in northern zigzag salamanders, *Plethodon dorsalis*, from Madison County, Kentucky in the spring of 2011. Adult salamanders were placed into Petri dishes with a choice between treated substrate

(filter paper treated with chemical cues) or untreated substrate (filter paper treated with distilled water). After a period of habituation, the salamander locations within the dishes were recorded every 3 minutes for 60 minutes. The dishes were then rotated 180° and tested for another 60 minutes. To test for the effects of tail autotomy and time on predator avoidance, the responses of tail autotomized salamanders to chemical cues were compared to responses of tail intact salamanders on days ranging from 1 to 12 following tail autotomy. Tail intact and tail autotomized *P. dorsalis* avoided the chemical cues of injured conspecifics and those of eastern garter snakes, *Thamnophis sirtalis*. Tail autotomy combined with the time since tail autotomy did not influence predator avoidance in *P. dorsalis* to chemical alarm cues of injured conspecifics or those of *T. sirtalis*. Also, *P. dorsalis* did not avoid chemical cues of tail intact or tail autotomized ravine salamanders, *P. richmondi* (a related sympatric species). Thus, *P. dorsalis* may reduce the possibility of predation by avoiding microhabitats containing chemical alarm cues of injured conspecifics or those of predators.

P92 **J. T. Pynne and R. M. Fincher.** Performance of 18 native tree species in forest restoration in abandoned cattle pastures in Costa Rica. Samford University, AL.

As a result of government policy and environmental service payments for protecting existing forest and reforesting agricultural land, Costa Rica has reversed its historical trend of deforestation to achieve a net afforestation of 2% per year. As more native species are being utilized, foresters are faced with a fundamental lack of information on performance in the full sun environment of abandoned agricultural areas. We evaluated the suitability of 18 old-growth native tree species for reforestation projects in Costa Rica, 13 of which have not previously been examined. We evaluated responses to light environment and quantified how leaf traits, survival and relative growth rates vary between sun and shade and across species. Our results indicate that, as predicted, shade grown individuals had lower growth (RGR), photosynthetic capacity (A_{max}), respiration (R_d), and light compensation point (LCP) and higher chlorophyll A and B than pasture seedlings. Higher shade LMA and lower sun A_{max} were associated with decreased mortality. However, species-specific performance was extremely varied across a shade tolerance spectrum, with shade tolerant species such as *Brosimum lactescens*, *Minquartia guianensis* and *Schlerobium costaricense* showing low RGR, survival and physiological performance in both light treatments, but with slightly improved performance in shade. Light tolerant species such as *Ceiba pentandra*, *Hyeronima alchorneoides*, and *Inga oerstediana* showed high RGR and survival in the pasture. We found no evidence for a classic trade-off between growth and survival (Wright *Et al.* 2010), but we did find evidence suggesting that there may be trade-offs between physiological performance and mortality.

P93 **Megan M. Seddon.** The trend in mean total cholesterol in Gordon County, Georgia over a twenty-five year period. Shorter University, GA.

Coronary heart disease (CHD) is one of the leading causes of death in the United States for both men and women. High total cholesterol (TC) levels have been identified as a risk factor and are correlated with higher incidence of CHD. A study was conducted to determine the trend in mean total cholesterol for Gordon County, Georgia since 1987. Historical data from a 1987 Gordon County health fair included the TC values, age, and gender of 560 participants. To collect the new data, a free total cholesterol screening was organized for Gordon County residents in December of 2011. The TC values of 201 study participants were collected. ANOVA analysis suggests that the newly collected TC values are significantly lower than in 1987 (p -value < 0.0001). This trend was seen in both males and females.

P94 **Elise M. Wygant and Lisa A. Donovan.** Investigation of wild *Helianthus* for drought resistance traits. University of Georgia, GA.

In order to understand how crop plants will respond to climate change, specifically decreases in soil moisture availability, there have been huge efforts to mine wild *Helianthus* species for traits to improve sunflower cultivation. Wilting and changes in stomatal conductance during soil dry down are two traits of interest for drought resistance. Here we ask, do three closely related wild species of *Helianthus* differ in response to soil moisture dry down? Species were grown either in pots with all three species together or each species alone. Water was then withheld and plants were assessed for stomatal conductance and wilting as soil moisture declined. For all species, there was only a 2% range in soil moisture at initial wilting. Stomatal conductance declined each day until wilting and the pattern was similar for all three species. However, preliminary results indicate that the species may differ in ability to recover from prolonged wilting. Overall these preliminary results suggest that while these species may not differ in their response to soil moisture decline, the potential for one of these species to persist in a wilted state and recover when re-watered is worth further investigation.

P95 **Z. C. Berry and William K. Smith.** Examining the effects of cloud immersion on plant physiology and functional traits of *Abies fraseri* and *Picea rubens* seedlings in the southern Appalachian Mountains, USA Wake Forest University, NC.

The high elevation spruce-fir communities of the southern Appalachian Mountains, USA are considered endangered, endemic, and characterized as relic boreal forests that may be persisting due to frequent cloud immersion. Previous studies have proposed a relationship between cloud immersion and the altitudinal distribution pattern of these two conifer tree species, *Picea rubens* (Red Spruce) and *Abies fraseri* (Fraser Fir), but few have examined the effect of cloud immersion on incident sunlight and the resulting effects on ecophysiology such as plant water relations. Incident sunlight (PPFD) and daily xylem water potentials were measured regularly through the summer growing season at Mount Mitchell State Park (35°46'13"N 82°15'48"W). Each day of the growing season was then classified based on its immersion level. In comparison to clear days, completely immersed days drastically reduced cumulative PPFD (11.09 mol/m² and 38.03 mol/m²). Maximum daily temperatures decreased by 2.1°C and minimum daily temperatures increased by 2.5°C on immersed days. For daily and seasonal water availability, there was a greater decrease in afternoon water status (up to 0.5 MPa) on clear days versus immersed days in both juvenile and adults of each species. Juveniles experienced lower water potentials than adults of both species throughout the summer season. With climate change scenarios predicting a higher cloud base (resulting in less immersion) and dryer conditions, examining the effects of immersion on the ecophysiology of *Picea rubens* and *Abies fraseri* is important for evaluating the future survival of these relic forests.

P96 **Sarah E. McGaughey, Chase M. Mason and Lisa A. Donovan.** The effects of ontogeny on leaf ecophysiological traits across the genus *Helianthus*. University of Georgia, GA.

Most plants produce numerous successive cohorts of leaves throughout their lifespan. These leaves likely serve very different ecological roles for a plant, as evidenced by relative differences in both the ultimate fate of the carbon captured by leaves produced at a given life stage and in the risk of the loss of those leaves to plant survival and reproduction. This study seeks to investigate whether cohorts of leaves produced at different ontogenetic stages serve potentially different ecological roles by assessing changes in leaf ecophysiological traits through time, focusing on the traits of the worldwide leaf economics spectrum. Specifically, photosynthetic rate, leaf nitrogen, leaf mass per area, leaf lifespan, leaf water content, and a suite of allied traits were evaluated. Three species were selected from across the genus *Helianthus* (*H. annuus*, *H. mollis*, and *H. radula*) to capture a diversity of growth forms and life histories, and several geographically disparate populations of these species were included to attempt to capture a wide range of intraspecific variation. Measurements were taken at five ontogenetic stages where possible (seedling, juvenile, pre-reproductive, flowering, and fruiting), and analyzed using

a repeated-measures approach. Many of the traits examined were found to vary considerably with ontogeny, suggesting that leaves produced at different stages in the life cycle function differently, and supporting the hypothesis of differing ecological roles for successive leaf cohorts.

- P97 **Benjamin A. Rausch, Benjamin P. Hagen, Chloe E. Hart, Derek L. Metz, Stephanie K. Hurst and Richard S. Phillips.** The effect of incubation temperature on fluctuating asymmetry in Mexican kingsnakes. Wittenberg University, OH.

Fluctuating asymmetry has received increased interest from ecologists as several studies suggest that it may be indicative of environmental or genetic stress, particularly in human altered environments. Although reptiles express acute physiological and developmental responses to varying temperatures, the effect of temperature on fluctuating asymmetry in the group remains largely unexplored. Moreover, few laboratory studies have examined fluctuating asymmetry associated with naturally encountered temperatures in ectotherms. Using a montane species of kingsnake, *Lampropeltis mexicana*, we subjected developing eggs to two incubation temperatures and compared fluctuating asymmetry estimates between treatments. To mimic temperatures documented in Mexican kingsnake habitat, we incubated eggs at 23.3°C (n = 17) and 28.9°C (n = 20) until hatchlings emerged. Using Adobe Photoshop®, we compared hatchlings' bilateral areas (cm²) of head scales and color patterns as an estimate of fluctuating asymmetry. To assess the random nature of the fluctuations, we tested the sidedness of individual scale measurements across each snake and found no evidence of directionality in the majority of snakes (92%, n=34). For both color and scale, we converted bilateral differences to absolute values and combined all phenotypic characteristics within each snake. While neither scale (t = 1.17, p = 0.25) nor color (t = 1.89, p = 0.07) area differences were detected between the two treatments, the impact of temperature on asymmetry may be biased low as our results only measured those animals that survived to hatch. We suggest future studies examine fluctuating asymmetry in embryos to mitigate potential bias associated with hatching success.

- P98 **Claire Campbell¹ and Jeff Warren².** Sap flux density in peatland species: a study of vulnerability to climatic exposure. ¹Furman University, SC, ²Oak Ridge National Laboratory, TN.

Increased soil drying from climatic warming could stress sapwood conductance for dominant peatland species such as *Picea* (black spruce). The vulnerability to plant xylem's progressive loss of conductivity was determined by simulating drought conditions. Vulnerability was measured by assessing water availability and flow conditions using a pressure chamber on small roots and a water potential gradient on large trunk samples. The thermal dissipation probe (TDP) technique was tested to determine the accuracy of Granier's intrinsic sap flow equation applied to *Picea*. TDPs used heat dissipation through saturated *Picea* boles to measure sap flux while simultaneously measuring gravimetric sap flux density. The Granier equation is scrutinized for discrepancies in its application to some species, with up to 60% error. *Picea* roots had high flow rates, with 50% conductance lost at 3.46 MPa and 2.56 MPa respectively, ample for the <2.2 MPa projected exposure. Difficulties encountered in testing TDPs included estimations of the conducting sapwood area and identifying base voltage for each probe. In stems with adequate sapwood depth, the Granier equation was similar to gravimetric measurements (R²=0.65) for *Picea*. There may be differences in the flux rates of sapwood depending on the radial variability within each sample. Generally, if the probe length was greater than sapwood area radius, false readings occurred from probe insertion into non-hydroactive heartwood. In trees with a ≥5.2 cm diameter, 1 cm TDPs can give accurate readings. This suggests that peatland species xylem water conductivity is ample for surviving projected climatic exposure.

- P99 **Florence C. Anoruo¹ and David Lincoln²**. Nitrogen availability and the rate of nitrogen fixation by *Frankia*. ¹Clafin University, SC, ²University of South Carolina, SC.

Frankia species are nitrogen fixing filamentous bacteria belonging to the group referred to as actinomycetes. The actinomycetes form symbiotic relationships with actinorhizal plants including Bayberry, Alder, Sweet fern, and Casuarina. In this study, the seedlings of *Morella cerifera* (*Myricaceae*) was inoculated with *Frankia* to determine the rate of nitrogen fixation. Germinated seedlings of *Morella cerifera* were planted into one gallon pots in sand medium. Two groups of 12 plants each were inoculated with *Frankia* spores and fertilized with two levels of nitrogen (1/4 strength and full strength Hoagland). Two additional groups of 12 plants each were un-inoculated but received two levels of nitrogen fertilization ((1/4 strength and full strength Hoagland). The uninoculated plants were separated from the inoculated group in a separate growth chamber. Both groups were maintained at 14/10 hour night/day photoperiod at daytime and nighttime temperatures of 27°C and 22°C respectively in the growth chambers. Acetylene reduction Assay method was used to evaluate the rate of nitrogen fixation within the four groups. A statistically significant difference was observed in the rate of nitrogen fixation between inoculated group fertilized with 1/4 strength and full strength Hoagland (P-Value = 0.0217). No statistically significant difference was observed between the two uninoculated groups.

- P100 **Alan W. Bowsher and Lisa A. Donovan**. Seedling root characteristics in relation to age, life history, and nutrient supply in *Helianthus*. University of Georgia, GA.

Plant leaves and roots exhibit tremendous variation across species and environmental gradients. Attempts to explain this variation often propose suites of correlated traits based on a fundamental trade-off between rapid resource acquisition and greater resource conservation. While a large body of evidence supporting such functional variation in leaves is rapidly accumulating, our understanding of root trait variation across species is still limited, due to the small number of cross-species comparisons for root traits. In this ongoing study, two annual (*Helianthus annuus* and *H. Niveus* ssp. *Tephrodes*) and two perennial species (*H. radula* and *H. mollis*) are being grown in both high and low nutrient supply in the greenhouse. At two different harvest dates, these four species are being examined for the following fine-root traits: specific root length, tissue density, mean diameter, branching intensity, and tissue N. I will use these results to determine the genetically-based species differences and potential trade-offs among root traits, as well as the effects of age, life history, and nutrient supply. This study will increase our understanding of variation in root form and function among herbaceous species, which have received very little attention to date in the literature.

- P101 **Jennifer K. Johnson¹, Howard S. Neufeld¹, Robert Kohut² and Stan Bartkowiak IV¹**. Comparative effects of ozone on two varieties of cutleaf coneflower, *Rudbeckia laciniata* var. *digitata* and *Rudbeckia laciniata* var. *ampla*. ¹Appalachian State University, NC, ²Boyce Thompson Institute at Cornell University, NY.

Many plant species are negatively affected by tropospheric ozone, including native and agricultural species. *Rudbeckia laciniata* var. *Digitata* (native to much of the United States) is an ozone bioindicator species. *Rudbeckia laciniata* var. *Ampla* (native to the Rocky Mountains) exhibits symptoms in the field consistent with exposure to ozone, but controlled exposures of this variety have not yet been done. The purpose of this study was to confirm whether the injury seen in variety *Ampla* is due to ozone, and if so, whether it differs in sensitivity from variety *Digitata*. Rhizomes of variety *Digitata* were obtained from Great Smoky Mountains National Park and variety *Ampla* from Rocky Mountain National Park, potted in the fall of 2010, and then grown in 2011 under ambient climate and ozone conditions in Boone, NC . Percent of leaf area with stipple (leaf injury consistent with ozone exposure) was assessed at periodic intervals from May to August. Injury

progressed from older to younger leaves in both varieties and was confined to the adaxial leaf surface, both symptoms characteristic of ozone exposure. Variety *Digitata* exhibited leaf injury earlier than variety *Ampla*, and by season's end had greater percent stipple, suggesting that it is more sensitive than variety *Ampla* to ozone. During 2012, plants will be subjected to controlled ozone exposures in open top chambers to confirm symptoms are due to ozone. Photosynthesis, stomatal conductance, and leaf injury will also be measured. This work will provide insight regarding differences in sensitivity among these two varieties.

P102 **Cristin E. Walters and William K. Smith.** Lateral growth and vegetative reproduction in the high elevation spruce-fir forests of the Medicine Bow Mountains, Wyoming. Wake Forest University, NC.

Species living at the alpine treeline must cope with exposure to high winds, freezing temperatures, and ice abrasion. Clonal growth has shown to be an advantageous trait for both herbaceous and woody species in alpine zones because it allows for growth close to the ground where wind abrasion is limited. The two dominant tree species in the Medicine Bow National Forest of southeastern Wyoming, Englemann spruce (*Picea engelmannii*).

P103 **Amanda Kyle and Renee E. Carleton.** Minor ectoparasite infestation does not increase corticosterone release in nestling eastern bluebirds. Berry College, GA.

Nestling birds are commonly infested with ectoparasites which may cause nestling mortality and/or colony abandonment. Blood loss from ectoparasite feeding has been shown to result in a reduction of hemoglobin levels and increase in erythrocyte production. Presumably, physiological stress and irritation associated with ectoparasites increases production of stress-related hormones such as the corticosteroids. We compared serum corticosterone hormone levels and percentages of immature erythrocytes of eastern bluebird (*Sialia sialis*) nestlings from nest boxes that were treated with a pyrethrin-based miticide with nestlings from untreated nest boxes. Presence of mites in nesting materials collected after fledging was visually assessed for both groups. No mites were observed from treated nests while mites in low numbers were observed from untreated nests. There was no statistical difference in hormone levels or percentages of immature erythrocytes between the two groups which suggests that mites had no effect on these parameters. In previous seasons however, we observed much greater numbers of mites in nests taken from untreated nest boxes. Mite populations may have been depressed due to sustained below freezing temperatures during the winter preceding the study. Exposure to relatively few mites does not appear to stimulate increased release of corticosterone.

P104 **Chelsea L. Cockburn, Eboni B. Brown, Michael Ferras, Katie N. Nowell and Justin W. Brown.** Role of brainstem serotonin in mediation of the thermoregulatory response to hypoxic stress. James Madison University, VA.

Evidence suggesting dysfunction in brainstem neurotransmission of serotonin (5HT) may impair proper thermoregulatory response to stress and contribute to Sudden Infant Death Syndrome (SIDS). Brainstem areas rich in 5HT, like the raphe pallidus (RaPa), mediate the thermoregulatory responses to hypoxic stress. We hypothesize that alteration in neurotransmission of the RaPa will alter the normal thermoregulatory response to hypoxic stress. Body core temperature (T_c) and selected ambient temperature (ST_a) were measured in conscious male Sprague-Dawley rats using radiotelemetry. Immediately prior to hypoxic stress, the RaPa was microinjected with muscimol (GABA-A receptor agonist) to block neurotransmission or 8-OH-DPAT (5HT_{1A} receptor agonist) to alter 5HT at the RaPa. Several control groups included ACSF (control vehicle) and a sham microinjection. T_c decreased following Muscimol, ACSF, and Sham injection with hypoxia by -2.7°C, -1.1°C, and 1.1°C respectively. There was a minimal decrease in ST_a following Muscimol (-4.1°C), ACSF (0°C), and Sham injection (-4.9°C). 8-OH-DPAT injection resulted in an attenuation of the hypothermic response (-0.47°C) to hypoxia while ST_a slightly increased (5°C). These data suggest that the RaPa area is involved in the thermoregulatory

responses to hypoxic stress. Activation of the inhibitory 5HT_{1A} receptor attenuated the normal hypothermic response to hypoxic stress while muscimol exacerbated it. Increased understanding of the role of 5HT neurotransmission in the brain stem is vital in order to determine the etiology of SIDS and hopefully prevent its occurrence.

P105 Patsy N. Jackson. The effects of ascorbic acid on *Drosophila* susceptibility to permethrin. Southern Adventist University, TN.

Permethrin, 3-Phenoxybenzyl (1RS)-cis,trans-3-(2,2-dichlorovinyl) -2,2-dimethylcyclopropanecarboxylate, is a widely used pesticide in the United States as well as other countries around the world. Because of the pervasive use many non-target species can be exposed resulting in health challenges to individuals and even populations. An organism's defense against toxins in general, including permethrin, is via detoxification by ubiquitous enzyme systems. A number of studies have shown that dietary vitamin supplementation can enhance detoxification. The current study tested the susceptibility of *Drosophila melanogaster* to permethrin subsequent to ingestion of various concentrations ascorbic acid. Percent knockdown was determined revealing a sex-dependent response. Ascorbic acid supplementation had no observable effect on male susceptibility to permethrin while in females those exposed to ascorbic acid experience a significant increase in susceptibility over the controls.

P106 Paul V. Cupp, Jr., Marissa Buschow, Lauren Goode, Jordan Kelsay, Susan King, Sagan Kleinrichert, Mathew Luttrell, Sabrina Schrader-McOwen and Ivan Moberly. Thermal tolerance and acclimation in house crickets, *Acheta domesticus*. Eastern Kentucky University, KY.

Critical thermal maxima (CTM) were used to determine thermal tolerances at acclimation temperatures (AT) of 10, 22, 28.5 and 35 C for house crickets, *Acheta domesticus*, purchased from a local supplier. While originally from SW Asia, this species has become widely distributed in many areas of the world, including the eastern US. It is active and breeds during summer or when maintained at warmer temperatures. The crickets were heated at a rate of 1 C per minute until the CTM endpoint (onset of spasms) was reached. The mean CTM for house crickets was 45.2 C at an AT of 10 C, 45.5 C at an AT of 22 C, 46.6 at an AT of 28.5 C, and 47.5 C at an AT of 35 C. The significant difference of over 1 C CTM between 22 and 28.5 C AT and the difference of 0.9 C between 28.5 and 35 C AT as compared to a 0.3 C difference between 10 and 22 C AT indicates a greater ability to adjust to higher temperatures than to lower temperatures. Thus, thermal acclimation may be related to the activity and breeding temperatures of this species.

P107 Joseph C. White and William K. Smith. Water sources in riparian tree species of the southeastern United States. Wake Forest University, NC.

Identifying water sources of riparian plants is critical for evaluating impacts of changes in environmental variables such as precipitation events and water pollution. A number of studies in the southwestern US have shown that mature individuals in arid regions, growing along snow-fed streams, often take up little or no surface water and rely almost solely on groundwater. Few comparable studies have been conducted to determine water sources of riparian species in the southeastern US. The purpose of the present study was to determine the source of water uptake for two common riparian species found in the foothills of the southern Appalachians, *Acer negundo* (Boxelder) and *Betula nigra* (River Birch). This was accomplished by analyzing signatures of stable isotopes found naturally in water, ²H and ¹⁸O. The study site (Newton, North Carolina) is located along the Jacob Fork River within a riparian zone typical of this region. Water samples were taken from surface and groundwater sources along with soil samples from varying depths. Woody tissue samples were also taken from systematically-selected, mature individuals of each species. In addition, xylem water potentials were measured in both species in an effort to determine any association between the source of water uptake and plant water potential. Rainfall, PAR levels, and other environmental variables were also recorded. Samples and

measurements were collected once each month during a growing season (June-November). Results of isotopic analysis were used to run mathematical mixing models to determine the amount of contribution of each water source to plant water uptake.

P108 Ksenia A. Fomina, Vladyslav I. Luzin, Olga N. Fastova, Aleksey A. Zakharov and Anton V. Yeryomin. Adverse impact of toluene vapors on the rat cortico-adrenal system. Lugansk State Medical University, Ukraine.

Purpose. Toluene is an important ecologically unfavorable factor. It can be emitted from the fuel, plastics, at different manufacturings. Our aim is to study adverse effects of toluene on the the hormonal status of the rat body. Results. We have identified a significant increase in basal level of adrenocorticotropin in the blood, to $91,53 \pm 0,47$ pg / ml, more control at 32.02%, in immature rats under the influence of toluene. We assume that the hypersecretion of adrenocorticotropin is caused by excessive production of corticoliberine in hypothalamus and subsequently (on the principle of direct communication) it leads to the secondary increase of glucocorticoids level. The concentration of adrenocorticotropin in young rats is $92,73 \pm 0,11$ pg / ml after 60-day exposure of toluene. The same concentration of adrenocorticotropin was determined in animals of senile period. Conclusions. We can conclude that the toluene vapour lead to a stable increase concentrations of adrenocorticotropin in blood in experimental animals.

P109 Ksenia A. Fomina, Vladyslav I. Luzin and Anton V. Yeryomin. Negative effect of toluene on the thyrotropic hormone production of mammalia as an example of rat. Lugansk State Medical University, Ukraine.

The aim of our research is the study of toxic effects of toluene on the the production of thyrotropic hormone. We carried out a study of 106 white male rats of three age series: I - immatures (age of 4 weeks); II - reproductive age (age 4 weeks to 4 months), III - senile period (age 4 to 20 months). The animals were divided into two groups in each series: a - intact; 2 - rats that were subjected to the influence of toluene vapors in a concentration of 500 mg / kg during 2 months. Determination of the concentration of hormones in the blood serum was carried out in the diagnostic laboratory in the Luhansk City Polyclinic № 9. We found that exposure of toluene vapors leads to a decrease in the concentration of thyrotropic hormone on the 33,39% ($0,005 \pm 0,0001$ pClU / ml) in immature rats. In adult rats, the concentration of TSH decreased by 35,84% ($0,0048 \pm 0,0001$ pClU / ml), and the old, it increased by 19,51% ($0,008 \pm 0,0001$ pClU / ml) compared with controls. Thus, toluene has a negative effect on the pituitary function in the early stages of ontogeny, but its effects are compensated adaptively in old animals.

P110 Vladyslav V. Luzin, Ksenia A. Fomina, Anton V. Yeryomin, Aleksey A. Zakharov and Olga N. Fastova. Toxic effects of toluene on the thyroid gland of mammalia as an example of rat. Lugansk State Medical University, Ukraine.

The aim of our research is the study of toxic effects of toluene on the hormonal function of the thyroid gland. We carried out a study of 106 white male rats of three age series: I - immatures (age of 4 weeks); II - reproductive age (age 4 weeks to 4 months), III - senile period (age 4 to 20 months). The animals were divided into two groups in each series: a - intact; 2 - rats that were subjected to the influence of toluene vapors in a concentration of 500 mg / kg during 2 months. We have identified increased concentrations of T3 on the 10.94% and T4 on the 17.18% in immature rats after inhalation exposure of toluene vapors. However, the effects of toluene led to a decrease in thyroid activity in mature rats. They serum T3 at 9.88% less than control, T4 - at 10.05%. T3/T4 ratio did not change (0.91%), suggesting an equivalent reduction in both fractions of thyroid hormones. The concentration of thyroid hormones decreased even more in old rats, T4 on the 46.02% and T3 to 28.16%. Such a decline in the thyroid function indicates a toxic effect of toluene.

- P111 **Alexey A. Zakharov, Svetlana A. Kashchenko, Oleg A. Churilin, Ksenia A. Fomina and Anton V. Yeryomin.** Ultramicroscopic structure of thymus after administration of imunofan. Lugansk State Medical University, Ukraine.

The last years are characterized by the steady height of amount of the immunopathological states among a population. This situation is related to the making progress worsening of ecological situation in the world, especially in industrial regions. Reaction of organism on related to it exogenous influences often shows up development of the immunodeficient states. For the correction of immune status immunomodulators of the last generation, which imunofan behaves to, is widely used presently. However, in literature data are absent about the ultrastructural changes of organs of the immune system, in particular, thymus, after application of this drug. Hereupon we carried out an experiment on 24 white rats-males which got the imunofan in a dosage 0,7 mkg/kg on a chart. Animals, got 0,9% solution of NaCl, served as a control. Through 1 and 30 days after completion of administration of drug the rats were taken out from an experiment, thymus was exposed to standard method for preparation of cuts which studied by means of electronic microscope EM - 125 (Kharkiv). The carried out research of thymus showed that introduction of imunofan in a therapeutic dose assisted the improvement of its blood supply, strengthening of mitotical activity of lymphocytes, especially in a subcapsular zone of cortex, to intensive development of organoids of synthesis of epithelioreticulocytes in a 30 day of supervision. The got results testify to the high degree of reactivity of thymus after administration of immunomodulator on the late terms of supervision, while in the early term (1 day) the substantial differences were not educed from control.

- P112 **Brenda L. Wichmann¹, Wendy B. Zomlefer¹, David E. Giannasi¹ and Richard Carter².** The GA-VSC herbaria collaborative: Phase I of a statewide consortium. ¹University of Georgia, GA, ²Valdosta State University, GA.

In April 2011, the University of Georgia Herbarium (GA) and Valdosta State University Herbarium (VSC) began a three-year collaborative project funded by the National Science Foundation, Collections in Support of Biological Research (CSBR) program (formerly the Biological Research Collection [BRC] program). The PIs are Curators Wendy Zomlefer (GA) and Richard Carter (VSC), and coPI, Emeritus Director David Giannasi (GA). Collectively, the two herbaria comprise over 324,500 accessioned sheets of vascular plants (including over 525 types), with focus on Georgia and the southeastern United States. The primary goal of the alliance is to produce an on-line GA-VSC Atlas linked to specimen images and label data. The GA Atlas, currently with 84,000 entries, will soon be released on-line for public viewing after completion of preliminary proofing, now underway. At VSC, over 8,000 specimens have been databased and imaged thus far, and funding has allowed infrastructure upgrades there, as well. Integrated outreach projects include a teacher workshop at Valdosta State University and the creation of a herbarium at TreesAtlanta, a non-profit organization promoting trees in urban Atlanta. All phases of the project involve undergraduate and graduate students at both institutions.

- P113 **Chelsea R. Davis and Gerald L. Smith.** Studies on *Hymenocallis* species of the Atlantic coastal plain. High Point University, NC.

The treatment of *Hymenocallis* in *Flora of North America*, vol. 26, recognizes *H. Crassifolia* Herb., *H. Duvalensis* Traub and *H. Pygmaea* Traub as species occurring in the Atlantic Coastal Plain. *Hymenocallis Crassifolia* is reported as occurring in the outer Coastal Plain from the Carolinas to northern Florida, *H. Pygmaea* from the Waccamaw River drainage in the Carolinas and *H. Duvalensis* from the inner Coastal Plain of Georgia and in adjacent areas of the Florida Panhandle. A current study, acquiring information from morphology, cytology, ISSR DNA fingerprinting and biogeography, is likely to expand the distribution of *H. Pygmaea*. A goal of our studies is to assess relationships among the Atlantic Coastal Plain species and to assess their relationship to other species being classified in Traub's Caroliniana Alliance which occur in the central and western Florida Panhandle.

P114 **Curtis J. Hansen and Leslie R. Goertzen.** Evolutionary pattern and process in *Marshallia* (Asteraceae). Auburn University, AL.

The genus *Marshallia* (Asteraceae) consists of eight species of herbaceous perennial plants endemic to the southeastern United States. It is an interesting and quite variable group; although all are attractive wildflowers, there are three common taxa, three uncommon taxa, two polyploid taxa (one an endangered species), and a putative new species. Traditional approaches utilizing morphology, isozymes, cytology, plastid restriction site mapping and DNA sequencing have failed to resolve the phylogeny of this enigmatic genus and numerous fundamental natural history questions remain unanswered. We performed a pilot sequencing study suggesting that phylogenetic resolution could be achieved with ca. 15 kbp of plastid data per taxon. For about the same cost, we can instead adopt a genome-skimming approach using next-generation sequencing (NGS) technology, assembling near complete plastid genomes and data from innumerable nuclear and mitochondrial loci for 10–12 individuals. These data will allow for the rigorous testing of phylogenetic hypothesis, evaluation of hybrid parentage and the nature of polyploidy, examination of phylogeographic patterns and a broader discussion of evolution, speciation and conservation issues within this genus. In addition, comparing *Marshallia* plastid genomes to a rapidly growing number of other genera of Asteraceae may provide insight into the placement of this phylogenetically isolated genus in this well-studied family. *Marshallia* represents an excellent test case for the application of NGS methods to a currently intractable phylogenetic problem. Much light will be shed on interesting biological, genetic and life history processes that in turn will greatly inform the systematics and conservation of this genus.

P115 **Alvin Diamond and Michael Woods.** *Rhododendron colemanii* (Ericaceae) in the southeastern United States. Troy University, AL.

Rhododendron colemanii, a species of deciduous rhododendron in section *Ptentanthera*, was described in 2008. Commonly known as the Red Hills Azalea or Coleman's Azalea, it is currently known from the Red Hills region of the upper Coastal Plain of Alabama and western Georgia. Based on herbarium records and personal collections, it is known from eight Alabama counties and three Georgia counties. Previously, specimens had been identified as *R. alabamense*, *R. austrinum*, *R. canescens*, *R. atlanticum*, or hybrids between these taxa. We present diagnostic features of the taxa. In addition, photographs and county level distribution maps are provided. The data for the distribution maps were gathered from specimens deposited in the herbaria of Troy University (TROY), J.D. Freeman (AUA), The University of Alabama (UNA), The University of South Alabama (USAM), Pullen (MISS), R.K. Godfrey (FSU), and Newberry College (NBYC).

P116 **Edgar B. Lickey.** Continued studies in the *Arrhenia sphagnicola* (Berk.) redhead, *Lutzoni moncalvo* & *vilgalys* species complex in Newfoundland. Bridgewater College, VA.

Continued work on collections of mushrooms from Newfoundland and Labrador, which were tentatively identified as *Arrhenia (Omphalina) Sphagnicola*, supports the hypothesis that there are at least three morphologically and genetically distinct taxa. Based on work comparing nuclear ribosomal DNA internal transcribed spacer (nrITS) sequences, none of these three groups correspond to the European *A. sphagnicola*, but instead at least one group may be allied with North America *A. gerardiana* (Peck) Redhead, Lutzoni, Moncalvo & Vilgalys. The two others may represent two new species. In addition, microscopic analysis has yielded micromorphological differences, particularly with respect to basidiospore shape and size, which appear to support the genetic data. Other collections referred to as *Omphalina pyxidata* (Bull.) Quel. also appear to be genetically "close" to *O. pyxidata*, but it is apparent that they are not identical and may represent two other putatively new species. However, further work is needed on the morphological characterization of these two taxa.

- P117 **J. D. Huffstetler and Gerald L. Smith.** Phylogenetic relationships among *Hymenocallis* species classified in Traub's *H. caroliniana* alliance. High Point University, NC.

A phylogenetic analysis was undertaken of *Hymenocallis* species which we are classifying in Traub's Caroliniana Alliance and of two puzzling unknown populations occurring in the central Florida Panhandle. Data was acquired from morphology, cytology, ISSR DNA fingerprinting and biogeography. Several consistent patterns of relationships were revealed. (1) The two unknown populations from the Florida Panhandle were sister to each other with strong bootstrap support; (2) the unknown populations formed a supported sister relationship to *H. Choctawensis* Traub, *H. Franklinensis* G. Lom. Sm., L. C. Anderson & Flory and *H. Gholsonii* G. Lom. Sm. & M. Garland; and (3) *H. Occidentalis* (Leconte) Kunth was sister to all the other clades of *Hymenocallis* taxa with strong bootstrap support.

- P118 **Matthew R. Tye and Pedro F. Quintana-Ascencio.** Modeling population growth and structure in the plant *Liatris ohlingerae*. University of Central Florida, FL.

Understanding demographic structure in populations is a vital component of conservation. By discerning which stages of a species' life cycle are important to population growth and structure, management strategies can be tailored to optimize conservation efforts. We will use a relatively new type of demographic model, an integral projection model (IPM), to address two demographic questions in the perennial *Liatris ohlingerae*, a federally listed herb. We first aim to determine the growth trajectory and population structure of the study species under conditions in which recent environmental conditions and management strategies are continued. Addressing this question will provide an important estimate of the threat posed to these populations and assess the effectiveness of current management strategies. We also seek to determine how the population growth rate and structure will change if environmental conditions or management strategies deviate from historical patterns. Thus far, preliminary analyses have revealed the effects of several parameters, such as habitat type and number of stems, on survival and reproduction. Using a model to address *L. ohlingerae*'s response to these changes will enable the identification of alternative management strategies. It will also elucidate the threat that future environmental changes, such as habitat modification and climate change, will have on the study population. Aside from answering two important conservation questions in *L. ohlingerae*, this study may also act as general framework for the use of IPMs in species with unusual life cycles. Our work will thus help to broaden the applicability of a rapidly expanding type of population model.

- P119 **David B. Greene.** Genetic variation of a population of *Spiraea virginiana* (Virginia spiraea), a rare, riparian shrub along the Cheoah River in western North Carolina. UNC Asheville, NC.

Small, fragmented populations of rare organisms often exhibit decreased genetic variation which reduction in variability can be further compounded by asexual reproduction. *Spiraea virginiana* is an early-successional specialist shrub restricted to riparian zones of high gradient rivers in the southern Blue Ridge and Appalachian Plateau physiographic regions. *Spiraea virginiana* populations are commonly small and isolated, because geographic features associated with these regions such as high elevation ridges create barriers that hinder gene flow between populations. Most reproduction is clonal, and dispersal of genets can occur during floods when rootstock fragments are eroded and deposited downstream. The goal of this study was to quantify genetic variation and population differentiation in *Spiraea virginiana* on the Cheoah River in North Carolina, a previously unexamined region within the species' range. DNA was extracted from 33 leaf samples of 16 subpopulations and is being amplified at four microsatellite regions to determine differences within and among demes. Results of this study will be compared to

those from other watersheds and used to inform management decisions for the Cheoah River's *S. virginiana*.

P120 **Cristina M. Caldwell¹, Michele Elmore², Julie Ballenger¹ and Kevin S. Burgess¹**. Introgressive hybridization in rare Georgia pitcher plants (*Sarracenia* spp.). ¹Columbus State University, GA, ²The Nature Conservancy.

Habitat modification and fragmentation can have serious demographic and genetic impacts on a variety of plant species. One such genetic threat is asymmetrical introgressive hybridization, which can lead to species extinction via genetic assimilation of rare parental genomes into that of more abundant congeners. However, little is known about the genetic ramifications of hybridization between parental taxa that do not differ in abundance. Pitcher plants belonging to the genus *Sarracenia* are carnivorous plants endemic to North America. Seven of the eight species within the genus are concentrated in the southeastern United States. Despite this heavy concentration, in Georgia, approximately 2% of pitcher plant habitat remains intact. Here, we investigate the potential occurrence of introgressive hybridization in sympatric populations of *Sarracenia rubra* (sweet pitcher plant) and *Sarracenia psittacina* (parrot pitcher plant), two species that are listed as threatened within the state of Georgia. Currently we are using DNA barcode markers to confirm the genetic identity of parental taxa as well as determine the parentage of putative hybrids. Furthermore, microsatellite analyses will be used to establish hybrid indices that will provide novel insight into the process of introgressive hybridization occurring between these two rare species. The application of this research to species management will be discussed.

P121 **Tabitha Marchbanks, Caleb Matthews and Cindy Bennington**. Genetic variability for the defensive response of passionflower (*Passiflora incarnata*) to herbivory. Stetson University, FL.

Plants have evolved chemical, morphological and biological mechanisms to defend against attack by insect herbivores, with virtually all plants employing more than one strategy. We asked whether simulated herbivory on passionflower (*Passiflora incarnata*) would increase leaf thickness, trichome density, and/or the production of extrafloral (EF) nectar and whether the magnitude of these responses differed among different genotypes. A total of 66 potted plants, belonging to nine genotypes, were evenly divided into treatment and control groups within a greenhouse. The leaves of plants in the herbivory treatment were clipped in half with scissors throughout the summer of 2011. We quantified the amount of EF nectar produced by each plant on two separate occasions in June. At the final plant harvest in September, we measured leaf thickness and trichome density on three haphazardly chosen leaves from each mature plant. Both leaf thickness and EF nectar production increased with herbivory ($p < 0.05$ in both cases), but there was no effect of treatment on trichome density. There were differences among genotypes for all three traits, and evidence for negative genetic correlations between traits. In particular, those genotypes that produced the largest amounts of EF nectar in response to herbivory had the least dense trichomes ($r = -0.65$); a negative correlation that could constrain evolutionary response to selection and may be responsible for the evolution and maintenance of alternative plant defense strategies within a species.

P122 **Thomas L. Fulghum¹, Lissa M. Leege and Jacob Thompson²**. Measuring long-term effects of deer herbivory on the rare plant, *Trillium reliquum* using matrix models. ¹Georgia Southern University, GA, ²Georgia Department of Natural Resources.

Knowledge of the effects of herbivory on endangered plant species can aid in management and conservation of rare plants and the prevention of future endangerment of other species. *Trillium reliquum* is an endangered herb that occurs in a three state region across the fall line of the Southeast. Previous studies have shown that it is vulnerable to deer herbivory, however, no long term studies have been conducted to

determine deer herbivory effects on population dynamics. Previous studies conducted on this species indicated populations exposed to deer herbivory were significantly smaller than those without deer herbivory. The objective of this study was to determine responses of *T. reliquum* populations to deer herbivory. In 2005, in three sites in GA, USA, we constructed deer exclosures with fencing (10x25 m) and compared plant population dynamics in exclosures with neighboring control plots of the same size. We monitored plant populations in these sites in 2006, 2007, and 2011 and tracked life stages of individual plants. From the 2006-2007 data, we constructed matrix models to project population sizes. Reproductive and subadult plants were consumed by deer more often than juvenile plants in deer accessible plots. For populations exposed to herbivory, models projected an 81% population decrease in size over 25 years, yet predicted a 70 % increase for deer excluded populations. This study suggests that reduction of deer populations may improve *T. reliquum* success.

P123 **Taylor Ricks and H. D. Wilkins.** Nest site characteristics of great blue herons and great egrets in three rookeries at Reelfoot Lake, Tennessee. The University of Tennessee at Martin, TN.

Herons and egrets nest in rookeries often located over water to possibly avoid predation or to be close to food resources. Within a rookery there may be interspecific competition for nesting sites with desirable characteristics such as secure location within a tree or away from the periphery of the rookery. Our goals were to describe the species composition of three rookeries, to determine if nest site partitioning was occurring, and to compare the structure of the three rookeries. The three rookeries in this study were all located in seasonally flooded cypress swamps. For each nest tree, we recorded the species, the diameter at breast height, the distance from the nearest boundary, and the number of heron/egret nests. For each nest, we noted the species, nest height, and nest location within the tree. Trees with larger diameters tended to support more nests than smaller trees, but the number of nests in a specific tree may be more related to crown structure than diameter. The density of nests was highest in the center of the rookery than around the periphery. Further study could look at the nesting success of centrally located nests versus peripheral nests. Great Blue Heron (*Ardea herodias*) nests were often in central forks, whereas, Great Egret (*Ardea alba*) nests were often located on peripheral branches. Egret nests appeared less stable than Great Blue Heron nests. Further observations within the rookeries as they are colonized may help determine how much these two species interact as they select nesting sites.

P124 **Heather Meadors, Sarah E. Redding and H. D. Wilkins.** Use of silent point counts and aural stimuli to detect barred owls in the area surrounding Reelfoot Lake, Tennessee. The University of Tennessee at Martin, TN.

Barred Owls are important nocturnal predators in forested ecosystems including bottomland swamps such as those found around Reelfoot Lake. Protocols for censusing Barred Owls vary between researchers. Our goal was to standardize census methods by comparing silent counts to counts using aural stimuli. Ten points were established and sampled twice a month from February to March 2011 and again from September 2011 to February 2012. At each point, we conducted 5 and 10 minute silent counts followed by playback of Barred Owl calls. We divided the time post-playback into 5 and 10 minute intervals. Ten minute silent counts detected more owls than 5 minute silent counts. Ten minute post-playback counts detected more owls than 5 minute post-playback counts. Ten min silent counts detected approximately the same number of owls as 5 min post-playback counts, but significantly fewer owls than 10 minute post-playback counts. We hypothesize that 10 min post-playback counts detected more owls because it allowed the owls to move closer to the source of the stimuli before either calling or flying through the area. We also counted the number and types of calls uttered before and after playback and found that using aural stimuli significantly increased the rate of calling and therefore the detectability of owls. Barred Owls have a varied repertoire of vocalizations. Which calls

uttered may change according to the owl's breeding status. In addition, the effectiveness of using aural stimuli may be impacted by breeding season, proximity to territorial boundaries, and moon phase.

P125 Stephanie Rhodes, Emma Hayes and Jennifer S. Borgo. Seasonal variations in diet of coyotes (*Canis latrans*) at Carolina Sandhills National Wildlife Refuge. Coker College, SC.

Foraging behavior of coyotes (*Canis latrans*) in the Southeastern United States has not been studied extensively. Our project looks at the impact of coyotes on key prey species and seasonal variations in coyote diet. Our study has taken place at Carolina Sandhills National Wildlife Refuge in McBee, South Carolina from May 2010 to present. The primary method to assess foraging has been collection and dissection of coyote scat samples from the study area. Plant remains constituted roughly 52% of total scat compositions. There was also evidence of heavy predation on mammal species (41%). Arthropod and avian remains followed in smaller percentages (5% and 1%, respectively). We also analyzed changes in diet composition over the course of a year. During Summer and fall, we found higher percentages of plant matter consumed (mean percent \pm SD; 94.50% \pm 0.85 and 85.38% \pm 0.28, respectively), while during the winter and spring, we saw an overall trend of mammal remains comprising the majority of coyote scat (74.66% \pm 0.37 and 70.73% \pm 0.36, respectively). During the reproductive period (January – May), scat samples were composed primarily of mammal remains (72.52% \pm 0.35). This pattern suggests breeding individuals are more likely to select prey species with the highest energy benefits. Through our undergraduate research at Coker College, we hope to increase current scientific knowledge concerning the behavioral patterns of these opportunistic predators, and provide valuable information for local wildlife managers. Future research could shed light on specific species preyed on by coyotes in our area.

P126 Sabrina L. Shrader-McOwen and Gary Ritchison. Use of auditory stimuli by Carolina chickadees (*Poecile carolinensis*) to recognize and inform conspecifics about predators. Eastern Kentucky University, KY.

By exposing flocks to study skins of different raptors, previous studies have demonstrated that Carolina chickadees (*Poecile carolinensis*) vary the characteristics of their 'chick-a-dee' calls, (the number of 'dee' notes per call) to convey information to conspecifics about the level of threat posed by potential predators. However, the responses of chickadees to the calls of different raptors and their ability to associate those calls with the presence of specific raptors has not been examined. In 2011-2012, I conducted two trials with each of eight flocks of Carolina chickadees in Madison County, Kentucky, with flocks exposed to the study skins of seven different raptors commonly found in Kentucky during one trial and to playback of the calls of those same raptors in another trial. Preliminary analysis indicates that Carolina chickadees respond differently to study skins than to playback of the calls of the same raptors, moving closer to study skins and uttering more calls. This difference appears to be particularly evident for smaller raptors that represent a greater threat to chickadees, such as eastern screech-owls (*Megascops asio*). These preliminary results suggest that chickadees recognize the calls of some raptors. In addition, chickadees that hear raptor calls stay further away (from the speaker) and call at lower rates than those that see the same raptor (study skin). Chickadees that only hear a raptor call may be less certain of its specific location and, therefore, may spend more time listening than calling and remain further away to minimize potential risk.

P127 E. N. Vanderhoff¹ and Travis W. Knowles². Antiphonal calling and duetting in mammals: do Amazonian bamboo rats *Dactylopsax dactylinus* do both?
¹Jacksonville University, AL, ²Francis Marion University, SC.

Antiphonal calls, calls and responses occurring at regular intervals, are an important means of communication between individuals. In some animals these calls can be highly synchronized to create duets. Among mammals antiphonal calling has been reported in

bats, elephants, rodents and primates. Duetting, usually occurring between monogamous pairs, is common in birds but rarer among mammals, occurring primarily in primates. The Amazonian bamboo rat *Dactylopsax dactylinus* appears to engage in both types of calling behavior. Bamboo rats, as their name suggests, are bamboo specialists living in and around bamboo thickets throughout much of Amazonia. Loud staccato vocalizations are given by residents of each bamboo patch and pairs often produce duets. In this review we will summarize the current literature on antiphonal calls and duets in mammals as well as present evidence for these types of calls in bamboo rats.

P128 **Michael K. Moore¹, Danny VanValkenburgh¹ and Victor R. Townsend, Jr.².** Defense behaviors of tropical harvestmen. ¹Mercer University, GA, ²Virginia Wesleyan College, VA.

Harvestmen exhibit a wide array of anti-predator behaviors, both passive (e.g., aposomatic or cryptic coloration) and active (e.g., stridulation, secretion of repugnant materials). Most of the recent research in this field has focused on Neotropical species, and only a few natural history observations are available for Caribbean species. In May 2011 we completed a field study of the defensive behaviors of 5 species (from 3 Families) found in Trinidad. The protocol is a modified design after Pomini et al (2010). Individuals collected in the field were seized on the proximal region of femora IV to simulate grasping by a predator, and their response recorded (i.e., stridulation, thanatosis, specifics of secretions from the ozopore, including color, odor and method of release). After 10 seconds the individual was either released from 2.5 cm above the ground, or a light dorsoventral pressure was applied with forceps to the opisthosoma. Again responses were recorded. Species varied little in response to the initial grasp then release treatment (overall with 18% of individuals remaining still and 82% running away). Significant interspecific differences were observed when light pressure was applied. Most individuals from the Manaosbiidae and Cosmetidae secreted a clear, odorless enteric secretion. In addition a few Cosmetids stridulated and one individual exhibited thanatosis while under pressure. Cranid responses varied by sex. Males most often had either no response or secreted a small amount of enteric fluid, while all females forcefully ejected a yellow odiferous fluid towards the posterior end of the body.

P129 **Jennifer S. Garbina and Nancy L. Buschhaus.** Effect of natal bean species and bean condition on hatching success and female oviposition behavior in bean beetles, *Callosobruchus maculatus* (Coleoptera: Chrysomelidae: Bruchinae). University of Tennessee at Martin, TN.

Female bean beetles, *Callosobruchus maculatus*, lay their eggs on a bean, the egg hatches into the larval life stage that burrows into the bean, the larvae consume the nutritive tissues of the bean as they grow, and then the larvae emerge as adults from the bean. Adult bean beetles do not consume food or water, they mate, and the female beetle lays her eggs on the beans of her choice, beginning the life cycle again. Therefore, female bean beetles may decide future food resources of their offspring when they lay their eggs on a certain type of bean, and female oviposition choice can affect growth, survival, and future reproduction of their offspring. We tested the effect of the species of bean (mung versus black-eyed pea) and the condition of bean (dry versus soaked) on the number of offspring that hatched from the bean and the female oviposition choice from three subsequent generations of offspring. We found a significant effect of bean species and bean condition on larval hatching success and subsequent adult generation oviposition choice.

P130 **Todd L. Scarlett.** Effects of hydroelectric generation on great blue heron (*Ardea herodias*) foraging and movements. University of South Carolina Lancaster, SC.

Tailwater streams below hydroelectric dams are subject to drastic changes in water depth and velocity over short periods of time. The effects of altered flow regimes on macroinvertebrates and fish have received significant study, but the effects on other

wildlife have received virtually no attention at all. I examined the effects of altered flow regimes on foraging success and movements of great blue herons (*Ardea herodias*) at the Lake Wylie Dam near Rockhill, South Carolina, USA. Heron foraging was observed from the dam structure to a distance of 850m downstream of the dam. Foraging rates were highest immediately downstream of the dam (1-170m from the dam). Herons on the dam structure itself exhibited the next highest foraging rates, followed by herons 170-500m below the dam. Herons 500-850m below the dam had the lowest foraging rates. When the hydro plant was not generating (low water flow), herons mostly foraged >500m below the dam in shallow water. During generation (high flow) most herons moved to just below or onto the dam structure near the outflow to feed either on stunned or dead fish entrained through the dam or schools of live shad that move about near the dam structure. Great blue herons generally forage solitarily. Hydroelectric dams concentrate foraging great blue herons into much greater densities than they are found elsewhere. This may impact breeding colony size and the distance travelled between foraging and nesting sites, particularly during the breeding season when adults are feeding young.

P131 **Marissa A. Buschow and David R. Brown.** White-throated sparrow (*Zonotrichia albicollis*) aggressive response to intruders declines throughout winter. Eastern Kentucky University, KY.

White-throated sparrows (*Zonotrichia albicollis*) are a species that winters in southeastern North America. They are territorial when breeding, yet form loose flocks with strict dominance hierarchies in the winter. Though agonistic interactions within the flock that define rank are well studied, levels of aggression toward unfamiliar individuals are unknown, especially how they may change as the non-breeding season progresses. We simulated intrusions with playback of unfamiliar vocalizations to flocks in Madison County, Kentucky, accompanied by a mounted sparrow model, during three time periods of winter: November, January, and March. We quantified behavioral responses in terms of aggression; primary indicators of response were latency to response, song and chip rate, and time spent within set distance intervals from the speaker. Preliminary results suggest a dramatic decrease in agonistic response between November and January. The higher levels of aggression in November suggests that at least some birds are more actively defending resources during the arrival period and that sensitivity to intrusions decreases.

P132 **Alyssa McNaughton¹, Erika Baldwin¹, Alexandria S. Jeffers², Peter VandenHurk³ and Dennis C. Haney¹.** The effects of legacy and current land use on stream biota in the piedmont region near Greenville, South Carolina. ¹Furman University, SC, ²SC Governor's School for Science and Mathematics, ³Clemson University, SC.

Much attention has been directed towards the influence of urban land use on stream and watershed processes, but comparatively little work has been done to examine the influence of legacy and current agricultural land use on stream ecosystems. Since prior research in rural areas of the South Carolina Piedmont showed consistently low diversity and high homogeneity of fish populations, the aim of our research was to investigate how both legacy (cotton farming prior to 1950) and current agricultural land covers (especially row crop and pasture) are affecting fish biodiversity in Piedmont streams near Greenville, SC. We selected 15-20 streams in the area for study based on similar stream number, width and watershed area. Within these parameters, streams with varying riparian borders (pasture, forest, and urbanized land cover) and at varying distances from historical mill sites (hypothesized to exhibit the greatest effects of antecedent cotton farming) were selected. At all sites fish were collected for both abundance and biodiversity measurements and for biomarker analyses. Preliminary results revealed a negative correlation between percent forested land cover and both Cyprinidae and total fish abundance. This suggests that organisms tolerant of human disturbance, like most Cyprinidae in this area, may survive better in urbanized streams than in forested streams where competition and other biotic interactions might be greater. We also discovered a

positive correlation between pasture cover and species richness. This suggests that pastured steams may provide more nutrients, sunlight, and algae, contributing to increased food supplies and indirectly species richness.

P133 **Bradley Wells¹, Ashley Baldrige², David Lodge² and Timothy Kreps¹.** Utilization of a seasonal resource pulse: consumption of smallmouth bass eggs by the invasive rusty crayfish. ¹Bridgewater College, VA, ²University of Notre Dame, IN.

The invasive rusty crayfish, *Orconectes rusticus* can alter lake food webs in multiple ways. They displace native crayfish while strongly reducing macrophyte and macroinvertebrate diversity and abundance. Rusties likely have complicated interactions with fish species. While many fish species utilize rusty crayfish as prey, the crayfish may negatively impact their predators. Rusty crayfish consumption of macrophytes reduces the available habitat for lake fishes and in some instances it has been documented that rusty crayfish can consume fish eggs. The smallmouth bass (*Micropterus dolomieu*) is a voracious crayfish predator and is currently being utilized in experiments where populations are manipulated as a tool for the management of rusty crayfish. If rusty crayfish are able to consume significant amounts of smallmouth bass eggs it would provide the energy in the crucial early season growth period and could potentially impact smallmouth populations and thus reduce their effectiveness as a long-term management tool. We collected rusty crayfish from two lakes in northern Wisconsin/Michigan at sites varying in nesting activity, before, during, and after the smallmouth bass spawn in the summer of 2011. We then examined crayfish diets for lipid globules (indicating egg predation) to determine how common smallmouth bass eggs are in the crayfish diet. Preliminary results indicate that consumption of fish eggs is common during the smallmouth spawning period. Surprisingly, fish eggs remained common in crayfish guts even after smallmouth spawning ended.

P134 **Meredith W. Kronn, Foster K. Veazey, E. G. Dobbins and Dr. K A. Bakkegard.** The effects of rock vanes on sedimentation in Shades Creek, Birmingham, AL. Samford University, AL.

Increased sediment deposition in watersheds caused by anthropogenic activities or land-use changes has detrimental effects on aquatic ecosystems. Reducing sediment decreases turbidity, improves light penetration, enhances productivity, and increases plant and animal species diversity. Shades Creek, a first order stream running through urban Jefferson County, AL into the Cahaba River, carries a high sediment load due to the suburban nature of the watershed and continuous land development. In 2010, ten artificial rock vanes, designed to funnel water away from the banks and into the center of the stream, were specifically constructed to reduce erosion and sediment deposition in a 400 meter reach of the creek. To determine if the rock vanes achieved their purpose, sediment was collected using ceramic tiles upstream, downstream, and within the zone containing the rock vanes. We hypothesized that we would measure less sediment downstream of the rock vanes than upstream. There was a significant reduction downstream in both inorganic sediment ($F=5.45$; $d.f.=69$; $p=0.002$) and organic sediment ($F=5.43$; $d.f.=69$; $p=0.002$) compared to upstream control and affected areas. There was also a differential distribution in sediment size between upstream and downstream sites. Though our data suggest the rock vanes are effective at decreasing erosion in Shades Creek, further study is necessary to determine the long-term effectiveness of rock vanes at significantly reducing erosion and sedimentation in reaches with obvious bank erosion.

P135 **Cody Mills and Kirsten Work.** Rapid population growth and impact on algal growth by the exotic snail, *Melanooides tuberculata*. Stetson University, FL. *Melanooides tuberculata* is an exotic freshwater snail from southeastern Asia that inhabits Volusia Blue Spring in Central Florida. Although present in Florida for decades, little is known about its biology or impact on ecosystems. In response to increasing concerns about eutrophication and exotic invasions, we measured demographic characteristics of

M. tuberculata and the effect of its grazing and egestion on algal growth. We also measured the grazing rate of predatory crayfish on *M. tuberculata* and determined whether grazing was size selective. Crayfish were allowed to graze on small (1-2 mm), medium (2-3 mm), and large (3+ mm) snails for three days. At the end of the three days, the remaining snails were counted and measured. Crayfish grazing rate was high (5-7 snails day⁻¹) and the crayfish selected the smallest snails. To determine the effect of snail grazing on algal growth, we measured initial and final weights of algae and change in algal coverage over a 10 day period in the presence and absence of snails. Algae was collected from Volusia Blue Spring and added to replicate containers of spring water in four different treatments: algae alone, algae with spinach separated by a divider, algae with spinach and snails that could roam freely, and algae separated from spinach and snails by a divider. Snail grazing clearly reduced algal coverage and the nutrients added by the spinach changed the algal taxonomic composition. However, longer trials may be required to show that the presence of *Melanoides tuberculata* increases algal biomass.

P136 **Katelynn L. Bell, Kelly A. White and Clay Runck.** Comparison of two methods for sampling zooplankton and notonectids in a storm water management pond. Georgia Gwinnett College, GA.

Storm water management ponds are often the most common aquatic habitats in urban and suburban landscapes and the number of these water bodies is increasing as rural areas are developed for residential, business, and industrial uses. While the physics and chemistry of these ponds have been well-studied in relation to their effectiveness at reducing input of sediment and dissolved chemicals to natural water bodies, the ecology of these systems is less well known. This study examined zooplankton and notonectids (Insecta: Heteroptera: Notonectidae) in a fishless storm water management pond on the campus of Georgia Gwinnett College. Two types of samplers (vertical tows with a plankton net and a tube sampler) were compared for collecting zooplankton and notonectids in this shallow ($Z_{max} = 1.5$ m) pond. There were no significant differences in density estimates for either cladocerans or copepods collected by the two samplers. However, there was a significant difference in copepod density between samples collected during the day and night with the plankton net. Neither sampler was effective at collecting notonectids, but the net sampler performed better at night than during the day at capturing the strong-swimming, visually-orienting notonectids.

P137 **Brian A. Clayton.** Effects on shallow groundwater in a wetland from tree removal. Joseph W. Jones Ecological Research Center, GA.

Isolated depressional wetlands are common landscape features in the southwest Georgia Coastal Plain. Because of normal drying in the summer and their relative small size, these wetlands are often degraded from human influences thorough agricultural, urban, and forestry land use practices. Changes in vegetation of the uplands and ecotone could affect the hydrologic cycle and the wetland's hydroperiod. It is hypothesized that the flow of water into isolated wetlands in our study area is primarily through rainfall and diffuse lateral movement of rainwater within the shallow soil layers underlying the wetland catchment. Because of low topography, shallow groundwater flow, rather than rapid runoff fills and maintains wetlands through their hydroperiod. We measured water levels in four shallow wells surrounding a hardwood encroached isolated depressional wetland from 2006 through 2011. In 2009 the hardwoods were removed from the ecotone and catchment area. Pre harvest drawdown rates within the 4 wells averaged 0.15, 0.12 and 0.14 feet per day for the years 2006, 2007 and 2008. Post harvest drawdown rates within the 4 wells averaged 0.05 and 0.08 feet per day for the years 2010 and 2011. Our data suggest hardwoods, primarily oak species, could decrease stored subsurface water which may cause wetland hydroperiods to be reduced.

P138 **Jeffrey J. Illinik.** Effects of tidal immersion and body mass on phosphorus cycling *Ofgeukensia demissa*. Virginia Wesleyan College, VA.

Geukensia demissa is an abundant filter feeder that may have important effects on nutrient cycling within East Coast salt marshes. This species is thought to interact mutualistically with salt marsh cordgrass (*S. alterniflora*), as nutrient cycling by mussels fertilizes the cordgrass, which provides attachment sites for mussels. We investigated phosphorus excretion and fecal deposition by *G. demissa* in the Lafayette River, Norfolk, VA, including how mussel mass and tidal immersion may impact rates of phosphorus cycling. Mussels were collected, cleaned, and placed in bags containing filtered estuarine water, which was later analyzed for PO₄ using the molybdenum blue technique. The results of the experiment showed a significant negative correlation between mussel dry mass and mass-specific phosphorus excretion and feces production. Lastly, we also observed a significant decrease in phosphorus release and feces production with increased time since tidal immersion.

P139 John N. McCall and D. C. Chance. Impacts of the BP oil spill on meiofaunal communities in an Alabama salt marsh. University of West Alabama, AL.

The Deepwater Horizon disaster of April 2010 impacted biological communities throughout the Gulf of Mexico. Among the communities impacted are the intertidal salt marsh systems of the northern Gulf, which are valuable as nursery grounds for many species of fish and invertebrates. The Deepwater Horizon event provides a unique opportunity to assess the manner in which salt marsh communities respond to stressors of this nature. We investigated meiofaunal communities in an intertidal salt marsh on Point aux Pins, AL, in Mississippi Sound. Data provided by the National Oceanographic and Atmospheric Association indicates that the eastern side of the Point was oiled following the BP event, while the western shoreline remained unaffected. We established sites in ecologically similar salt marsh creeks on the eastern and western sides of the Point. Monthly meiofaunal samples were collected from January through November of 2011. Meiofauna were identified to major taxon and enumerated. Nematodes and harpacticoid copepods were the dominant meiofauna. Densities of both were higher at the western site in January and February of 2011, before harpacticoid densities at the eastern site increased dramatically in March. Both nematodes and harpacticoid copepods demonstrated seasonal trends in abundance, rising to a peak in late Spring, then crashing in the late Summer and early Fall. While the two sites demonstrate differences in meiofaunal abundance, it is difficult to determine the degree to which these differences can be associated with oil spill impacts. Further work is planned to elucidate this connection.

P140 Archana Reddy S. Addla. Molecular characterization of root growth components in scarecrow regulated developmental pathway. Auburn University, AL.

The SCARECROW (SCR) gene, a transcription factor of GRAS protein is important for the root and shoot development in major plant species. The loss-of-function of *Scr* mutants exhibit short root, abnormal radial pattern in the root and shoot and shoot agravitropism. SCR is required in meristem maintenance for the continuous root growth and for the asymmetrical divisions in meristem to form normal cell layers in root and shoot. The application of induced mutagenesis, physical mapping and complementary genomic approaches was proposed to dissect the molecular and genetic basis of SCR regulated root developmental pathway. Significant functional interaction between SCR and its targets can be deduced from the phenotypic effects of *Scr* suppressor mutations. *scr1* mutant seeds were mutagenized to generate suppressor mutants. Three *Scr* root suppressors (*Srs*) that had increased root length (*Srs1*, 2 & 3) were isolated. All three lines exhibit abnormal radial pattern and shoot agravitropism same as *scr* mutant indicating that the root suppressors function in the meristem maintenance. Genetic analysis confirms that the *Srs* suppressors are recessive mutations in three different genes. The CAPS (cleavage amplified polymorphic markers) and SSLP (simple sequence length polymorphic) markers were used in the first-phase linkage mapping of two suppressors to identify the corresponding genes. I will present the phenotypic analysis of the three root growth suppressors as well as the mapping progress. The suppressor mutants identified

in this study represents the first step in elucidating the mechanisms of meristem maintenance for indeterminate root growth.

P142 Kayla M. Bingham, Caroline H. Wallace and Victoria L. Turgeon. 3-dimensional cell culture of motor neurons and Schwann cells. Furman University, SC.

The use of two-dimensional (2D) cell culture has been used for decades to investigate cell proliferation and survival in the nervous system; however, 2D culture does not provide optimal conditions to investigate the mechanisms by which Schwann cells myelinate axons. In order for a Schwann cell to entirely myelinate an axon, it must be able to extend its cytoplasm completely around the axon. Since a cultured axon is attached to the plastic surface of a typical 2D culture dish, the Schwann cell's cytoplasm does not have access to the basal portion of the axon and the process of myelination is halted. Therefore, to study the entire process, axons must be suspended in a gel matrix, mimicking the extracellular matrix of the organism, enabling the Schwann cell access to all sides of the axon. While some three-dimensional (3D) cultures systems exist, none allow for the compartmentalization of these cells in a way that mimics the organization of the vertebrate nervous system. The purpose of this study was to develop a protocol for a novel 3D cell culture system to allow for the co-culturing and proper compartmentalization of motor neurons and Schwann cells. Using rat tail type I collagen as the scaffold and a modified 3DKube® system which allows for perfusion flow, Schwann cells were shown to myelinate axons by 96 hours as confirmed by immunocytochemistry. The establishment of this protocol will now enable specific questions regarding myelination to be answered under conditions that more accurately model the vertebrate nervous system.

P143 Simone M. Dixon, Candice M. Meuleners and Victoria L. Turgeon. Activation of protease activated receptor-1 (PAR-1) decreases cytoskeletal organization in cultured oligodendrocytes. Furman University, SC.

Many cells of the nervous system express protease activated receptor-1 (PAR-1) on their plasma membranes. Activation of this receptor has been shown to decrease survival in these cells and recent evidence suggests that this cell death is linked to alterations in the cells' cytoskeletons. Oligodendrocytes rely on their cytoskeleton arrangement not only for their own survival, but also to extend their plasma membranes around nearby axons providing myelin. The insulation provided by myelin results in faster signal transduction between neurons and their targets and also allows for faster uptake of growth factors by the neurons, ultimately aiding the viability of the entire system. To determine how the oligodendrocyte cytoskeleton is altered, oligodendrocytes were examined following PAR-1 activation both *In vivo* and *In vitro* and compared to control groups. Following PAR-1 activation *In vivo* oligodendrocytes exhibited decreased processes with rounded soma unlike their control counterparts that exhibited several thickened, but shortened processes radiating out in multiple directions. Furthermore, preliminary *In vitro* immunocytochemistry results of stained actin microfilaments show that the PAR-1 treated group has a lower overall fluorescence. While additional data is need to confirm these results with statistical confidence, these studies do suggest that PAR-1 activation decreases cytoskeleton organization thus altering the overall morphology of oligodendrocytes.

P144 John A. Sullivan. Developmental effects of glucocorticoid prednisone on zebrafish (*Danio rerio*) embryogenesis. Furman University, SC.

Prednisone is an important steroid that is widely used for anti-inflammatory purposes, and is occasionally prescribed to pregnant mothers and young children. The phenotypic effects of glucocorticoid Prednisone on embryo development were studied in the zebrafish (*Danio rerio*) model system. Assays included one solvent control (dimethyl formamide) and three treatment groups of 1 mg/L, 10 mg/L, and 100 mg/L of Prednisone. Embryos were observed through microscope and development was documented photographically. Measurements were taken for alterations in head trunk angle (HTA), craniofacial

development, body size, somitogenesis, and for the presence of lesions. HTA was significantly greater in 100 mg/L group at 72 hours post fertilization (hpf), which was expected because similar glucocorticoids had this effect. Alterations in somitogenesis included significantly greater somite width and significantly smaller somite angle in 100 mg/L group at 72 hpf. No differences were observed in craniofacial development, body size, and there was no significant presence of lesions in treatment group. These findings were contrary to what has been observed with similar glucocorticoids. Future studies should address why Prednisone did not have these effects.

P145 **Tara L. Brown and Nancy L. Buschhaus.** The effect of varying sea water condition and temperature on survivability of sea urchin, *Lytechinus pictus*, embryos. University of Tennessee at Martin, TN.

Sea urchins are commonly used as models for studying developmental processes due to features like external fertilization, the ease of obtaining gametes, and the transparency of eggs and embryos. Development in the sea urchin proceeds from the fertilized egg to the larval stage in approximately 3 – 5 days. The planktonic embryos and larvae are susceptible to depredation by both micro- and macro-organisms and are affected by the physical state of the water in which they reside. We examined the survivability of cohorts of sea urchin, *Lytechinus pictus*, embryos from fertilization to pluteus larval stage under several water treatments (control, treated to remove macro-organisms, treated to remove micro-organisms, and treated to remove both) and under several temperature regimes that reflect fluctuating temperatures in intertidal zones and projected temperature increases due to global climate change. We found a significant effect of water treatment and a significant effect of temperature on the survivability of cohorts of sea urchin embryos.

P146 **Anna E. Coursey, Ayana Smith, Anna E. Henshaw, Madeline M. Olson, Virginia A. Young and Michael K. Moore.** Epizotic cyanobacteria associated with a neotropical harvestman (Opiliones, Sclerosomatidae) from Tobago. Mercer University, GA.

In this study, we describe experiments undertaken to identify microorganisms first observed on external surfaces of sclerosomatid harvestmen (*Prionostemma* sp.) collected in Tobago. In the field, we collected multiple adults that had blue films growing upon the dorsal surfaces of the carapace and abdominal scutum. Examination by light microscopy revealed dense clusters of what appeared to be blue-green algae arranged within small pits that cover the external surfaces of the carapace, abdominal scutum, and coxae. Genomic DNA was extracted from the films of multiple specimens and was subsequently used as a template to amplify a conserved intergenic spacer region within the phycocyanin locus by PCR. The presence of a 700 base pair PCR product in DNA from harvestmen that had the film but not in DNA from harvestmen lacking the film would confirm our hypothesis. Results of our genotyping will be presented. Importantly, data that support our hypothesis would represent only the third confirmed occurrence of epizotic cyanobacteria on Neotropical harvestmen and the first from outside of Central America.

P147 **William H. Dees¹, J. T. Guidry¹, Kaleigh A. Helo¹, Irvin J. Louque¹, Shreedu Pradhan¹, Omar E. Christian¹, Cecilia Richmond¹ and Jill Hightower².** Effects of plant and animal extracts on mosquitoes. ¹McNeese State University, LA, ²Calcasieu Parish Mosquito and Rodent Control Department, LA.

We evaluated the effects of plant and sponge extracts on mosquitoes, including oviposition preference and egg/larval survival. The organic extracts of plants and plant leaves, roots or fruit of *Artocarpus communis*, *Clusia rosea*, *Coccoloba* sp., *Datura* sp., *Hibiscus sabdariffa*, *Hypericum brachyphyllum* and *H. hypericoides*, and whole sponges were evaluated against *Aedes aegypti* mosquitoes. The crude methanolic or ethyl acetate extracts were added to distilled water and tested against mosquitoes. In oviposition experiments, *Clusia rosea* leaves extracted in ethyl acetate slightly attracted ovipositing

mosquitoes. Ethyl acetate extracts of *Hibiscus sabdariffa* and *Coccoloba* sp. showed slight repellency. Ethyl acetate extracts of *Hypericum hypericoides* and methanolic extracts of all plant materials strongly repelled ovipositing mosquitoes. In experiments on egg eclosion, mosquito larvae emerged earlier and in greater numbers in water with extracts (less sponge extracts) when compared with controls. Mortality was observed in three of the experimental studies. No mortality was noted in the controls.

P148 **Jacqueline N. Webb**. Homology of modified terminal setae and evolution of Family Buthidae (Scorpiones). Marshall University, WV.

Within the order Scorpiones, the largest and most widespread family is Buthidae, which comprises most medically important scorpion species. The phylogeny of Scorpiones and Buthidae have been matters of dispute among arachnologists for many years. Previous phylogenetic studies have relied heavily on microanatomical sensory setae (hairs) such as trichobothrial patterns and the constellation array. Grouped "spade-like" and "blade-like" derived setae found on the distal tip of the pedipalps of buthid scorpions have been observed under both light microscope and scanning electron microscope and analyzed to determine if the degree of modification follows previously suggested phylogenies for the family. As the behavior and sensory functions of scorpions have been used as models in the field of robotics, analysis of the function or functions of these sensory structures is warranted.

P149 **Julie A. Tierney¹, Barbara K. Reynolds¹ and Albert E. Mayfield²**. Impact of hemlock woolly adelgid and low doses of imidacloprid on radial growth of eastern hemlock. ¹University of North Carolina at Asheville, NC, ²USDA Forest Service, NC.

The hemlock woolly adelgid (*Adelges tsugae* Annad) is an exotic invasive insect that causes the decline and mortality of eastern hemlock (*Tsuga canadensis*), an ecologically important species in the eastern United States. Imidacloprid, a systemic insecticide, is routinely used to temporarily control *A. tsugae* populations on individual trees. In 2006, sixty infested *T. canadensis* were treated with 25%, 10%, or 0% of the label rate of imidacloprid via soil injection; half the trees in each treatment were also treated with fertilizer. To assess the impact of these treatments and adelgid infestation on hemlock radial growth, increment cores at breast height were extracted in September 2011 from all hemlocks and from 15 white pines (*Pinus strobus*) for comparison with a non-infested species. Tree ring widths were cross-dated and standardized by fitting a linear or negative exponential curve through the ring width series up to the first year of adelgid infestation (2004) and extrapolating forward to 2011. Three-year mean radial growth indices were compared in three time periods (2003-2005, 2006-2008, and 2009-2011) among treatment groups using repeated measures ANOVA. There was no significant difference in 3-year mean radial growth between fertilized and unfertilized treatment groups. White pine and hemlock 3-year mean radial growth indices did not differ until the 2009-2011 period, during which white pine radial growth was significantly greater than all hemlock treatments, and hemlocks treated with 25% label rate of imidacloprid produced significantly more radial growth than untreated (0% imidacloprid) hemlocks. Low dose treatments of imidacloprid may be effective in reducing growth impact of the hemlock woolly adelgid while reducing cost and environmental impact relative to full-dose treatments.

P150 **William H. Dees¹, Christopher J. Kirkhoff¹, Alan M. Shudes¹, Taylor P. Wood¹, Jessica C. Choate¹, Irvin J. Louque¹, J. T. Guidry¹ and Josh Hightower²**. Larval water mites parasitizing mosquitoes in southwest Louisiana. ¹McNeese State University, LA, ²Cameron Parish Mosquito Abatement, LA.

We report data from ongoing investigations of larval water mites (Acari: Hydrachnida) parasitizing field-collected mosquitoes from southwest Louisiana. In our first investigation conducted in September 2010 near a freshwater marsh in Moss Bluff, Louisiana, using

Centers for Disease Control light traps, we collected 1,014 mosquitoes representing five genera and nine species. Forty-five mites were found infesting 38 mosquitoes. The following mosquito species (with the estimated percent parasitized) were identified: *Aedes sollicitans* (11.1%), *Anopheles crucians* (1.7%), *Culex* spp. (including *Cx. erraticus*, *Cx. restuans*, and *Cx. salinarius*) (4.7%) and *Uranotaenia sapphirina* (3.1%). All mites, but one, were attached to either the thoracic or the abdominal regions. In this investigation, three mosquito species, *Ae. albopictus*, *An. quadrimaculatus* and *Psorophora columbiae*, were not parasitized by mites. In the second investigation, initiated in July 2011, we are investigating mites occurring on mosquitoes collected from saltwater, brackish and freshwater marshes. Ongoing analysis from trap collections in July and August 2011 suggests the presence of very few larval water mites on mosquitoes. More than 75,000 mosquitoes were collected from all three sites. However, to date, only 8 *Arrenurus* spp. and 2 unknown larval mites have been found exclusively infesting 10 *Ps. columbiae* mosquitoes. This is in contrast to the 2010 study in which no *Ps. columbiae* were infested. Since *Ps. columbiae* mosquitoes generally inhabit floodwater and since there has been no recent evidence of water mites in permanent habitats, we attribute the few parasitized mosquitoes to the current drought conditions occurring in south-central United States.

P151 **Ashton B. Arnold and Sarah M. Noble.** A survey of gastropods along the Mobile Bay causeway, south of the Mobile-Tensaw Delta. University of Mobile, AL.

Gastropods were collected along the shoreline on both sides of the Mobile Bay Causeway, south of the Mobile-Tensaw Delta. Samples were randomly collected by hand at ten sites. The sample locations have fine sediment and brackish water, a combination of freshwater from the Mobile and Tensaw Rivers and salt water from the Gulf of Mexico via Mobile Bay. Living specimens and empty shells were collected. This survey serves as a baseline for future studies of the gastropods in this area.

P152 **Victor R. Townsend and Maynard H. Schaus.** Comparative study of the reproductive anatomy of harvestmen (Arachnida, Opiliones) from the Cayo District, Belize, with additional novel observations regarding their natural history. Virginia Wesleyan College, VA.

The biology of Neotropical harvestmen (Arachnida, Opiliones) that occur in Central America is poorly known. In Belize, there are 28 known species of harvestmen, however there have been new studies of the natural history, taxonomy or morphology of these arachnids in over 30 years. In January 2012, we collected adults and nymphs of multiple species representing the families Cosmetidae and Sclerosomatidae from several sampling sites within the Cayo District. We dissected the penises of adult males and prepared them for examination with SEM. These specimens were sputter coated with gold and photographed with a Hitachi S3400N SEM. In addition to comparing reproductive anatomy, we also provide novel observations of microhabitat selection and feeding, as well as the first reports of the ecological interactions between Belizean harvestmen and ectoparasitic larval mites.

P153 **Robert W. Van Devender and Amy S. Van Devender.** Land snails of North Carolina. Part 2. Small species with low spires. the Euconuliidae, Discidae, Gastrodontidae, Zonitidae, Pristolomatidae, Punctidae, Strobilopsidae, and Valloniidae of North Carolina. Appalachian State University, NC.

P154 **Kinsey T. Skalican, Shannon M. Berardi and Zachary J. Loughman.** Life history of the crayfish *Cambarus chasmodactylus* from the central portion of the species range. West Liberty University, WV.

The life history of *Cambarus chasmodactylus* was studied in Anthony Creek, West Virginia from May through October 2011. Animals were collected monthly. Reproductive and molt states along with morphometrics were recorded for all individuals, after which the majority

of animals were returned to the stream. Monthly, 10-20 females along with any ovigerous individuals encountered carrying eggs/instars were vouchered to determine egg/instar complement number. Nonreproductive females were dissected in the laboratory to determine monthly gonadic development. Among adults two mass molts, one in May and another in September, occurred over the activity season. The majority of males molted from form I to form II in May and back to form I following the September molt. Females displayed active glair glands May to late June, with ovoposition occurring July into early August. Females carried instars September through the fall and possibly into winter. Ovigerous females averaged 168 eggs/instars. Egg/instar complements were positively correlated ($r^2 = 0.81$) to carapace length. Age histogram analysis indicated six size cohorts within the population with the largest individuals five years old or older.

P155 Andrew Dotson, Chris Murdock, Robert Carter and Benjie Blair. A method for detection of bacterial pathogens in ticks collected from Oak Mountain State Park, AL. Jacksonville State University, AL.

Dog ticks (*Dermacentor variabilis*) and lone star ticks (*Amblyomma americanum*) have been shown to be vectors of spotted fever group Rickettsiae (SFGR). The SFGR include *Rickettsia rickettsii*, causative agent of Rocky Mountain Spotted Fever, and *Rickettsia parkeri*, a newly identified pathogen. To determine the percentage of ticks with the spotted fever group Rickettsiae bacterium in their guts, ticks will be collected from Oak Mountain State Park, Alabama by the dragging method. This method consists of dragging a white flannel cloth along the forest floor and gathering all ticks caught on the cloth. Ticks will be preserved in alcohol, and the species, sex, and developmental stage determined in the lab. The ticks will then be processed and DNA isolated. Real-time ploymerase chain reaction (PCR) will use primers previously published to target *The R. rickettsii* citrate synthase gene, gltA.

P156 Lauren Timmons and R. B. Cromer. Association of white-tailed deer (*Odocoileus virginianus*) populations and deer ticks (*Ixodes scapularis*) in urban and rural settings in the Central Savannah River Area. Augusta State University, GA.

Deer ticks (*Ixodes scapularis*) are a common tick in the Central Savannah River Area (CSRA) of Georgia and South Carolina. This species is known to carry the bacterium *Borrelia burgdorferi* that causes Lyme disease. Lyme disease is a growing concern for individuals in the USA because it can cause rheumatoid arthritis and other illnesses. Research was conducted from August 2011 to December 2011 at Brick Pond Park, an urban park in North Augusta, SC, and at a rural area in Edgefield, SC to monitor deer and tick populations. Two motion detecting wildlife cameras were set up at each location to determine deer population activity. Photographs were viewed weekly to determine deer activity. The number of visits was recorded along with male to female ratios. Ticks were collected through a number of methods including tick dragging, dry ice tick trapping, and removing ticks off deer harvested by local hunters. White-tailed deer visits were greater at the Edgefield rural sight. No ticks were collected at the urban Brick Pond site, while thirty ticks were gathered from the rural Edgefield site. Further methods, including PCR, will be used to determine if these ticks have the bacterium associated with Lyme disease.

P157 Katelynn A. Monti and Abbie M. Tomba. Identification of trematodes using molecular techniques. University of Mary Washington, VA.

Trematodes are parasitic flatworms with complex lifecycles involving mollusk intermediate hosts and vertebrate definitive hosts. Trematodes are important to freshwater ecosystems because they have dramatic effects on the reproductive output and feeding of their snail intermediate hosts. Being able to accurately identify and understand the lifecycles of parasites is a key component to understanding their ecological effects. However, their larval stages are often cryptic and indistinguishable by morphological features alone. Thus, the goal of this project is to use molecular techniques to identify the larval stages by

matching them to adult parasites. To do this we collected two species of pleurocerid snails, *Elimia virginica* and *Leptoxis carinata*, as well as potential definitive host species of fish from the Little and Rappahannock Rivers in eastern Virginia. Fish were collected using a kick seine and then exposed to a lethal dose of MS-222. Fish and snails were preserved in 95 % ethanol, and dissected for parasites which were also preserved in 95 % ethanol. Parasites were lysed with Proteinase K and the internal transcribed spacer of the ribosomal DNA (rDNA) was amplified with PCR and sequenced. Snail parasite prevalence was 5% and 4% in the Rappahannock and the Little Rivers respectively. We have found four different taxa of parasites in snails including members of the families of Schistosomatidae and Opcoelidae. One species of trematode has also been isolated from the swallowtail shiner (*Notropis procyne*). We are continuing to extract parasites from fish and sequence rDNA to compare with sequences from larval parasites.

P158 Lindsey Childress and Riccardo Fiorillo. Trematode assemblage of aquatic snails in black Bayou Lake NWR in northeast Louisiana. University of Louisiana at Monroe, LA.

All digenetic trematodes have heteroxenous life cycles that include a mollusc, typically a snail, as a 1st intermediate host and 2 or 3 additional hosts. Our objective was to characterize the trematode assemblage of snails in Black Bayou Lake NWR near Monroe, Louisiana. Parasitized snails shed free swimming trematode larval stages called cercariae. In September 2010, we began collecting aquatic snails monthly from Black Bayou Lake NWR. Through April 2011, we collected and examined 4918 snails (3755 *Physa gyrina*, 902 *Micromenetus* sp., 219 *Pseudosuccinea* sp., 42 *Helisoma anceps*) for shedding cercariae. Overall, only 23 individuals, mostly *Physa gyrina*, were infected (< 0.5 %). We recovered 4 different types of cercariae: 2 furcocercous cercariae, 1 xiphidiocercaria (armatae type) and 1 monostome cercariae. Infected *Physa gyrina* (n = 20), *H. anceps* (n = 2), and *Micromenetus* (n = 1) were host to 3, 2 and 1 cercariae types, respectively. However, no single individual host was infected with more than one trematode species.

P159 Kimberly S. Holley¹, William Birkhead¹, Kevin Burgess¹ and Greg Moyer². Interspecific hybridization between a rare, endemic bass (*Micropterus cataractae*) and a more abundant, invasive bass (*M. punctulatus*). ¹Columbus State University, GA, ²U.S. FWS Warm Springs Fish Technology Center, GA.

When parental species differ in abundance, interspecific hybridization can lead to asymmetrical introgression. In this study, I determined the extent and apparent direction of hybridization between shoal bass (*Micropterus cataractae*), a rare endemic species to the Apalachicola drainage, and spotted bass (*M. punctulatus*), an introduced and more abundant species. Pelvic fin tissue (N = 130) was taken from bass species in the Chattahoochee River and analyzed for hybridization using 4 polymorphic microsatellite markers. The frequency of hybrids was 15.4% (N = 20), with hybrids having a significantly higher proportion of spotted alleles present. This suggests that asymmetrical introgression can be a potential threat to shoal bass populations.

P160 Katrina Morgan, Megan M. DeRocher and David M. Hollis. Isolation of plasticity related gene 1 (*prg-1*) in the brain of the adult bullfrog (*Lithobates catesbeianus*). Furman University, SC.

Plasticity related gene 1 (PRG-1) is a membrane-associated lipid phosphate phosphatase expressed specifically in neurons that facilitates axonal outgrowth during development. Studies on PRG-1 have thus far been limited to the mammalian central nervous system (CNS). To begin examining PRG-1 in anamniotic vertebrate CNS development, we attempted to isolate *Prg-1* from the brain of an amphibian, the bullfrog (*Lithobates catesbeianus*). Using degenerate primers we isolated a 322bp fragment which, based on sequence analysis using the Basic Local Alignment Search Tool (BLAST; predicted sequences filtered), showed highest homology (69% identity) to mammalian *PRG-1*, also

known as lipid phosphate phosphatase-related protein type 4 (*LPP4*; Accession # NM_001128199). At the protein level, the deduced amino acid sequence also showed highest homology to mammalian PRG-1 (64% identity; Accession #EHB07719). Preliminary studies from endpoint polymerase chain reactions (PCR) showed the expression of this gene in the brain tissue of adult bullfrogs (n = 3), but not in those of tadpoles (n = 6). Acquisition of the full-length sequence via Rapid Amplification of cDNA Ends (RACE) to obtain gene specific primers for Real-Time (RT) PCR will be used to verify this putative differential expression of *Prg-1* during amphibian brain development. Characterization of amphibian *Prg-1* would allow for future functional studies to understand its role in anamniotic brain development, as well as their capability for adult brain repair and regeneration.

P161 Ethan F. Milton, Jessica A. Barb, John M. Burke, Steven J. Knapp and Lisa A. Donovan. QTL analyses of drought resistance traits in *Helianthus* under well watered and drought conditions. University of Georgia, GA.

The aim of this study is to identify quantitative trait loci (QTL) underlying variation in traits associated with drought resistance within a BC1 interspecific mapping population of *Helianthus*. The mapping population used was devised from a cross between cultivated *Helianthus annuus* (accession NMS377) and its closely related wild relative *H. argophyllus* (accession ARG-1820), an annual that is proposed to be drought resistant based on its native habitat in coastal Texas and characteristic dense white leaf pubescence. In this study, individuals were grown under irrigated and non-irrigated field conditions and scored for a suite of 13 leaf and biomass traits. As expected, the non-irrigated plants had a smaller leaf area and more water-use efficient leaves (based on measurements of leaf carbon isotope discrimination, δC^{13}) than irrigated plants. For irrigated plants, preliminary QTL analyses detected QTL for specific leaf area, integrated WUE and the leaf reflectance parameter (NDVI). The QTL analyses for the non-irrigated plants are still being evaluated. The detection of QTL for drought related traits and presence of stability for these QTL across irrigated and non-irrigated environments may be informative for marker assisted breeding for greater drought resistance in cultivated *Helianthus*.

P162 Parth Patel and Clem Bell. Sequencing allelic series in coding and non-coding regions of the human genome. Mercer University, GA.

Single nucleotide polymorphisms (SNPS) were determined for allelic series in both a coding and a non-coding region in the Human genome. The allelic series for the coding regions was from the *PKU* (phenylketonuria) gene. Phenylketonuria, an autosomal recessive metabolic genetic disorder, is caused by the mutation in the gene for the phenylalanine hydroxylase enzyme. The phenylalanine hydroxylase enzyme is crucial in metabolizing the amino acid Phenylalanine to Tyrosine; thus the DNA sequence of this coding region should be fairly conserved. We also sequenced an allelic series from a non-coding region for comparison. Our non-coding sequence is from the *TPA-25* locus. *TPA-25* is a commonly used molecular marker that contains an *Alu* fragment; the *Alu* insert is found within the intron of the tissue plasminogen activator gene. We will compare the rates of transitions, transversions, and single base-pair additions or deletions in the coding region versus the non-coding region.

P163 Valarie A. Burnett. An immunohistochemical survey of cr+, pv+, and som+ interneuronal subtypes and their distribution in rat perirhinal cortex. Newberry College, SC.

Perirhinal cortex (PR) is critical in recognition memory and temporal lobe epilepsy (TLE), but little is known about the characteristics and distribution of its cell types. We previously reported the presence of three distinct subpopulations of interneurons, calretinin (CR+), parvalbumin (PV+), and somatostatin (SOM+)-positive cells, in rat perirhinal cortex. Most of these cells colocalized with GABA but not with one another. The majority of CR+ cells were located in cortical layer 2 (L2), whereas the PV+ and SOM+ cells were mainly found

in L5. The present study examined the morphological subtypes of these subpopulations and their distributions in rat PR. Two subtypes of CR+ cells were observed: small to medium multipolar cells of variable staining intensities and darkly stained bitufted and bipolar cells. PV+ cells were multipolar with fusiform or oval somata and included medium to large darkly stained cells and small to medium moderately stained cells. SOM+ cells were the most diverse. Three subtypes of SOM+ cells were characterized: medium to very large multipolar and bitufted cells with dark complete staining, small to medium multipolar and bitufted cells with moderate to dark staining of intracellular components and dendritic initial segments, and small to medium lightly stained cells. Oval, medium to dark, multipolar cells were the most prevalent CR+ subtype and occurred in L1-L6. Dark, oval cells were the most numerous PV+ subtype and were located in L2-L5. Medium to dark, small to medium cells were the most frequent SOM+ subtype and were observed in L2-L6.

P164 Ryan Wauford and Irma Santoro. Are combined synthetic food dyes mutagenic? Reinhardt University, GA.

Synthetic food dyes have been used in the processing of numerous foods which are consumed on a day-to-day basis. The FDA has banned many synthetic food dyes due to their carcinogenic effects; however some have been allowed to remain in foods. Recent studies have yielded varying results concerning the mutagenic potential of the remaining food dyes. However, these dyes have mostly been tested singularly, and do not account for possible synergistic effects. Therefore, the question arose: can the synergistic effects of synthetic food dyes found in foods elicit a mutagenic response in cells? *Saccharomyces cerevisiae* was used in a biological assay to test the mutagenic potential of synthetic food dyes used in the processing of Fruity Pebbles. The hypothesis for this experiment was that if synthetic food dyes had mutagenic potential, there would be an increased mutation rate at an altered lysine allele in *S. cerevisiae*. Dyes were abstracted from the fruity pebbles, sterilized, and added to liquid growth media. *S. cerevisiae* cells were incubated in the liquid media until stationary phase and then plated on two types of media; one containing all necessary growth factors, and one lacking lysine. After a three day incubation period, colonies were counted to obtain frequency and reversion rate. No substantial evidence was found at 5g fruity pebbles/mL dH₂O or 10g fruity pebbles/mL dH₂O. Future investigation will include a dose response curve until a mutagenic response is induced, or cell death occurs.

P165 Andrew R. Morris¹, Joann A. Conner² and Peggy Ozias-Akins². Efficient mapping of asgr-carrier chromosome transcripts in F1s using caps? ¹Abraham Baldwin Agricultural College, GA, ²University of Georgia, GA.

Apomixis is a form of asexual reproduction found in plants. The result of apomixis is offspring that are genetically identical from generation to generation to the maternal plant. Some plant species, such as *Pennisetum* and *Cenchrus*, reproduce using apospory. Apospory is a form of apomixis in which the development of an unreduced embryo sac is formed usually from a cell of the nucellus. The unreduced egg cell then forms an embryo without the need of fertilization by pollen. In *P. squamulatum*, apospory is controlled by a single dominant locus designated the Apospory-Specific Genomic Region (ASGR). It was possible to identify transcripts that were derived from the ASGR-carrier chromosome through comparative sequencing analysis and SCAR (Sequence characterized amplified regions) marker development of transcriptomes of an apomictic donor plant [*P. squamulatum*] and a backcross 8 (BC8) line containing only the ASGR-carrier chromosome. SCAR specificity was not preserved while mapping the SCARs to the ASGR using a F₁ segregating population containing many *P. squamulatum* chromosomes. The current strategy is to identify if CAPS (Cleaved Amplified Polymorphic Sequences) markers are better for mapping.

P166 Shawn Sparks and Roger Sauterer. Factors for optimizing 2-dimensional polyacrilimide gel electrophoresis. Jacksonville State University, AL.

2-Dimensional Gel Electrophoresis separates proteins by isoelectric point and molecular weight. Using a consistent protein sample, (30ug Bio-Rad E. coli proteins) we tested parameters to obtain optimal resolution in 2-D gels. Protein was diluted in IEF sample buffer, rehydrated on pH 4-7 IPG strips, ran using Invitrogen's Zoom IPG runner on 10% SDS-PAGE gels, and silver stained. We performed two trials per variable. Protein load (1.35ug; 9.45ug; 54ug; 209ug) showed 54ug as optimal while more streaking occurred using 209ug. SDS added to sample IEF buffer (0%; 0.02%; 0.1%; 0.3%) resulted in 0% and 0.02% SDS appearing similar while higher concentrations increased streaking. Ampholine concentrations (0.0%; 0.2%; 0.5%; 2.0%) resulted in minimal streaking using 0% ampholines, and increased streaking with higher ampholine concentrations. IEF run time was varied (10,700V-Hr; 4200V-hr (control); 1770V-Hr) using different ampholine concentrations. 0% ampholines showed consistent protein focusing at all run times. 10,700 V-hr runs showed poor focusing using 0.2% ampholines and little difference using 0.5 or 2% ampholines. 1770 V-hr run showed the best resolution using 0% ampholines and increased streaking at higher ampholine concentrations. Ampholine pH ranges (mix 1:2:2 of 3-10, 4-6, 5-8; 4-6 only; 3-10 only; 5-8 only) were tested resulting in 3-10 only and 5-8 only appearing similar while the mix and 4-6 appeared weakly focused. Detergents used in the sample buffer (2.0% SB3-10; 1.0% ASB-14; mix [1.0% ASB-14, 2.0% SB3-10, 4.0%CHAPS]; 4.0% CHAPS) appeared similar with the exception of 4.0% CHAPS which focused poorly.

P167 Garrett P. Tanner. Involvement of 5-lipoxygenase and estrogen in the production of 15-hete. Guilford College, NC.

There is evidence that females have greater incidence of developing Pulmonary hypertension (PH) than males. The long-term goal of this research is to examine how estrogen contributes to the production of 15-hydroxyeicosatetraenoic acid (15-HETE). The focus of this research is to understand the involvement of the 5-lipoxygenase (5-LO) in the production of 15-HETE. The main role of 5-LO is to produce 5-HETE, but when 5-LO is phosphorylated the functionality of 5-LO changes. Rabbit pulmonary arteries (PA) were used as a model for human pulmonary arteries. In the beginning of this research we determined how estrogen treatment influenced the production of 15-HETE. Our results from Liquid Chromatography–Mass Spectroscopy (LC-MS) showed an increase in 15-HETE and Western Blot results showed an increase in 15-LO expression. Treatment with estrogen also increased 5-LO expression but did not increase 5-HETE. In addition, the expression of phosphorylated 5-LO increased with treatment of estrogen; we hypothesized that this enzyme may have the functionality of producing 15-HETE instead of 5-HETE, which is done by its non-phosphorylated counterpart. Treating PA with a p38 kinase inhibitor (SB 203580), which was used to block phosphorylation of 5-LO, and evaluating with High Performance Liquid Chromatography (HPLC), we found that there was no affect on the production of 15-HETE. Further studies are needed to confirm the effectiveness of inhibitor. This research may lead to development of novel therapeutic agents that reduce 15-HETE synthesis to treat pulmonary arterial hypertension.

P168 Yoedono Sovyanhadi, Gabriel Spencer and Bakari Thomas. Vitamin C intake by prostate cancer cell line pc-3 as affected by glucose starvation and vitamin availability in the media. Oakwood University, AL.

The apoptotic-inducing potency of vitamin C against cancer cells has long been accepted. This project aims to find the highest level of vitamin C intake by PC-3 cells as influenced by glucose deprivation and vitamin availability. In the first study, glucose starvation of 0, 1, 2 and 3 hours were tested by incubating the cells in PBS. The PBS was changed with fresh medium before addition of 25, 50 and 75 µg/mL vitamin C. After 15 minutes incubation, the amount of vitamin left in the media was determined. The second study consisted of two steps. The first step was examining cell tolerance to concentrations of

vitamin C. In the second step, vitamin C at 50, 100, 150, 200 and 250 $\mu\text{g}/\text{mL}$ and glucose starvations of 0, 1, 2, and 3 hours were tested. In this case, the PBS was not changed with fresh medium. Results of these studies indicated that PC-3 cells more readily took glucose than vitamin C after starvation. When glucose was absent, the percent absorption of vitamin C ranged from 69 to 88%. The highest absorption of 198 $\mu\text{g}/\text{mL}$ occurred after 1 hour glucose deprivation and treatment of 250 $\mu\text{g}/\text{mL}$ vitamin C. Apparently, the active transport of the vitamin has reached saturation at this level. This treatment level will be further used for investigating intracellular Fenton's reaction by supplying ferrous-sulfate and catalase inhibitor. The overall study will significantly contribute to the development of effective therapeutic strategies for cancer as well as tissue-specific delivery of vitamin C-drug conjugates.

P169 **Jonathan A. Akin.** Endurance physiology and tail autotomy in the ground skink *Scincella lateralis*. Northwestern State University of Louisiana, LA.

Ground skinks are normally widely foraging predators in the leaf litter of woodlands throughout the Southeast but change their behavior to sit-and-wait foragers following tail autotomy. In this study, the endurance ability of lizards was measured in an artificial racetrack both before and after tail autotomy. In addition, flow respirometry was employed to determine respiratory quotient differences between the tailed and tailless individuals.

P170 **Susan L. Caster and Betsie Rothermel.** First survey of gopher tortoises and their commensals in an isolated Florida scrub habitat surrounded by cattle pasture. Archbold Biological Station, FL.

Under the State of Florida's management plan for gopher tortoises (*Gopherus polyphemus*), cattle pastures are sometimes used as recipient sites for relocated tortoises, but little is known about the ability of such disturbed habitats to support tortoise populations. Our objective was to describe the demographics of a natural population of tortoises on the Archbold Reserve in a working beef cow pasture for comparison with better-studied populations in undisturbed habitats. The pasture includes xeric scrub habitat as well as areas of hydric soils. Using standard survey techniques, we located, measured, and classified the activity status (active, maintained, unmaintained and abandoned) of > 400 burrows. We also monitored 60 randomly selected active burrows with wildlife cameras in 3-day rotations, recording 363 30-second video clips of gopher tortoises and 588 clips of other vertebrate animals at burrow entrances. Burrow density in the whole study area was 3.11 burrows/ha; in the scrub habitat alone it was 13.45 (11.45 adult only) burrows/ha. These densities were much higher than predicted from burrow densities in undisturbed scrub. Size of burrows was unimodally distributed, with 57% larger than 31 cm and less than 15% smaller than 21 cm, indicating a potential lack of recruitment. Gopher tortoise activity levels were not significantly different in the different habitats. The three most frequently recorded vertebrates at burrow entrances were mice (Family Cricetidae), eastern cottontail rabbits (*Sylvilagus floridanus*) and spotted skunks (*Spilogale putorius*). We recommend further research to determine the suitability of grazed pasture as tortoise habitat.

P171 **Leslie Ouy and Michael K. Moore.** Gradient adaptations in anuran larvae: an Akaike information approach. Mercer University, GA.

Changes in biotic and abiotic factors that occur across environmental gradients are often correlated with alterations in animal distributions. Species composition of larval anuran assemblages vary primarily along gradients of biotic (e.g., predator distribution) and physical factors, such as temperature and oxygen levels, that vary within (or between) pond habitats. In the lab we tested the behavioral responses of tadpoles of the cricket frog (*Acris crepitans*) to altered temperature and oxygen conditions. We then examined the distribution of larvae in the field to determine the factors most important in influencing habitat choice within a pond. Measured variables included abiotic conditions (dissolved oxygen concentration DO, temperature, water depth), vegetative structure, predator type,

and predator abundance as distributed along a gradient established perpendicular to the shoreline. In the lab, *Acris* tadpoles were very tolerant of low oxygen and high temperature conditions. In the field tadpoles showed significant patterns of habitat preference along the gradient. In general, larvae were limited to shallow, warmer habitats with lower oxygen content and fewer predators. The best fit AIC model identified DO, temperature and % vegetative cover as the factors determining distribution of *Acris* in the field. Tadpoles of *Acris* crepitans appear to be 'stress specialists' and are well adapted to microhabitats unused by other anuran species in these communities.

P172 **Elliott J. Diggs¹, Yong Wang¹ and William B. Sutton²**. Habitat association, use, and response to prescribed burning and thinning in pine-hardwood forests between two snake species in northwestern Alabama. ¹Alabama A&M University, AL, ²University of Tennessee Knoxville, TN.

Black kingsnakes (*Lampropeltis nigra*) feed on a diverse array of animals, including copperheads (*Agkistrodon contortrix*). Little is known about the relationships between these two snake species regarding their associations in habitat use, movement, predator-prey relationships, and effects of habitat modification due to forest management practices. A study will be conducted to identify the home range and microhabitat features of the two species. Interests include testing the temporal and spatial correlation of home range and habitat features between these two species and examine if there is a positive predator-prey relationship between the two species. Also, examine how forest management practices including logging and prescribed fires affect the habitat use and home range of the two species and their relationships regarding these aspects. The study will be conducted in the Bankhead National Forest along the southern terminus of the highly dissected portion of the Southern Cumberland Plateau in Lawrence, Winston, and Franklin counties of northwestern Alabama, U.S.A, where both species are common. Snakes will be captured using drift fence arrays equipped with funnel traps from March to November in 2012-2013. Adults of both species will be implanted with radio transmitters for a total 20 snakes per season. The snakes will be located every 2-3 days, and locality will be recorded using a handheld Global Position System. Home range will estimated and habitat features will be quantified.

P173 **Padraic T. Conner¹, Yong Wang¹ and Callie J. Schweitzer²**. Herpetofaunal and small mammal response to stored carbon regimes on the Cumberland Plateau. ¹Alabama A&M University, AL, ²USDA Forest Service.

Energy policies in developed nations are placing greater importance on plant based bio-fuels to supplement fossil fuel demands and reduce crude oil dependence. As a result, intensive biomass production will be needed to meet these demands. In addition, carbon sequestration through forestry is gaining increased attention. This has lead to a greater interest in carbon production and storage potential in native forests. There has been little research examining herpetofaunal and small mammal response to stored carbon regimes. The study area is located on the mid-Cumberland Plateau in northern Grundy County, Tennessee. The study is being conducted in conjunction with a USDA Forest Service study examining oak regeneration techniques. The study uses a randomized complete block design with three treatments (shelterwood, oak-shelterwood, and control). Each treatment has been replicated five times with treatment units measuring approximately 5 hectares. Utilizing drift fence arrays and Sherman live traps, a population of herpetofauna and small mammals were sampled to determine differences in abundance, diversity, and makeup in 2011 and will be surveyed again in 2012. Vegetation surveys were conducted in 2011 will be conducted in 2012 to determine the ratio of carbon stored in: overstory, midstory, understory, litter, and coarse woody debris. ANOVA will be used to assess wildlife response to different ratios of stored carbon.

- P174 **Megan A. Barbour and Carlos D. Camp.** Morphological differences in larvae of two cryptic species of dusky salamander (Genus *Desmognathus*). Piedmont College, GA.

Cryptic species are those that are nearly indiscernible morphologically. Cryptic species, particularly those that are sympatric, can be problematic for investigators requiring accurate species identification. Many cryptic forms, however, are distinguishable through morphometric analysis. The black-bellied salamander (*Desmognathus quadramaculatus*) and the dwarf black-bellied salamander (*D. folkertsii*) are cryptic members of the family Plethodontidae and are found sympatrically across most of their respective ranges in the mountains of northeastern Georgia. Although the two species closely resemble each other, adults are distinguishable morphometrically as well as by size and subtleties of color pattern. The intent of this project was to test for such differences in the larval stages. We collected specimens from two allopatric sites, i.e., where only one of these species occurs; both sites are located in Stephens County Georgia. We measured 21 morphological variables and analyzed species differences using principle-components analysis. In addition we tested for differences in mean body size, and we classified the tail color of each specimen quantitatively with a color chart and tested for differences using nonparametric analyses. Principal components dominated by digit length, head width, and head height were significantly different between the two species. Moreover, larval *D. quadramaculatus* had significantly larger mean body sizes, and larger larvae had significantly redder tails than did similar-sized larvae of *D. folkertsii*. These distinctive features may prove useful in distinguishing the two species in studies of larval communities in which they both reside.

- P175 **Zach I. Felix.** Morphological variation within the *Plethodon wehrlei* group: preliminary findings. Reinhardt University, GA.

The *Plethodon wehrlei* group includes both the Wehrle's salamander (*P. wehrlei*) and the Cow Knob salamander (*P. punctatus*), both of which are distributed in the Appalachian Mountains. A thorough investigation of morphological variation within this group has not been completed despite evidence that such variation exists. Various populations, including the yellow-spotted variant from Tennessee, Kentucky, and West Virginia as well as two groups from Virginia that were formerly raised to the level of biological species, appear to exhibit unique and distinct morphological characters. Multivariate statistical techniques are increasingly used to detect subtle and consistent inter-population differences within seemingly identical salamander species. I measured a series of morphological characters on > 150 museum specimens of the two species. I used multivariate statistical methods to compare the size and shape between the two species and among populations of *P. wehrlei*. These comparisons were made in light of preliminary phylogenetic data on the interrelatedness of various populations. Interestingly, significant variation existed among populations of the Wehrle's salamander; these differences rivaled the differences between the two species in some cases. These data will add to our understanding of the classification and evolution of these interesting species.

- P176 **Joel A. Borden¹, Gabriel J. Langford², David H. Nelson¹ and Clinton S. Major¹.** Observed variability in herpetofauna of the Mobile-Tensaw Delta, Alabama. ¹University of South Alabama, AL, ²Florida Southern College, FL.

A herpetological field survey was conducted from 6/2003 - 10/2003 and 6/2004 - 2/2005 within the Mobile-Tensaw Delta (MTD) located in Mobile and Baldwin Counties, Alabama. Sampling techniques included minnow traps, hoop traps, dipnets, hand captures, visual surveys, cryptozoan (cover) boards, drift fences with attached funnel traps, anuran vocalization, and PVC refugia (for treefrogs). A total of 40 species were encountered; 15 amphibians (N=1945) and 25 reptiles (N=913). Bronze frogs (*Lithobates clamitans*) and Bullfrogs (*L. catesbeiana*) were the most abundant amphibians, 42% and 28%, respectively. The most frequently encountered reptiles were Eastern ribbon snakes (*Thamnophis sauritis*) and Ground skinks (*Scincella lateralis*), 24% and 17%, respectively.

There was a major decline in catch per unit effort (CPUE) between years with amphibian captures declining from 1.731 to 0.163 CPUE (90.5%) and reptiles from 0.442 to 0.186 CPUE (42.1%). Overall, herpetofaunal captures were down from 2.174 to 0.350 CPUE (84%). Total numbers of treefrogs (*Hyla sp.*), snakes, and lizards increased from 2003 to 2004/2005 primarily due to the addition of drift fences with surface funnels as well as an overall increase in trap numbers. The MTD is a dynamic ecosystem that undergoes intense and prolonged flooding events that may vary greatly between seasons and years. The dramatic shifts in abundance observed from 2003 to 2005 may be the result of this variation in flood cycles on the herpetofaunal community. These changes in abundance lead to swings in annual reproductive rate, especially in amphibians, that may affect overall trophic structure within the ecosystem.

P177 Josh Hulsey, Robert Carter and Mark Meade. Fish assemblages in headwater streams of the upper Tallapoosa River System. Jacksonville State University, AL. The fish fauna of the headwaters of the Tallapoosa River drainage is poorly documented and may support a number of threatened or endangered fish. First order and second order streams of the Tallapoosa system, in particular those streams on the Southeastern edge of the Talladega District of the Talladega National Forest, were surveyed to determine the fish species present. Typical species encountered included those tolerable of perennial headwater streams such as the green sunfish, *Lepomis cyanellus*, the creek chub, *Semotilus atromaculatus*, and the largescale stoneroller, *Campostoma oligolepis*. Species of concern to state environmentalists also encountered included the Tallapoosa darter, *Etheostoma tallapoosae*, the muscadine darter, *Percina smithvanizi*, and the Tallapoosa sculpin, *Cottus tallapoosae*. We are continuing surveys focusing on documenting communities and sites in the region with potential habitat for vulnerable species.

P178 Lynelle T. Pompey. Identification of the genes needed for antibiotic production in a bacillus isolate. Claflin University, SC. Antibiotics, compounds that inhibit the growth of bacteria, are powerful medicines that fight bacterial infections. Many pathogens such as *Staphylococcus aureus* and *Pseudomonas aeruginosa* are the cause of community and hospital acquired infections. Over the years, these pathogens have developed resistance to antimicrobial agents. As such antibiotic resistance has created a need for research on new emergent antibiotics. In our laboratory a *Bacillus* isolate was identified that produced an antibiotic. The purpose of this research was to identify the genes needed for antibiotic production. The approach taken involves testing the antibacterial activity of *Escherichia Coli* transformed with a cosmid library of the *Bacillus* genomic DNA. The *Bacillus* genomic DNA was isolated and end-repaired. The DNA was then ligated into cosmid pWEB TNC vector (Epicentre) and packaged into lambda phage. The phage was then used to infect *E. coli* which was plated on LB agar containing ampicillin. The titer of the cosmid library was 600 cfu/ml with an estimated total cfu of 300. Lambda phage containing the pWEB TNC vector ligated to the control DNA supplied in the kit had a titer $> 5 \times 10^4$ cfu/ml. Assuming that the genome of the *Bacillus* isolate is similar in size to *Bacillus Subtilis*, 480 colonies will be needed to have a representative library. A new cosmid library is being made with protocol modifications to increase the titer. *E. coli* carrying the cosmids will be screened for antibiotic production.

P179 Pearl R. Fernandes, Jeffrey Long, Michelle Forehand and Toby Shuler. Taking science from the laboratory to the community. University of South Carolina Sumter, SC. The increasing frequency of microbial resistance to antibiotics is of great concern to both medical providers and the general public. *Staphylococcus aureus* is a bacteria, often referred to as "Staph" and commonly found on the skin and in the nose of healthy people. Methicillin-resistant. *Staphylococcus aureus* (MRSA) is a strain of Staph that has developed resistance to β -lactam antibiotics and cephalosporins. At-risk populations include children, college students living in dormitories, and athletes. Poor sanitation and

hygiene habits increase the risk for MRSA. Since there have been cases of MRSA in schools and hospitals in Sumter County where the University of South Carolina Sumter is located, the objectives of the present study were to (1) isolate MRSA from various sites on the USC Sumter campus; (2) identify MRSA using standard microbiology laboratory protocols; and (3) conduct a public health intervention campaign on the campus and in the community. Swabs were collected from campus computers, snack machines, and gym equipment and tests for MRSA conducted. Our results indicated that 8 out of 75 (9.4%) samples from the computer lab, and 11 out of 54 (23.8%) samples from the snack machines tested positive for MRSA. None (0%) tested positive from the gym. Results from our public health intervention campaign indicated that educating the students and the community on proper hand hygiene and sanitation is vital to the health of the campus and community.

P180 **Reid D. Brown¹, Marirosa Molina², Adelumola Oladeinde¹, Tommy Bohrmann², Christopher Fitzgerald¹, Greg Myrthil³ and Kelvin Wong².** Water quality response to changes in agricultural land use practices at headwater streams in Georgia. ¹SSA contractor to the USEPA, ²USEPA, ³University of Georgia, GA.

Poorly managed agricultural watersheds may be one of the most important contributors to high levels of bacterial and sediment loadings in surface waters. We investigated two cattle farms with differing management schemes to compare how physicochemical and meteorological parameters influence contaminant loadings in headwater streams. Farm A employs a high-intensity cattle rotation with intermittent direct stream contact. Farm B allows unrestricted access to the stream. Rain event and biweekly baseflow samples were collected along the stream for each farm. Samples were analyzed for *E. coli*, Enterococci, total suspended solids (TSS) and turbidity. Farm B had significantly higher base flow loading rates for enterococci ($p=0.003$), *E. coli* ($p=0.001$) and TSS ($p=0.018$), as well as significantly higher storm flow loading rates for enterococci ($p=0.035$). At Farm A, TSS positively correlated with turbidity ($R^2=0.80$), *E. coli* ($R^2=0.47$) and enterococci ($R^2=0.46$). In Farm B, a positive correlation was only observed between TSS and turbidity ($R^2=0.69$), despite the strong correlation observed between *E. coli* and enterococci in Farms A ($R^2=0.58$) and B ($R^2=0.88$). Our results suggest that the difference in management practices studied here does not alter the relationship between TSS and turbidity, but may have an effect on the relationship between sediment and microbial contaminants. Rain intensity was found to strongly correlate with all contaminants, while a weaker correlation was observed with total amount of storm rainfall. Additional multiple regression analysis will be conducted using real-time weather data to construct a model aiming to predict the concentrations of contaminants in stream water.

P181 **Jessica A. Fuller.** Bacteria associated with agricultural industry waste products pre- and post-exposure to mercury. Claflin University, SC.

Mercury is a highly toxic element that has no known biological role, but is considered one of the most hazardous waste contaminants. The toxic substance is commonly found in both aqueous and sediment environments as a result of waste produced from contaminated industrial activities. Because mercury is persistent in the environment, it is imperative to explore remedial methods that would lower the toxicity contaminating the environment. Bacterial remediation strategies have been investigated as a method towards reducing toxic levels of mercury. Bacteria associated with soybean hulls and rice hulls pre and post mercury treatment were isolated in pure culture to identify the genera and species. A total of 32 and 27 isolates were collected from soy hulls pre and post mercury exposure, respectively. PCR was successfully performed on 34 of the isolates using the universal primer pairs 16sFBAC/16sRBAC (1466bp in size) and the 530F/1392R (862bp in size). Amplification results showed that the primer pairs amplified the correct DNA fragment sizes from the unknown bacterial isolate. DNA sequencing was performed on the tested isolates using the Big Dye Terminator V3.1 cycle sequencing kit using an

Applied Biosystems 3100 genetic analyzer. Sequence results will be used to perform a BLAST search at the National Center for Biotechnology Institute information database to determine the genera and species of the bacteria. After determining the genera and species of the unknown bacteria, an experiment will be developed to determine the ability of the individual isolates to biodegrade mercury.

P182 Ezinne Okpan. Isolation and identification of bacteria associated with highly characterized peats pre- and post- chromium (vi) exposure. Claflin University, SC.

Heavy metal contamination imposes stress on organisms and their presence poses environmental and disposal problems due to their non-degradable nature. Chromium is known for its high toxicity and has been connected to major health hazards. Bioremediation is an evolving alternative that offers the possibility to destroy toxic pollutants using natural biological activity. The objective of this project was to identify microbes that are associated with highly characterized peats that may be useful in bioremediation of chromium. Peats were obtained from the Okefenokee swamp in Georgia, the Loxahatchee swamp trail in the northern everglades in Florida, and from a large sphagnum-filled peatland in Maine. Bacteria were cultured from the peat samples before and after exposure to chromium (VI). The 16s rRNA gene was amplified by colony PCR and sequenced. BLAST database comparisons showed that of the 52 isolates from the pre-chromium treatment of the peats, 24 belonged to the genus *Bacillus*, 9 to *Lysinbacillus*, 6 to *Paenibacillus*, 3 to *Rhodococcus*, 2 to *Brevibacillus* and *Acidovorax* respectively and 1 each to *Cohnella*, *Erwinia*, *Streptomyces* and *Pseudomonas*. No significant similarity was found for 2 isolates. For the 34 bacterial isolates from post-chromium treatment of the peats, 12 belonged to the genus *Paenibacillus*, 3 to *Bacillus* and 1 to *Micromonospora*. No significant similarity was found for 18 isolates. The isolates with no database matches were mainly due to poor sequence quality. These bacteria that survived chromium exposure may have the potential to biotransform chromium and, hence, may be useful in bioremediation of this pollutant.

P183 Meghan M. Gawne, Cursty Sexton, Jazmin Thrash and Dinene L. Crater. Characterization of MECA in MRSA isolates from High Point University students. High Point University, NC.

Staphylococcus aureus is a bacterium naturally found all over the human body. It is usually harmless, but can be treated with antibiotics if an infection occurs. In recent years, scientists have found several strains of *S. aureus* that are resistant to common antibiotics, termed Methicillin-resistant *Staphylococcus aureus* (MRSA). The first objective of this study was to determine the prevalence of MRSA in High Point University students. To accomplish this, we took nasal samples from 600 students and grew what we collected on mannitol salt agar (MSA) plates, a selective media that differentiates for *S. aureus*. Colonies were isolated from MSA positive plates, and were then grown in the presence of oxacillin antibiotic discs (1 µg). We found that 3.8% of our total samples (23 of the 600) continued to grow in the presence of the antibiotic, suggesting that these staphylococcal strains are MRSA. Future directions will proceed with molecular testing to investigate whether each MRSA strain is either Healthcare-Associated (HA-MRSA) or Community-Associated (CA-MRSA). We will amplify *MecA* (a specific gene in MRSA that blocks the activity of beta-lactam antibiotics) using polymerase chain reaction (PCR) techniques, and compare the *MecA* sequences to the *MecA* database to determine if each strain is HA- or CA-MRSA. Finally, we will compare our end results with the statistical data we collected from each student to look for correlations, such as students with HA-MRSA who may have recently been hospitalized or students with CA-MRSA that may work out in the same campus facilities.

- P184 **Alexandra Proctor, Sara Shelton, Tiffany Cathey, H. D. Wilkins and Linda K. Husmann.** Characterization of a novel *Clostridium* species isolated from the cloaca of the yellow-bellied sapsucker. The University of Tennessee at Martin, TN.

During the winter, Yellow-bellied Sapsuckers (*Sphyrapicus varius*) excavate sap wells in trees, where they ingest phloem, the tissue located beneath the bark that is responsible for sugar transport. Since trees are dormant, there is very little movement of sugars, suggesting that the sapsuckers are consuming plant material that is low in sugars, but rich in cellulose, a complex carbohydrate that is generally indigestible by vertebrates. We hypothesize that Yellow-bellied Sapsuckers carry bacteria in their digestive tract that break down cellulose, releasing sugars that can then be used for nutritional gain. To determine what species are present in the gut of a sapsucker, the cloaca of a window-killed sapsucker was cultured on a differential media to screen for bacteria capable of degrading cellulose. Forty-three isolates exhibiting carboxymethylcellulase activity were obtained representing a minimum of five different species. Preliminary sequencing of the 16S rRNA genes from the representative isolates of these species indicates that one is a *Clostridium* species exhibiting $\leq 97\%$ similarity to known organisms in databases. This isolate is an aerotolerant, gram-variable, endospore-forming, alpha-hemolytic rod. Taken together, the results of biochemical screening and genetic sequencing indicate that this isolate represents a novel organism distinct from previously described aerotolerant species of the genus *Clostridium*.

- P185 **Tara K. Grayson and Brian S. Burnes.** Commensal bacteria on the eyes of college student contact wearers. The University of West Alabama, AL.

Bacterial loads are known to exist on human eyes, but how much? What kind of bacteria actually grow on a human eyeball? These are some of the questions that motivated this research. I conducted a five week study in which I collected weekly swabs from the right eye of eight college students. The eight students included four contact wearers and four non-contact wearers: two males and two females for each category. Each swab was streaked on a petri dish which was then incubated at 30°C. After incubation, I counted all the different bacterial colonies on each student's petri dish for that week and recorded the data. Each week, in addition to having their eye swabbed, the students completed a stress test to determine if stress levels are correlated with bacterial growth. The potential roles of temperature and precipitation as major factors determining bacterial growth were also examined. Over the course of the five weeks, as the temperature continually dropped and precipitation increased the number of commensal bacteria increased. The bacterial loads ranged over two orders of magnitude between subjects. Molecular identification of the bacterial colonies is in progress.

- P186 **Robert D. Perry and Mark E. Christensen.** DNA transformation in an aquatic environment using *Acinetobacter calcoaceticus*. Georgetown College, KY.

The nature of DNA transformation among bacteria in natural freshwater environments is poorly understood. An experimental transformation system was designed that is aimed at characterizing baseline parameters of transformation in freshwater using a defined bacterial species, *Acinetobacter calcoaceticus*, known to readily undergo transformation on solid substrates under natural conditions. Freshwater samples from Elkhorn Creek in Scott County, Kentucky, were collected in early fall 2011 and sterilized. Transformations were set up using the sterile creek water, together with a defined concentration of live streptomycin-sensitive (str^s) *A. calcoaceticus* cells and a DNA extract prepared from killed streptomycin-resistant (str^r) *A. calcoaceticus*. Controls with live cells alone or DNA extract alone were set up in parallel. All tubes were incubated for up to 10 days at room temperature with constant agitation. At various times, aliquots were withdrawn and plated on brain heart infusion (BHI) agar or BHI agar containing streptomycin. Results showed that the live *A. calcoaceticus* str^s cells are readily transformed with the DNA carrying the str^r marker under the conditions used. The amount of transformation observed reached a

peak level at about four days of incubation. No str^r colonies were observed on the control plates. These findings show that transformation of *A. calcoaceticus* can readily occur in the laboratory while being agitated under dilute conditions mimicking the creek water environment. Future experiments will study transformation in unsterilized creek water to determine the impact of the presence of other bacterial species.

P187 Brian Z. Hedges, Andrew J. Jajack, Patrick M. Tomko and Jay A. Yoder. Description of preventive methods for controlling mold allergy and asthma associated with keeping Madagascar hissing cockroaches as pets and in educational settings. Wittenberg University, OH.

Children, teachers, zookeepers, and pet owners who handle hissing cockroaches, *Gromphadorhina Portentosa*, are vulnerable to developing severe allergies from medically-significant molds found on these insects that could lead to anaphylactic shock and asthma. Repeated exposure may lead to watery eyes, runny nose, and difficulty breathing as a result of inhaling mold spores that are associated with these cockroaches and their cages. By imbedding cockroaches in various agar media and subculturing hyphal tips, we examined the impact of providing different amounts of food to the cockroach, and the impact of a non-parasitic mite (*Gromphadorholaelaps Schaeferi*), which lives on these cockroaches and participates in a cleaning symbiosis, on the amounts and kinds of molds that these cockroaches carry. Results showed a high abundance of mitosporic fungi, *Alternaria* sp., *Aspergillus Flavus*, *Aspergillus Niger*, *Cladosporium* sp., *Pencillium* sp., *Trichoderma* sp., and zygomycetes, *Mucor* sp., *Rhizopus* sp. on untreated cockroaches. Mite infestations, up to 20 mites per cockroach, reduced the number of these cockroach body surface molds by nearly one-half. Depriving cockroaches of food suppressed mold levels by nearly one-third and, importantly, caused a shift in fungal composition to strains that are less allergenic; i.e., less *Rhizopus* sp. The combination of having mites plus limiting food reduced cockroach surface molds by 65%. Because of the risk associated with handling these cockroaches, it is a point of public awareness that this risk for mold allergy to hissing cockroaches may be reduced by proper hygiene, hand washing, maintaining mite infestations on cockroaches, and feeding cockroaches less frequently.

P188 Rachelle Falk and David R. Wessner. Investigating the cytotoxic and antiviral properties of atriazolenucleoside analog. Davidson College, NC.

Over the last twenty-five years, several nucleoside analogs have been approved for use as antiviral drugs. These medications include antiretroviral drugs like zidovudine (AZT) and didanosine (ddI). These drugs all function by interfering with normal viral replication, thereby limiting the signs and symptoms of disease. While nucleoside analogs have been successfully used in the treatment of HIV/AIDS, their cytotoxic side effects and the development of viral resistance to these drugs make the development of additional nucleoside analogs imperative. Recently, collaborators in the Department of Chemistry at Davidson College have synthesized several triazole compounds that may function as inhibitory nucleoside analogs. One of these compounds was tested for its cytotoxicity on mouse L929 fibroblast cells using neutral red and LDH assays. An immunofluorescence assay was used to determine the compound's relative effect on the replication of five different reovirus variants. While the drug did not exhibit any cytotoxicity, it also did not significantly reduce reovirus replication.

P189 Amelia Morgan, Zak Kronquist and Dinene L. Crater. MRSA in the gym: do common cleaning supplies eliminate MRSA from standard work-out equipment at High Point University? High Point University, NC.

Methicillin resistant *Staphylococcus aureus* (MRSA) is an extremely dangerous strain of bacteria due to its acquired antibiotic resistance. Because it is able to spread so quickly and readily, MRSA is especially threatening to hospitals and community centers such as schools and universities. The first goal of this study was to sample and identify the

prevalence of MRSA on the High Point University (HPU) campus. Six hundred students were randomly sampled by swabbing the lining of their nasal cavity. Samples were inoculated onto Mannitol Salt Agar (MSA) plates and subsequently tested using antibiotic disks (oxicillin, 1 µg) to test their resistance. Of the 600 students sampled, 121 students tested positive for *S. aureus* (20%), however, only 23 of those 121 (19%) samples were methicillin-resistant. To summarize, approximately 3.8% of the sample population was MRSA-positive. Since the CDC (www.cdc.gov) states that 29% of the US is infected with *S. aureus*, with 1.5% being MRSA positive, HPU has a higher prevalence rate of MRSA than the national average. The second part of the study will focus on the prevention of MRSA at HPU. Since the majority of the 23 students who provided MRSA strains were either varsity athletes or worked out at campus facilities, we will focus on sampling common gym surfaces to see if MRSA can colonize such surfaces. Commercial cleaning supplies will be tested to determine their effectiveness in killing MRSA on the infected surfaces in the laboratory environment.

P190 **Barbara L. Biebinger and Christi L. Magrath.** The impacts of wastewater treatment and antimicrobial agents on *Saccharomyces cerevisiae*, a comparative analysis. Troy University, AL.

Within the last few years, research has indicated the prevalence of antibiotic resistant microbes in wastewater treatment plants or in the receiving bodies of water, but studies have not been conducted simultaneously that include information of the prevalence of antibiotic resistant microbes in both wastewater treatment plants and receiving bodies of water. Previous research has shown that the *Saccharomyces* Genome Deletion Strains may be useful in identification of potential antimicrobial compounds' mechanisms of action and indirect impacts on basic molecular functions. Preliminary analysis of the deletion strains sensitivity to wastewater exposure has indicated either increased or decreased drug response, increased or altered stress response, or other factors that may indicate altered drug response (such as belonging to the gene ontology functional group "response to chemical stimulus"). This research includes analysis of the deletion strains' growth in influent, effluent, upstream, downstream, and other locations near the Troy Wastewater Treatment Plant (WWTP) in Troy, AL (a secondary level treatment facility) and Walnut Creek (moderately impaired). A chemical analysis and assessment of the effects on antimicrobial sensitivity patterns in *S. cerevisiae* is being completed. Therefore, sample collection and chemical analysis, followed by an environmental sensitivity mapping of the waters flowing into and through the WWTP, will enable a thorough assessment of a simple biological community.

P191 **Yin Gu, Marirosa Molina, Tommy Bohrmann, Mike Cyterski, Tom Purucker, Gene Whelan.** Estimation of decay rates for fecal indicator bacteria and bacterial pathogens in agricultural field-applied manure. US Environmental Protection Agency, GA.

Field-applied manure is an important source of exposure to pathogenic organisms in surface water bodies for humans and ecological receptors. We analyzed the persistence and decay of fecal indicator bacteria and bacterial pathogens from three sources (cattle, poultry, swine) for agricultural field data collected in Watkinsville, Georgia. Data from a completely randomized split-plot design was generated by collecting runoff from rainfall simulation experiments on small manure-applied field plots and a control over a three week period. A one-stage exponential decay model was used to estimate decay coefficients and half-lives for 17 different indicators/pathogens for four different sampling periods. We present seasonal estimations of decay rates for fecal bacteria and compare these values to similar studies from the literature. Although a number of bacteria were not analytically recoverable, others (e.g., *Campylobacter*, *Clostridium*, *Cryptosporidium*, *E. coli*, *Enterococci*, *Giarida*, *Salmonella*) had seasonal estimates of decay with half-lives ranging from one day to two weeks. We examine the strength of the correlation between

fecal indicator bacteria and pathogen decay rates and examine the influence of other field variables such as temperature, sunlight, moisture content, and manure source.

- P192 **Zackary H. McMullan and Lisa A. Blankinship.** The effects of spices on the growth of *B. megaterium*, *E. coli*, *P.aeruginosa*, and *S. aureus*. University of North Alabama, AL.

The ability of spices to inhibit the growth of bacteria is what prompted this experiment. Long before the discovery of antibiotics, medicinal plants were used to treat common illnesses and infections. The purpose of this experiment was to determine if spices could inhibit or limit bacterial growth. Four bacterial species (*Bacillus megaterium*, *Escherichia coli*, *Pseudomonas aeruginosa* and *Staphylococcus aureus*) were tested for their ability to grow in the presence of spices or honey. This experiment involved extract from black peppercorn, cinnamon, and cloves and locally produced honey. Each test substance was sterilized, diluted (10%, 5%, 1%, 0.5%, 0.1%, 0.01%), and mixed with nutrient broth to form the test media. Bacterial cultures were grown overnight in nutrient broth then added to each of prepared broth. Samples were incubated at several temperatures to determine the effects of cold (4°C), room temperature (21°C), human body temperature (37°C), and fever temperature (40°C) on bacterial growth. All samples were tested in triplicate.

- P193 **Nitya T. Rao, Steven Price, Jackie Guzy and Michael Dorcas.** The Davidson College herpetology lab's outreach program: using reptiles and amphibians to enhance science education. Davidson College, NC.

Reptiles and amphibians, or herpetofauna as the group is commonly referred to, are ideally suited as educational animals and can be used to teach children and adults about a variety of topics in the sciences. For example, the wide variety of life history characteristics within this group can be used to illustrate the principle of natural selection. An example of a mimicry complex can spark a discussion of evolutionary biology. These interesting animals can supplement lessons on topics ranging from behavioral ecology to comparative anatomy to population biology. Providing real-life examples reinforces lessons and teaches children the pertinence of sometimes abstract theories or fields of study. The Davidson College Herpetology Lab's Outreach Program, partially supported by Duke Energy, is centered on the idea that introducing the public to reptiles and amphibians not only advances conservation efforts but also increases scientific awareness. Run almost entirely by undergraduates, the Outreach Program gives presentations at local schools and participates in events promoting conservation and science education. The capstone event is the annual Reptile Day which typically attracts more than 800 visitors. During Reptile Day, conservation organizations from around the state join Davidson students in teaching the public about local herpetofauna and how to protect them. Since 2005, the Outreach Program has given more 200 presentations and reached out to more 20,000 people. By using local herpetofauna to educate the public, the Davidson Herpetology Outreach Program has increased conservation awareness in our area and assisted science education efforts.

- P194 **Jacob S. Francis.** The successes and challenges of creating a cooperative multi-state inquiry-based environmental education curriculum: a case study from northern West Virginia and southwestern Pennsylvania. Oglebay Institute's Schrader Environmental Education Center, WV.

Recently there has been an overwhelming call for outdoor, inquiry-based environmental education with emphasis placed on the importance of giving both future scientists and non-scientists 'authentic' research experience to fostering scientific literacy in the lay public. The educational benefits of inquiry-based curricula in higher education have been widely investigated and have been shown to increase students' understanding of material; reasoning ability; and attitude towards science, technology, engineering and math (STEM) disciplines, yet the widespread adoption of such programs has yet to be fully realized in middle school curricula across the state of West Virginia and Pennsylvania. We reviewed

student and teacher feedback from a nearly decade long inquiry based outdoor environmental education program, Mission Ground Truth: 21, that was piloted with schools from the Northern Panhandle of West Virginia and the South-eastern corner of Pennsylvania to determine the success and academic value of 4 different activities: benthic macroinvertebrate surveys, water chemistry monitoring, point-centered-quarter forest composition studies, point centered bird counts. We found that many formal educators value the field experience that students received, but that there was a significant need to tie outdoor science education to state standards to justify its cost. We also found that more specific assessment tools are needed to determine the educational impact of our program.

P195 **Irma M. Santoro.** Using popular creative non-fiction literature as the main text to ignite interest, cultivate critical thinking skills and confront ethical and moral issues related to science in a biology classroom. Reinhardt University, GA.

Science education initiatives emphasize that students need to understand that science: 1) is interconnected with other disciplines; 2) has ethical implications; and 3) must be used to make informed decisions that impact individuals and society. Because Science doesn't begin in a textbook, it became clear that scientific knowledge should be taught in a relevant context that explores real-life issues. How can we convey these messages in a standard biology course? A traditional Cell Biology course was redesigned by using the creative non-fiction book "The Immortal Life of Henrietta Lacks" by Rebecca Skloot as the primary reading source to introduce the scientific topics of study together with a traditional Cell Biology textbook to further supplement the main concepts. "The Immortal Life of Henrietta Lacks" along with multitask assignments, allowed for the development of critical thinking skills. As students explored different topics from multiple perspectives, they recognized the interconnectedness of science and society and confronted ethical and moral issues related to science. A comparison of exam scores, essay responses, engagement level, as well as students' own reflections, demonstrated that this approach did not sacrifice content knowledge, rather it enhanced the overall learning process.

P196 **A. D. Panvini.** From botany class project to arboretum status. Belmont University, TN.

With fewer universities housing their own herbaria or even offering plant science courses, biology majors infrequently have the opportunity to learn common plants in their geographic area or about the utility of a herbarium. To overcome this problem and to provide students a meaningful project that demonstrates the pragmatic aspects of plant cataloguing and collecting, the students enrolled in botany over several years completed an inventory of trees on campus, complete with herbarium specimens. Their cumulative work has resulted in two major outcomes beyond the herbarium collection. First, the university is in the process of applying for arboretum status. Second, as part of a class project in an Eco-Justice and Faith course one of the botany students developed a campus Tree Trail brochure to "encourage reflection and appreciation for nature." Details of the project and information on the process of applying for arboretum status will be included, as will student learning outcomes achieved through this project. The presentation will illustrate how the herbarium project exemplifies key concepts central to the AAAS efforts to reform undergraduate biology education, including reinforcement of the scientific process and key competencies, relevancy and authenticity, informal and informal assessment, and collaboration.

P197 **Latanya Hammonds-Odie and Alessandra Barrera.** Journey into hela cells – an inquiry-based learning experience across two upper-level courses. Georgia Gwinnett College, GA.

During the spring 2011 semester, we implemented a project to ascertain the effectiveness of an embedded cell biology focused research module in coordinated upper-division Biotechnology Lab and Bioinformatics courses. The objective was to give a practical

foundation in basic molecular biological techniques and a relevant scenario for exploring the power of bioinformatics. Another objective was to have students read and discuss the bestseller, *The Immortal Life of Henrietta Lacks* by Rebecca Skloot. Twenty senior Biology majors concurrently enrolled in both courses participated in this research experience revolving around HeLa cells. We assessed the effectiveness of the integration of the courses on student engagement, enthusiasm and interest using the Classroom Undergraduate Research Experience (CURE) survey as well as an end of course questionnaire along with course evaluations and course assessments. Students enjoyed the collaborative work and felt a sense of meaning and purpose to their research projects. They also indicated that the coordination provided deeper comprehension of course material. The longer term vision for this project is to generate the reagents which would allow students to follow their gene of choice throughout cell division in real-time.

P198 Nick Ragsdale. Teaching biology to a fifth grader or problem-based learning in a general education biology class. Belmont University, TN.

Problem-based learning (PBL) is a popular trend in biology courses. One need only look at all of the suggestions and examples online to see that this is true. However, many of the current PBL is centered on medical case studies for biology majors. While these PBL scenarios are interesting, they may appear daunting to the student in a non-majors biology course. One can even find an ample amount of material on PBL problems geared toward investigative learning within the non-majors laboratory setting. However, these PBL scenarios geared to the non-majors laboratory are often centered on the laboratory experience that is confusing to a non-major. The current works describes a pilot PBL task, which asks the non-major to focus their efforts on a problem that they can easily understand: How does one teach a biological concept to a younger and less experienced individual? Students worked in groups to determine the best way to teach a biological concept covered in their course to a fifth grader. After several planning sessions and after receiving critiques from the instructor and fellow classmate, the groups created the teaching tools that they would need to “teach.” Each group presented their materials to the class and was ask to grade each other on the effectiveness of the “teaching plan.” Each student was asked to complete a survey to help determine the effectiveness of this PBL task. Future utilization of this PBL task will include the non-major “teachers” utilizing their material to teach home-schooled students.

P199 Merry C. Clark and Lisa Blumke. Development of an inquiry based laboratory module for use in undergraduate biology courses. Georgia Highlands College, GA.

Georgia Highlands College, a two-year associate degree-granting institution, previously had no inquiry based learning activities in the biological science curriculum. We have developed a laboratory module that has been successfully implemented in multiple introductory biology courses. This module uses the bean beetle, *Callosobruchus maculatus*, as a model for scientific inquiry. We address the basic steps in the scientific method, as well as behavioral and evolutionary topics. This laboratory module has a limited budget, and is therefore easy to incorporate into a variety of college biology labs. Our preliminary results indicate that student learning is enhanced in classes that have used these inquiry based learning activities.

P200 Amy Vu and R. M. Fincher. Investigation of arbuscular mycorrhizal fungi colonization in native tropical forest species in a reforestation project in Costa Rica. Samford University, AL.

Arbuscular mycorrhizal fungi (AMF) are abundant in tropical forests, providing host plants with greater surface area for uptake of water and nutrients, in particular phosphorus. In previous experiments, AMF in old growth rainforest have been shown to improve plant growth, water uptake, drought tolerance, root longevity, and seedling survival, and to reduce host plant stress. Reforestation plantations are now the dominant forest cover in

Costa Rica, and yet, surprisingly, our knowledge of AMF in anthropogenically constructed forests remains fragmentary. We investigated the relationship between root colonization by AMF and plant growth rate in 6 native tree species planted in secondary forest and in a reforestation plantation in old cow pasture in Costa Rica. We predicted that AMF colonization rates would be higher in secondary forest, increasing plant growth rate and survival, and that association with nitrogen-fixing bacteria would enhance AMF colonization. We found that AMF colonization rates were lower in the forest than in pasture and there was no association between AMF abundance and mortality or plant growth. Mean percent AMF colonization rates were lower in nitrogen-fixers than in non-nitrogen-fixers in the forest, while this pattern was reversed in the field. This may result from a trade-off in allocation of limiting resources in high and low light environments. In the forest, plants may allocate carbon rewards to nitrogen-fixing mutualists, maximizing production of nitrogen-containing photosynthetic molecules. In the field, plants may allocate resources to the AMF mutualism to maximize uptake of the limiting nutrient phosphorus from potentially depleted pasture soils.

P201 **Brandie K. Stringer¹, Yong Wang¹ and Callie J. Schweitzer²**. Forest management and songbird communities: breeding success and temporal trends. ¹Alabama A&M University, AL, ²USDA Forest Service Southern Research Station.

Understanding songbird response to silvicultural practices is crucial to their conservation, as many songbird species are dependent upon periodic disturbance for their habitat needs. The purpose of this study is to examine the effects of oak regeneration forest management treatments on two breeding songbird communities with respect to temporal patterns of species composition, relative abundance, and breeding success. The study area is located on the mid-Cumberland Plateau in northern Jackson County, Alabama; one block is at Miller Mountain, a parcel of the privately-owned Stevenson Land Company and two blocks are at Jack's Gap, a tract belonging to Forever Wild[®] Land Trust. As part of a randomized, complete block replicate design, fifteen 4-ha stands were treated in 2001 with one of five target overstory retention percentage treatments: 0 (clearcut), 25, 50, 75, and 100 (control). In 2011, three new stands were added to the study for a total of eighteen stands. Breeding songbirds were surveyed (using territory mapping) 9-10 times per year during the peak of breeding season of 2010 and 2011, and will be surveyed again in 2012. The breeding success of each nest will be quantified and overall avian reproductive output will be estimated based on territories detected and breeding success indices. Vegetation structure data were collected around each nest in 2011, and will be collected again in 2012. Cicada surveys were conducted during (2011) and will be conducted after (2012) a 13-year emergence period. Some preliminary data are presented.

P202 **Kathryn A. LeCroy¹ and David E. Carr²**. Assessment of the reproductive fitness costs of plant defense investments and inbreeding in *Mimulus guttatus*. ¹Birmingham-Southern College, AL, ²University of Virginia, VA.

This study examined how male fertility was affected by both inbreeding and indirectly by trade-offs due to investment in costly defensive traits (trichomes). The study further examined whether pollinators consequently discriminate against plants undergoing this resource tradeoff from one characteristic supporting fitness over the other. I used *Mimulus Guttatus* (yellow monkeyflower) and a forager who discriminates against poor reproductive characters, *Bombus impatiens* (common Eastern bumble bee). *M. guttatus* populations have been undergoing selection for four generations, consisting of inbred groups selected for narrow stigma-anther separation (SAS - a feature associated with the evolution of selfing in *Mimulus*) or outbred groups selected for wide SAS, and a fully outcrossed control group. All groups also underwent selection for high or low trichome densities. The control group had highest pollen viability, and all other selection regimes had reduced viability. Low viability was expected for inbred regimes but not for outcrossed regimes -- we

concluded there are two different genetic mechanisms occurring for this reduced viability ($P < 0.0001$) and pattern of reduced quantity. There is little evidence supporting tradeoffs between pollen production and trichome production. Although there was reduced fertility in all selected lines, *B. impatiens* visited all outbred regimes as if there was no distinction between the three, and discriminated significantly against the inbred groups ($P < 0.0001$). Although there is a weak relationship between pollen viability and residual visitation by bees after controlling for flower number, there must be other explanations for this discrimination against inbred regimes beyond pollen quantity and viability.

P203 Justin L. Harkey, Gary Walker and Mike Madritch. Species-area relationships along a cliff face in Todd, NC. Appalachian State University, NC.

Within the last three decades, cliff ecosystems have received increasing attention from ecologists. Cliffs have been shown to harbor important, unique, and vastly different communities compared to surrounding landscapes. Much of their diversity is related to the distinct climates found on different faces, as well as reduced anthropogenic disturbance. As recreational climbing continues to threaten cliff-system communities, research to help understand cliff-face community structure is essential for preservation and management. Species-area curves can be a useful tool when assessing cliff communities. These curves can represent the overall diversity encompassed in the sampling area, and serve as a comparison among different cliff systems. When applied to continuous cliff systems and disjunct cliffs within the same system, results of species-area curves can be used to formulate climbing management plans towards conservation efforts. The results of this preliminary study show that a representative species-area curve can be achieved using sampling methods implemented here. The curve obtained in this study also contained many characteristics typical of island habitats, such as a steep slope and relatively low diversity.

P204 John Enz. Native (winter) pollinator, of a non-native ornamental plant, *Viburnum suspensum*, in urban north Florida. Jacksonville University, FL.

Sandankwa viburnum, *Viburnum suspensum*, is an evergreen viburnum shrub native to the Ryukyu Islands, a chain of islands northeast of Taiwan. Unlike other viburnums, it prefers hot, dry climates with sandy soils which have made it a very popular landscaping hedge in Florida. Its flowers are tubular, white, five-petaled, and born on drooping panicles. These flowers begin to blossom in mid-winter when insect pollinators are scarce. The purpose of this study is to characterize the winter insect flower visitor species composition during the initial 1 month winter flowering period, January 15 - February 15th, in an urban residential subdivision. To obtain the winter insect flower visitor list, a typical residential hedge will be observed twice each day for 30 minutes at mid-morning and mid-afternoon. In addition, each insect species will be examined in terms of its pollen carrying ability by collecting representative insect species individuals for pollen examination. Results will be analyzed to determine if significant differences exist in flower visitation or pollen load among the insect visitor species.

P205 Renee B. Welfare¹, Jeremy D. Proctor¹, Marcus E. Jones² and Jay F. Bolin¹. The germination ecology of the federally endangered Michaux's sumac (*Rhus michauxii*, Anacardiaceae) including endozoochory. ¹Catawba College, NC, ²Norfolk Botanical Garden, VA.

The conservation status of the federally endangered Michaux's sumac (*Rhus michauxii* Sarg) is attributed to fire suppression. Numerous hard seeded plants in fire-adapted ecosystems can survive high temperatures and germinate in response to scarification caused by high fire temperatures. Using seeds collected from Virginia Army National Guard-Maneuver Training Center Fort Picket and subsequently manually scarified, we discovered that imbibition of intact seeds was prevented by endocarp impermeability. Then we explored if dry heat, as an analogue for wildfire, could be used to break physical dormancy. Replicated dry heat treatments applied at 60, 80, 100, 120, 140, and 160 °C (5

and 10 min), and a control, yielded no germination. All seeds were subsequently manually scarified. During the next 4 weeks, a range of 47.8 ± 4.8 to 56.7 ± 12 % germination was observed for scarified seeds of the 60 and 80 °C (at 5 and 10 min) treatment groups, not significantly different than scarified control seeds. We concluded that heat from fire is a poor candidate to break *R. michauxii* seed dormancy. We hypothesized that endozoochory, seed passage through the digestive tracts of animals, may play an important role in the scarification of *R. michauxii* because many *Rhus* spp. form part of the diets of frugivorous birds. Here we present experimental data on the effect of endozoochory by Bob White Quail on the germination of *R. michauxii*, *Rhus copallinum*, and *Rhus glabra*, three species that frequently co-occur in NC and VA.

P206 Rachel Burnett and Peter May. Wading bird species richness and abundance relative to fluctuating water levels at a wetland restoration site. Stetson University, FL.

Wading birds use various environmental and social cues when choosing foraging and nesting sites. Previous studies in Florida wetlands have shown that the abundance and species richness of wading birds is inversely correlated with water stage while the effect of the fluctuation of water levels on abundance has mixed results. I predicted that a) species richness and abundance would be greatest at lower water depths, b) species richness and abundance would be greater during short-term periods of receding water levels compared to rising and stable water levels, and c) the relative abundance of Snowy Egrets, *Egretta thula*, to Great Egrets, *Casmerodius alba*, would be greater at lower water depths. Thirteen species commonly found at Emerald Marsh Conservation Area (EMCA) in central Florida were included in the study. Total species richness, total abundance of wading birds, and abundance for seven individual species was compared across four ranges of water stages and three fluctuation phases using two-factor ANOVAs. The relative abundance of Snowy Egrets to Great Egrets as water level and fluctuation phase changed was also analyzed with a two-factor ANOVA. The results indicated that most wading bird species are using low water stage as an environmental cue for optimal foraging, but are not affected by short-term fluctuations in water levels.

P207 Betsie B. Rothermel, Elizabeth H. Boughton and Joshua H. Daskin. Initial responses of Florida endemic cutthroat grass and wet prairie vegetation to cattle exclusion and alternative fire regimes. Archbold Biological Station, FL.

The side slopes of inland sand ridges in south-central Florida support communities dominated by cutthroat grass (CTG; *Panicum abscissum*), an endemic bunchgrass restricted to saturated soils and adapted to frequent fire. Remnant cutthroat communities, many slated for hydrological restoration, occur within pastures on the 1,476-ha Archbold Reserve. However, we lack basic information to guide restoration, including how fire season affects CTG, and whether continued grazing is compatible with restoration. In summer 2010, we established 16 study plots in semi-improved pasture and randomly assigned plots to two treatments: continued grazing vs. no grazing (cattle excluded) and winter vs. summer burning (n = 4 plots per treatment combination). After conducting the first prescribed burns in January and July 2011, we assessed initial effects of cattle exclusion and fire season on species richness and vegetation composition, as well as CTG cover and flowering. Richness increased in 2011 over all treatments, possibly because the pasture had not been burned for 28 months prior to our study. Species composition differed significantly between grazed and ungrazed plots in 2011, due mainly to greater *Eleocharis* spp. and sedge cover in grazed plots, and more *Schizachyrium scoparium* without grazing. Soil moisture also explained a large amount of the variation in species composition. Not surprisingly, ungrazed plots had taller vegetation, including CTG. Neither grazing nor fire season affected CTG cover within the first year, however, grazed plots had significantly more flowering culms of CTG. Results of this ongoing experiment will inform restoration and management of this unique grassland community.

P208 **Judy Redden, Lisa Krueger and H. D. Wilkins.** Comparing a visual estimation method to the use of seed traps to determine an appropriate method for correlating mast production to red-headed woodpecker abundance in a bottomland hardwood forest. The University of Tennessee at Martin, TN.

Red-headed Woodpeckers (*Melanerpes erythrocephalus*) cache acorns as a winter food source therefore their abundance is likely dependent on annual mast production. Our goal is to see if woodpecker abundance is correlated with acorn production. To determine an appropriate method for estimating mast production, we compared a visual estimation method to the use of seed traps. To census woodpeckers, we established five points 250 m apart along a trail. We established nine 50 m X 50 m plots along a 1km long transect parallel to the trail to determine oak density. We deployed four 1 m X 1 m PVC seed traps per plot. Acorns were collected from the trap periodically, identified, counted, and weighed to estimate biomass. The visual method consisted of counting the number of acorns observed in 30 sec for each oak in the plots. For analysis, we categorized acorns as either red oak or white oak since they differ in content, which may impact their quality as a food source. Red oaks occurred at a density of 29 trees per ha while white oaks occurred at a density of 14 trees per ha. The visual method detected 343 red oak acorns compared to 15 white oak acorns. Using seed traps, we collected 1,172 red oak acorns compared to 8 white oak acorns. While the two methods are not directly comparable due to the location of the four traps within the plot as compared to visually inspecting each oak in each plot, we can see a similar pattern.

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Beta Beta Beta

Paper and Poster Abstracts

***From the 55th
Tri-Beta Annual Meeting***

***Held with the 73rd
Annual ASB Meeting***

Hosted by

The University of Georgia

Athens, Georgia

April 4-7, 2012

Beta Beta Beta

Paper and Poster Abstracts From the 55th Tri-Beta Annual Meeting

Paper Presentations Southeastern District I

Bachman, Alicia. Sigma Phi, Guilford College. Avian Populations Among Semi-permanent Beaver Pond Impoundments of Varying Successional Stages.

North American beavers are natural ecosystem engineers, and the varying stages of beaver ponds contain examples of dynamic and diverse ecosystems within a relatively small area. I am currently censusing avian populations within beaver pond impoundments of various successional stages. I established six sites in each of the habitats created by different stages, sizes and ages of beaver ponds on a single land tract in Greensboro, NC. Bi-weekly point counts are being conducted at each site, as well as monthly mist-netting. The property containing these beaver ponds has been preserved as green space and is currently being adapted for recreational trail use, but no avifauna studies have been conducted to assess the biodiversity on the 440 acre tract. By monitoring bird populations within these habitats, I hope to establish a baseline study for the future management of such areas as well as to show a relationship between avian populations and the stages of ecological succession of beaver pond impoundments.

Houtz, Marie L. Sigma Phi, Guilford College. Antibody Response to Bovine Submaxillary Mucin in CD22 Δ 1-2 and Wild Type Mice.

Tn is a cryptic core α -N-acetylgalactosamine on mucin molecules and forms sialyl Tn when modified with sialic acid. STn is often exposed in carcinomas due to incomplete and aberrant glycosylation of mucin molecules. CD22 is a cell surface molecule belonging to the SIGLEC family of lectins. Its extracellular domain binds α 2, 6-linked sialic acid ligands. We investigated how mice expressing a form of CD22 unable to bind sialic acids (CD22 Δ 1-2) responded to immunization with (BSM), which bears high levels of sTn. BSM-Elisa assays were performed to detect and quantify amounts of antibodies produced against BSM. WT and CD22 Δ 1-2 mice were tested for antibody responses preceding and following a TNP Ficoll and BSM immunization. CD22 Δ 1-2 mice and WT mice produced the same amount of immune response to the non-sialylated carbohydrate antigen (TNP-Ficoll) indicating CD22 ligand binding is not required for antibody responses to non-sialylated carbohydrate antigens. CD22 Δ 1-2 mice made higher IgM responses to BSM than the WT mice demonstrating the role of the sialyl motif in "self" recognition. Since BSM immunization yields anti-sTn antibody responses that may provide protection against sTn-bearing tumors, future studies examining the role of CD22 in protection against sTn bearing tumors is warranted.

Willis, Robin. Sigma Phi, Guilford College. The Protective Effect of Natural Flora on Pathogen Challenge in *Caenorhabditis elegans*.

Natural flora is defined as a blend of microbes routinely found in/on an organism. It's generally located where contact with the external environment occurs, like the skin, respiratory tract, and digestive system. The relationship between natural flora and its host is not completely understood, but thought to be symbiotic. Natural flora receives necessary nutrients, mobility and a stable and protective environment. The host may

benefit nutritionally, and receive digestive support. Additionally, numerous studies suggest natural flora may also influence the susceptibility of the host to illnesses. This study is looking at the effect of antibiotics on natural flora, does exposure alter the natural flora and compromise potential protection against pathogens. *Caenorhabditis elegans* was chosen as a model for this study for many reasons, mainly the low number of natural microbes, which in laboratory conditions is composed primarily of *Escherichia coli*, *OP50*. In order to test the possible protective effect of resident bacteria, *C. elegans* were exposed to an antibiotic that *OP50* was susceptible and subsequently challenged with different antibiotic resistant strains of pathogenic bacteria. If the natural flora provides protection, it would be expected the antibiotic treatment would amplify the effects of the pathogenic bacteria challenge.

Bessette, Christopher W., Ashley E. Schiffmacher, Joseph M. Macedonia, and Gabriel J. Langford. Beta Eta, Florida Southern College. Adaptive Phenotypic Plasticity on the Hindlimb of the Cuban Brown Anole (*Anolis sagrei*).

Phenotypic plasticity is the environmentally induced ability of a genotype to produce more than one alternative phenotype. A laboratory experiment in which hatchlings were reared in cages containing either small-diameter or large-diameter supports revealed that phenotypic plasticity had a significant effect on hindlimb growth (Losos et al., 2000). We replicated and extended this laboratory study to determine first whether phenotypic plasticity in *A. sagrei* hindlimb growth is a repeatable phenomenon, and whether the outcome has an impact on perch use later in life. We reared two cohorts of *A. sagrei* hatchlings on small-diameter or large-diameter dowels in a lab setting; at ten weeks of age we found lizards on broad dowels exhibited significantly greater hindlimb growth than lizards on narrow dowels. Subjects then were transferred to an outdoor enclosure that contained both perch sizes, and observations were made of perch use frequency. These observations were terminated early because a design flaw allowed subjects to move among cohorts; therefore we repeated the entire experiment with new cohorts of hatchlings, and a design that ensured the isolation of treatment groups. Results of our replicated experiments, as well as the adaptive significance of phenotypic plasticity in *A. sagrei*, will be discussed.

von Bodungen, Heather. Sigma Phi, Guilford College. Large Mammals in Manyara Ranch, TZ: Assessment of the Viability of a Wildlife Corridor.

Manyara Ranch, a conservation area in Northern Tanzania, is comprised of many vital habitats and supports a wide diversity of species. The presence of watering holes and the restricted grazing of livestock in the ranch under current ownership sustains a diverse range of wildlife populations which rely upon the corridor year round. Manyara Ranch is located within the Kwakuchinja wildlife corridor, one of the few corridors that has remained intact within the Manyara-Tarangire ecosystem. Few studies have been conducted in the Kwakuchinja corridor since the change in ownership of Manyara Ranch, which is currently held by the Tanzania Land Conservation Trust (TLCT), enacting a policy that allows restricted grazing of livestock in the area. A road transect count was conducted to determine species density, diversity, resource utilization, and biomass of large mammals in order to assess wildlife and livestock dynamics within the ranch. Results revealed no significant difference between species densities across designated zones of Manyara Ranch ($H=4.988$, $p=0.0674$). Bush grassland comprised of the largest diversity and was utilized the most often (48%) by large mammalian species. The biomass of wildlife was significantly larger than that of livestock within the ranch ($p < 0.001$) with roughly 80% of the ranch's biomass contributed by wildlife and 20% by livestock.

Burns, Karolyn. Sigma Psi Chapter, Florida Institute of Technology. Feeding Ecology of Juvenile *Tetrapterus albidus*.

As an economically important species in the recreational fishing industry, white marlin are heavily exploited with a harvest of 1000 to 2000 metric tons annually. Despite the vulnerability of this long-lived species, very little is known about their larval biology or early life stages, hindering the ability to make responsible management decisions to ensure the continued persistence of this species. Samples from a research cruise approximately 250km west of Tampa in summer 2011 from the neustonic (surface) layer provided an initial evaluation of the feeding habits of these juveniles. These were dissected and their stomach contents analyzed for species content and fullness. The results demonstrate that these fish are primary piscivores, switching from copepods to larval fish as the main food source at around 8mm in length, and these food resources include younger fish of the same species. Cannibalism in billfish has been previously reported, but this is the first documented case in this species. The length and stomach contents were also recorded for the ingested fish, giving a greater range of sizes for which we have feeding data. Understanding the requirements of these fish at early stages will help to shape decisions regarding their conservation and habitat needs.

*Sloan, Tyler. Sigma Psi, Florida Institute of Technology. The Effects of Temperature on the Feeding Kinematics and Behavior of Two Trophically Distinct Invasive-fish species: the Specialist *Belonesox belizanus* and the Generalist *Cichlasoma urophthalmus*.

Invasive fishes have the ability to adapt to environmental conditions in the invaded ecosystem and utilize resources that may have been absent in their native ecosystem. *Belonesox belizanus* and *Cichlasoma urophthalmus* are both invasive fishes in Florida. Ecomorphological studies conclude that *C. urophthalmus* is a trophic generalist while *B. belizanus* is a trophic specialist. The current Florida distribution of these species suggests that *C. urophthalmus* spreads northerly into the colder regions of Florida at a faster rate. This study was designed to test the hypothesis that the prey-capture kinematics and behavior differ between both invasive fish species at a given temperature and also vary for each species across temperatures. Analysis of Variance revealed that (1) excursion and timing variables differed between species and (2) the kinematics of prey-capture did not vary across temperatures in both species. This interspecific comparison suggests that both species have the same temperature tolerance and that any difference in their rate of spread across Florida may be driven by factors other than species-specific physiological tolerance to temperature.

Shedlofsky, Lydia B. Sigma Phi, Guilford College. Site Directed Mutagenesis of the FMN Riboswitch in *Photorehabdus luminescens luminescens*.

Riboswitches are a common mechanism for controlling gene expression in bacteria, and is based on secondary structure in the leader sequences of messenger RNAs. Riboswitch categories are based on their method of regulation and their specific binding ligand. Riboswitches are generally composed of an aptamer domain, which interacts with the regulatory ligand, and an expression platform, which modulates gene expression. Specific ligand binding to the aptamer domain results in a conformational change in the expression platform to control gene expression, e.g. by the formation of a transcriptional terminator or by occluding a ribosomal binding site, or both. We are using site-directed mutagenesis of the Flavin MonoNucleotide (FMN) riboswitch, which controls the biosynthesis of riboflavin, an essential precursor in the biosynthesis of coenzyme FMN. Our goal is to explore the utility of targeting riboswitches for developing novel antimicrobial agents. We hypothesize that fixing the FMN riboswitch in the 'off' position in *Photorehabdus lumenscens*, a pathogen of *Caenorhabditis elegans*, will result in a decrease in its virulence.

Millan, Ashley M. Sigma Psi, Florida Institute of Technology. Abundance and Dispersal of Cephalopod Paralarvae in the Florida Current.

The Florida Current, which flows northward into the Atlantic Ocean, is a major dispersal pathway for larval organisms, and influences the recruitment dynamics of marine species. Cephalopod paralarvae were collected from ichthyoplankton samples gathered at five stations along a 15 km transect across the Florida Current near Fort Lauderdale, during bi-monthly cruises from late 2006 to November 2007. Six hundred and twenty-two paralarvae were found in the sample. All specimens were measured and determined to be within seven taxa: *Octopus burryi*, *Macrotritopus defilippi*, *Abralia veranyi*, *Onykia carriboea*, *Onychoteuthis banksii*, *Pterygioteuthis* sp., and *Histioteuthis* sp. Data from Bongo net and Tucker trawls provided information used to establish the spawning patterns, density, and abundance of the different species. The mantle length was measured to conclude differences in size and developmental stages. *Abralia veranyi* and *Onykia carriboea* were found to be the most abundant species, accounting for 50% and 26% of the specimens, respectively. These data provide a basis on which, if monitored, a mechanism model could be created to establish the main spawning sites and possible levels of recruitment for these cephalopod species.

Hull, Michael. Nu Upsilon, Bridgewater College. Uncovering the secret of regeneration blastemas.

This study was conducted to gain insights into the processes of post-traumatic regeneration in axolotls. Aim 1: to initiate formation of regeneration blastemas in isolated limbs *in vitro* and to determine the best culture conditions to support that process. Aim 2: to conduct a proteomic analysis comparing blastemas grown under different culture conditions and *in vivo* blastemas developing at the site of limb amputation in animals. We report that regeneration blastemas can form on the proximal ends of isolated limbs *in vitro* under varied culture conditions. The initial analysis of protein profiles showed a greater variety of proteins in later blastema stages than in samples from early blastema stages. The data also showed that protein profiles of cultured blastemas were comparable to those of *in vivo* blastemas. This evidence indicates that the factors, which control limb regeneration, are located intrinsically within the regenerating limb cells and that extrinsic circulating factors are not necessary for the initial stages of limb regeneration.

***District I Brooks Award Winner, Best Paper.**

Paper Presentations Southeastern District I and II

*Clippinger, Amy K. Mu Iota, Northern Kentucky University. Behavioral Characterization of Atp13a2 Deficient Mice Carrying a Transgenic Alzheimer's Gene.

An animal model for Kufor-Rakeb syndrome, an atypical form of Parkinson's disease, has been generated by knocking out the Atp13a2 gene in mice. This gene encodes a lysosomal P-type transport ATPase that is thought to be necessary for normal lysosomal function, particularly that of protein degradation. Accordingly, we postulate that Atp13a2 deficient mice (Atp13a2^{-/-}) will be more prone to neurodegenerative diseases such as Alzheimer's, in which protein aggregates have been shown to contribute to neuronal dysfunction and cognitive impairment. To test this hypothesis we introduced a gene into Atp13a2 deficient mice that is associated with familial Alzheimer's disease, the human mutant amyloid precursor protein gene (APP). Mice were tested in the Morris water maze spatial memory task at 6, 9 and 12 months. Brains were analyzed for the presence of protein aggregation.

Lemay, Katie. Beta Phi, The University of West Alabama. The Impact of the Deepwater Horizon Oil Spill on Macrofaunal Habitat Utilization in Alabama Salt Marsh Communities.

The Deepwater Horizon disaster of April 2010 resulted in the spill of massive amounts of oil into the Gulf of Mexico. A substantial amount reached the coast and impacted coastal salt marshes. Salt marshes are known to serve as nursery habitats for many juvenile marine organisms. As part of a larger study examining the effects of the BP oil spill on a salt marsh environment in coastal Alabama, I examined macrofaunal utilization of two sites in an intertidal salt marsh on Point aux Pins, near Bayou La Batre, AL. NOAA imagery indicated that one site, on the eastern side of the Point, was impacted by oil in August of 2010 while an ecologically similar site on the western shoreline was unaffected. We built weirs to sample macrofauna inhabiting a network of tidally flooded salt marsh creeks at the two sites, and collected monthly samples from January through November of 2011. Preliminary results indicate that the western site maintains a greater diversity of macrofauna, as well as supporting macrofauna in greater numerical abundance.

Alex, Neena. Mu Omicron, Columbus State University. The Effect of 17 β -estradiol on Angiotensin II Production in Astrocytes under Oxidative Stress.

Angiotensin II (Ang II) is a protein hormone involved in the renin-angiotensin system (RAS) and is synthesized by several human cell types including glial cells in the central nervous system. Research has established that Ang II is involved in neural regulation of blood pressure, control of water intake, and sodium appetite. In high amounts, Ang II is associated with increased blood pressure and can lead to pathogenic cardiovascular effects associated with hypertension. Previous research also suggests that 17 β -estradiol plays a patho-protective role against cardiovascular disease by acting on RAS to decrease blood pressure. Thus, this study aims to investigate whether 17 β -estradiol accomplishes its patho-preventative role in part by acting at the neural level to inhibit Ang II production. The astrocytes were treated with hydrogen peroxide to simulate oxidative stress *in vitro*. The astrocytes were then treated with 17 β -estradiol and tamoxifen, an estrogen receptor inhibitor. Production of Ang II was measured using ELISA Angiotensin II Assay. Ang II levels in the supernatant of cells treated with 17 β -estradiol varied little from that of cells untreated with 17 β -estradiol. These results suggest that 17 β -estradiol does not affect Ang II production at the neural level to protect against hypertension-related cardiovascular disease.

Gluszek, Catherine and Scott Heldt. Mu Tau, Christian Brothers University and the University of Tennessee Health Science Center. Fear Acquisition and Changes in GABAergic mRNA.

Previous research has shown that the amygdala, hippocampus, and prefrontal cortex play critical roles in the acquisition of fear in both animals and humans. Activity in these brain regions is regulated by the inhibitory neurotransmitter gamma-aminobutyric acid (GABA) which serves to control fear in the mammalian brain. In this study, we examined whether the acquisition of fear induced changes in GABA transmission by using rtPCR to measure mRNA levels of GABA-related genes in the amygdala, hippocampus, and prefrontal cortex after the acquisition of Pavlovian fear in mice. Results revealed that protocols used to examine training-induced mRNA changes produced reliable acquisition of tone-induced fear as measured by conditioned freezing. All brain areas showed changes in mRNA levels of GABA receptor-associated protein (GABARAP) which is known to be involved in trafficking of GABA receptors to and from the plasma membrane. These results suggest that fear training induces learning-related changes in GABA transmission which may be important for the acquisition of conditioning fear. Supported by the Neuroscience Institute Merit Fellowship

Langfitt, Terry. Mu Omicron, Columbus State University. DNA Sequencing for Genes Homologous to the *Candida albicans* SAPs 4-6 in *Candida dubliensis*.

Recently speciated *Candida dubliensis* fails to display the same range of secreted aspartyl proteases (SAPs) exhibited from its ancestor *C. albicans*. The lack of expressions of SAPs 5 and 6 is suspected to be the main reason that *C. dubliensis* is far less virulent than its ancestor, as these SAPs are expressed in *C. albicans* during hyphal formation. The purpose of this study was to determine the genes to SAPs 5 and 6 were present, but not expressed, or absent in *C. dubliensis*. Using three *C. albicans* strains as controls, this study tested four different *C. dubliensis* strains' genomes for orthologs to the SAP 5 and 6 genes found in *C. albicans*. An absence of banding by the *C. dubliensis* strains after PCR and gel electrophoresis led to the conclusion that SAPs 5 and 6 are not expressed in *C. dubliensis*.

*Sinclair, Kathryn. Psi Beta, James Madison University. Phenotypic and Molecular Characterization of *Drosophila melanogaster* *RhoA* mutants.

Morphogenesis is the umbrella term for various cell shape changes and rearrangements that occur during development. *RhoA* protein plays an essential role in cell shape driven morphogenetic processes. For example, *RhoA* in mice is present at the site of neural tube morphogenesis (Ybot-Gonzalez et al. 2007). In *Drosophila*, *RhoA* homozygous mutant embryos die as a result of failed head involution morphogenesis (Halsell et. al., 2000). Molecular and phenotypic characterization of five extant *Drosophila RhoA* suggests they are complete loss-of-function point mutations. In this study, two additional mutant alleles, *RhoA*^{3.5.1} and *RhoA*^{4.4.2}, are being studied. Phenotypic analysis suggests *RhoA*^{3.5.1} may be a complete loss of function allele while *RhoA*^{4.4.2} exhibits a unique partial loss of function phenotype. DNA sequencing of the mutant alleles should reveal the linkage between the molecular defects and these phenotypes.

Morris, Kevin. Beta Kappa, University of Mississippi. Effects of miRNA on Beta Tubulin Isootypes.

A common active ingredient in chemotherapy drugs, taxane, has been shown to have limited effectiveness in treating tumors that are initially resistant or become resistant to taxanes after repeated cycles of chemotherapy. By using β -tubulin isotypes as tumor biomarkers, we can create better prognosis for cancer treatments and counteract drug resistance after repeated chemotherapy treatments. Because changes in the drug receptor may be linked to drug resistance, we investigated changes in β -tubulin isotypes in response to paclitaxel treatment in MCF7 breast cancer cells. We found that paclitaxel induced a 2–3 fold increase in mRNA for *TUBB2A* and *TUBB3* genes. The increase in β -tubulin IIA mRNA was due to both enhanced stability and increased transcription, unassociated with G2/M arrest. We used micro-RNA superarrays to look for changes in families of micro-RNAs that might be linked to drug-induced changes in β -tubulin isotype mRNA and/or protein. We found a significant decrease in the tumor suppressor, miR-100 and a significant increase in miR-200c in MCF7 cells in response to paclitaxel treatment.

Gawne, Meghan, Cursty Sexton, Jazmin Thrash and Dinene L. Crater. Phi Zeta, High Point University. Characterization of *mecA* in MRSA isolates from High Point University Students.

Staphylococcus aureus is a bacterium naturally found on the human body. It is usually harmless, but can be treated with antibiotics. In recent years, scientists have found several strains of *S. aureus* that are resistant to several antibiotics. These strains are termed Methicillin-resistant *Staphylococcus aureus* (MRSA). The first objective of this study was

to determine the prevalence of MRSA in High Point University students. To accomplish this, we took nasal samples from 600 students and grew what we collected on mannitol salt agar (MSA) plates. Plates positive for *S. aureus* were then grown in the presence of 1 mg/ml of oxacillin antibiotic discs. We found that 3.8% of our total samples continued to grow in the presence of the antibiotic indicating them as MRSA positive. Future directions will proceed with molecular testing to investigate whether each strain is either Healthcare-Associated (HA-MRSA) or Community-Associated (CA-MRSA). We will amplify *mecA* (a specific gene in MRSA that blocks the activity of beta-lactam antibiotics) using polymerase chain reaction (PCR), and compare the *mecA* sequences to that of known *mecA* sequences to characterize each strain as HA or CA-MRSA. We will compare our results with the statistical data collected from students to look for correlations like students with HA-MRSA who have recently been hospitalized or students with CA-MRSA that work out in the same area.

Fisher, Elizabeth A. Sigma Phi, Guilford College. Seasonal Resource Competition, Biodiversity, and Habitat Selection in Wildlife Sanctuaries of Amboseli Ecosystem.

Wildlife sanctuaries in Kenya's Amboseli ecosystem function as wildlife dispersal areas and livestock grazing areas. Suitability for wildlife conservation depended on whether the presence of livestock affected wildlife within the sanctuaries. Foot transects were taken in Osupuko, Motikanju, Kilitome, Kimana, and Elerai-Rupet Wildlife Sanctuaries during early wet seasons and late dry seasons to assess temporal and spatial presence of wildlife and livestock within specific habitats in the sanctuaries. Jaccard's similarity index, Pianka's habitat overlap index, Simpson's diversity index, and Ivlev's habitat selection index were used to assess seasonal resource use interactions between wildlife and livestock. Overall, the presence of potential for resource competition and overlap did not dictate the same trends in wildlife diversity and selection of habitats in any sanctuary. In three out of five wildlife sanctuaries there was a seasonal trend in which wildlife and livestock selected different habitats in the early wet season and both selected the same habitat in late dry season. Presence of livestock did not always negatively affect wildlife. In areas where wildlife is negatively affected by livestock, there may be an overabundance of livestock thus depleting the resources available. Individualized grazing plans should be created for each wildlife sanctuary.

***District II Brooks Award Winners, Best Papers.**

Poster Presentations Southeastern District I

Blankenship, Veronica & Jessica Cornett. Eta Iota, Emory & Henry College. Interaction of Various Genes with the Gibberellin Biosynthesis Pathway in *Arabidopsis thaliana*.

Through this project, we studied the *hdg11-1* and *hdg12-2* mutations of the *Arabidopsis thaliana* plant in collaboration with Dr. Christine Fleet. The main goal of the project was to produce a microarray to observe effects that the *hdg11-1* allele mutation had on the entire genome of the *Arabidopsis* plant and to determine if the mutations affect the gibberellin's biosynthesis pathway. The genes that showed the greatest change will be of interest for future research. The microarray tiff files were then analyzed by using the MAGIC software to determine the genes in the mutant with significant fold changes (anything larger than a two-fold change was considered to be significant). In addition, we used qPCR, or quantitative polymerase chain reaction, to compare the *hdg12-2* mutants with the Columbia wild type. Since the *HDG11* and *HDG12* genes are thought to function similarly, due to a close resemblance at the amino acid level, we compared the resulting ratios to

those from *hdg11-1* mutants. The data we gathered seem to support the claim that *HDG11* and *HDG12* regulate the gibberellin growth hormone genes similarly.

Bound, Jessica A. & Constance L. Rogers-Lowery. Tau Eta, Catawba College. Changes in Composition of Coral Larvae Exposed to Different Levels of Carbon Dioxide.

As the levels of atmospheric CO₂ increase, the pH of the oceans will become more acidic, potentially affecting the physiology of marine organisms, such as coral. While much research has been dedicated to the impact of CO₂ levels on calcification, skeletogenesis, and other physiological mechanisms of adult coral, little has dealt with early developmental stages. In the current study, planula larvae of the coral *Favia fragum* were exposed to different levels of atmospheric CO₂ (ambient = 390ppm, 700ppm, and 1300ppm) for 10 days. At that point, larvae were assayed for the amounts of total lipids, total carbohydrates, and proteins. As the larvae aged, the amount of lipids decreased; however, there was a greater decrease at elevated CO₂ levels. After 10 days, protein levels did not decrease in normal CO₂ treatment, but there was a significant decrease at 700ppm and 1300ppm. Total carbohydrates increased as the larvae aged, with 1300ppm CO₂ having the highest content of carbohydrates. This data may indicate that larvae exposed to higher levels of CO₂ utilize energy stores (lipids) to produce higher levels of carbohydrates to deal with the lower pH of their seawater.

Bryant, Sarah A., Chris M. Tavares, Jordyn A. Schulz, Hillary H. Doyle, Ryan A. Shanks, and Steven A. Lloyd. Psi Rho, North Georgia College & State University. Adolescent Exposure to Methamphetamine Leads to Sensitization to Methamphetamine in Adult Mice.

Sensitization is a hallmark of addiction defined as pretreatment with one stimulant leading to greater stimulant sensitivity in the future. Plastic changes caused by adolescent exposure to methamphetamine (METH) may lead to addiction in adulthood because this is a critical window of development in the brain. METH is a dopamine (DA) agonist that induces change in DA levels and inhibits DA reuptake. Increases in locomotor activity indicate changes in the DA pathway. We hypothesized that adolescent mice exposed to METH will show an increase in sensitization when exposed to a sub-acute challenge dose in adulthood. Male and female adolescent mice were subjected to a chronic abuse dosing paradigm or control saline. After a washout period of 90 days, adult mice were exposed to a sub-acute dose of METH or control saline. Locomotor behaviors were assessed with an open field chamber to operationalize sensitization of the treatment groups (adolescent treatment/challenge dose): saline/saline, saline/METH, METH/saline, and METH/METH. Results indicate a significant interaction effect in the METH/METH females that is different than the control groups. This indicates that adolescent exposure to METH causes long lasting plastic changes to the DA pathways in the brain resulting in a potential increase in addictive behaviors.

Cicanese, Matthew J., Eric J. Kjellmark, and Gabriel J. Langford. Beta Eta, Florida Southern College. Lichen Biodiversity of Northwestern Polk County, Florida: Implications for Air Quality.

Lichens are excellent indicators of atmospheric air quality because even relatively low levels of common air pollutants can significantly alter the physiology, composition, growth, distribution, and reproduction of lichen communities. This long-lived, cosmopolitan group of symbiotic organisms is frequently used to monitor air quality throughout the world, yet few attempts have been made to survey lichens in upland habitats of central Florida. In this study, epiphytic lichen floras were surveyed in three distinct habitats: rural (Lakeland Highland Scrub Preserve), suburban (Florida Southern College campus), and metropolitan (downtown Lakeland). Lichen species were photographed and measured, then collected and preserved in the Florida Southern College herbarium. Surveyed specimens were then

identified using a North American species key. To spatially display results, a GPS point was recorded for each specimen and imported into ArcGIS. Some of the common species collected in our region are: Bumpy Ramalina (*Ramalina complanata*), Candleflame Lichen (*Candelaria concolor*), Common Button Lichen (*Buellia stillingiana*), Dirinaria Lichen (*Dirinaria picta*), Southern Strap Lichen (*Ramalina stenospora*), Streaked Rosette Lichen (*Physcia atrostriata*), and White Fringe Lichen (*Heterodermia albicans*). In general, our results were consistent with previous studies; increasingly diverse and abundant (i.e., healthy) lichen communities occurred as we moved further from the urban center.

Cockburn, Chelsea L. Psi Beta, James Madison University. Role of Brainstem Serotonin in the Mediation of the Thermoregulatory Response to Hypoxic Stress.

Evidence suggesting dysfunction in brainstem neurotransmission of serotonin (5HT) may impair thermoregulatory response to stress and contribute to Sudden Infant Death Syndrome (SIDS). Brainstem areas rich in 5HT, like the raphe pallidus (RaPa), mediate the thermoregulatory responses to hypoxic stress. We hypothesize that alteration in neurotransmission in RaPa will alter the normal thermoregulatory response. Body core temperature (T_c) and selected ambient temperature (ST_a) were measured in conscious male Sprague-Dawley rats using radiotelemetry. Immediately prior to hypoxic stress, the RaPa was microinjected with muscimol (GABA-A receptor agonist) to block neurotransmission or 8-OH-DPAT (5HT_{1A} receptor agonist) to alter 5HT at the RaPa. Several control groups included ACSF (control vehicle) and a sham microinjection. T_c decreased following Muscimol, ACSF, and Sham injection with hypoxia by -2.7°C , -1.1°C , and 1.1°C respectively. There was a minimal decrease in ST_a following Muscimol (-4.1°C), ACSF (0°C), and Sham injection (-4.9°C). 8-OH-DPAT injection resulted in an attenuation of the hypothermic response (-0.47°C) to hypoxia while ST_a slightly increased (5°C). These data suggest that the RaPa is involved in thermoregulatory responses to hypoxic stress. Activation of the inhibitory 5HT_{1A} receptor attenuated the normal hypothermic response to hypoxic stress while muscimol exacerbated it. Increased understanding of the role of 5HT neurotransmission in the brain stem is vital in order to determine the etiology of SIDS and hopefully prevent its occurrence.

Cole, Caitlin, Paige Gable, Shelley Bright & Nancy Eufemia Dalman. Psi Rho, North Georgia College & State University. Optimizing the *Tetrahymena* Toxicant Assay for Inquiry-based Learning in Introductory Biology Laboratories.

We refined an available *Tetrahymena* phagocytosis protocol while developing a novel laboratory experience. *Tetrahymena pyriformis* are inexpensively grown protozoans that feed indiscriminately. External changes alter *Tetrahymena* feeding rate making our protocol useful in understanding effects of environmental alterations. Our protocol is an inquiry-based lab in which biology students have the opportunity to conduct novel hypothesis-driven experiments. To test the efficacy of this lab activity, two introductory biology sections conducted the *Tetrahymena* phagocytosis experiment and were compared to two course sections that participated in a non-hypothesis driven activity. Students engaging in the novel exercise developed their own hypotheses and conducted unique *Tetrahymena* phagocytosis experiments. These students were tasked with statistically analyzing data, interpreting results, and graphically depicting data. A Student Assessment of Learning Gains self-reporting survey recorded knowledge of the scientific method before and after engaging in the laboratory exercises. Learning outcomes for three pedagogical categories were assessed in both groups by comparing pretest to posttest scores using two-way ANOVAs. The experimental group exhibited slightly higher, but not significant, knowledge gains in the three learning outcomes. Voluntary interviews reported favorable attitudes regarding the inquiry-based exercise. Furthermore, an online version of our lab is being developed.

Cone, Rachel. Tau Eta, Catawba College. Temperature and Carbon Dioxide Effects on Carbonic Anhydrase in *Aiptasia* spp.

Due to increased levels of atmospheric CO₂ associated with global climate change, the pH of seawater is becoming more acidic. This may have a negative effect on organisms, especially those that produce skeletons containing bicarbonate. Carbonic anhydrase catalyses the reaction of carbon dioxide to bicarbonate. While *Aiptasia* spp. (sea anemone) does not produce a skeleton it serves as a theoretical model for studying the effects of ocean acidification on physiology of related coral. Biologically, sea anemones thrive in relatively moderate water temperatures (20-23°C) which served as our standard spectrophotometer monitoring temperature. Sea anemones were treated with CO₂ concentrations of 392ppm (control), 700ppm and 1300ppm. Their homogenized tissue was analyzed with a colorimetric method on a UV/Vis spectrophotometer. Samples were held at temperatures of 10, 20, and 30°C while absorbances were recorded. Carbonic anhydrase activity levels were determined in units of activity per gram of protein. Protein concentrations were determined using the Bradford assay. The objective of this research was to determine the effects of elevated CO₂ and different temperatures on carbonic anhydrase in *Aiptasia* spp. There was a significant increase in activity level with an increase in temperature. There were significant differences observed at 700ppm CO₂ when compared to other levels.

Edwards, Meghan, Amanda Faucher, and Andre Hawkins. Beta Eta, Florida Southern College. Biodiversity Survey of Dragonflies and Damselflies (Odonata) at Three Lakes in Lakeland, Florida.

Information on odonate biodiversity from the lakes of Central Florida is scarce. The purpose of this study was to sample the odonate assemblage of three lakes in Lakeland, Florida, and compare the assemblage to other surveys conducted in the Southeastern United States. Over a six week period, adult and larval Odonates were collected using standard air nets and aquatic dip nets. Specimens were identified to species and compared using the Shannon-Wiener diversity index and simple comparative statistics. Due to a collection bias, adult damselfly samples and larval dragonfly samples were used for diversity indices. To date, we have collected at least five different species for both dragonflies and damselflies. The greatest damselfly diversity was found at Lake Hunter, whereas dragonfly identification is on-going and will be discussed. On a region scale, the discovered odonate biodiversity in Lakeland, FL appears to be comparable to studies conducted in similar habitats from the Southeast. Overall, our study has established a foundation for future odonate research at Florida Southern College.

Gable, Paige, Caitlin Cole, Anna Beth Pruitt, & Nancy Eufemia Dalman. Psi Rho, North Georgia College & State University. The Effects of Zinc from Tire Mulch on the Rate of Phagocytosis in *Tetrahymena*.

Rubber tire mulch is being used in children's playgrounds and landscape. There is potential for aquatic ecosystem contamination from zinc found in the ground tire mulch. In the present study, we assessed the cytotoxic effects of zinc on feeding rate of *Tetrahymena pyriformis*. *Tetrahymena* are ciliated protozoans that are found in fresh water environments. These protozoans are indiscriminate feeders via phagocytosis, and their feeding rate can be altered by environmental changes. The *Tetrahymena* were exposed to an isotonic saline solution or an environmentally realistic zinc concentration of 0.07 mg/L zinc in isotonic saline. Phagocytic rate was determined by counting the quantity of fluorescently coated latex beads consumed by each *Tetrahymena* over 65 minutes. Over time, the zinc exposed *Tetrahymena* showed increased mortality and decreased feeding rates as compared to the unexposed *Tetrahymena*. These results suggest that run-off from tire mulch may have adverse effects on aquatic organisms. We are currently

conducting studies to determine the lowest observable effect concentration (LOEC) for zinc toxicity to *Tetrahymena* phagocytosis.

Helton, Amanda K., Schulz, Jordyn, Lloyd, Steven A. and Shanks, Ryan A. Psi Rho, North Georgia College and State University. The Effects of Methamphetamine on the Expression of PRX in Dopaminergic Areas of the Brain.

Abuse of the psychostimulant and dopamine (DA) agonist, methamphetamine (METH), leads to neurodegeneration of DAergic neurons in the striatum and prefrontal cortex. However, previous data in our lab indicates DA neurons in the hypothalamus are not susceptible to METH-induced neurodegeneration. This studies focus is on the antioxidant mechanisms available to deal with the toxic free radicals created by METH induced oxidative stress. One antioxidant, peroxiredoxin (PRX), represents a family of six antioxidant isoforms that reduces hydrogen peroxide, peroxytrite, and organic hydroperoxides. We hypothesized that PRX expression in response to METH exposure would be increased in the hypothalamus as a protective mechanism and decreased in the striatum and prefrontal cortex. Male C57B1/J6 mice were exposed to an abuse dosing paradigm of METH or saline. Prefrontal cortex, striatum, and hypothalamus regions were collected and processed for PCR analysis of PRX mRNA expression using isoform specific primers. There were no significant changes in the striatum, but there were significant METH-induced increases in PRX II, III, and VI in the hypothalamus and significant decreases in PRX III, V, and VI in the prefrontal cortex. This study provides insight into the response of PRX isoforms to DAergic damage and possible protective mechanisms underlying METH-induced neurodegeneration.

McClain, Ray, April Pearson, Katelyn Stillinger, and Toan Nguyen. Beta Eta, Florida Southern College. Microalgae Cultivation in Open and Closed Cultivation Systems.

Microalgae are currently being cultivated for a range of different products, but none more important than biofuel. It was not until recently, however, that scientist have showed an increased interest in microalgae applications for biofuel. The focus has been largely narrowed to microalgae species that exhibit rapid reproduction rates and high lipid yields. Two general methods, open and closed system, are used for microalgae cultivation. Both cultivation methods have notable advantages and drawbacks. To test the biofuel potential of each cultivation method, we performed two experiments, using the microalgae *Chlorella*. The first experiment yielded results that suggest a strong correlation between direct cell counts and indirect spectrometric absorption readings in simulated closed system cultivation. In addition, our results indicated that the introduction of turbulence to closed system cultivation yields higher growth rates for the algae *Chlorella*. Our second experiment explored a design for open pond cultivation. We constructed six open ponds, however three of the ponds were covered to prevent debris from entering ponds; temperature, pH, and cell counts were collected for all six ponds. The open pond results were inconclusive, primarily due to several major setbacks that concerned pond design and a lack of vigorous algal growth.

Mincey, Katherine, Tau Kappa, Georgia Southern University. Physical and Elemental Defenses of Nickel Hyperaccumulators and Their Affects on Herbivory.

This study examines the effectiveness of physical and elemental defenses in *Alyssum murale* in reducing herbivory from specialist (*Pieris rapae*) and generalist (*Vanessa cardui*) lepidopteran herbivores. I compared herbivore responses to *A. murale* grown in Ni-amended soil at four levels (0ppm, 100ppm, 500ppm, 2000ppm) and herbivore responses to a related non-accumulator species, *Alyssum montanum* that possesses trichomes but no elemental defenses. Choice experiments were set up to test larval response to trichomes only, nickel only (at 4 levels) and combined trichomes and nickel.

Significant differences were seen in the food choices of specialist and generalist larvae. *P. rapae* showed a strong preference for cotyledons (without trichomes) rather than true leaves (with trichomes). Nickel was not a strong deterrent for *P. rapae*. *V. cardui* showed no preference for cotyledons over true leaves, and it consumed cotyledons and true leaves at all nickel levels indiscriminately. Both species, however, when only given a choice of true leaves at different nickel levels, preferred to eat those with lower nickel levels. Overall, these results suggest that the elemental and physical defenses combine to protect *A. murale* against herbivory, particularly by specialist herbivores.

Pass, Thomas, Esmeralda Gonzalez, Amanda Helton, Anna Herdliska, Ryan A. Shanks, and Steven A. Lloyd. Psi Rho, North Georgia College & State University. The Effects of Adolescent Methamphetamine Exposure on Executive Functions in Adult Mice.

Methamphetamine (METH) is a highly exploited, psycho-stimulant drug that leads to neurotoxicity from oxidative damage in the dopaminergic regions of the brain. Recent data indicates increases in adolescent METH abuse. This key developmental window is characterized by changes in the striatum and pre-frontal cortices where normal alterations are already occurring. We hypothesize that METH exposure during adolescence will cause differences in adult executive functions for both male and female mice. To test executive functioning of adult mice exposed to METH during adolescence, C57Bl6J mice were injected with either 5 mg/kg of METH or saline for ten days starting on post-natal day (PND) 22. Following the injection period, the mice underwent a two month wash-out period. On PND 90, mice began assessment in a 5-Choice Serial Reaction Time Task Operant Chamber (5CSRTT). This chamber uses both positive punishment and positive reinforcement to shape discriminate responses. We found trending differences between METH-exposed males and saline males for correct responses, omissions, and correct latency. These are associated with changes in attention, hyperactivity, and decision-making abilities. Our results suggest that gender-specific effects may occur. Overall, the trending differences show that following adolescent exposure to METH, long-term cognitive deficits may persist into adulthood.

Propst, Lindsey. Nu Upsilon, Bridgewater College. Antibiotic Activity of Extracts of Several Basidiomycete Species.

In this study I analyzed the antibacterial and antifungal activities of several basidiomycete species using extracts of dried material and/or liquid growth media (glucose, peptone, yeast extract) of live cultures. The species surveyed include *Armillaria mellea*, *Agaricus sylvicola*, *Agaricus arvensis*, *Chlorophyllum molybites*, *Amanita muscaria*, *Lepista nuda*, and *Lactarius vinaceorufescens* among others. Intracellular metabolites were obtained from dried fungal specimens and were extracted using a Soxhlet extractor. These metabolites were then dissolved into a set of three different solvents: ethyl acetate, methanol, and chloroform. Extracellular metabolites were obtained from the GPY liquid medium after approximately 6 to 8 weeks of mycelial growth. These metabolites were filtered to isolate compounds under 10,000 MW. All extracts were tested against seven bacteria including *Staphylococcus aureus*, *S. epidermidis*, *Salmonella typhimurium*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Bacillus subtilis*, and *Enterobacter aerogenes* as well as two yeast fungi *Saccharomyces cerevisiae* and *Candida parasilicosis*. So far, only intracellular extracts from dried material of *Agaricus arvensis* showed antibiotic activity against *B. subtilis* at a concentration of 30 g/L when dissolved in methanol. Further analyses on more extracts and other species of basidiomycetes are being conducted.

Pruitt, Anna Beth, Caitlin Cole, Paige Gable & Nancy Eufemia Dalman. Psi Rho, North Georgia College & State University. Effects of New Tire Crumb Leachate on the Rate of Phagocytosis in *Tetrahymena*.

Used tires are now being recycled and utilized as playground mulch or for landscape coverings. Toxic chemicals used in the production of these tires and in the mulching process can leach out and enter into the aquatic ecosystem via rainwater run-off. Commonly found in freshwater environments, *Tetrahymena pyriformis* are single-celled, ciliated protozoans that feed indiscriminately by phagocytosis. *Tetrahymena* are model organisms for *in vitro* toxicological studies due to their short life span, easy cultivation and sensitivity to xenobiotics. To evaluate the effects of chemicals leached into aquatic ecosystems, *Tetrahymena* were cultivated and placed in a series of varying leachate concentrations or in an isotonic saline solution. The leachate was prepared by shaking new tire crumbs in a saline solution for 48 hours and then filtered and chilled; the stock was then serially diluted to represent an environmentally realistic range of concentrations. The rate of phagocytosis was observed over a 65 minute time series by quantifying the number of fluorescently coated latex beads consumed by each organism. *Tetrahymena* placed in high leachate concentrations consistently phagocytosed fewer beads than those in a saline control. These results suggest that leached chemicals from new tire crumbs decrease the rate of phagocytosis in exposed *Tetrahymena*.

*Rigano, Kim. Sigma Psi, Florida Institute of Technology. Visual Capabilities of Yellow Ratsnakes (*Elaphe obsoleta quadrivittata*) as Predators of the Threatened Florida Scrub-jay (*Aphelocoma coerulescens*).

In habitats ideal for the threatened Florida scrub-jay, such as the Merritt Island National Wildlife Refuge (MINWR), populations continue to decline. Video recordings suggest the yellow ratsnake as the main predator of scrub-jays (Carter et al., 2007), and fire suppression in MINWR may enhance scrub density and therefore success of semi-arboreal predatory snakes. This research aimed to understand the advantage ratsnakes may gain hunting in dense scrub by examining their visual capabilities through a structural and functional analysis of the retina. The relative abundance and distribution of rod and cone photoreceptors was determined using high-resolution light microscopy of semi-thin (i.e., 1µm thick) plastic sections in order to assess vision in bright and dim light. To confirm rod and cone identities, immunofluorescence labeling of photoreceptor opsin proteins was performed and analyzed by laser-scanning confocal microscopy in retinal cross sections. Photoreceptor densities and lens diameters were quantified to determine theoretical spatial acuity. Data from adult and juvenile eyes was compared as differences in predatory behavior have been observed between age classes (personal observation). This research will help determine the role of vision in yellow ratsnake predation, and aid in developing a successful conservation program for the Florida scrub-jay.

Rooker, Kelly. Bridgewater College, Nu Upsilon. The Indirect Effects of Predators on oyster Reefs: Reconciling the Relative Influence of Mortality, Competition, and Behavior at the Intermediate Trophic Level.

Understanding the consistency of consumptive (CE) versus non-consumptive (NCE) effects across predator species is critical for understanding predator-prey interactions and their influence on foundation species. We conducted an outdoor mesocosm experiment to compare the relative importance of CEs and NCEs in a tri-trophic oyster system using the locally dominant hardhead catfish as the top predator. We manipulated the presence of catfish cues in the water, simulated predation on mud crabs through daily manual culling, and then quantified mud crab foraging rates on juvenile oysters. The simulated predation had a significant effect on mud crab foraging rates with higher culling (i.e. lower mud crab densities) resulting in higher per capita foraging rates. In addition, there was an interaction between the presence of catfish cues and culling rate: crab foraging rates were higher in

the presence of fish cues at the high culling rate, but lower in the presence of fish cues in the absence of culling. Juvenile oyster abundance mirrored crab foraging rates. Our results demonstrate that mud crab density and catfish cues interactively affect mud crab foraging rates and juvenile oyster abundance. In addition, they suggest that the relative importance of CEs and NCEs may be predator-specific.

Starr, Adara and Gerald L. Smith. Phi Zeta, High Point University. Systematic Investigations in *Habranthus* species Native to South America and Two Hybrid Complexes.

A systematic study of *Habranthus* species native to South America and two hybrids were undertaken. *Zephyranthes atamasca* (L.) Herb., native to the Southeastern United States served as the outgroup. Relationships were indicated by ISSR band patterns and by morphological measurements and character observations. We also considered somatic chromosome numbers as indicators of relationships and as evidence for hybridization. The character states were scored and the data used to build a matrix which was analyzed in PAUP* 4.0b2. The tree that was generated from the matrix in MacClade 4.0 revealed patterns of sister taxa relationships, and several of the clades were supported by bootstrap values.

Visser, Stephanie J. Sigma Psi, Florida Institute of Technology. Adaptive Significance of Snake Skin Microarchitecture: the Roles of Body Mass and Life History.

The epidermal surface of skin in most snake species exhibits complex microarchitecture that varies across taxa and different regions of an individual snake's body. Almost nothing is known about the adaptive significance of the microornamentation. Some authors have argued that these microscopic patterns have no adaptive significance, but may serve as phylogenetic markers. The work described here compares the epidermal microarchitecture among species that vary widely in mass, ecology and phylogeny, with the goal of identifying a functional significance. Here we report a scanning electron microscopic analysis of epidermal microarchitecture in two snake species: the massive, terrestrial Burmese python (*Python molurus*), and the extraordinarily small and fossorial Brahminy blind snake (*Ramphotyphlops brahminus*). On *P. molurus*, parallel ridges cover the dorsal scale epidermal surface. On the ventral scale epidermal surface, parallel finger-like patterns are present. The epidermal surface of *R. brahminus* is radically different. *R. brahminus* epidermal surfaces exhibit no structural specializations at all. As a fossorial snake, it does not thermoregulate by absorption of solar radiation, and its small body mass may not require friction in order to move efficiently. These results support the conclusion that epidermal microarchitecture has adaptive significance, perhaps modulating diffraction and frictional characteristics of the epidermis.

Wassick, Ann. Sigma Psi, Florida Institute of Technology. Effect of Salinity and Temperature on the Survivorship and Development of Larvae of the Green Porcelain Crab *Petrolisthes armatus*.

Adult green porcelain crabs, *Petrolisthes armatus*, inhabit estuaries along the tropical and subtropical regions of the Atlantic coast. Although adult crabs are capable of tolerating the variable temperature and salinity conditions within estuaries, it is unknown whether *P. armatus* larvae are capable of completing development in areas near the adult habitat or whether they, like many estuarine crabs, are exported from the estuary to undergo development in coastal areas where environmental conditions are less variable and stressful. The purpose of this study was to determine the effect of salinity and temperature on the development rate and survivorship of newly hatched *P. armatus* larvae. Following release, zoea larvae were maintained in individual compartments containing water at one of two temperatures (25 or 30 °C) and one of five salinities (15, 20, 25, 30, or 35 psu).

Both survivorship and time to metamorphosis to the first crab stage did not differ significantly among the salinity treatments. However, survivorship was higher at 30 °C than at 25 °C. Crabs also developed faster at 30 °C than at 25 °C. Collectively, these results support the hypothesis that *P. armatus* larvae are retained near the adult habitat and complete development within polyhaline regions of estuaries.

Williams, Amanda G. and Constance Rogers-Lowery. Tau Eta, Catawba College. Metabolic Response to Ocean Acidification in the Colonial Cnidarian *Hydractinia symbiolongicarpus*.

Anthropogenic carbon dioxide emissions have increased at an astounding rate since the dawn of the industrial era. Due to their incredible buffering capacity, the earth's oceans have absorbed approximately 30% of all anthropogenic CO₂, resulting in a global decrease in seawater pH. This process, known as ocean acidification, has been shown to have profound effects on marine calcifiers, potentially due to the decreased availability of carbonate and bicarbonate needed for various calcification mechanisms. While many studies have confirmed a decrease in calcification rate in select calcifying species, particularly tropical corals, little is known about how acidification will affect metabolic rate. Likewise, the effects of acidification on calcifiers inhabiting estuaries have not been well studied. Estuaries are unique environments that play a crucial role in the growth and development of young marine organisms, making it critical to understand the ecological and organismal implications of acidification in these areas. Because they seem to be among the most sensitive to pH shifts and changes in dissolved carbon concentrations, some estuarine calcifiers may effectively serve as sentinel species. This study examines metabolic rate in the calcifying colonial cnidarian *Hydractinia symbiolongicarpus* in response to exposure to environments with heightened concentrations of dissolved CO₂.

Paton, J.C., L.D. Leverett, and C.L. Jolls. Tau Gamma, East Carolina University. The Integration of GIS and Ecology: Examining Plant Density of *Packera tomentosa*.

Ecology is the scientific study of the distribution and abundance of organisms in relation to abiotic and biotic factors. Techniques in Geographic Information System (GIS) can be used to alter, store, and analyze these distributions and abundances on a map using computer software. This integration of GIS and ecology can provide significant tools for asking relevant questions. We examined the spatial distribution flowering plant *Packera tomentosa*, woolly ragwort, a member of the sunflower family (Asteraceae) native to the coastal plain of the southeastern United States. A 25 x 50 m plot with 5 m² subplots was established at East Carolina University's West Research Campus (WRC) and we used the ArcMap 10 program within the ArcGIS software (ESRI, Redlands, CA) with an orthographic picture of the site to create maps of the sampling plot. GPS coordinates of the plot provided the groundwork of the 5 m² grid system used to visualize the density of *P. tomentosa*. The map suggested high numbers of plants and lower proportions of flowering individuals in 5 m² plots. Based on the primary literature, we hypothesized a trade-off between total plant density and the proportion of plants flowering. We found no statistically significant correlation between total plant density and proportion of plants flowering ($r^2 = 0.016$, $P > 0.05$). Although we did not detect a relationship between density and flowering in *Packera tomentosa*, this study emphasizes the value in using GIS to visualize spatial patterns in ecology, including some that may otherwise be hidden.

Phillips, Brian K. and Anna Herdiska, Ryan Shanks and Steven Lloyd. Psi Rho, North Georgia College & State University. An Assessment of a Novel Behavioral Neuroscience Laboratory Exercise.

We developed and assessed the effectiveness of a novel cross-disciplinary laboratory experience for introductory biology students using a sequential, hypothesis - driven design

focused on increasing competency in the use of the scientific method. The sample participants for this study were taken from a small public university in the Southeast enrolled in freshman biology courses (n=122). Control (n=66) and experimental groups (n=56) received the same lecture materials and participated in many of the same laboratory exercises. However, the experimental group participated in a novel behavioral neuroscience lab exercise. In sequential laboratory periods, the students in the experimental group developed and defended a formal hypothesis, executed their study using a murine behavioral chamber of their design, analyzed the primary data, and presented their results. Both groups were administered a pre/post test to evaluate the effectiveness of this novel experience using the Experimental Design Ability Test and the Student Assessments of Learning Gains instruments. A 2-way ANOVA revealed a group by pre/post test interaction effect in higher order learning objectives. The significant increase in higher order learning of the experimental group is indicative of a greater self-reported and demonstrated knowledge of the scientific process.

***District I Johnson Award Winner, Best Poster.**

Poster Presentations Southeastern District II

Armuelles, Hayden. Beta Phi, The University of West Alabama. Is *Curvularia* Thermotolerance Virus a good virus?

Global warming is causing agricultural industries to losing billions of dollars every year due to crop damages from higher temperatures and drought. One approach to solving this problem is to understand how wild plant species survive and flourish in unsuitable environments and adapt their survival mechanisms into crop plants. One such plant, panic grass or *Dichanthelium lanuginosumi*, grows in Yellowstone National Park and can survive temperatures of 65°C in geothermal soil. Panic grass' survival mechanism is based on a symbiotic relationship with a fungus, *Curvularia protuberate*, carrying the virus *Curvularia* thermotolerance virus (CThTV). The fungal-viral symbionts provide thermotolerance not only to panic grass but also to crop plants including corn, wheat, watermelon and tomato. This research examines the role of fungal melanin in providing plants with protection needed against heat stress. We have observed that the virus reduces the fungal melanin present in the cell wall under stress conditions. Therefore, it allows movement of specific protective biochemicals from fungus to plants, providing them with thermotolerance. Understanding the interaction mechanism between plant, fungus and virus is important before using this system in crop production.

Boudinot, Sara, Krista Parker, Megan Jones, Christi Magrath, and Teresa Moore. Mu Epsilon, Troy University. Filamentous Growth Mutations in *Saccharomyces cerevisiae* strains: genetic analysis.

The organism *Saccharomyces cerevisiae* (baker's yeast) is known to form unique growths and display altered morphology when exposed to stressful conditions. When a stressor is added to the yeast's environment, filamentous growth often results. To identify genes and/or proteins that are influenced by various environmental stressors and gain understanding of the mechanism of response, certain genes that deal with filamentous growth can be knocked out and the physiological and cellular differences assessed. Three yeast knockouts with deletions in filament formation genes (Δ Gas1, Δ Uba4, Δ Tpk2) were previously identified, and growth rate, morphology, and filament formation capabilities were all noted. Mating Δ Gas1 with Δ Uba4, Δ Gas1 with Δ Tpk2, and Δ Tpk2 with Δ Uba, using standard yeast genetics, allows creation of heterozygotes that can be used in the environmental analysis of wastewater related stress. In our analysis, the heterozygotes

displayed altered morphology in media designed to induce stress and meiosis (sporulation media). Increased filamentation and decreased tetrad formation were evident in the heterozygotes, when compared to a wild type diploid. In the future, these heterozygotes can be subjected to additional genetic analysis, such as tetrad dissection and genotype confirmation using PCR. Assessing the morphology and the degree of filamentation of double knockouts grown on media exposed to three different water samples [distilled water (control), water collected in an area where treated wastewater from the Troy Wastewater Treatment Plant is dumped into Walnut Creek (effluent), and water collected upstream of the wastewater treatment plant] will allow the use of yeast to decipher how particular filamentous growth genes work in response to environmental stressors.

Mandiga, Hemalata. Mu Omicron, Columbus State University. [Evaluating the Efficacy of Indian Herbal Medicines on Cancer Cells and Confirming their Genetic Identity using DNA Barcoding.](#)

Plants have been used for thousands of years as remedies to cure the sick and now a growing number of Americans are turning to natural medicines because of their low cost and decreased side effects. Ayurvedic medicines, in particular, have been shown to prevent DNA mutation, decrease tumor formation, reverse the process of carcinogenesis and even inhibit cancerous cell growth. This study focuses on the species identification and efficacy of herbal medicines previously identified as potentially beneficial for anti-cancer treatment. The purpose of this study was to sample manufactured Ayurvedic capsules, extract their plant derivatives, and apply them to cancer cell lines to evaluate their effect of cell growth and proliferation. Furthermore, DNA barcoding was employed in an attempt to confirm the species composition of each of the capsules employed in this study. Preliminary results indicate that in some cases putative anti-cancer treatments have an effect on cancer cell lines and DNA barcoding shows potential for the confirmation of species identity. This research underscores the potential use of DNA barcoding to assess the quality of naturopathic medicines as well as the need for further testing to confirm the efficacy of anti-cancer treatments currently on the market.

Murphy, Pache. Beta Zeta. University of North Alabama. [Using PCR to Amplify Four Antibiotic Resistance Genes.](#)

Antibiotic resistance is an emergent problem in healthcare due to the overuse and misuse of antibiotics. Unless action is taken to prevent the spread of antibiotic resistance, healthcare could return to a pre-antibiotic state within the next two generations. The goal of this project was to use PCR to detect antibiotic resistance genes in bacteria isolated from the hands and cell phones of cell phone owners in order to rapidly determine the antibiotic resistance profile of the bacterial isolates. This study is part of a four year project that will monitor antibiotic resistance profile changes among study participants. Genomic DNA was isolated from several samples collected during the first year of our study and PCR amplified using primers for penicillin, oxacillin (methicillin), gentamicin, clindamycin and erythromycin resistance genes. The use of PCR to determine antibiotic resistance saved time and reagents compared to the traditional Kirby Bauer method.

Nelms, Christen, and Dantria Grace. Beta Phi, The University of West Alabama. [Ozone Stress Response in Northern Red Oak.](#)

Ozone pollution places environmental stress on trees resulting in early leaf aging and loss of photosynthetic capacity. Currently, genetic databases are limited in providing the genomic resources to improve the sustainability of hardwood trees. To help solve this problem, undergraduate students were trained at an institution funded by the National Science Foundation. The focus of this study was to identify and examine the genes responsible for environmental stress responses in Northern red oak (*Quercus rubra L.*), an

important North American hardwood, seedlings when exposed to 30 days of differing ozone concentrations in closed ozone chambers. These concentrations were 150, 225, and 300 parts per billion. The leaf tissue in seedlings of Northern red oak was harvested, and genetic material was isolated after the exposure period. To identify the plants' full genome, 454 sequencing technology was used. Cytoscape programming indicated genetic locations of ozone stress responses in various plant cell structures. Results showed that specific stress genes were activated as ozone concentrations increased. The results of this project are significant in helping the scientific community use innovative genetic tools to overcome environmental stresses that are threatening our forests.

*Onyango¹, Joshua, Rylan S. Larsen², Ben D. Philpot². (1) Oakwood University (2) University of North Carolina at Chapel Hill. Presynaptic NMDA Receptors Do Not Promote GABA Release in the CA1 region of the Hippocampus and L2/3 of the Visual Cortex.

Presynaptically located NMDA receptors (preNMDARs) increase neurotransmitter release probability at inhibitory and excitatory synapses in the neocortex. Our objective in this study is to observe any changes in miniature inhibitory or excitatory postsynaptic current frequency (mIPSC and mEPSC respectively) when preNMDARs are selectively blocked. Based on previous findings, we hypothesized that blocking preNMDARs will decrease the frequency of spontaneous release of neurotransmitters in the CA1 region of the hippocampus and L2/3 of the visual cortex. Artificial Cerebral Spinal Fluid (ACSF) containing TTX, NBQX, and picrotoxin was utilized to isolate spontaneous (TTX) inhibitory (NBQX) and excitatory (picrotoxin) neurotransmission. The internal solution contained in the recording pipette comprised of an NMDAR antagonist (MK-801) to selectively block postsynaptic NMDARs in hyperpolarized cells (-80mV). We did not observe any significant changes in mIPSC or mEPSC frequency when the NMDA antagonist D-AP5 was bath applied while recording in CA1 of the hippocampus. Similarly we did not observe any changes in mIPSC frequency in the visual cortex however the frequency of mEPSCs was reduced in response to D-AP5 application. This implies that the preNMDARs on inhibitory synapses in these brain regions are not tonically active, possibly due to differential subunit composition or absence of their expression.

Patel, Parag D. Mu Omicron, Columbus State University. DNA Barcoding of Indian herbal Medicines and Testing their Effects on Cancer Cell Lines.

Many cultures rely on the use of medicinal plants as the main source of treatment for numerous illnesses. Specifically, the amount of people world-wide that are diagnosed with cancer is increasing at an accelerated rate. Testing the quality and efficacy of plant-based medicines that are currently on the market is an essential component of the prevention and treatment of this disease. The purpose of this study was to test the quality and efficacy of Ayurvedic capsules that contain various plant based-remedies previously identified as beneficial to overall health. I used DNA barcoding to confirm the species identity of 25 different capsules and applied liquid extracts of each capsule to cancer cell lines to test their efficacy on cell growth and proliferation. Preliminary results indicate that DNA can be isolated from Ayurvedic capsules and that DNA barcoding shows potential for species identification in some cases. Furthermore, preliminary results also indicate that extracts from Ayurvedic medicines that have been previously identified as benefiting general health also have potential anti-proliferative and apoptotic inducing properties in cancer cell lines. This research underscores the need to test for safety, quality, and efficacy of putative treatments for the benefit of the consumer plant-based medicines.

Stracener, Steven. Beta Zeta, University of North Alabama. Effect of Local Bacteria and Fungi on R.I.F.A.

The feral species of Red Imported Fire Ants (RIFA) has been a pest in North America since the 1950's. The stings containing ferric acid can cause anaphylactic shock and the nests have been known to interfere with established plant, animal, and other native ant populations. This, when coupled with the advancements in microbial control over the past two decades has led to the question "Can microbes be used to control a feral species like RIFA?" and if so would this control lead to new problems. The experiment attempts to answer those questions in a series of trials. Microbes were isolated from local soil samples, grown in controlled conditions and exposed to a colony in controlled conditions. A sample of dead ants were then taken from the colony and put into broth tubes to create a "master mix." This mix was then isolated by species in the lab and also tested against another colony. The second trials dead ants were taken and a second master mix was made for trial two. In both trial one and trial two microbes are in cold storage awaiting genus species identification through Biolog.

Umoren, Mfoniso. Mu Omicron, Columbus State University. Ethnobotanical Genomics of the Medicinal Plants of Nigeria: DNA Barcoding Confirms the Identity of Species Having Antibacterial and Antifungal Properties.

The goal of this research was to confirm the species identity of medicinal plants in West Africa and evaluate their medicinal efficacy. Specifically, I collected 12 plant species in Nigeria that are known widely for their antibacterial and antifungal properties. DNA barcoding was then used to confirm species identification based on sequence variation in the *rbcL* gene region of the chloroplast genome. Plant extracts from each species were then isolated and applied to plates containing bacterial and fungal cultures to evaluate their medicinal efficacy. Preliminary results indicate that DNA barcoding can be used to confirm the species identification of medicinal plants collected in Nigeria. Furthermore, in some cases, plant extracts confirm putative antibacterial and antifungal properties. Results not only provide a novel contribution to the Ethnobotanical literature but also provide insight for researchers in Nigeria who are currently working with these medicinal plant species.

Ulm, Jodie and Diannea Wilson. Mu Iota, Northern Kentucky University. Morphological Comparisons of *Physalis pubescens* and *Physalis grisea*.

Physalis grisea (the "ground cherry") is a cultivated relative of *P. pubescens*. The ranges for the 2 species overlap in southeastern United States, and the two species look very similar. Further distinctions between these species are needed to improve dichotomous keys (for field identification). The fruits and seeds of *P. pubescens* and *P. grisea* have been harvested, counted, and weighed. T-tests of fruit and seed data resulted in significant differences between the two species in seed count, seed weight, and fruit measurements. We are currently studying seedling traits and mature vegetative morphology to look for further differences between these two species. Based on our results so far, we agree with the taxonomists who have chosen to recognize these as two distinct species, rather than one variable species as was historically done.

Elson, Katherin. Mu Iota. Northern Kentucky University. Synthesis of Sacro-Endothelial Reticulum ATPase (SERCA) Inhibitor for Prostate Cancer Cells.

In 2011, an estimated 240,890 cases of prostate cancer occurred in the United States and 33,720 of those cases resulted in death. For this reason, research has focused to develop compounds capable of inflicting apoptosis of prostate cancer cells. An enzyme found in prostate cancer cells known as sacro/endoplasmic reticulum calcium ATPase (SERCA), functions by transferring Ca^{2+} ions from the cytosol into the sarcoplasmic reticulum. When SERCA ion transport is inhibited, cell death occurs. The purpose of this project is to link a SERCA inhibitor compound to a pre-synthesized peptide for specific prostate antigens excreted by prostate cancer cells. This will be performed using conventional organic

laboratory techniques to synthesize the compound. Proton and carbon nuclear magnetic resonance (NMR) and mass spectroscopy will allow characterization of the compound. Upon isolation, the bioactivity will be assessed on the SERCA enzyme activity.

Derek McCalla^{1,2}, Pralay Majumder, Ph.D.¹, Jocelyn McDonald, Ph.D.¹ ¹Department of Molecular Genetics, Lerner Research Institute, Cleveland Clinic, Cleveland, OH ²Department of Biological Sciences, Oakwood University, Huntsville, AL. Candidate-Based Rnai Screen With Par-1 In Collective Cell Migration.

Cell migration is vital for a variety of tissue remodeling processes, especially during embryonic development, wound healing and tumor metastasis. While the mechanisms regulating single cell migration are fairly well studied, less is known about how cells coordinate migration in collective groups. The goal of our research is to discover key conserved cellular and molecular pathways that regulate collective cell migration *in vivo*. We study the genetically tractable migration of *Drosophila* border cells, which move as a cohesive group of 6-10 epithelial-derived cells during late oogenesis. It is known that Par-1 regulates border cell migration. However, the mechanism of Par-1 has not been established completely. To better understand Par-1's mechanism, this project was designed to study the interaction between Par-1 and other proteins found by a yeast-2-hybrid screen. We used gal4-UAS system to specifically express RNAi in border cells and hence knockdown the expression of specific gene or genes. Flies with the Par-1 RNAi were crossed individually with flies containing the other RNAi found by the yeast-2-hybrid screen. The progeny was isolated, dissected and their ovaries stained and examined to determine the impact of each cross on migration. The results showed EF1 Gamma and Anon-20EA enhanced the Par-1 phenotype causing a higher percentage of incomplete border cell migration. Glycogen Synthase had a slight suppression of the Par-1 phenotype. No significant effect on Par-1 was found for MRLP44 and CG11164. Together, our data indicate the potential ways with which Par-1 affects border cell migration.

Oehrle, Melissa. Mu Iota. Northern Kentucky University. Antimicrobial Properties of Medicinal Plants of Ecuador.

Resistance by bacteria to known antibiotics is on the rise, and therefore there is an urgent need to discover new antibiotics. Plants and their endophytic fungi and actinomycetes are a potential source of new antimicrobial drugs. This research was designed to take advantage of a class trip to Ecuador to collect and test different plants for their antimicrobial activity. Ecuador contains a vast diversity of biomes, ranging from desolate, mountainous regions to temperate wetlands to lush rainforests. This variety accounts for a diverse flora that local people use in part for medicinal purposes. Plants were collected from various elevations and biomes. These included plants, such as *Uncaria tomentosa* (Cat's claw), or *Croton lechleri* ("dragon's blood") that have known medicinal properties, as well as plants not known for their medicinal effect. Extracts from the plants were tested against mouth "normal" flora, *Staphylococcus aureus*, and *Escherichia coli*, in order to observe if a zone of inhibition could be obtained. Zones of inhibition were seen both from microbes grown from the plants (endophytic flora) as well as from extracts of some of the tested plants. This research demonstrates that plants from Equatorial regions like Ecuador are potential sources for new antimicrobial drugs.

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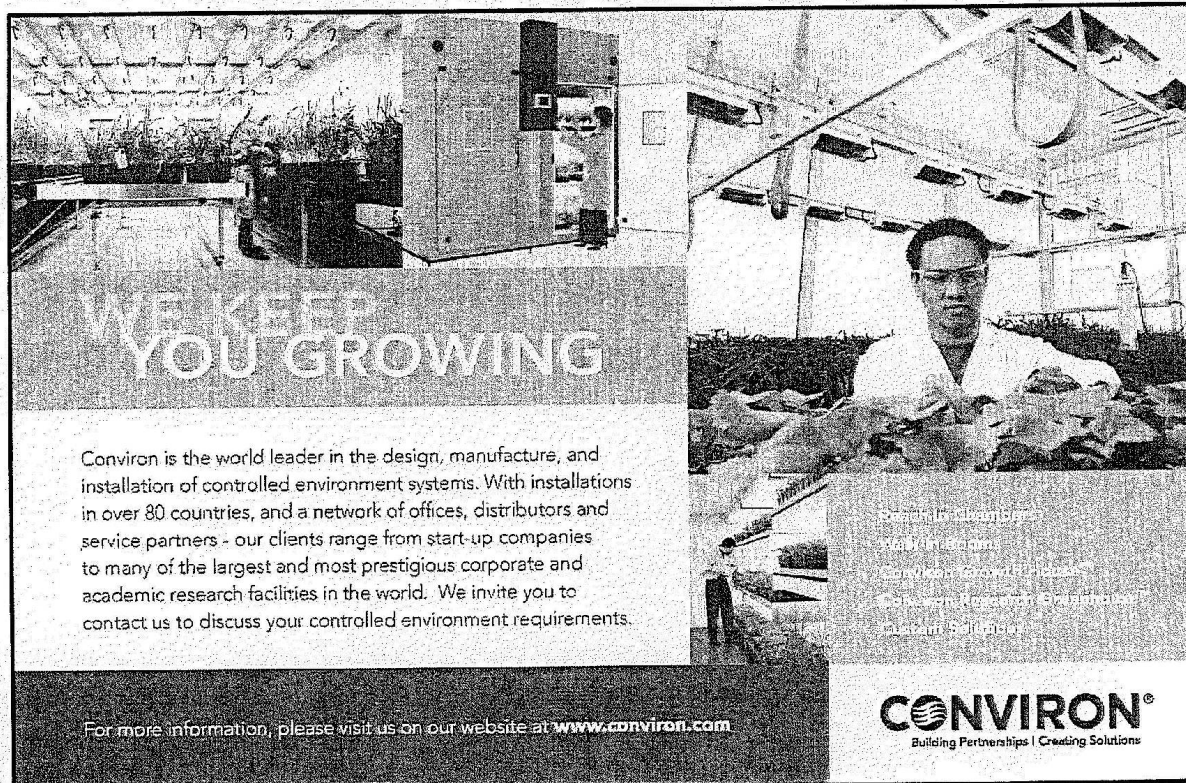
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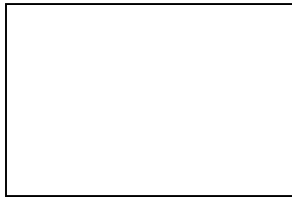
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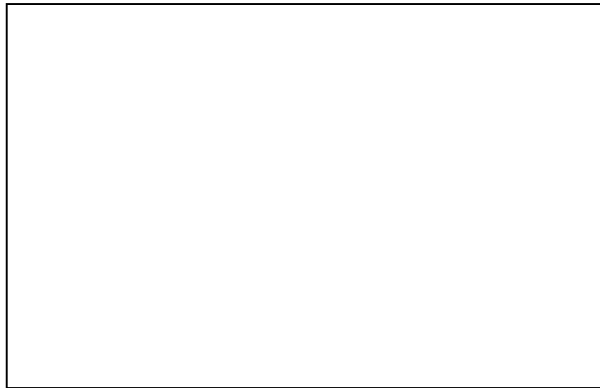
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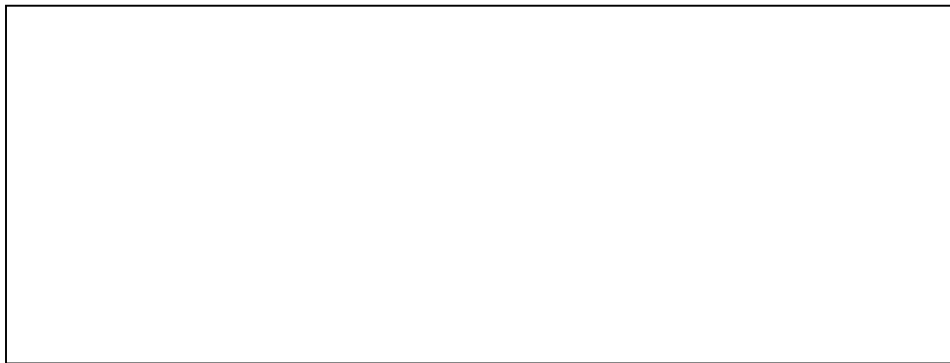
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OBITUARIES
George Canting Kent, Jr.
1914-2012

George C. Kent, Jr. passed on Wednesday, January 4, 2012, age 97, of Pittsburgh, PA, formerly of Baton Rouge, LA. Son of the late George C. Kent, Sr. and Charlotte Dela-mater. Husband of the late Lila Kent. Father of Carolyn Rovee-Collier, of Stockton, NJ. Brother of Donald Kent of Hurley, NY. Grandfather of Ben (Kersten) Rovee of Ohio Township and Christopher Rovee of Palo Alto, CA. Great-grandfather of Zachary Rovee and Julian Rovee, and also survived by numerous nieces and nephews. Mr. Kent received a B.S. in Biology at Maryville College and received his Ph.D. in Comparative Anatomy at Vanderbilt University. He was a tenured professor since 1942, at LSU where he was Chairman of the Zoology Department and was recognized as an Alumnus Professor after retirement. He authored the textbook, "Comparative Anatomy of the Vertebrate's," which is currently used in academia in 39 countries. He was a member of The Association of Southeastern Biologists for many years and served as vice president in 1950-51, executive committee member in 1952-55, and president in 1956-57. Services and interment held within the privacy of the family. Memorial contributions may be made to Wounded Warriors Project, 4899 Belfort Road, Suite 300, Jacksonville, FL 32256, www.woundedwarriorproject.org. Arrangements by the Lawrence T. Miller Funeral Home, Inc., 460 Lincoln Avenue, Pittsburgh, PA 15202. www.ltmillerfuneralhome.com.



Published in The Times-Picayune, 3800 Howard Ave., New Orleans, LA 70125-1429.

**Stephen Lee Timme
1950-2012**

Dr. Stephen Lee Timme, 61, Bella Vista, Arkansas, formerly of Harrisonville, MO, died Tuesday, April 10, 2012 at his home. Funeral services will be held at 12:00 noon Saturday, April 14, 2012 at the Atkinson Chapel in Harrisonville with visitation from 10:00-12:00. (Cremation to follow). Memorial contributions may be made to: Kansas Native Plant Society, R. L. McGregor Herbarium, University of Kansas, 2045 Constant Ave, Lawrence, KS 66047-3729; or Missouri Native Plant Society, P.O. Box 440353, St. Louis, MO 63144-4353; or c/o Atkinson Funeral Home, 600 West Wall Street, Harrisonville, MO 64701.



Stephen was born August 27, 1950 in Kansas City, KS, the son of William Everett and Esther Mae (Brabble) Timme. He married Susan Lee (Shroyer) Rozgaja on October 10, 2009 in Bentonville, Arkansas.

Stephen received his undergraduate and master's degree in biology from Southwest Missouri State University, Springfield, MO and a PhD in botany from Mississippi State University. He taught biology courses at Pittsburg State University, Pittsburg, KS. He served in the United States Army from 1969-1970, serving with the 101st Airborne Division in Vietnam, where he received two purple hearts. He was at one time a member of ASB.

He was preceded in death by his father, one brother, Clay Timme, one sister, Sue Parrish. He is survived by his wife, Susan, of the home; two sons, Caleb Timme and Zach Timme, both of Pittsburg, KS; his mother, Esther Timme, Harrisonville, MO; three stepchildren, Steven Rozgaja, Windsor, Ontario, Tania Rozgaja, Melbourne, FL and Nikolas Rozgaja, Bentonville, AR; two brothers, Wyatt Timme and his wife, Betty, Arvada, CO and Matthew Timme and his wife, Sandy, Harrisonville, MO; one sister, Robin Timme, Archie, MO; one grandson, Gunner Timme; cousins, nephews, nieces and friends.

Published in The Morning Sun, 701 North Locust Street, Pittsburg, KS 66762.

Donald R. Windler
1940-2012

Donald R. Windler, professor emeritus at Towson University, died on March 11, 2012 in Lansing Michigan at age 72. Don was born in Nashville, Illinois on February 1, 1940. He earned his Bachelor of Science and Master of Arts at Southern Illinois University, Carbondale in 1962 and 1965, respectively. Don was hired as an Assistant Professor of botany in the Department of Biological Sciences at what was then Towson State College in August 1969. He completed the requirements for a doctor of Philosophy at The University of North Carolina, Chapel Hill in 1970.



At Towson he established the herbarium (BALT), which has grown largely under his direction to over 50,000 specimens including vascular plants, non-vascular plants and lichens. The herbarium serves as a depository for 19th century specimens from the Maryland Natural History Society and now continues to receive specimens from the Mid Atlantic region and throughout the world.

Don continued his research in the Leguminosae (Fabaceae) by studying *Neptunia*, *Crotalaria* and *Mucuna* of the New World. This and other endeavors led to the publication of over 15 articles in various journals. He also published articles on the lichens of the Mid Atlantic, floras of various regions, and a common interest article on aquatic insectivorous plants for *Smithsonian* magazine. At Towson, he developed and taught an upper level course called Field and Systematic Botany and developed an extensive laboratory manual/text to accompany it. In addition, Don taught major's courses in General Botany, Vascular Plant Taxonomy, Biosystematics, and Biological Literature, and he also taught a non-major's biology course. He supervised the theses of six graduate students, most of whom examined the floras of Maryland parks and recreation areas including Gunpowder Falls State Park, Catocin Mountain National Park and Soldiers Delight Natural Environmental Area.

Don quickly was promoted to Professor, served the department as its Chair for several years (1984-1987 and 1990-1995), and he also served as Acting Dean for the college of sciences for three years. He was instrumental in developing the graduate program for biological sciences and was a charter member of the Towson Chapter of Sigma Xi. An additional important contribution that Dr. Windler made to the department, college and university was the development of a biology alumni newsletter. This was a semiannual newsletter sent to every biology alumnus that could be located with information of developments in the department, provided vignettes on alumni and updates on current alumni. The newsletter was so successful that the University Alumni Association took over the

letter and mailing list and used it as a model for the current alumni magazine. His effort was important in increasing donations to biology scholarship endowments. He was also successful in negotiating the development of a biology scholarship specific to transfer students that was initially funded by a retired biology faculty member.

Dr. Windler also took great concern in the development of the Glen Arboretum on campus modeled after the arboretum at UNC Chapel Hill. A six-acre parcel of land was set aside in the University Master Plan for development into an arboretum. Don convinced the University Foundation to establish an endowment for the arboretum, which has grown in value with donations from alumni. The Glen Arboretum is an ongoing program that bears witness to his dedication. He retired from Towson University as professor emeritus in January 2003.

Dr. Windler is survived by his daughter Erica, son-in-law Peter, and grandson Aiden, who live in Michigan.

Dr. James C. Hull, Department of Biological Sciences, Towson University, Towson, MD 21252.

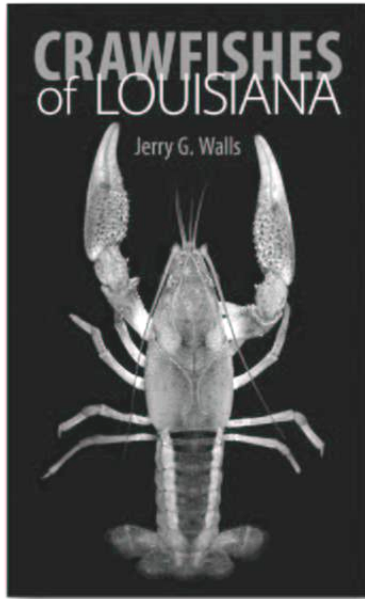
Journal Editor's note: It is fitting to add that Dr. Windler received the Elizabeth Ann Bartholomew Award in absentia from the Southern Appalachian Botanical Society at the 2010 annual meeting of the Association of Southeastern Biologists. Award committee chair, Dr. Lisa Kelly, received the award for Dr. Windler from SABS treasurer Dr. Charles Horn. The announcement was published in Southeastern Biology 57(4):492-493, 2010 as follows:

Elizabeth Ann Bartholomew Award

The society annually presents the award in memory of Elizabeth Ann Bartholomew's untiring service to the public, to plant systematics, and to the organization. The award is presented to individuals who have also distinguished themselves in professional and public service that advances our knowledge and appreciation of the world of plants and their scientific, cultural, and aesthetic values, or exceptional service to the society. **Donald R. Windler**, retired professor of Biology at Towson University, was selected for the 2010 award. He now lives in Nashville, Illinois. He received the award for his dedication to SABS in helping to develop and grow the endowment and service as the society president. A detailed presentation of his accomplishments can be found in the September 2010 issue of *Castanea*.



Chair of the SABS Elizabeth Ann Bartholomew Award Committee Lisa Kelly (right) receives the Bartholomew award for Donald R. Windler from SABS Treasurer Charles Horn.



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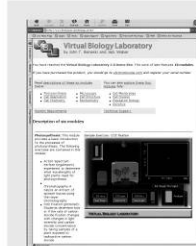


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