Botany in North Dakota and beyond

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Kyoto University, Japan
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2019 – 11 – 08

Outline

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Flora of North Dakota

オオバコ: *Plantago* and *Plantagineae*

ツゲ科: *Buxus*, *Haptanthus* and other Buxaceae

Bitterbushes, *Picramnia* family

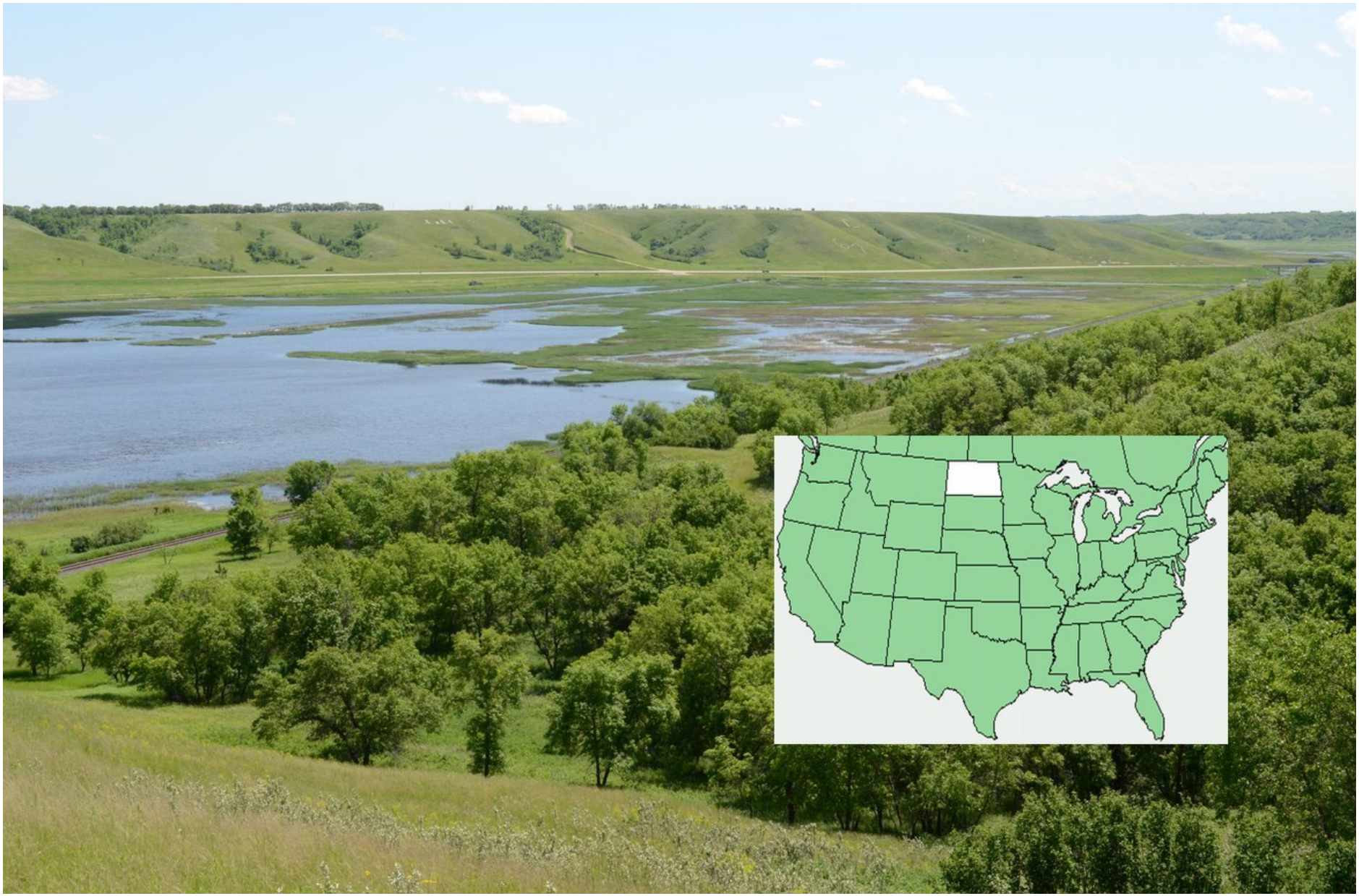
Other research projects

Teaching projects

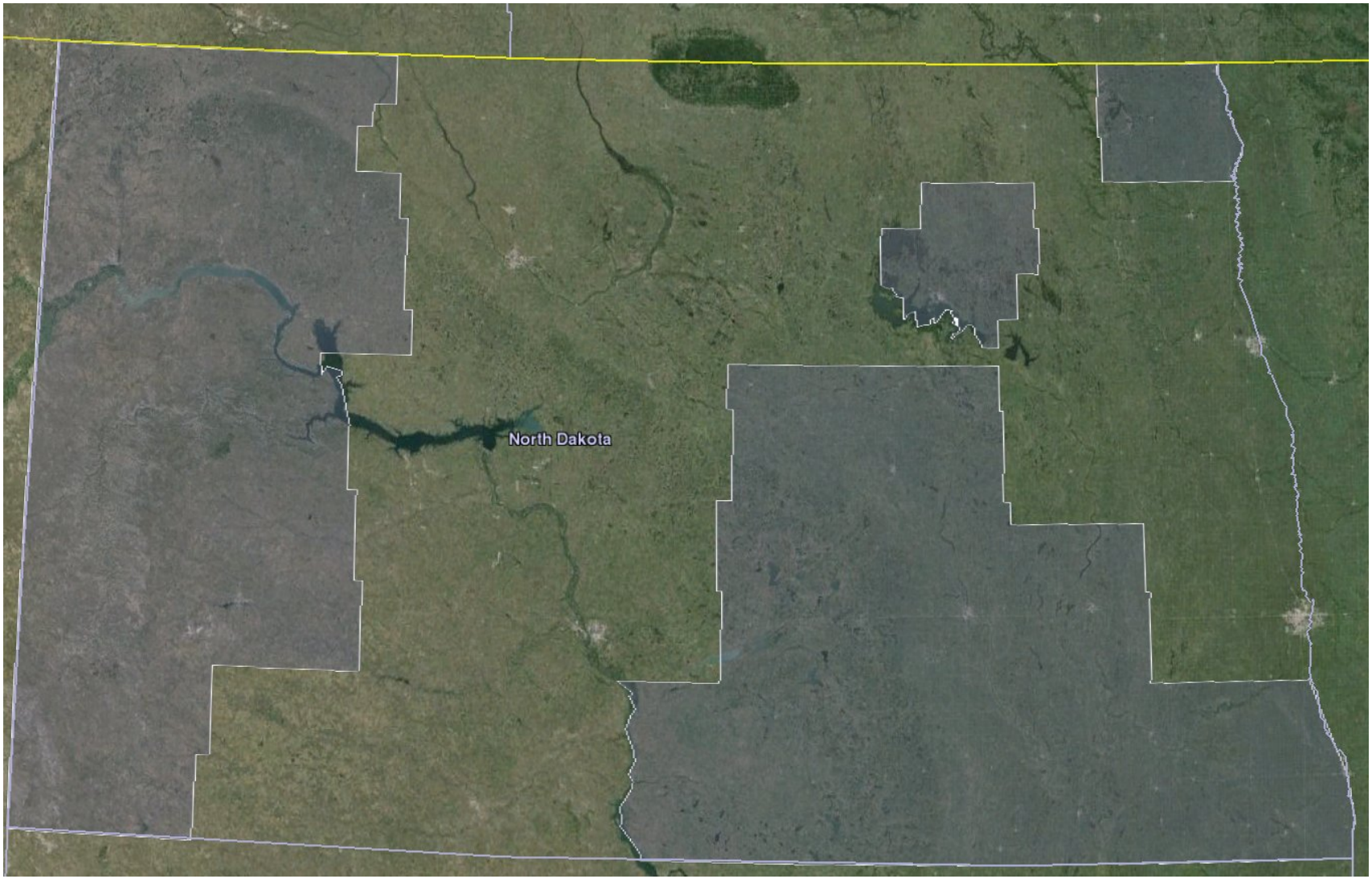
Flora of North Dakota

Before 2010

North Dakota



One of the least botanically researched states



Only 55% of territory covered, some counties have less then 20 herbarium samples in public databases.

Flora of North Dakota

Main Achievements

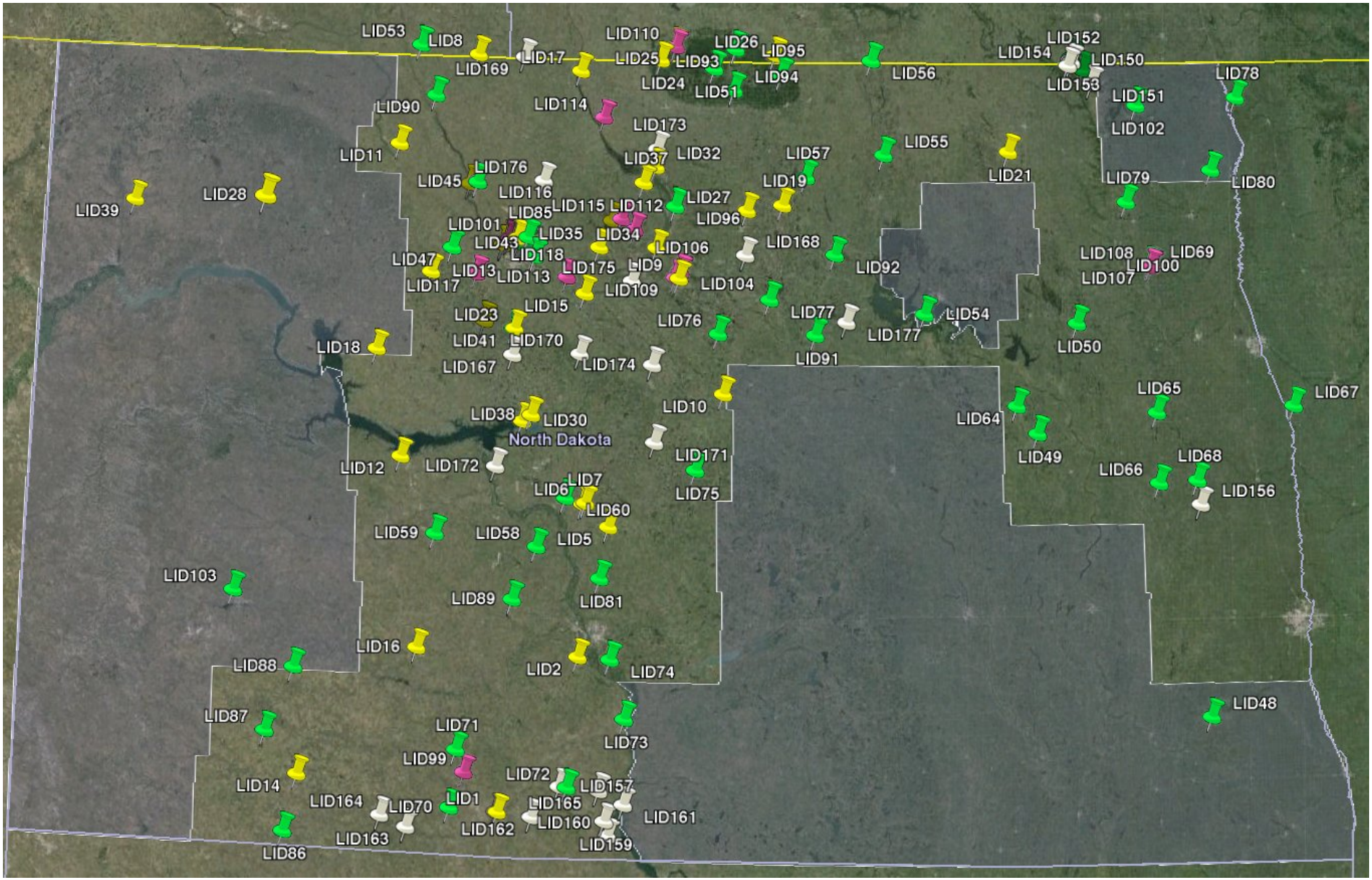
North Dakota flora research

Oak savanna growing on aeolic sands

We tried to concentrate our efforts in most floristically interesting regions.

Typical collection plot

Now in 2019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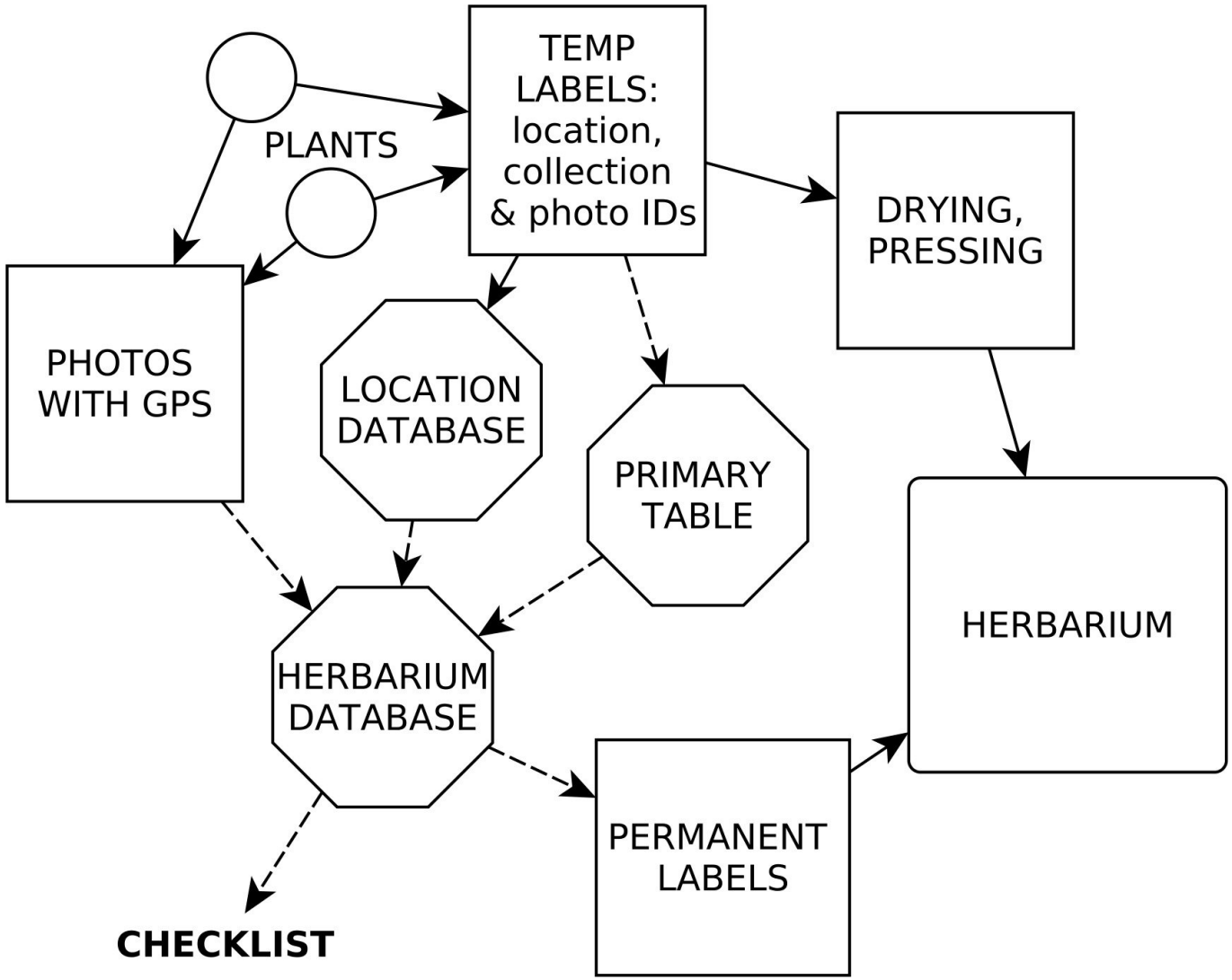
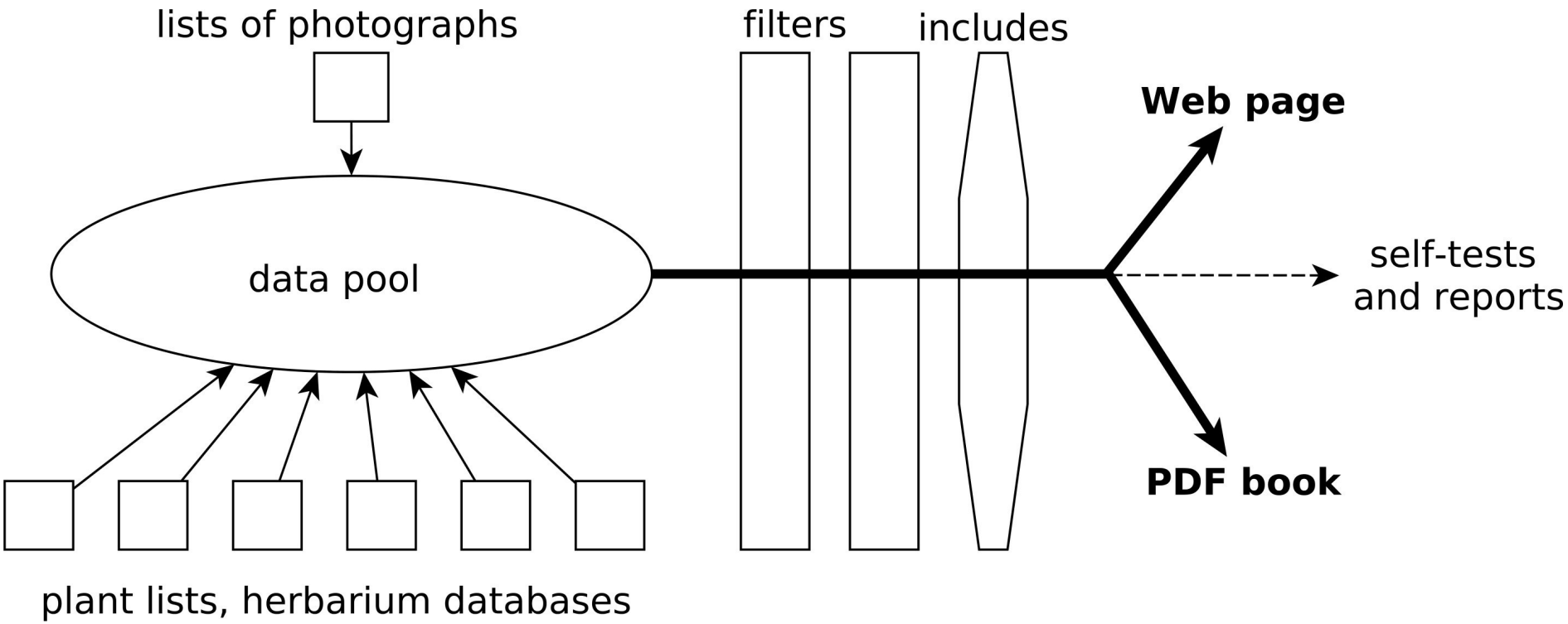
Collection workflow



Plant collection movie (2 min)

Checklist workflow



(This is how **Rmanual** works, the R-based semi-automatic workflow which is capable to make photographic manuals from the set of flat tables and images.)

Flora of North Dakota: the Web page

Flora of North Dakota: Checklist

Version 2, 20190220

[Citation] Shipunov, A. Flora of North Dakota: Checklist. Version 2. Ed.: Kartesz, J., and Nishino, M. 2017—onwards. http://ashipunov.info/shipunov/fnddb2/index.htm

Book in PDF format, with maps, images and more (> 125 Mb!)

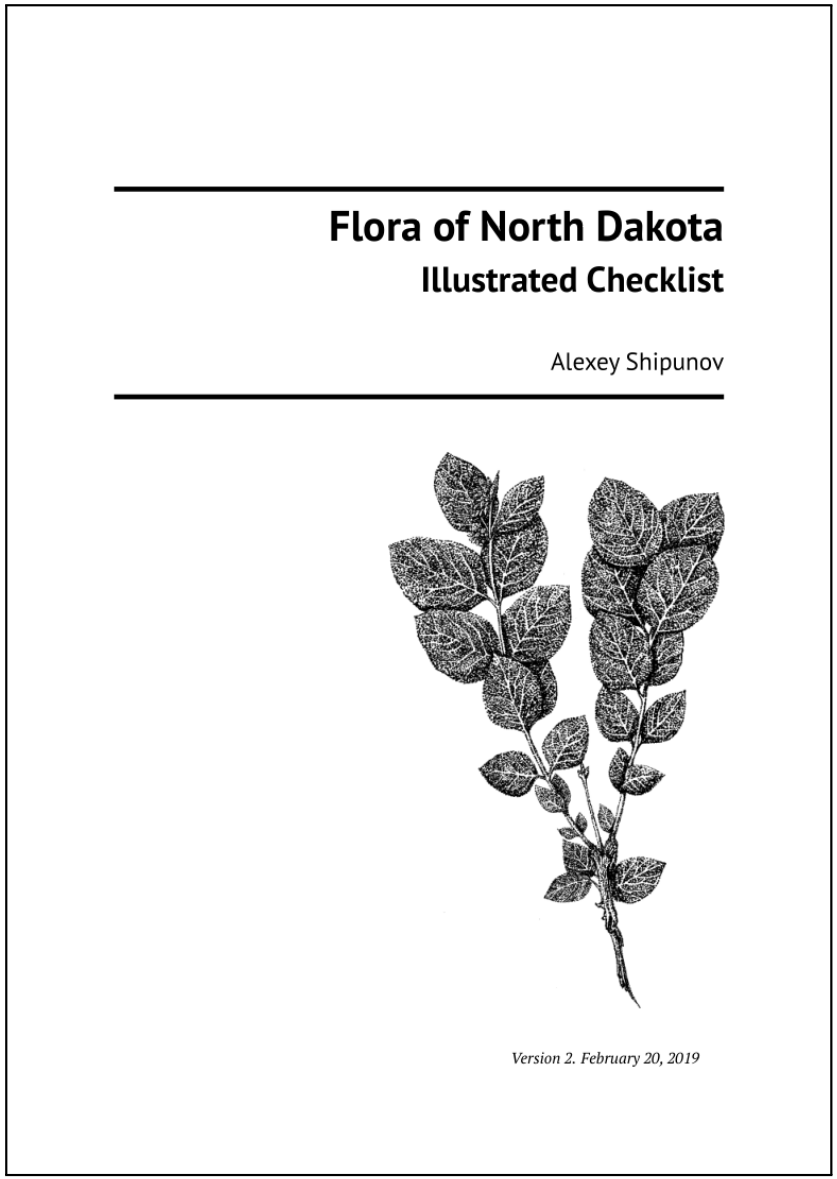
SEARCH NAMES CONTAINING SHOW 10 SPECIES

Family	Species	Counties	Sources	Extra info
Acoraceae	*Acorus americanus*, sweetflag	BOTTINEAU, GRAND FORKS, MCHENRY, PIERCE, RANSOM, TOWNER. Introduced.	*1*, 5, 5, *6*, 7, *7*, *15*, *16*, *27*, *28*, 29, *33*, 34, 35, 39, 41, 43, *43*, 47	Map
Adoxaceae	*Sambucus nigra*, black elderberry	BARNES, BURLEIGH, CASS, EDDY, EMMONS, GRAND FORKS, KIDDER, LOGAN, MCINTOSH, PEMBINA, RICHLAND, SIOUX, STUTSMAN, WALSH, WARD. Introduced.	*1*, 4, *5*, *7*, *8*, *11*, *17*, *19*, *25*, *26*, 29, *30*, *31*, 39, *41*, 43, 48	Map
Adoxaceae	*Sambucus racemosa*, red elderberry	CASS, RANSOM, RICHLAND, SARGENT, TRAILL, WALSH	1, 4, 5, *5*, 25, 26, 29, 39, 41, 43	Map, Photo
Adoxaceae	*Viburnum lentago*, nannyberry	BARNES, BENSON, BILLINGS, BOTTINEAU, BURKE, BURLEIGH, CASS, CAVALIER, DUNN, EDDY, EMMONS, GRAND FORKS, GRANT, GRIGGS, KIDDER, LOGAN, MCHENRY, MCINTOSH, MCKENZIE, MCLEAN, MERCER, MORTON, MOUNTRAIL, NELSON, OLIVER, PEMBINA, RAMSEY, RANSOM, RENVILLE, RICHLAND, ROLETTE, SARGENT, SIOUX, STARK, STEELE, STUTSMAN, WALSH, WARD	1, 3, 4, 5, *5*, 6, 7, *7*, 11, 13, 14, 17, 18, 19, 21, 24, 25, 26, 27, 28, 29, 30, 31, 32, 39, 41, 42, 43, 44, 45	Map, Photo, Photo, Photo, Photo, Photo
Adoxaceae	*Viburnum opulus*, European cranberrybush	BARNES, BENSON, BOTTINEAU, BURLEIGH, CASS, CAVALIER, GRAND FORKS, MCHENRY, NELSON, PEMBINA, PIERCE, RAMSEY, RANSOM, RICHLAND, ROLETTE, SARGENT, STEELE, STUTSMAN, TOWNER, TRAILL, WALSH, WARD	1, 3, 4, 5, *5*, 6, 7, *7*, *11*, 14, *17*, 18, *25*, 26, *27*, *28*, 29, *30*, 39, 40, 41, 42, 43, 45	Map, Photo, Photo, Photo, Photo, Photo
Adoxaceae	*Viburnum rafinesquianum*, downy arrowwood	BOTTINEAU, CASS, CAVALIER, GRAND FORKS, PEMBINA, ROLETTE, WALSH	1, *3*, 4, 5, *5*, 6, 7, *7*, *14*, *27*, 28, *29*, 30, 39, 41, 43, *45*	Map, Photo, Photo
Alismataceae	*Alisma gramineum*, narrowleaf water plantain	BARNES, BENSON, BILLINGS, BOTTINEAU, BURKE, BURLEIGH, CAVALIER, DICKEY, DIVIDE, DUNN, EDDY, EMMONS, FOSTER, GOLDEN VALLEY, GRAND FORKS, GRANT, HETTINGER, KIDDER, LAMOURE, LOGAN, MCHENRY, MCINTOSH, MCKENZIE, MCLEAN, MERCER, MORTON, MOUNTRAIL, NELSON, PIERCE, RAMSEY, RANSOM, RICHLAND, SARGENT, SHERIDAN, SLOPE, STARK, STEELE, STUTSMAN, TRAILL, WARD, WELLS, WILLIAMS	1, 2, 3, 4, 5, 6, 7, *7*, 8, 11, 13, 15, 16, *17*, 18, 19, 21, 24, 26, *27*, 28, 29, 31, 32, 39, 41, 43, 44, 45, *45*, 47	Map, Photo, Photo, Photo
Alismataceae	*Alisma plantago-aquatica*, European water plantain	BARNES, BENSON, BILLINGS, BOTTINEAU, BOWMAN, BURKE, BURLEIGH, CASS, CAVALIER, DICKEY, DIVIDE, DUNN, EDDY, EMMONS, FOSTER, GOLDEN VALLEY, GRAND FORKS, GRANT, GRIGGS, HETTINGER, KIDDER, LAMOURE, LOGAN, MCHENRY, MCINTOSH, MCKENZIE, MCLEAN, MERCER, MORTON, MOUNTRAIL, NELSON, OLIVER, PEMBINA, RAMSEY, RANSOM, RENVILLE, RICHLAND, ROLETTE, SARGENT, SHERIDAN, SIOUX, SLOPE, STARK, STEELE, STUTSMAN, TRAILL, WALSH, WARD, WILLIAMS. Introduced.	1, 3, 5, 6, 11, 12, 13, 15, 16, 24, 25, 31, 32, 42, 44, 45	Map
Alismataceae	*Alisma subcordatum*, American water plantain	BENSON, BILLINGS, BURKE, CAVALIER, DICKEY, EDDY, FOSTER, GRAND FORKS, LAMOURE, LOGAN, MCINTOSH, MCLEAN, MOUNTRAIL, OLIVER, PEMBINA, RAMSEY, RANSOM, RICHLAND, SARGENT, SIOUX, STEELE, WARD, WELLS	1, 2, 4, 7, 8, 10, 14, 17, 18, 19, 21, 26, 27, 29, 30, 39, 41, 43, 47	Map, Photo, Photo, Photo, Photo, Photo, Photo, Photo, Photo
Alismataceae	*Alisma triviale*, northern water plantain	BARNES, BENSON, BILLINGS, BOTTINEAU, BOWMAN, BURKE, BURLEIGH, CASS, CAVALIER, DICKEY, DIVIDE, DUNN, EDDY, EMMONS, FOSTER, GOLDEN VALLEY, GRAND FORKS, GRANT, GRIGGS, HETTINGER, KIDDER, LAMOURE, LOGAN, MCHENRY, MCINTOSH, MCKENZIE, MCLEAN, MERCER, MORTON, MOUNTRAIL, NELSON, OLIVER, PEMBINA, RAMSEY, RANSOM, RENVILLE, RICHLAND, ROLETTE, SARGENT, SLOPE, STARK, STEELE, STUTSMAN, TRAILL, WALSH, WARD, WILLIAMS	4, 8, 9, 19, *21*, 28, 29, 39, 41, 42, 43, 45, 47	Map, Photo, Photo, Photo, Photo
Family	Species	Counties	Sources	Extra info

Species 1-- 10 from 1,607 total

http://ashipunov.info/shipunov/fnddb/

Flora of North Dakota: the book

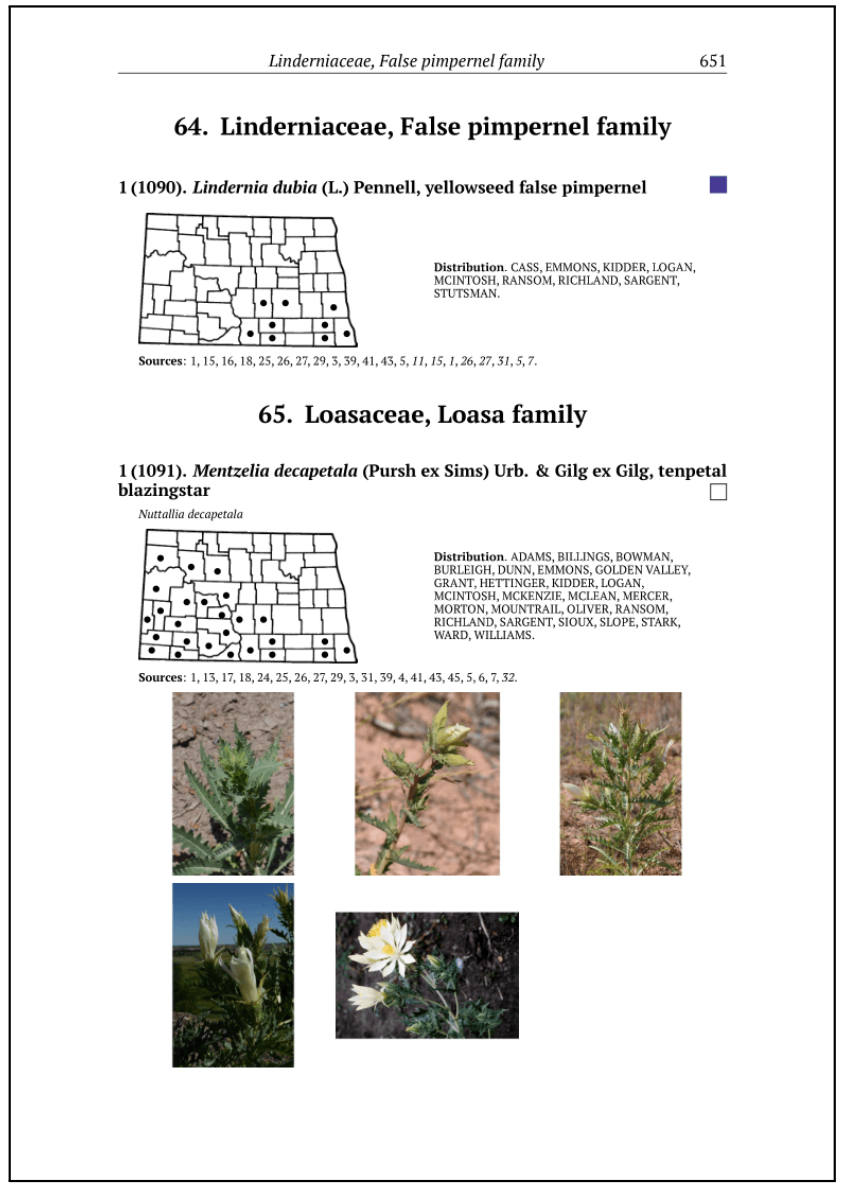


Flora of North Dakota

Illustrated Checklist

Alexey Shipunov

Version 2. February 20, 2019



64. Linderniaceae, False pimpernel family

1 (1090). *Lindernia dubia* (L.) Pennell, yellowseed false pimpernel

Distribution. CASS, EMMONS, KIDDER, LOGAN, MCINTOSH, RANSOM, RICHLAND, SARGENT, STUTSMAN.

Sources: 1, 15, 16, 18, 25, 26, 27, 29, 3, 39, 41, 43, 5, *11*, *15*, *1*, *26*, *27*, *31*, *5*, *7*.

65. Loasaceae, Loasa family

1 (1091). *Mentzelia decapetala* (Pursh ex Sims) Urb. & Gilg ex Gilg, tenpetal blazingstar

Nuttallia decapetala

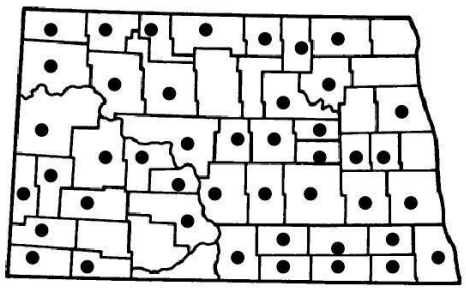
Distribution. ADAMS, BILLINGS, BOWMAN, BURLEIGH, DUNN, EMMONS, GOLDEN VALLEY, GRANT, HETTINGER, KIDDER, LOGAN, MCINTOSH, MCKENZIE, MCLEAN, MERCER, MORTON, MOUNTRAIL, OLIVER, RANSOM, RICHLAND, SARGENT, SIOUX, SLOPE, STARK, WARD, WILLIAMS.

Sources: 1, 13, 17, 18, 24, 25, 26, 27, 29, 3, 31, 39, 4, 41, 43, 45, 5, 6, 7, *32*.

Checklist PDF

PDF book, typical page

3 (1172). *Linum perenne* L., blue flax



Distribution. ADAMS, BARNES, BENSON, BILLINGS, BOTTINEAU, BOWMAN, BURKE, BURLEIGH, CASS, CAVALIER, DICKEY, DIVIDE, DUNN, EDDY, EMMONS, FOSTER, GOLDEN VALLEY, GRAND FORKS, GRIGGS, KIDDER, LAMOURE, LOGAN, MCINTOSH, MCKENZIE, MCLEAN, MERCER, MORTON, MOUNTRAIL, OLIVER, RAMSEY, RANSOM, RENVILLE, RICHLAND, ROLETTE, SARGENT, SHERIDAN, SLOPE, STARK, STEELE, STUTSMAN, TOWNER, WARD, WELLS, WILLIAMS. Introduced.

Sources: 1, 2, 4, 6, 7, 8, 11, 13, 19, *21*, 24, 26, 31, 32, 43.

Photographed in VI–VIII.

Every page of book combined from multiple sources

574 *Plant List*

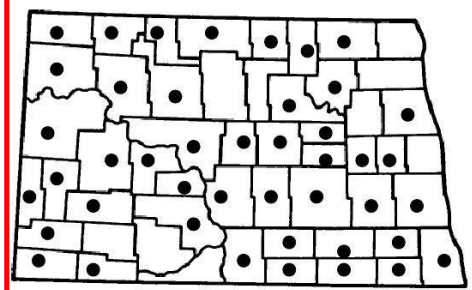
Automatic numeration

Table of authors

Table of common names

3 (1172). ***Linum perenne*** **L., blue flax**

Table of color codes



Integrated species list

Distribution. ADAMS, BARNES, BENSON, BILLINGS, BOTTINEAU, BOWMAN, BURKE, BURLEIGH, CASS, CAVALIER, DICKEY, DIVIDE, DUNN, EDDY, EMMONS, FOSTER, GOLDEN VALLEY, GRAND FORKS, GRIGGS, KIDDER, LAMOURE, LOGAN, MCINTOSH, MCKENZIE, MCLEAN, MERCER, MORTON, MOUNTRAIL, OLIVER, RAMSEY, RANSOM, RENVILLE, RICHLAND, ROLETTE, SARGENT, SHERIDAN, SLOPE, STARK, STEELE, STUTSMAN, TOWNER, WARD, WELLS, WILLIAMS. Introduced.

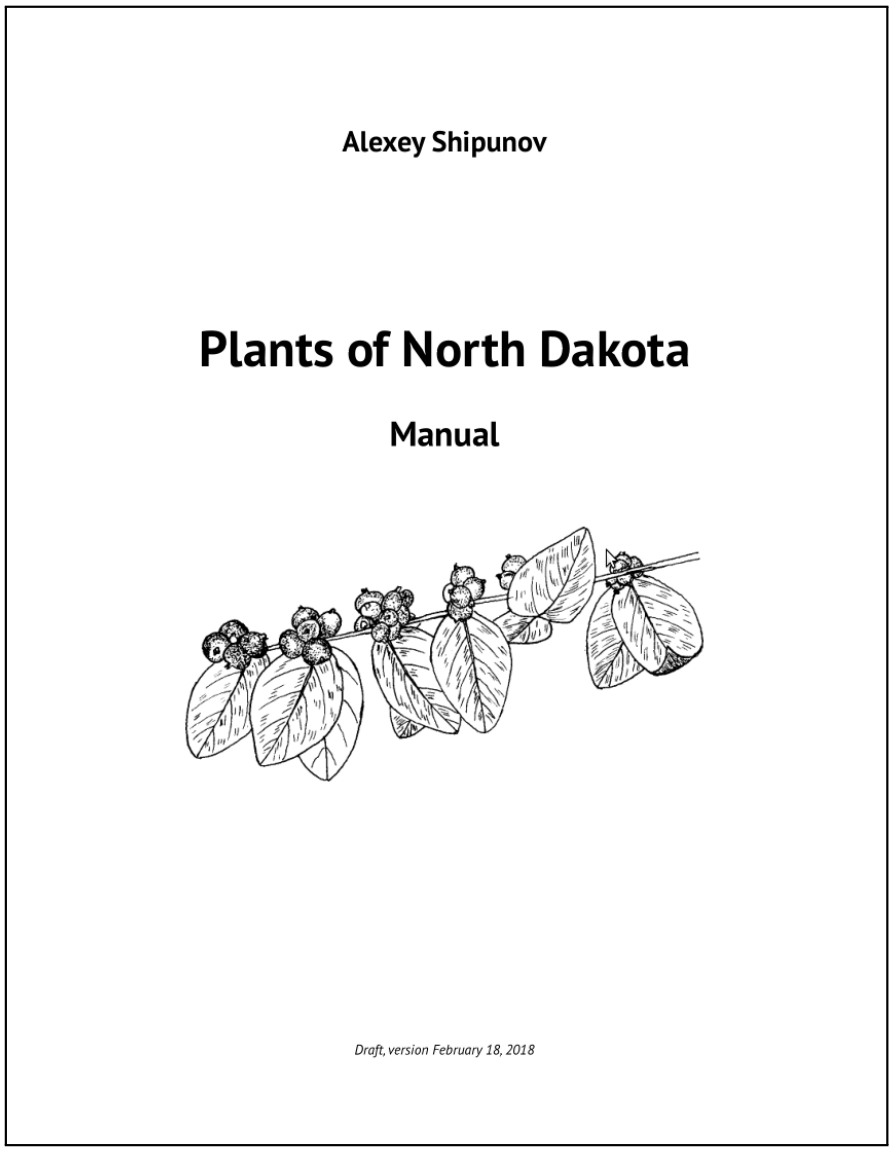
Sources: 1, 2, 4, 6, 7, 8, 11, 13, 19, *21*, 24, 26, 31, 32, 43.

Photographed in VI–VIII.

Names of photo folders

List of photos + thumbnails of images

North Dakota plant manual



Alexey Shipunov

Plants of North Dakota

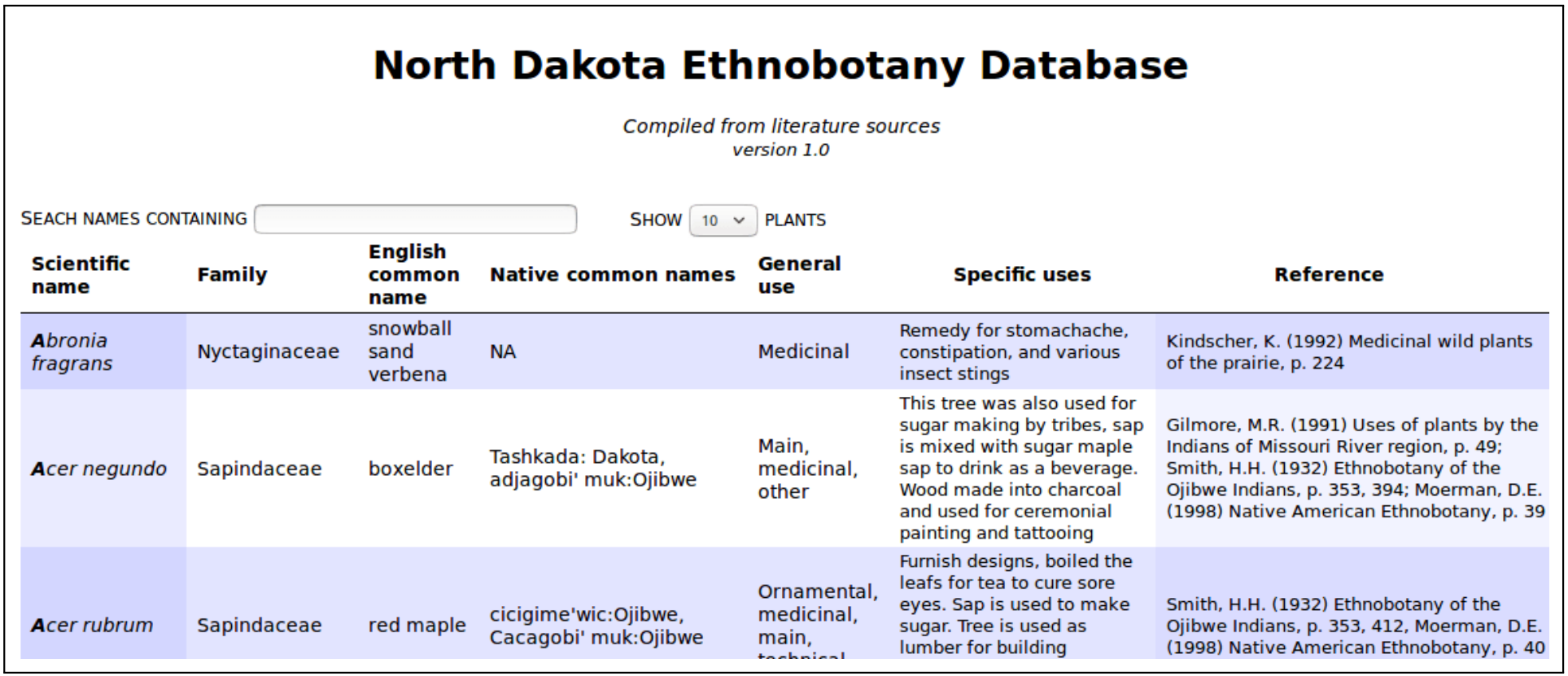
Manual

Draft, version February 18, 2018

Contents

Plant Manual PDF

North Dakota Ethnobotany Database



North Dakota Ethnobotany Database

Compiled from literature sources
version 1.0

SEACH NAMES CONTAINING SHOW 10 PLANTS

Scientific name	Family	English common name	Native common names	General use	Specific uses	Reference
Abronia fragrans	Nyctaginaceae	snowball sand verbena	NA	Medicinal	Remedy for stomachache, constipation, and various insect stings	Kindscher, K. (1992) Medicinal wild plants of the prairie, p. 224
Acer negundo	Sapindaceae	boxelder	Tashkada: Dakota, adjagobi' muk:Ojibwe	Main, medicinal, other	This tree was also used for sugar making by tribes, sap is mixed with sugar maple sap to drink as a beverage. Wood made into charcoal and used for ceremonial painting and tattooing	Gilmore, M.R. (1991) Uses of plants by the Indians of Missouri River region, p. 49; Smith, H.H. (1932) Ethnobotany of the Ojibwe Indians, p. 353, 394; Moerman, D.E. (1998) Native American Ethnobotany, p. 39
Acer rubrum	Sapindaceae	red maple	cicigime'wic:Ojibwe, Cacagobi' muk:Ojibwe	Ornamental, medicinal, main,	Furnish designs, boiled the leafs for tea to cure sore eyes. Sap is used to make sugar. Tree is used as lumber for building	Smith, H.H. (1932) Ethnobotany of the Ojibwe Indians, p. 353, 412, Moerman, D.E. (1998) Native American Ethnobotany, p. 40

http://ashipunov.info/shipunov/school/biol_310/nd_ethnobotany.htm

オオバコ: *Plantago* and *Plantagineae*

What are *Plantagineae*

Genus *Plantago*

About 230 species, distributed worldwide. Above is *Plantago barbata* (Torres del Paine, Patagonian Andes).

Littorella

Only three species, in lakes or desalinated seas: Patagonia, American Great Lakes and Northern Europe

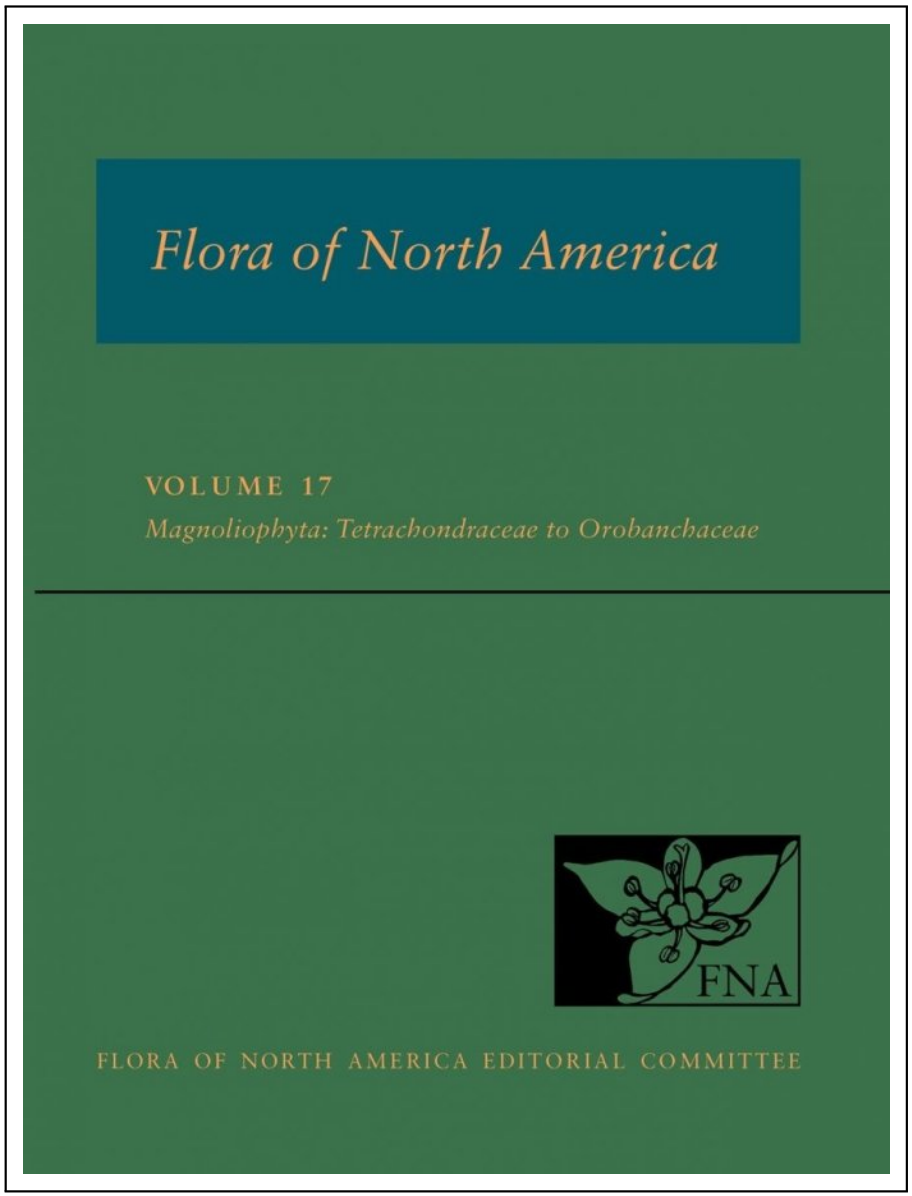
Aragoa, Columbian páramo endemic

About 20 species, mostly in Columbia, only one in Venezuela.
Affinities were unknown before 2000s.

オオバコ: *Plantago* and *Plantagineae*

Current results

Plantago of North America



1. **Littorella americana** Fernald, Rhodora 20: 62. 1918
• American shoreweed, littorelle d'Amérique

Perennials fibrous-rooted. **Leaves** dark green or green when dry, usually arcuate, linear, or subulate, 10–40 × 1–2 mm, glabrous. **Spikes:** staminate flowers 1, peduncles 5–30 mm, glabrous; pistillate flowers 2–5, at base of plant; bracts rounded. **Flowers:** sepals 2.5–3 mm; corolla lobes erect; stamen connective to 1 mm. **Nutlets** 2.5–3 mm. **Seeds** 2–3 mm. $2n = 12$.

Flowering summer. Shorelines of lakes, ponds, and slow moving streams; 0–200 m; St. Pierre and Miquelon; N.B., Nfld. and Labr. (Nfld.), N.S., Ont., Que.; Maine, Mich., Minn., N.H., N.Y., Vt., Wis.

The relationship between *Littorella americana* and Eurasian *L. uniflora* (Linnaeus) Ascherson has been debated. Molecular data provide support for recognition of North American plants as a distinct species (R. K. Hoggard et al. 2003).

Plantago americana (Fernald) Rahn is an invalid name and pertains here.

40. PLANTAGO Linnaeus, Sp. Pl. 1: 112. 1753; Gen. Pl. ed. 5, 52. 1754 • Plantain
[Latin *planta*, sole or flat, and *-ago*, resemblance, alluding to leaf shape of *P. major*]

Alexey Shipunov

Psyllium Miller

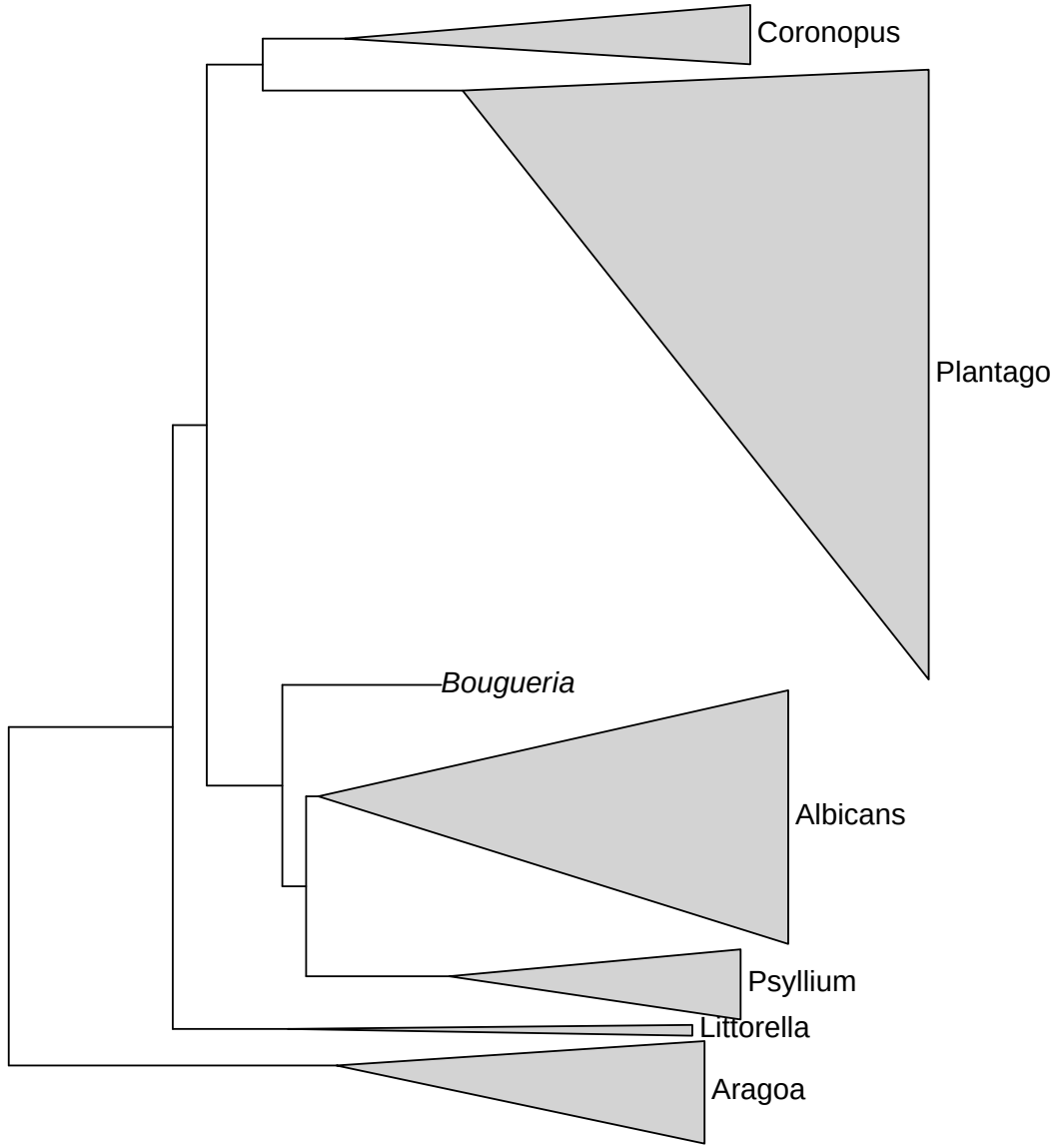
Herbs, annual or perennial, sometimes biennial [rarely suffrutescent or arborescent]; caudex usually present when perennial. **Stems** present or absent, if present, erect, glabrous or hairy. **Leaves** usually basal, usually alternate, (cauline and opposite in *P. afra*, *P. indica*, *P. sempervirens*); petiole absent or present; blade fleshy, leathery or not, margins entire or toothed. **Scapes** erect or ascending, rarely decumbent (*P. coronopus*), surpassing leaves, sometimes slightly so (*P. tweedyi*) or not (*P. major*). **Inflorescences** axillary, spikes or spiciform, dull, sometimes shiny (*P. canescens*, *P. lanceolata*, *P. media*); bracts present. **Pedicels** absent or present; bracteoles absent. **Flowers** bisexual; sepals 3 or 4, nearly distinct (abaxials connate in *P. lanceolata*), oblong, calyx radially, rarely bilaterally, symmetric, cuplike; corolla semitransparent, radially or weakly bilaterally symmetric, lateral lobes smaller, ± tubular to ± funnelform, tube base not spurred or gibbous, tube glabrous, rarely hairy (*P. coronopus*, *P. maritima*), lobes 4; stamens 2 or 4, free, equal, filaments glabrous; staminode 0; ovary 2-locular, placentation free-central, sometimes axile; stigma elongate. **Fruits** pyxides, lanceoloid, rarely ovoid (*P. macrocarpa*), dehiscence circumscissile (indehiscent or dehiscence not circumscissile in *P. macrocarpa*). **Seeds** (1 or)2–35, black or brown, sometimes dark red (*P. rhodosperma*) or yellowish brown (*P. virginica*), oblong, wings absent. $x = 4, 5, 6$.

Species ca. 210 (32 in the flora): North America, Mexico, Central America, South America, Europe, Asia, Africa, Pacific Islands (New Zealand), Australia.

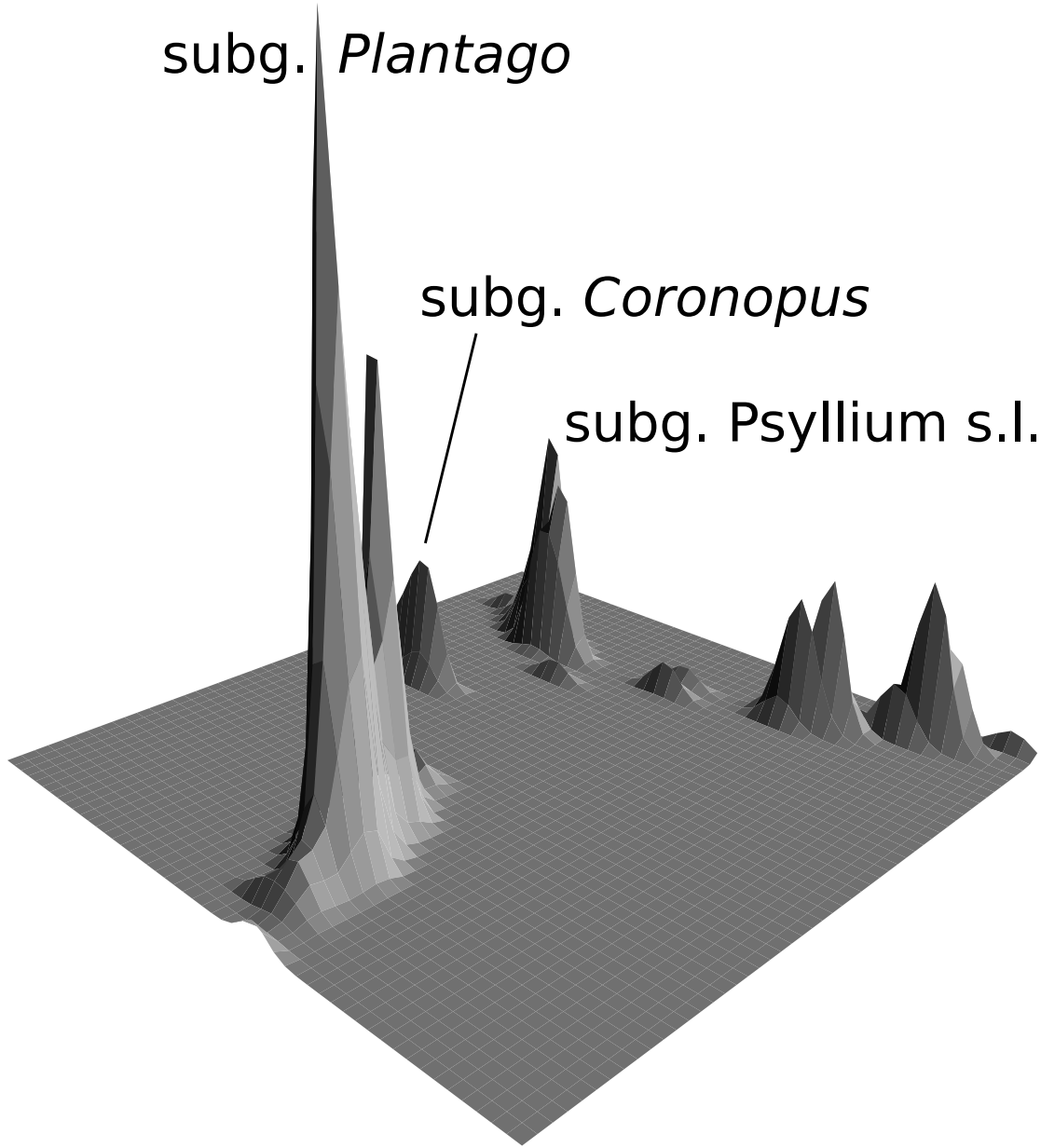
Plantago lanceolata and *P. major* have become established on all continents except Antarctica. A specimen of *P. asiatica* Linnaeus (New York City, *US 295731*) is ambiguous as to locality, and there is no evidence that it is established outside of cultivation in the flora area. Among North American *Plantago*, several native species have been introduced to states or provinces outside their native range.

For species with bilaterally symmetric calyces, sepal lengths in the descriptions are for the adaxial sepals.

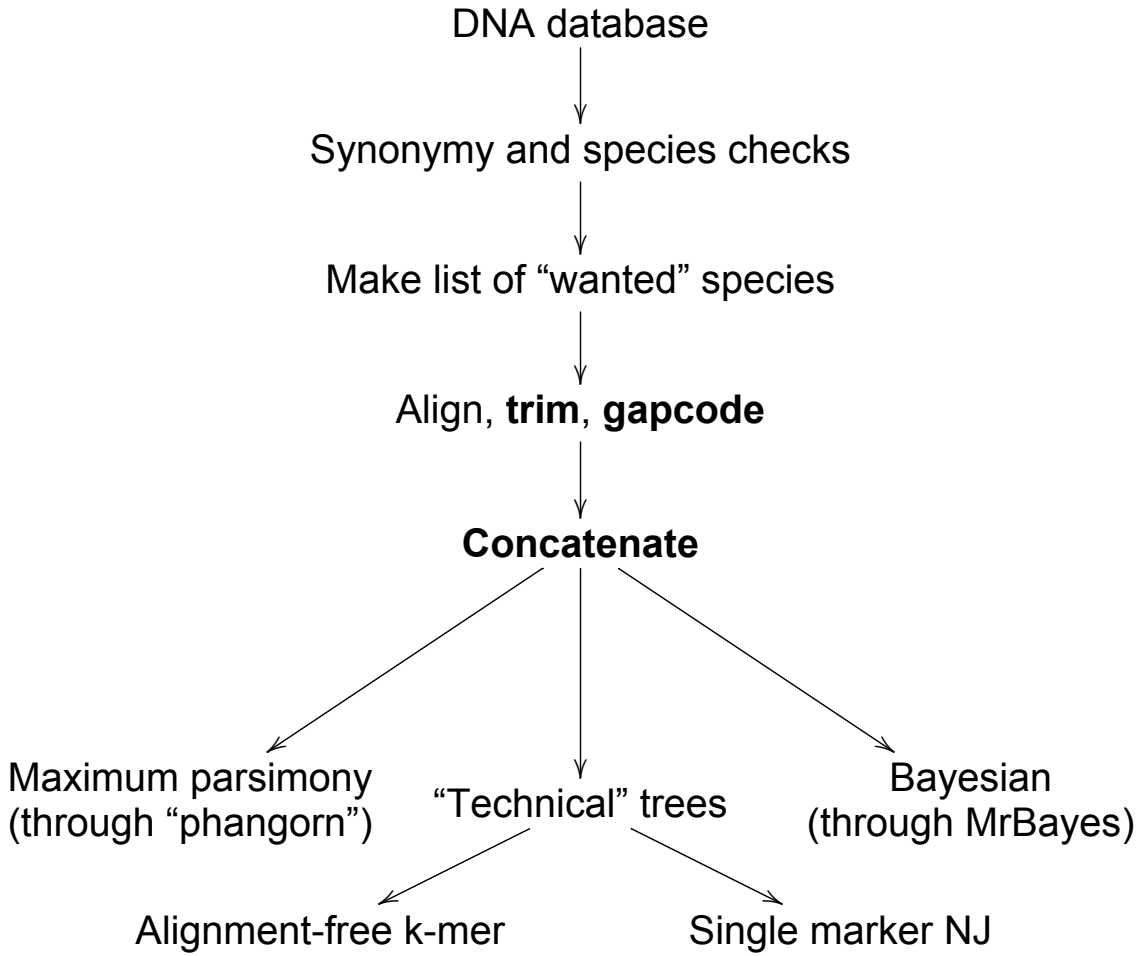
219 species, 1700 sequences, 900 tree terminals



Phylogenetic density: 3D surface

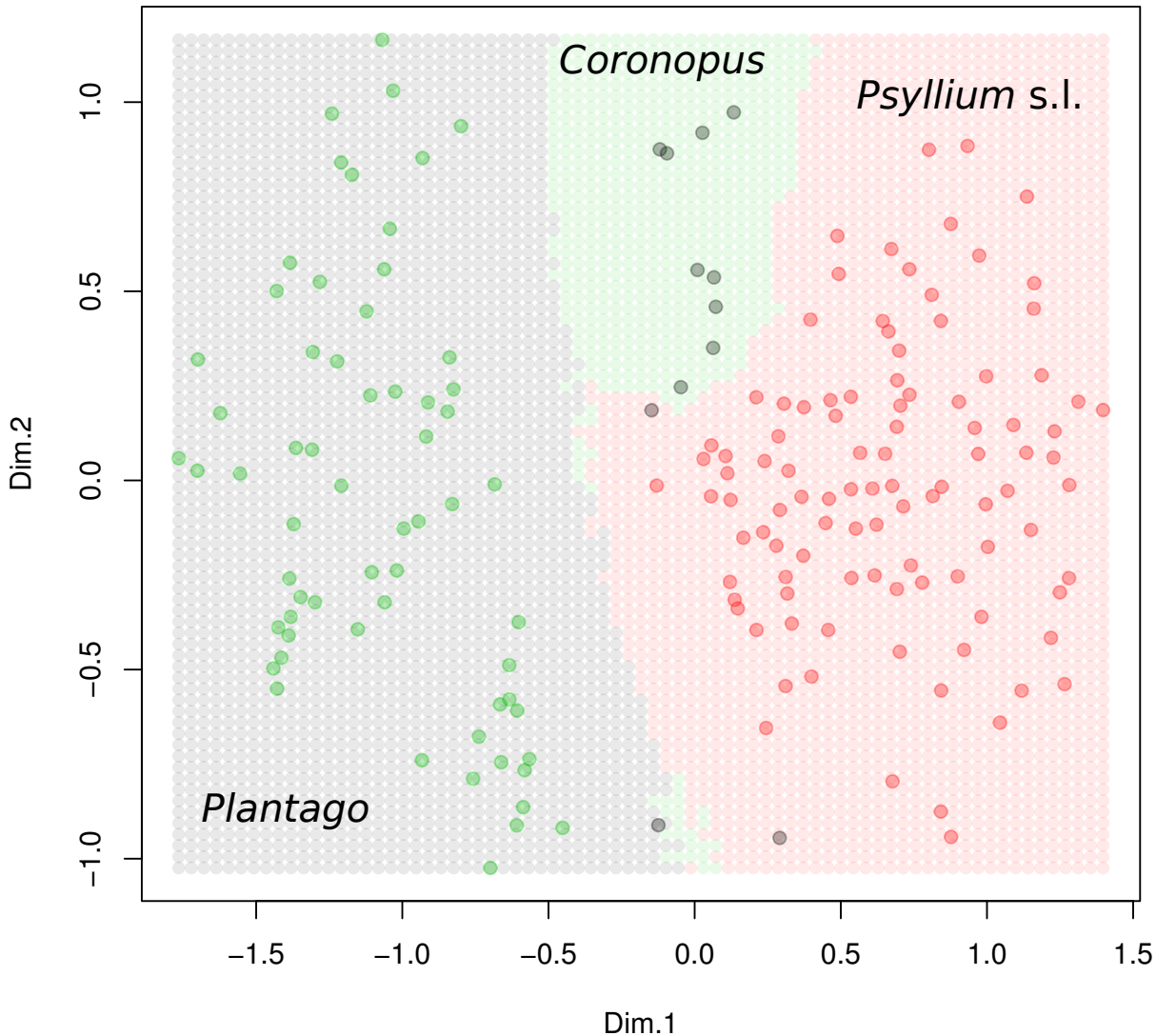


Ripeline



That amount of work is possible to manage with **Ripeline**, semi-automatic R-based workflow which is capable to work with thousands of sequences.

Machine learning places unsampled species

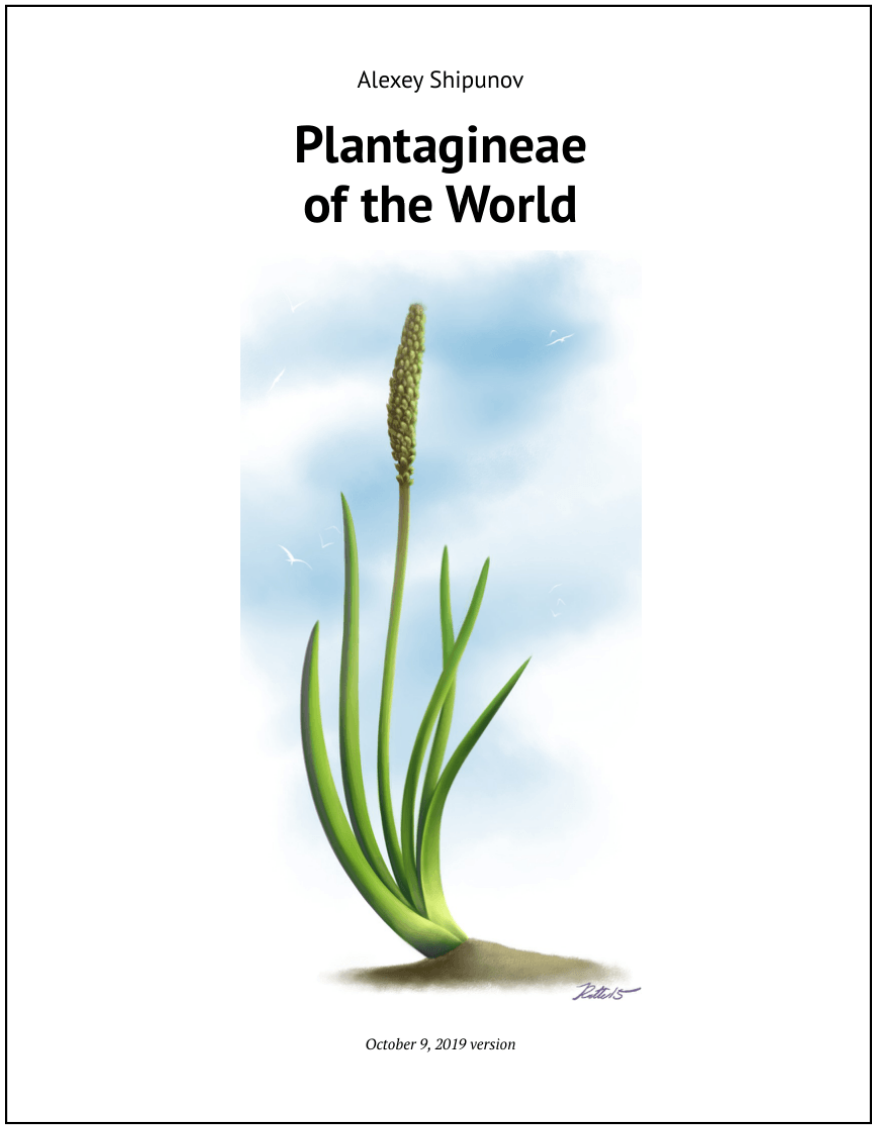


Colors (subgenera) are from DNA, positions (species)—from morphology. If species has no DNA, its position will tell subgenus.

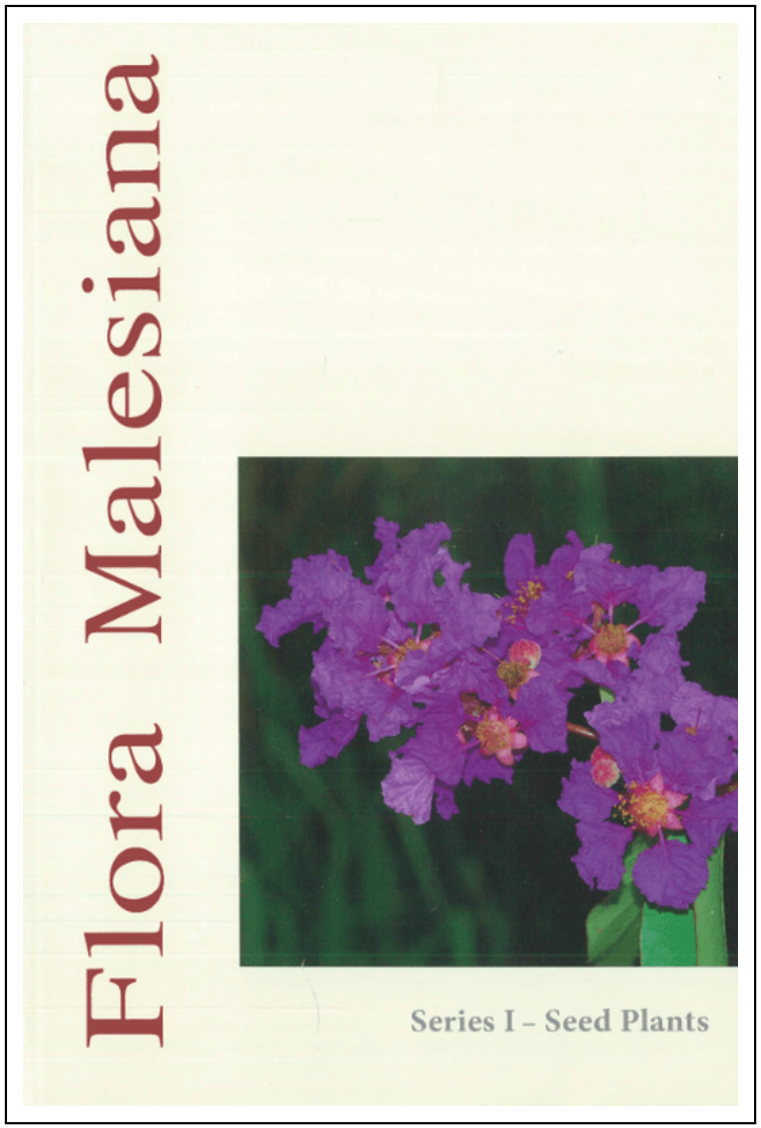
オオバコ: *Plantago* and *Plantagineae*

Perspectives

The review of *Plantagineae*



Regional reviews



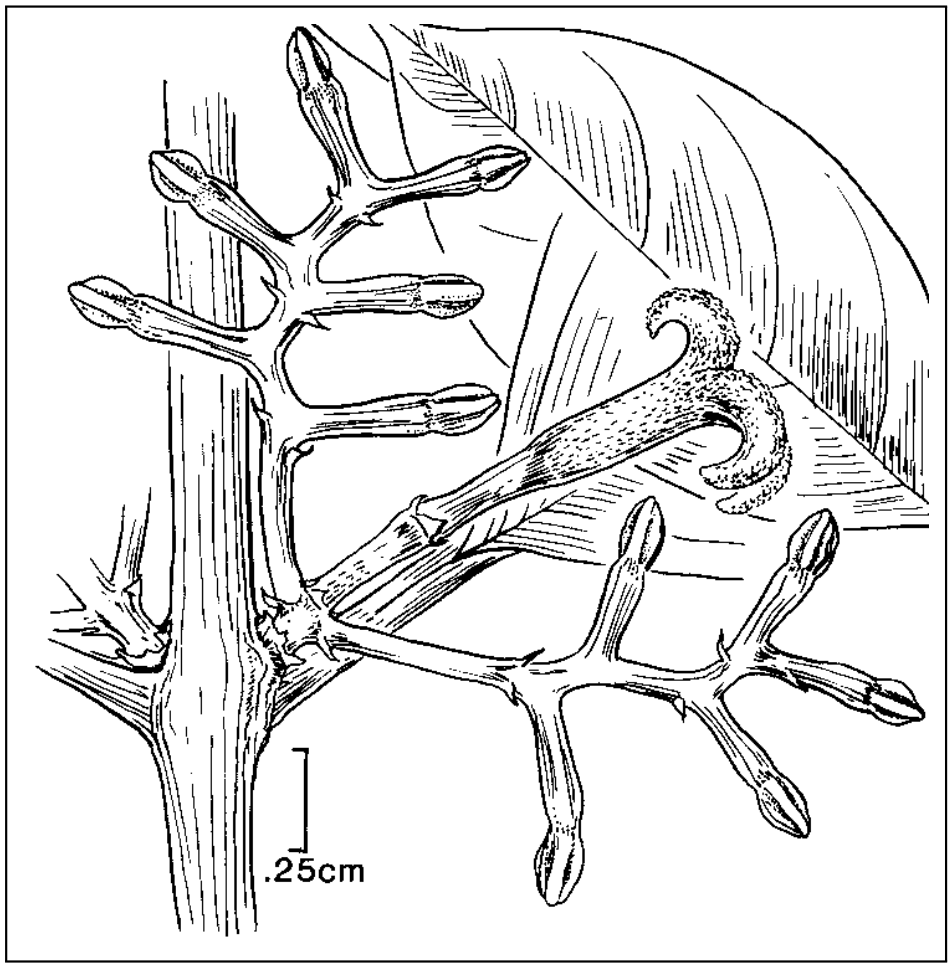
"Flora Malesiana" and "Flora of Lower Volga"

Plantago hakusanensis, *P. japonica*, and hybridity in plantains

ツゲ科: *Buxus*, *Haptanthus* and other Buxaceae

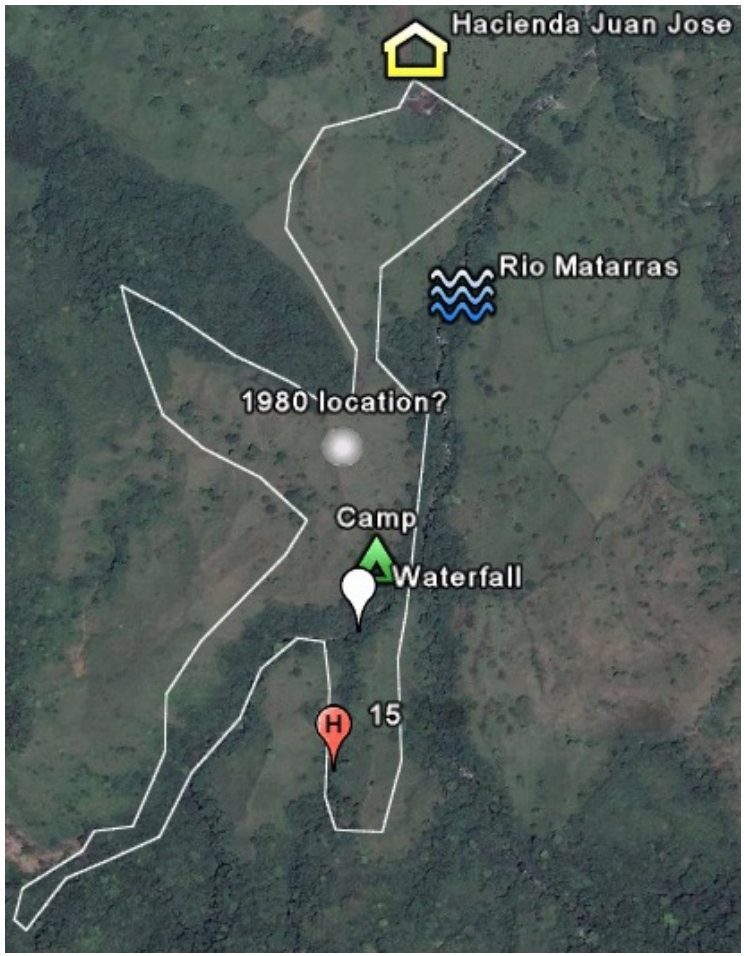
Haptanthus story

Haptanthus hazlettii



One of the most rare plants in the world...

Search strategy



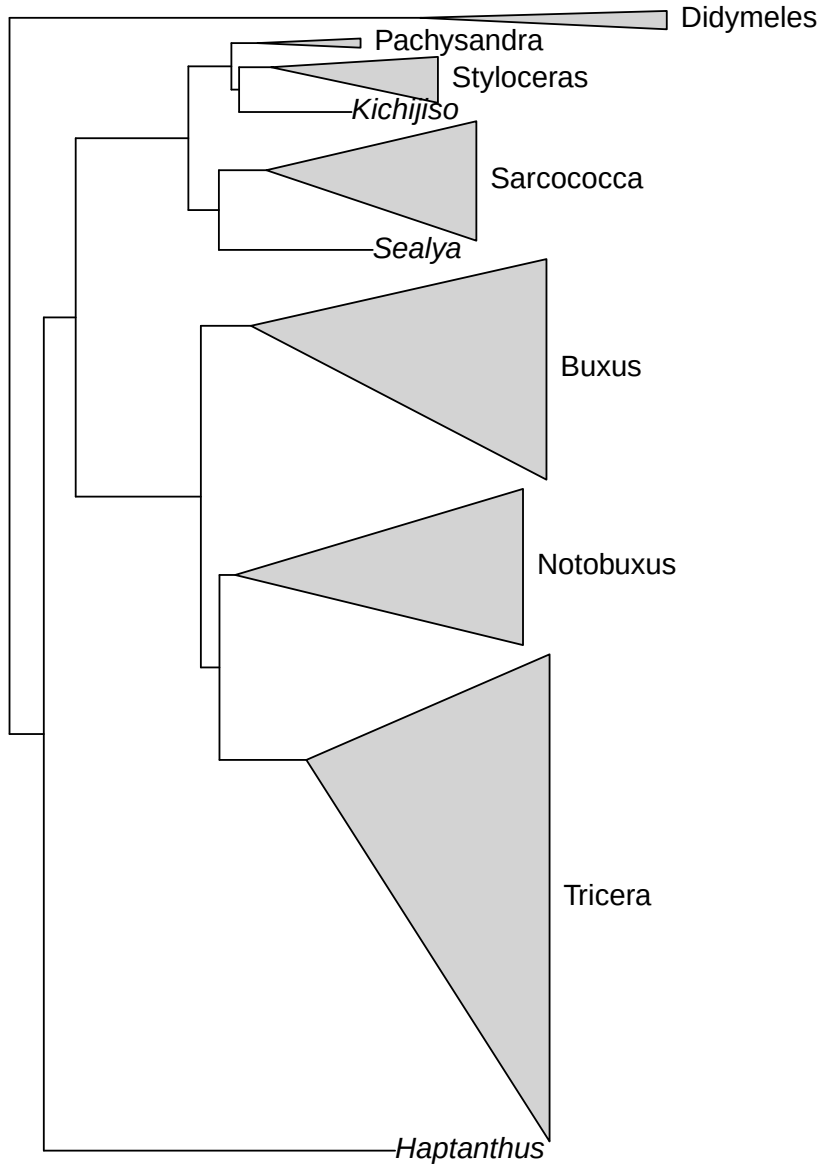
The main strategy was to search along borders of tree cuts/pastures/plantations. Most of flowering small trees are concentrated there.

Haptanthus found again!

ツゲ科: *Buxus*, *Haptanthus* and other Buxaceae

Most important developments

Phylogeny of *Buxaceae* sensu lato



Didymeles toamasinae nom.prop., new species from Madagascar

Kihijiso terminalis nom.prop. and *Sealya conzattii* nom.prop.: species of two new monotypic genera

Bitterbushes, *Picramnia* family

What is Picramniaceae

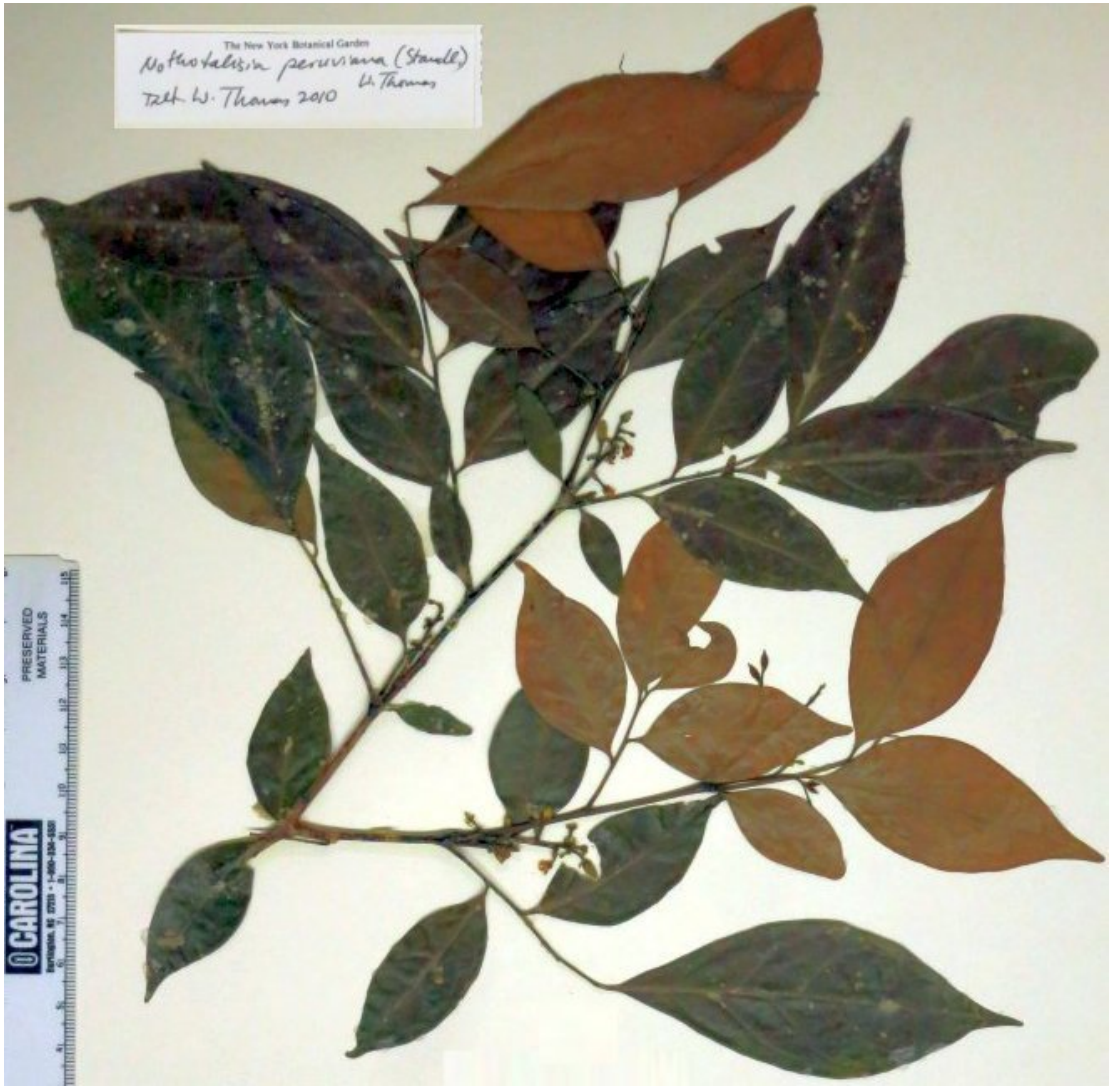
Picramnia

About 40 species, mostly in Central and South America, one species (*P. pentandra*) in USA (Florida).

Alvaradoa

About 8 species, mostly in Central America (*A. amorphoides* also in Florida).

Nothotalisia

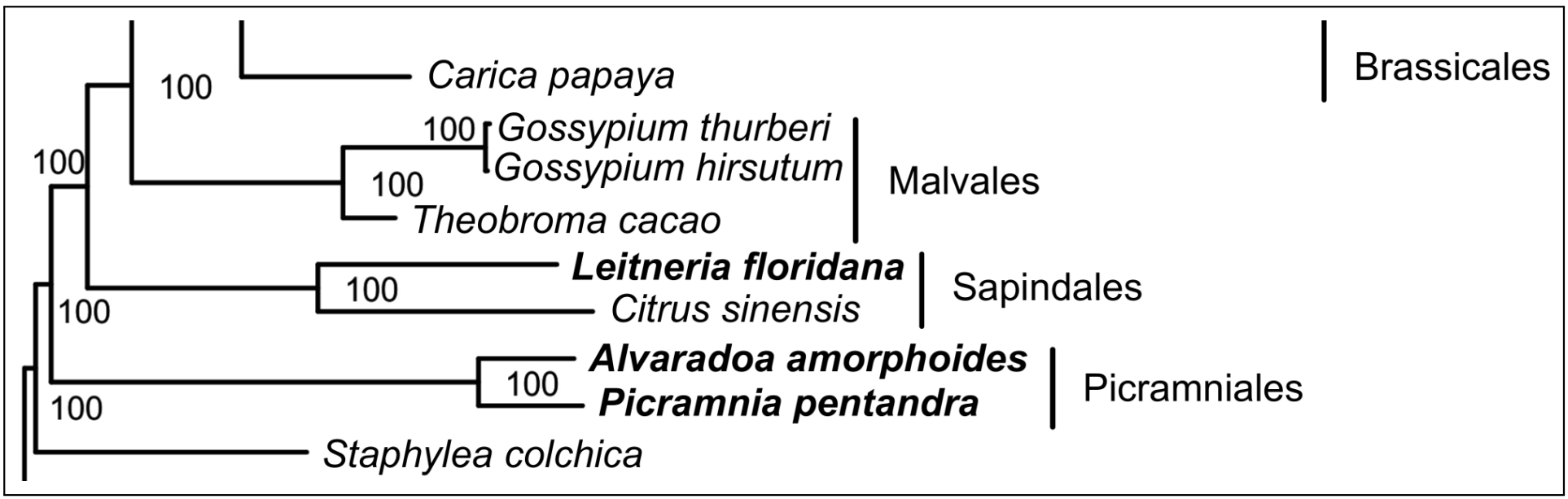


Only recently discovered but spans from Panama to Peru. 3 species.

Bitterbushes, *Picramnia* family

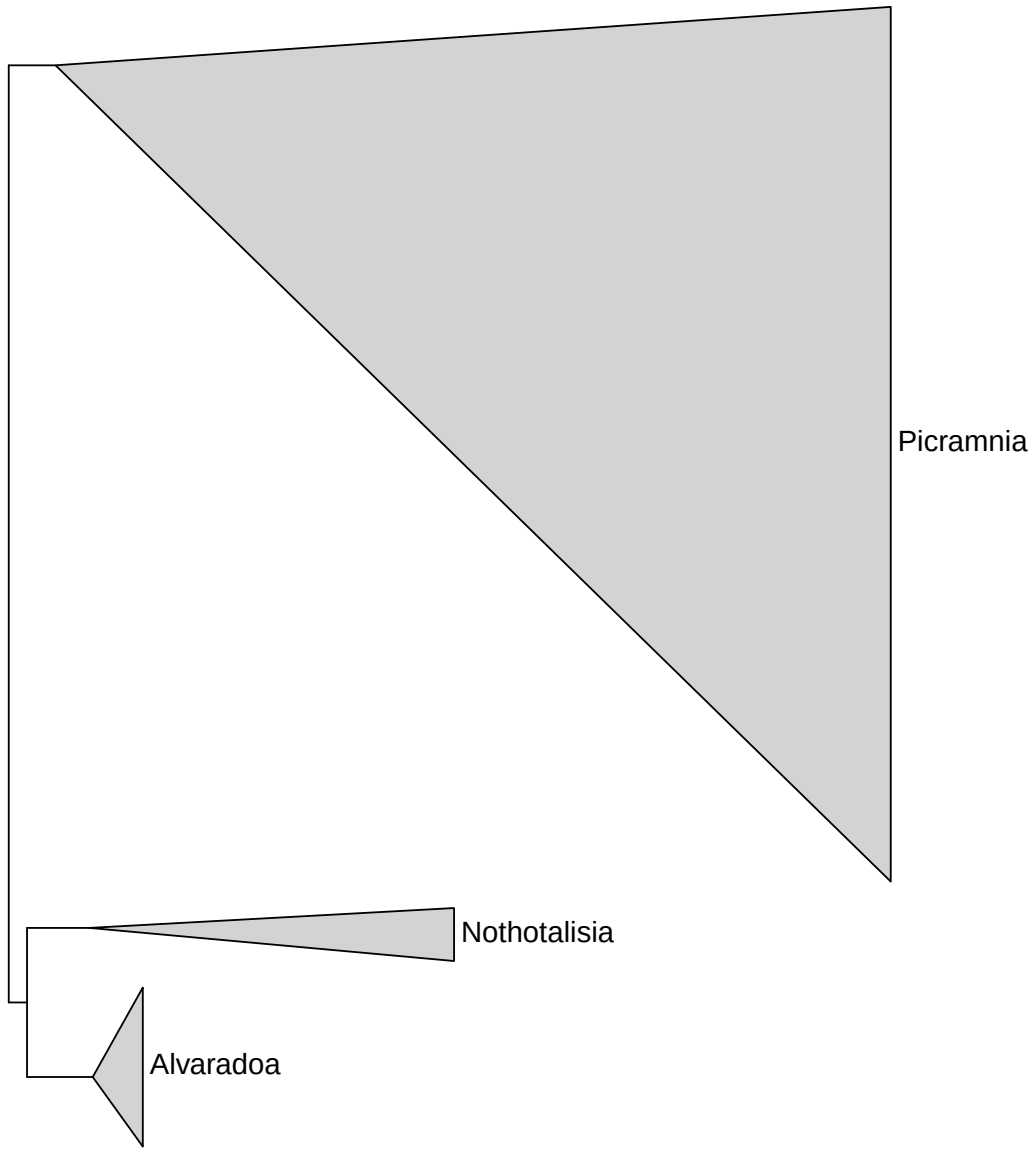
Results in Picramniaceae phylogeny

Phylogenomics

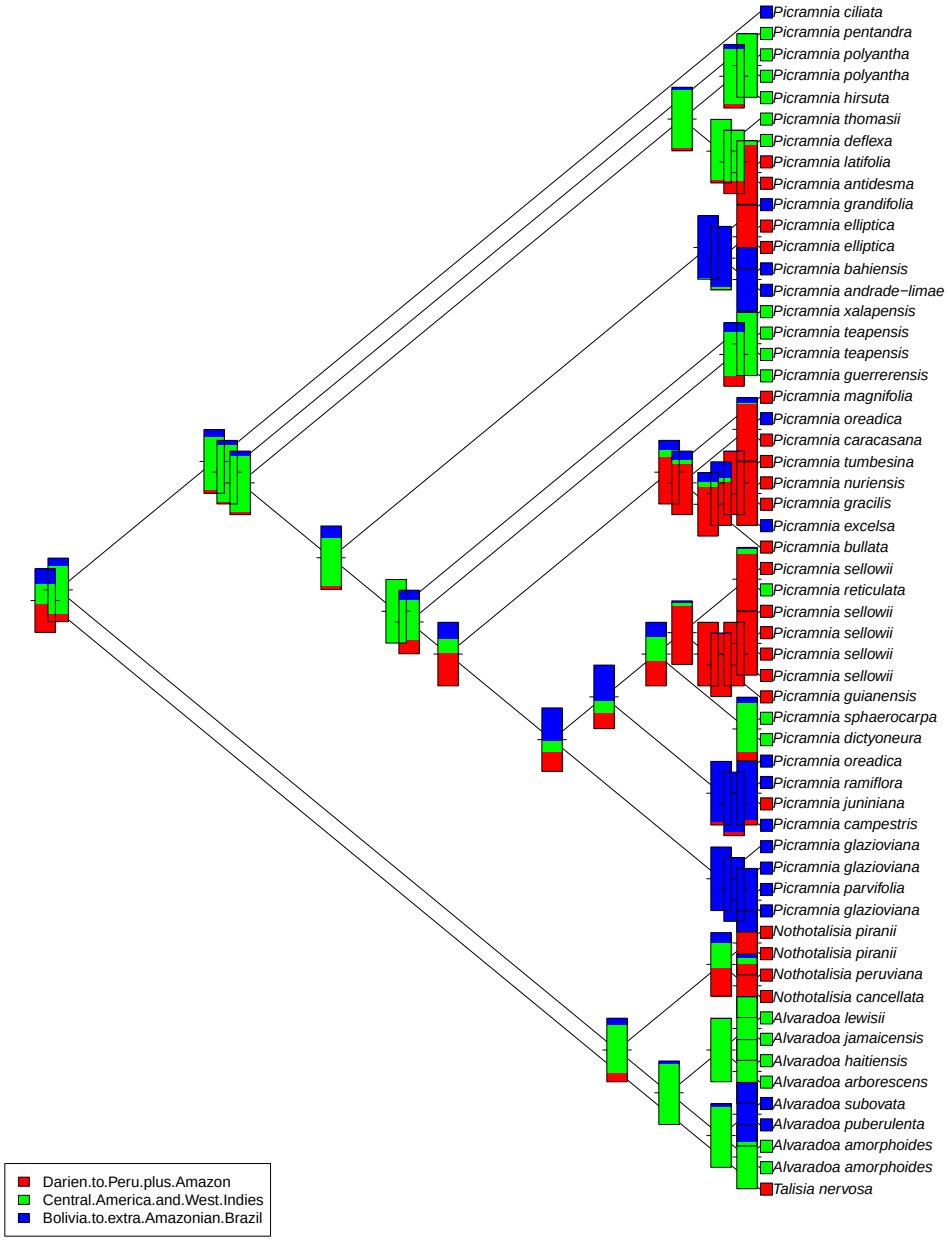


Plastome phylogeny with Picramniales support
(Logacheva & Shipunov, 2017, fragment)

First phylogeny of Picramniaceae: 95% of species coverage



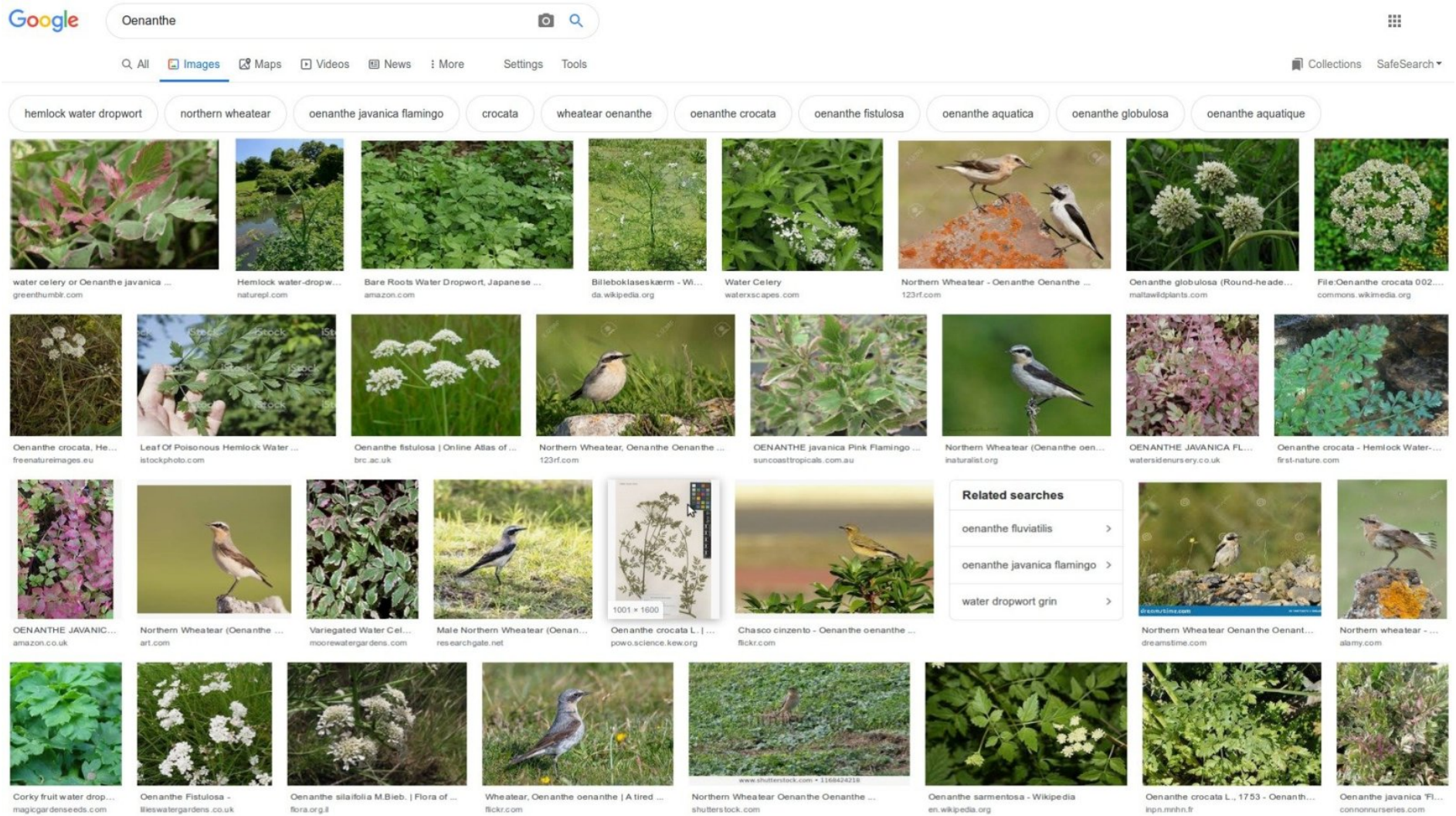
Geographical patterns in Picramniaceae phylogeny



Other research projects

Hemihomonyms

What happens if you search for “Oenanthe” in Google?



Hemihomonyms Database

Problem

If two different species, genera or other taxons have the same name, this name is a *homonym*. Homonyms are illegal if they belong to the same code of nomenclature. If same name belongs to different codes, it is a *hemihomonym* (Starobogatov, 1991). Despite of their validity, hemihomonyms are misleading and even dangerous.

Solution

If there is a possibility that name is a hemihomonym, use postfix **(b)**, **(c)** or **(z)** for names covered by Botanical, Bacteriological, or Zoological codes of nomenclature, respectively. To check if name is a hemihomonym, please use table below or

check name [ ] with this search API prototype.

hemi homonyms

What to show : ◉ **all names** OR ○ **names in three codes** OR ○ **botanical and zoological** OR ○ **botanical and bacterial** OR ○ **bacterial and zoological** AND ☐ *comments*

Show 10 entries Search: Oenanthe

Botanical	Zoological	Bacterial
Oenanthe (b)	Oenanthe (z)	

Botanical	Zoological	Bacterial

Showing 1 to 1 of 1 entries (filtered from 1246 total entries)

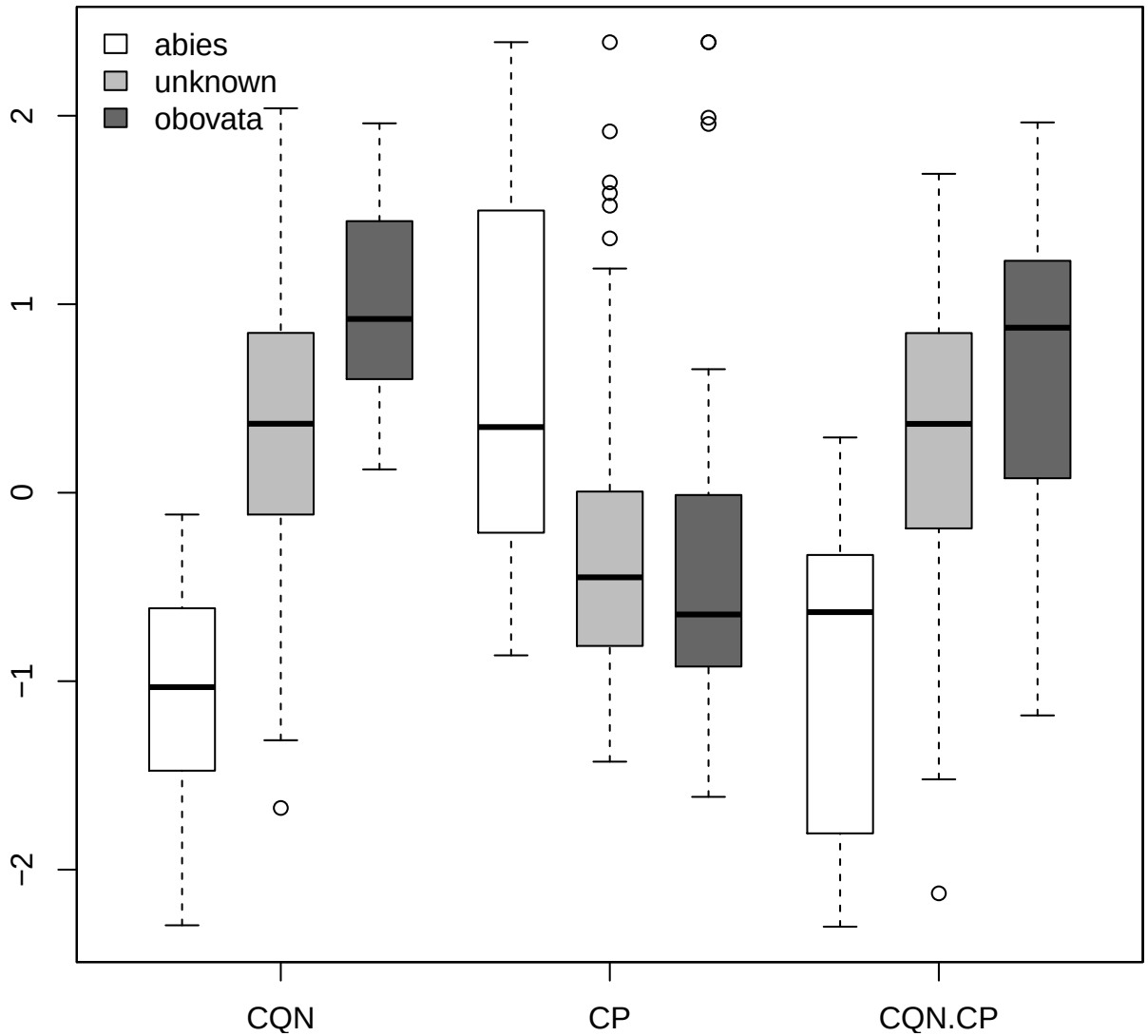
Hemihomonyms Online Database

Other research projects

Russian Arctic spruces

Picea ×fennica, the putative hybrid between *P. abies* and *P. obovata*

Molecular affinities do not correspond with morphology

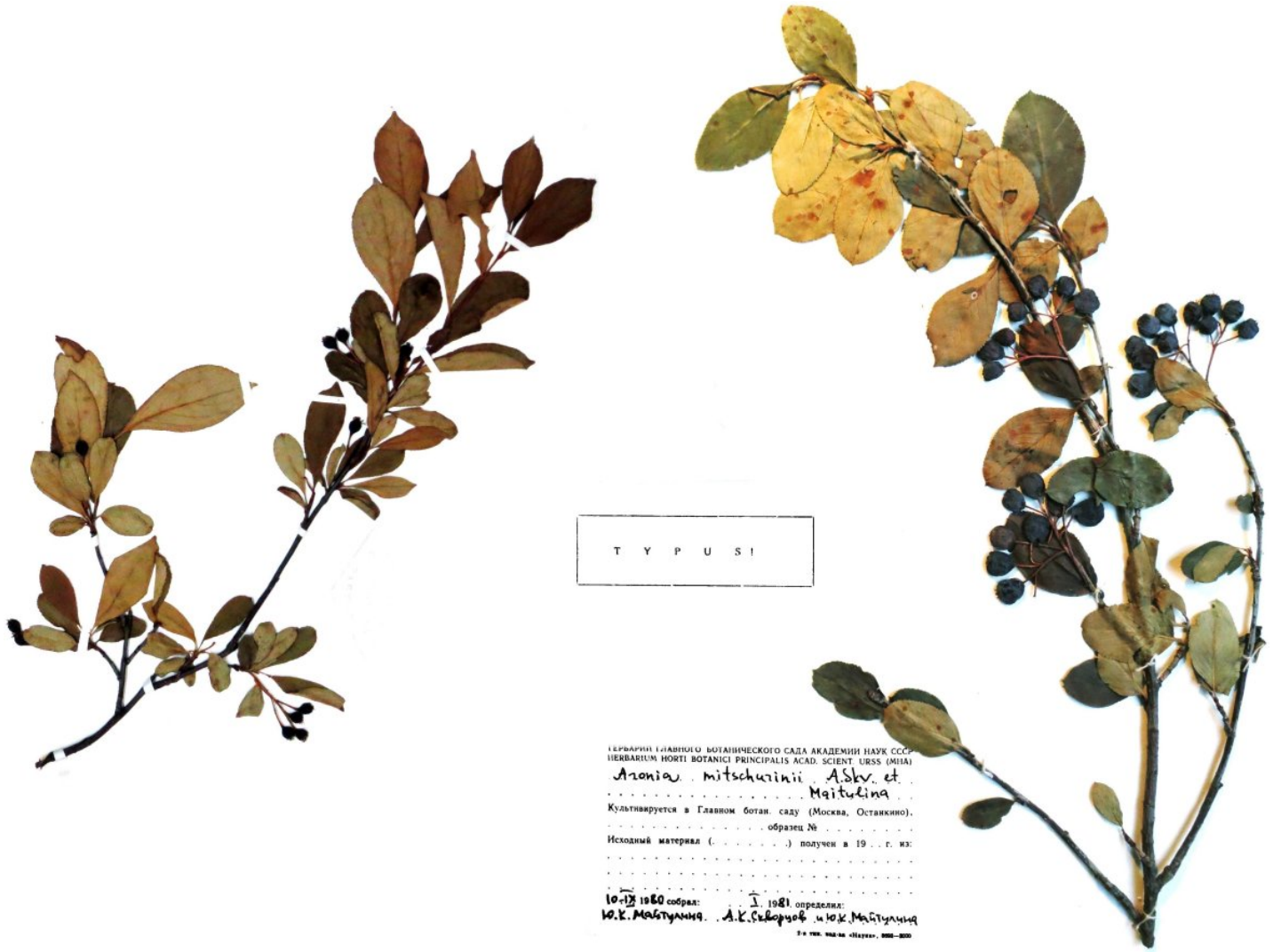


Russian European Arctic hybrid species almost always deviates towards Siberian parent, *Picea obovata*.

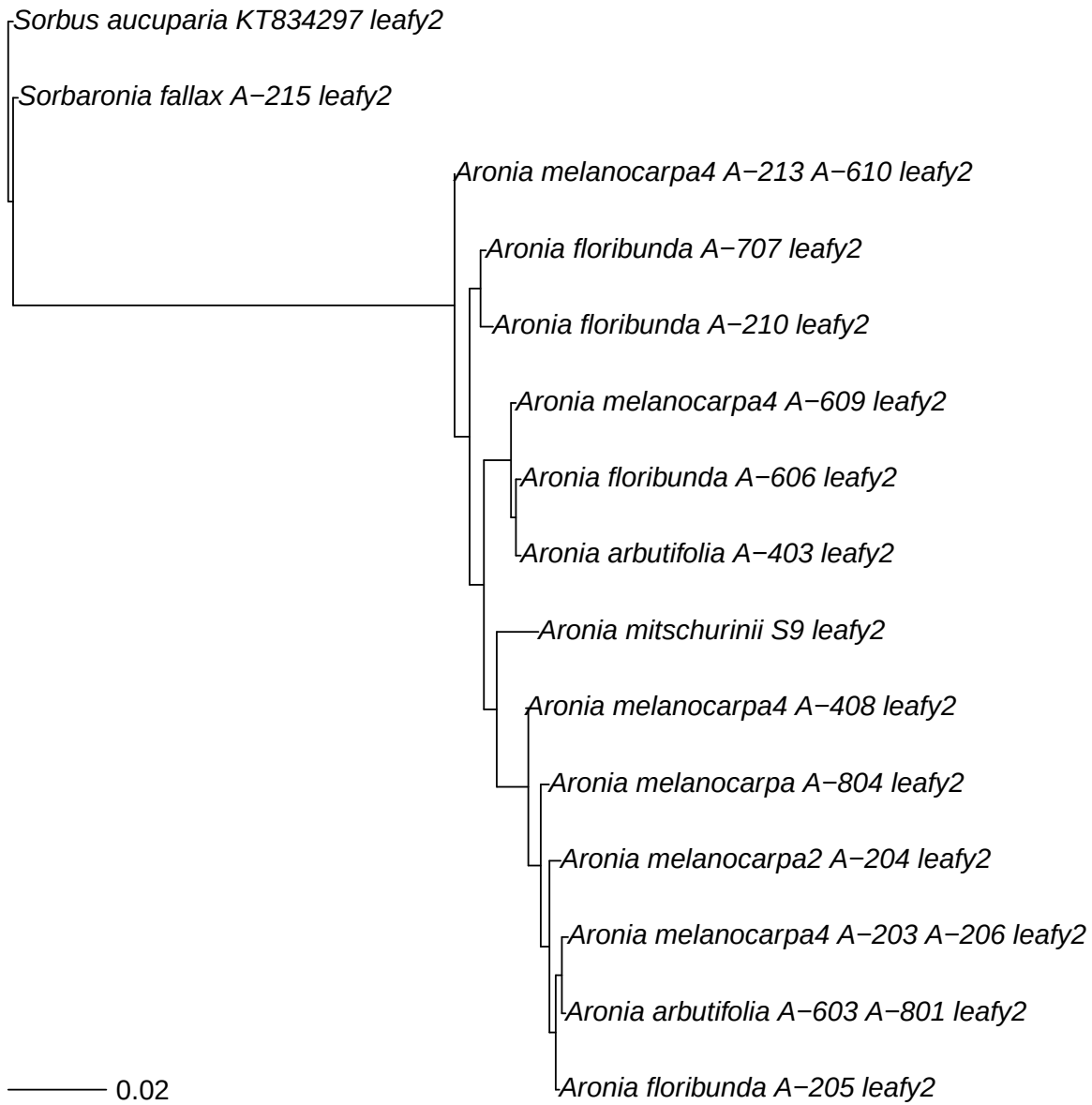
Other research projects

Chokeberries, *Aronia*

Russian *Aronia mitschurinii* is either a hybrid or spontaneous mutation of American *A. melanocarpa*

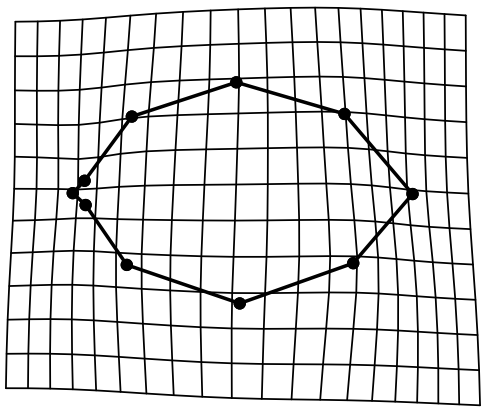


We did not find any support for the hybridity

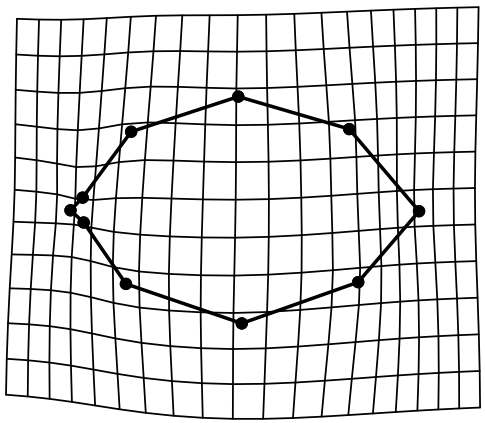


Geomatric morphometry points on the serious differences between Russian species and other chokeberries

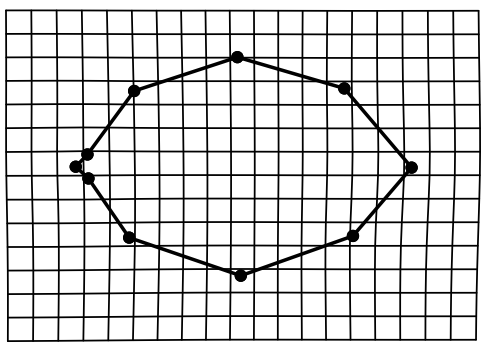
A. arbutifolia



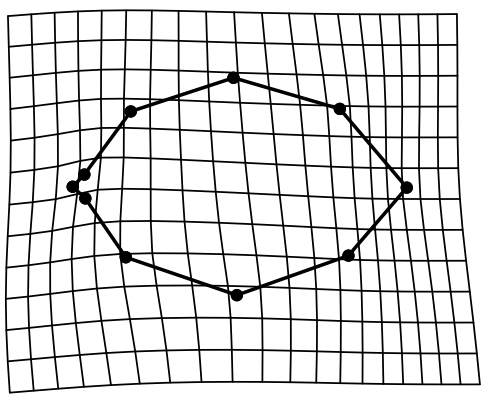
A. melanocarpa



A. mitschurinii



A. floribunda

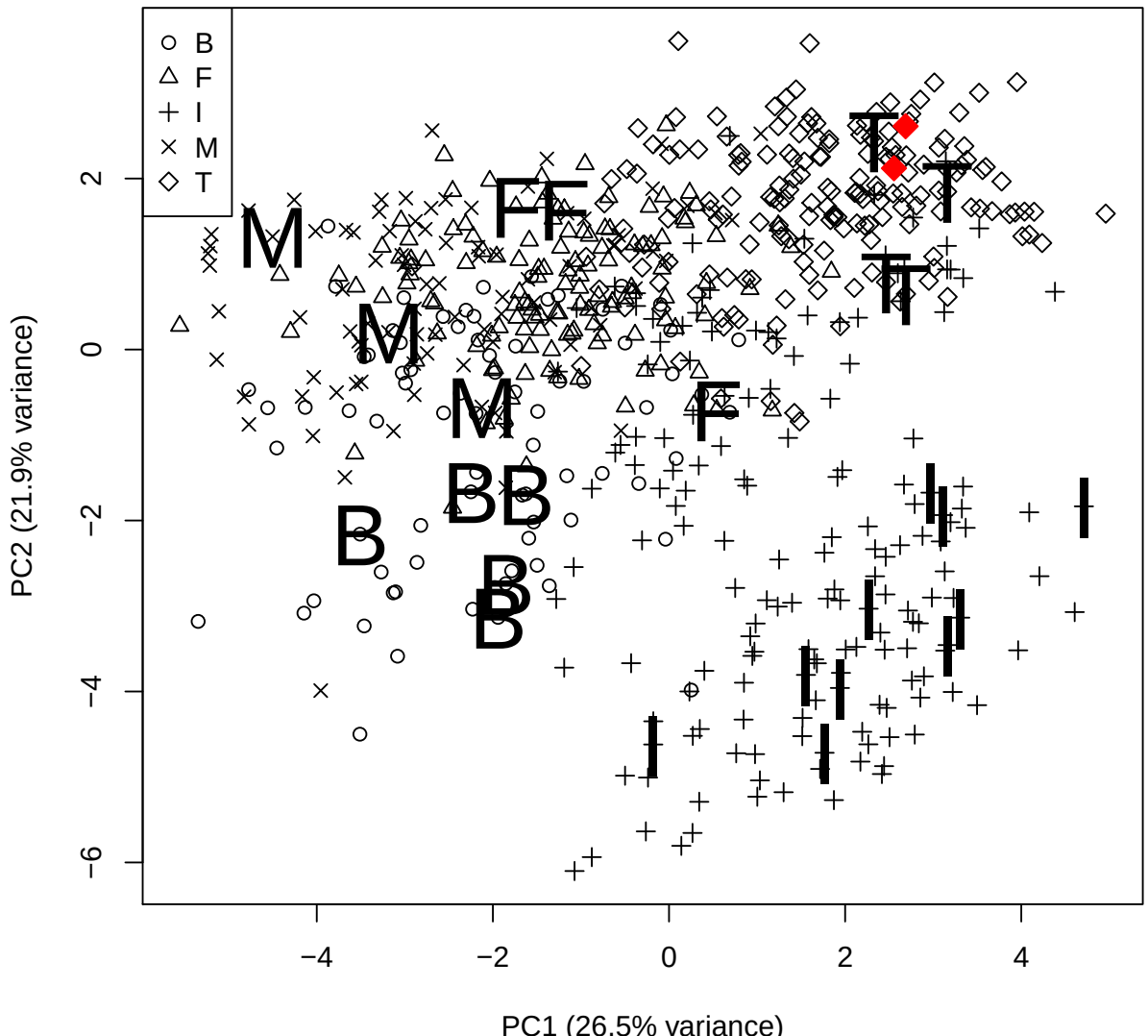


Other research projects

Dactylorhiza “northern tetraploids”

Dactylorhiza “northern tetraploids”

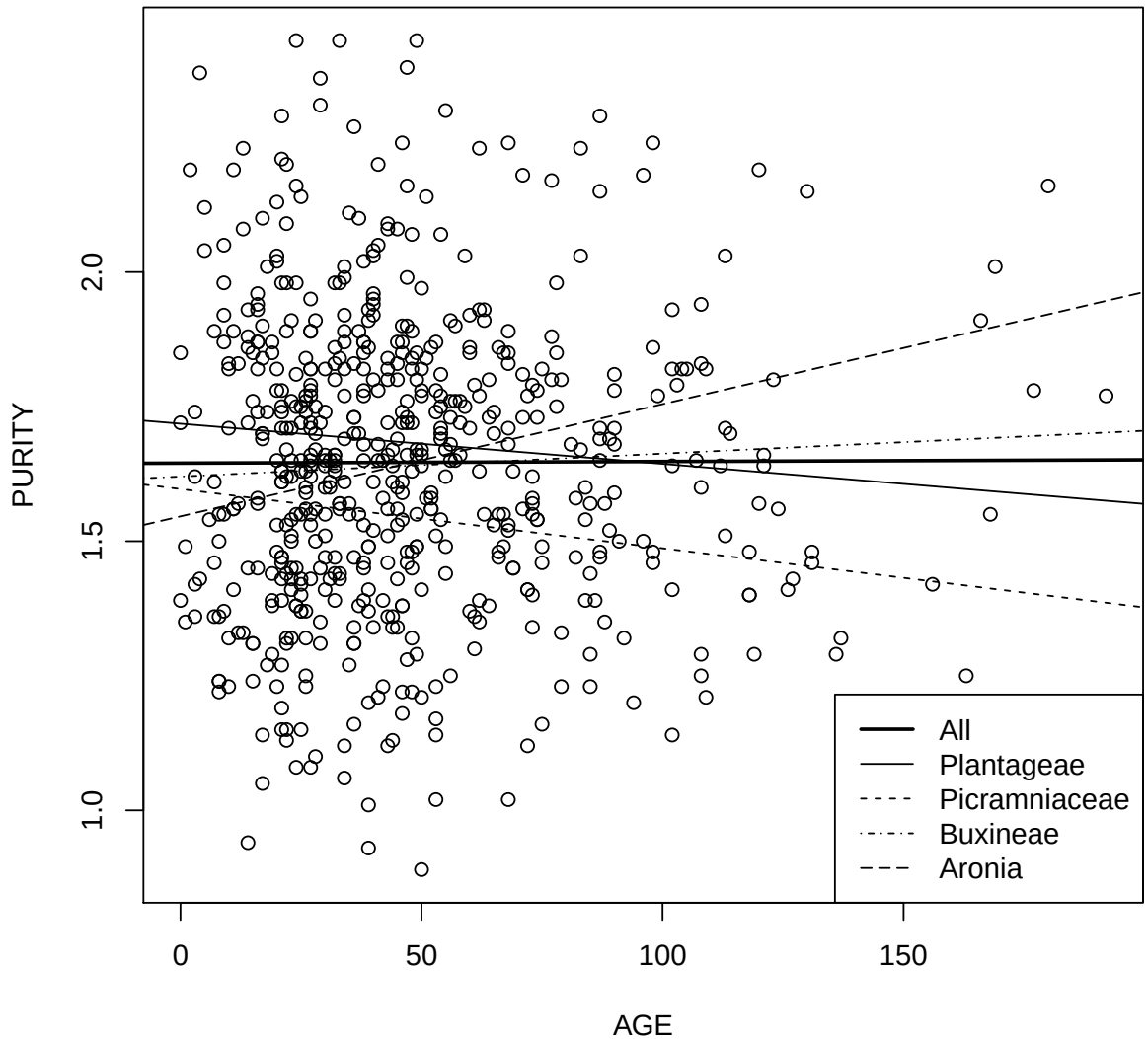
Manifold learning with “anchors” allows to connect these with *Dactylorhiza psychrophila* described in 1920s



Other research projects

DNA purity from ancient samples

DNA purity suffers only a little from the age of sample

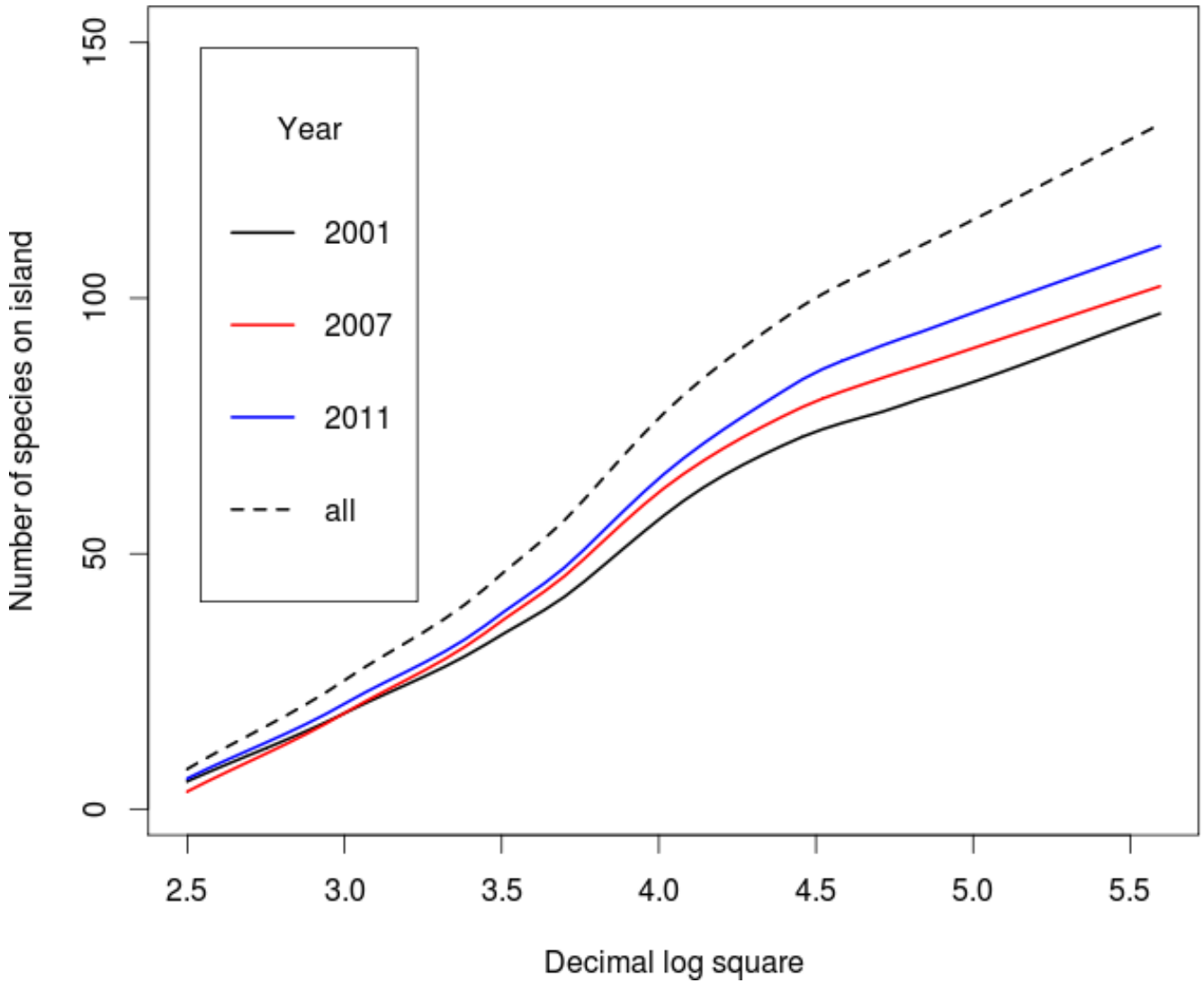


Other research projects

Flora of Small islands in Arctic White Sea

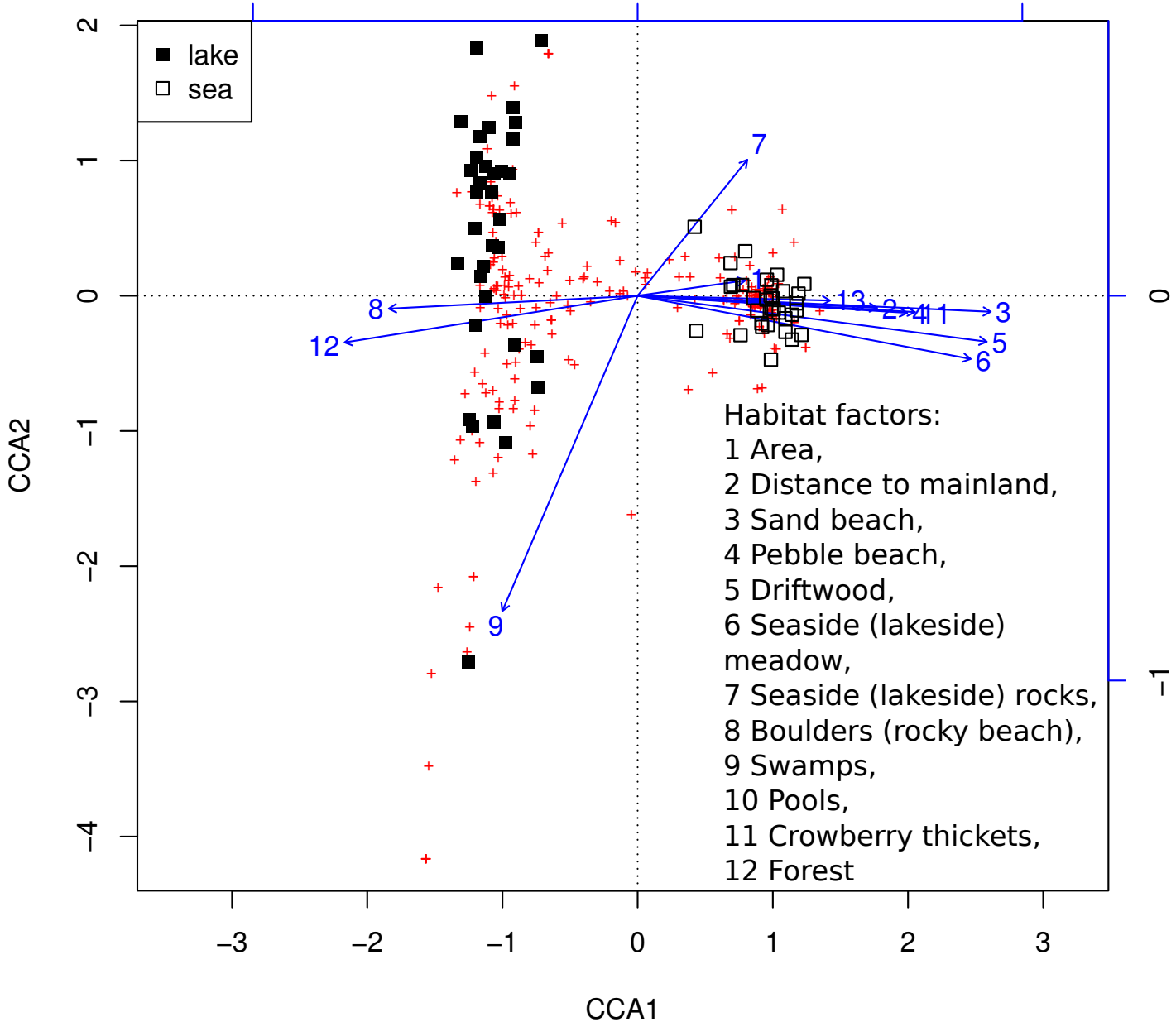
Small, uprising islands of the White Sea (Russian Arctic)

Number of species grows differently for different types of islands



Extremely rare stable population of *Epipogium aphyllum* orchid

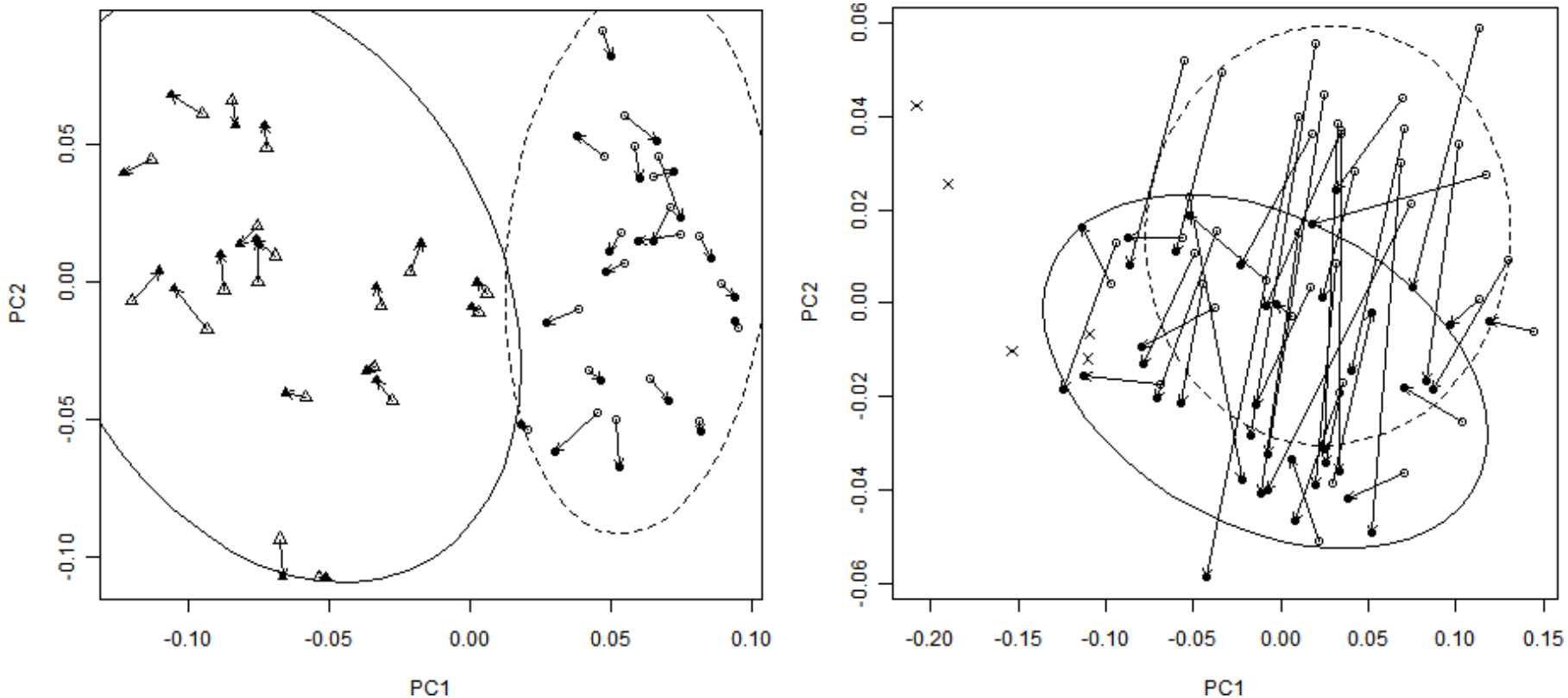
Islands on lakes and on sea, how do they differ?



Other research projects

Stability of Shape and Size in Herbarium

Herbarization may lead to significant shape changes



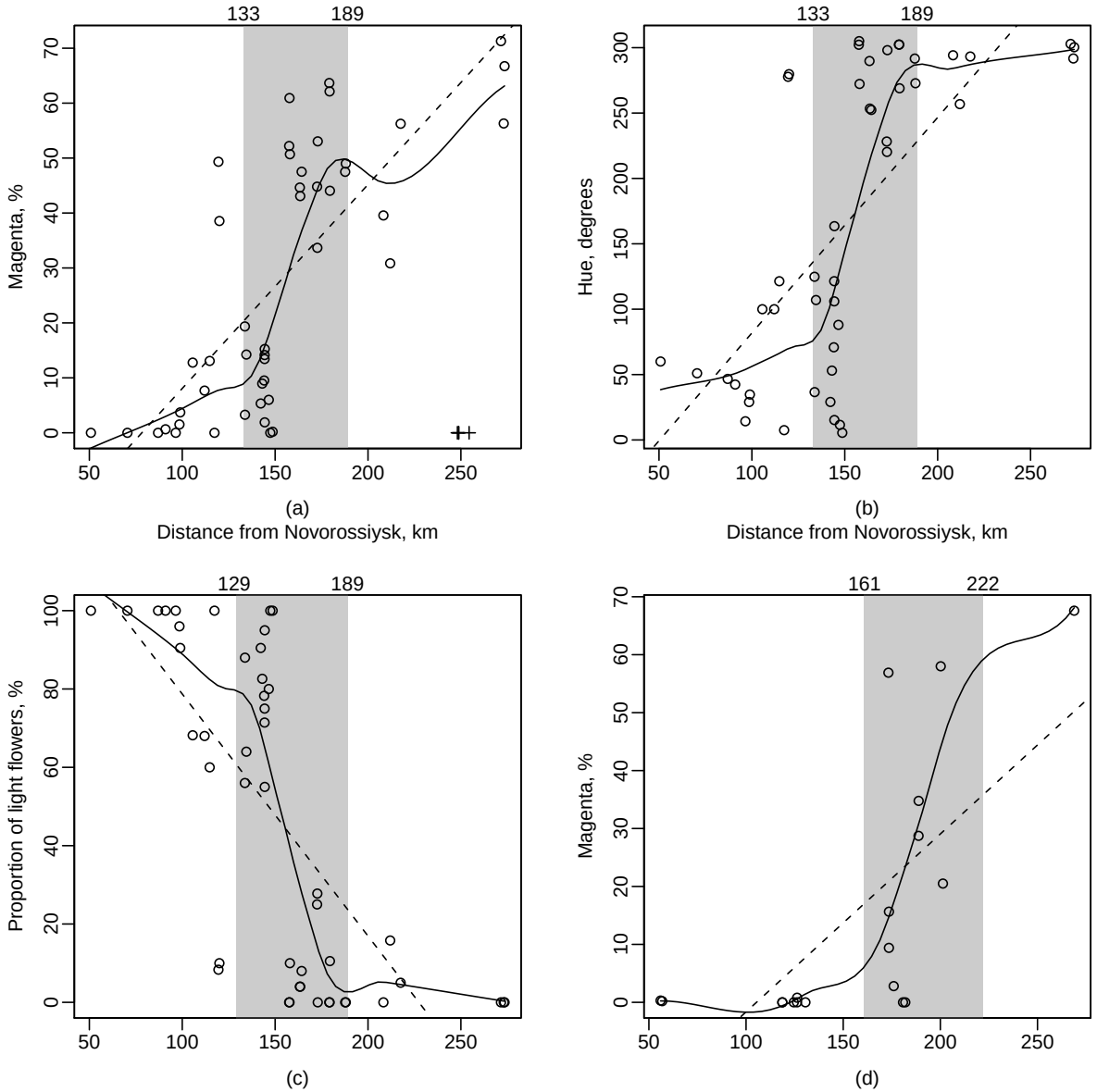
Whereas herbarization did not change distance between two *Ribes* species (left), leaves of *Potamogeton perfoliatus* become more similar to leaves of close species, *Potamogeton praelongus* (right).

Other research projects

Caucasian primroses

Primula vulgaris changes flower color along the Black Sea coast

Extensive sampling helped to find the “inflection point”



Teaching projects

Introduction to Botany

The original botany textbook

Introduction to Botany

Alexey Shipunov

December 7, 2018

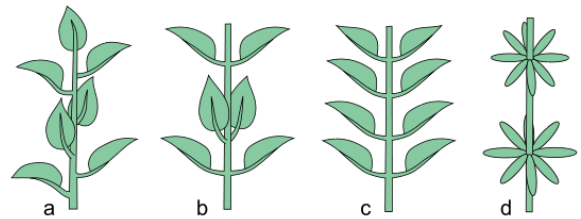


Figure 5.24. Types of phyllotaxis (leaf arrangement): a spiral (alternate), b and c opposite, d whorled.

This sequence of numbers made with simple rule: in the every following fraction, the numerator and denominator are sums of two previous numerators and denominators, respectively. The sequence looks fairly theoretical but amazingly, it is fully applicable to plant science, namely to different types of spiral phyllotaxis (Fig. 5.25).

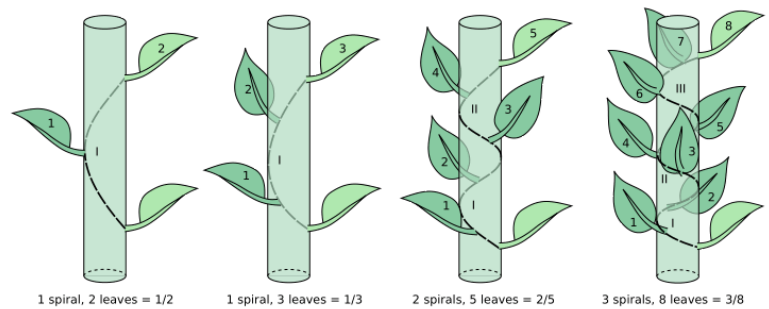


Figure 5.25. Four first Fibonacci types of spiral phyllotaxis: $\frac{1}{2}$, $\frac{1}{3}$, $\frac{2}{5}$, and $\frac{3}{8}$.

To determine formula of spiral phyllotaxis, one needs to start with arbitrary leaf (or leaf scar) and then find the next (upper) one which is *directed the same way*, lays on the same virtual line. Then, the imaginary spiral should be drawn trough basements from the started leaf to the corresponding upper leaf.

This spiral should go through all intermediary leaves, there might be one, two or more intermediary leaves. Also, the spiral will go at least one time around the stem. (Instead of the imaginary spiral, it is sensible to use a thin thread). One needs to count all leaves in the spiral except the first, and also count number of rotations.

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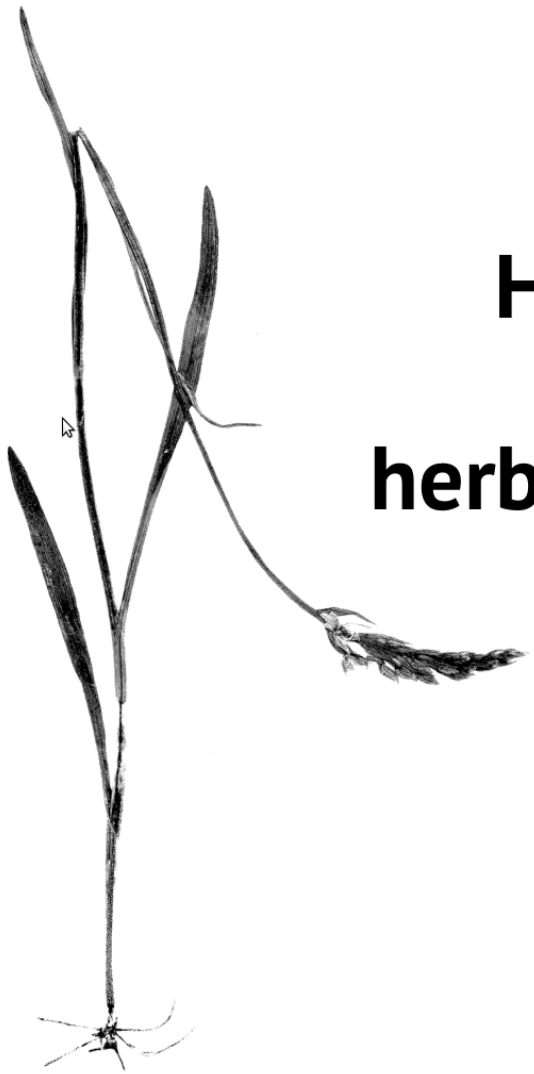
Textbook PDF (contains also information for Rmanual and Ripeline)

How to make herbarium



How to make herbarium

Alexey Shipunov

July 23, 2018

of the press. Then tie it up as tight as possible. There are many ways to do it (see, for example the scheme on Fig. 1.4) but the most important is to press well. If you clench the press in a corner, and it is does not contact, then it is packed well. When your press is ready, you may want to label it with today's date; this is especially important if you have multiple presses.

First and second runs are most important for pressing while subsequent runs are more important for drying. Consequently, on the third and following days it is not necessary to tie really hard. At the end of drying cycle, it is also recommended to reduce number of drying sheets to 1 or 2 between collections.

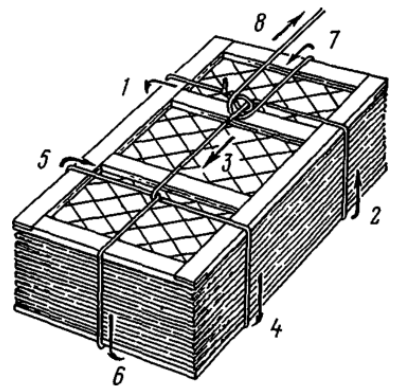


Figure 1.4: Tying the press: "typographical way" (figure is taken from Skvortsov, 1977).

1.4 Drying

If weather is dry and sunny, presses are better to keep outside. Wind will make the drying process even better. If weather is worse, drying takes place indoors. Do not apply any heating tools without careful thinking because the quality of herbarium suffers from overheating. If you must, apply heating not more than 20–30 min per hour, and turn your press every 10–15 min.

The most important factor in drying is **to change drying sheets**. Change wet sheets with the dry ones as frequently as possible (see below). You can dry drying sheets

11

PDF of the manual

New biology laboratories

Unique “Concepts of Biology” class based on evolution and history of life

Laboratory 12

“*Evolution. The Origin of Species*” Board Game

12.1 Background

“Evolution” is the game based on the theory of **Charles Darwin**. It offers players to create their own species of animals with their own abilities all the while fighting to control the one important resource—**food**. By regulating the population of your creatures, obtaining new useful abilities and fighting off opponents, you must survive till the end of the game and stand at the head of the food chain.

Note that this board game is not about evolution in populations of single species. It mostly concerns with *ecological evolution*, formation of ecosystems with prey and predators and so on.

At the beginning all players receive 6 cards; with them you can either create a creature or place an ability on an already created one: for example make it Huge or Poisonous.

The game is turn based and each turn is divided into separate phases:

1. Players create creatures and apply abilities to them;
2. With the help of a dice the amount of food is decided;
3. Players turn-by-turn take food tokens from the pile to feed their creatures: some need only one, while others, depending on their abilities may require two, three or even more to satisfy their hunger;
4. Animals that are not completely fed will starve and become extinct. The completely fed animals survive and grant their player more cards to create new creatures and new abilities.

Once the deck is empty everyone counts their points. Points are awarded for each creature that survived and for each ability on them. The winner is the one who creates the most balanced ecosystem.

12.2 Procedure

Every table becomes a team. Instructor will show you a YouTube video (http://youtu.be/0zDigM1vcNU) explaining how to play. The game’s instructions are included below for reference. The team will then play one full game. When game is finished, prepare your report.

Note: there is also an extended, newer version of this game (*orange boxes*). If you team chose this one, it could take a bit longer to play (about 10–15 min). Also, extended game has slightly different rules so study them carefully! Instructor has a right to add up to 3 extra points for playing the extended game.

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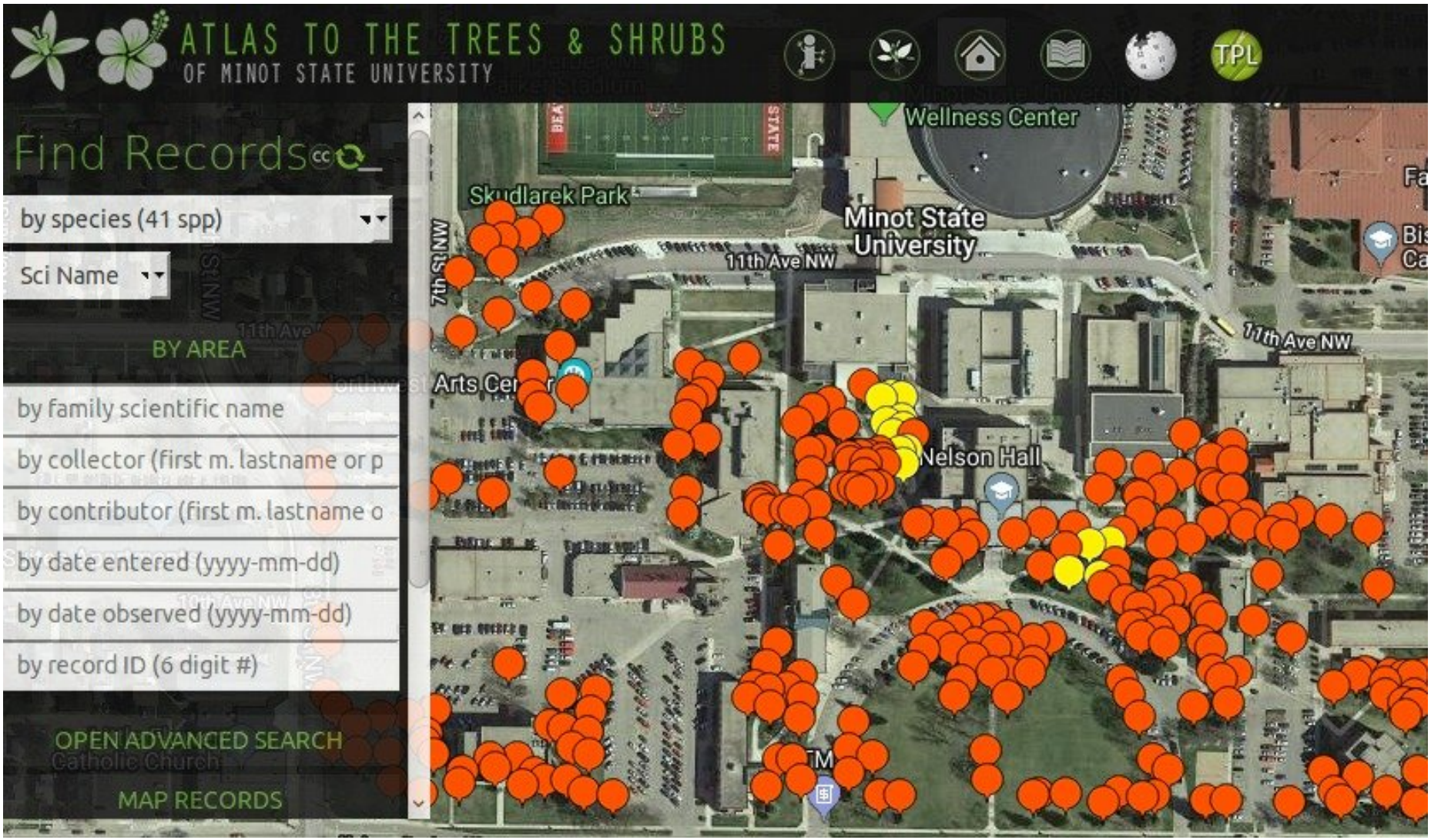
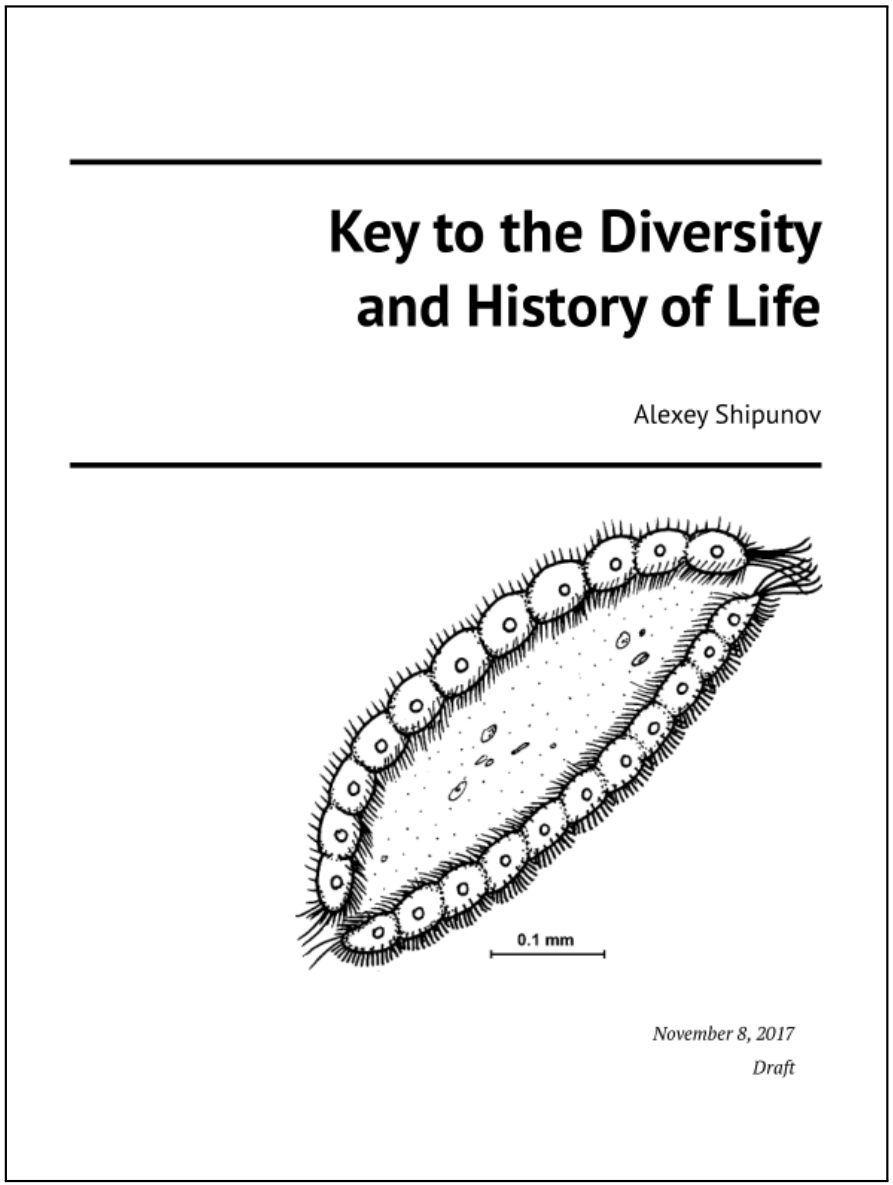
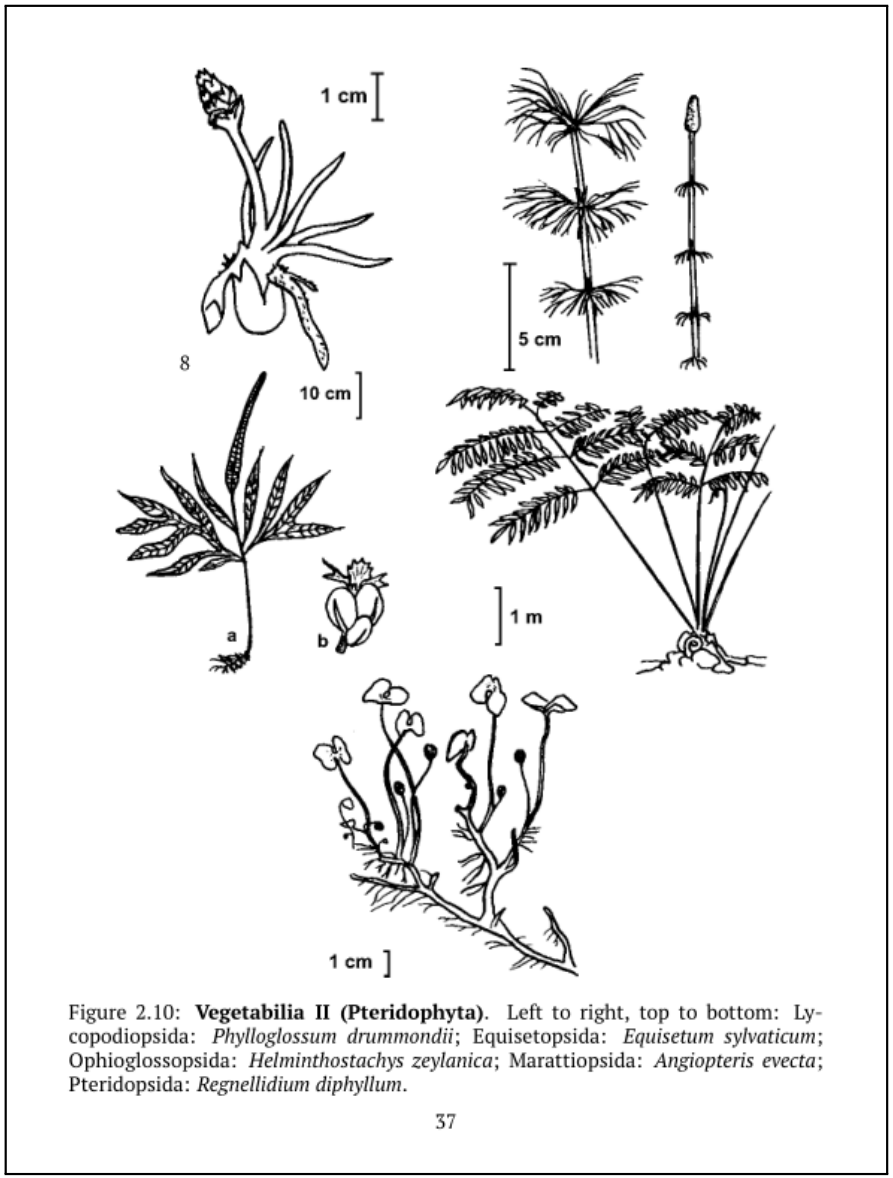
Atlas to the Trees and Shrubs of Minot State University



https://natureatlas.org/plants/minot/

Diversity, geography and history of life textbook



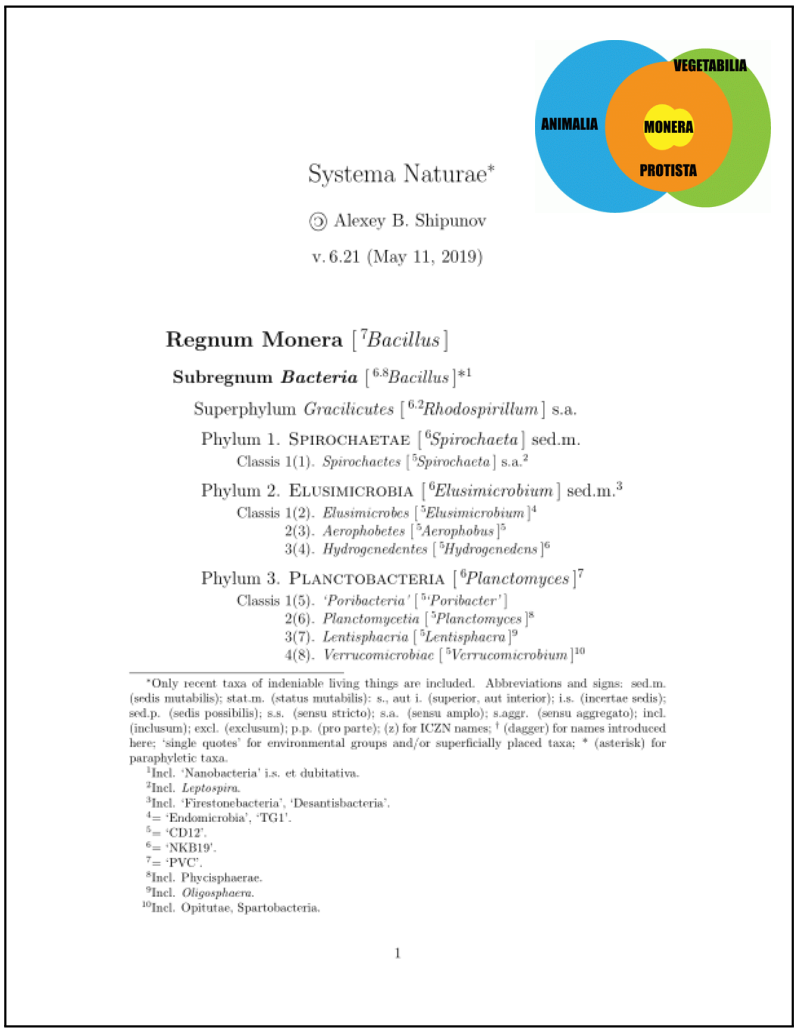


Textbook PDF

Teaching projects

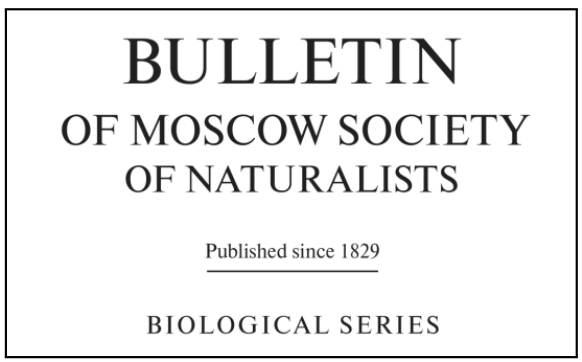
Internet projects

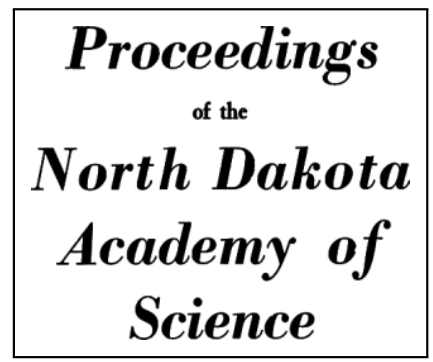
Classifications of flowering plants and all living world



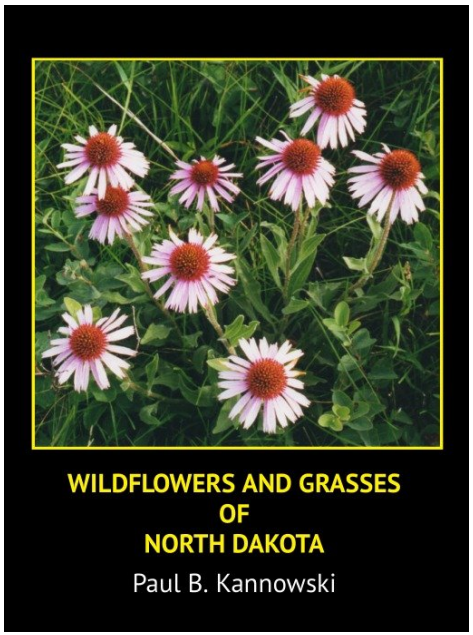
Constantly updated since 1990s

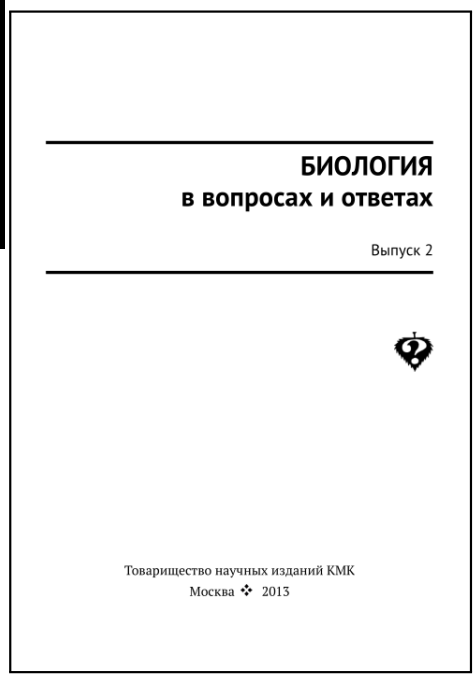
Support Web sites of several scientific journals

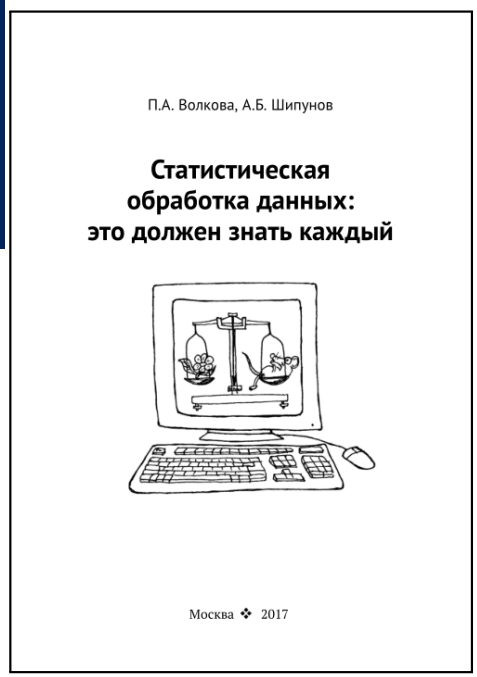




Books: authoring, co-authoring, editing







Open collection of plant images

PLANT (AND OTHER) IMAGES IN PUBLIC DOMAIN

Name	Last modified	Size
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20190825_dc/	2019-09-09 11:39	-
20190821_wa/	2019-08-22 21:52	-
20190801_japan/	2019-08-20 00:35	-
20190716_new_caledonia/	2019-09-05 18:40	-
20190713_royal_np_sydney_australia/	2019-07-13 13:34	-
20190629_brunei/	2019-07-11 06:38	-
20190615_sandy_bay/	2019-06-18 18:04	-
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20190418_west_ca/	2019-04-23 22:54	-
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20181217_japan/	2018-12-24 08:29	-
20181020_ecuador/	2018-10-27 20:38	-

Collection URL

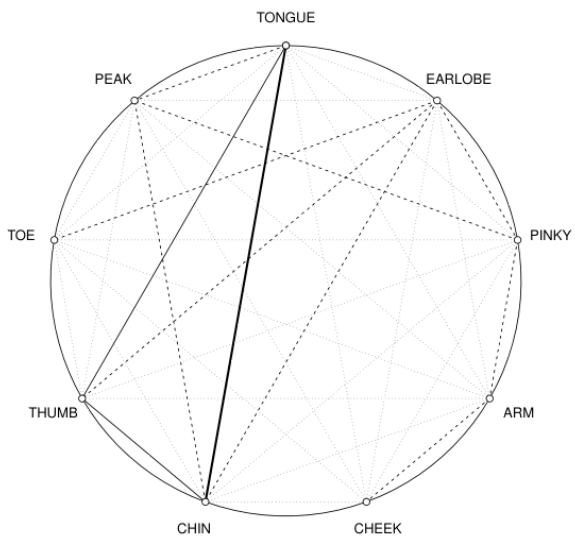
Teaching projects

Data Analysis with R

Data Analysis and R together: textbook

Visual Statistics
Use R!

Alexey Shipunov



April 10, 2019 version

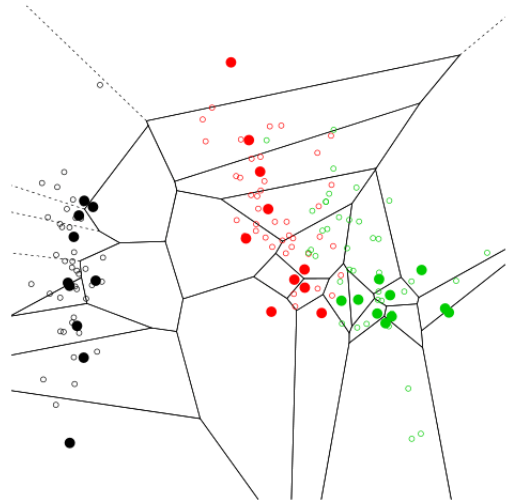


Figure 9.6: Visualization of training data points neighborhoods with Voronoi decomposition.

```
> Misclass(unlist(iris.p), iris.unknown[, 5]) # shipunov
Classification table:
            obs
pred         setosa versicolor virginica
  setosa         40          0         0
  versicolor      0         40         7
  virginica       0          0        33
Misclassification errors:
    setosa versicolor  virginica
       0.0        0.0       17.5
Mean misclassification error: 5.8%
> iris.pp <- predict(iris.dd, iris.unknown[, -5],
+ outsider.method="Ignore")
> sapply(iris.pp, as.character) # shows points outside train clouds
  [1] "Ignored"    "Ignored" ...
```

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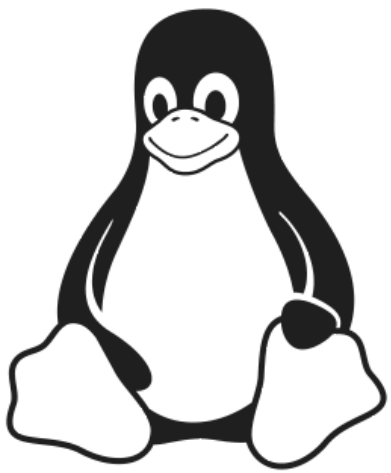
Textbook PDF

Computer Literacy for Science Majors

Alexey Shipunov

Computer Literacy for Science Majors

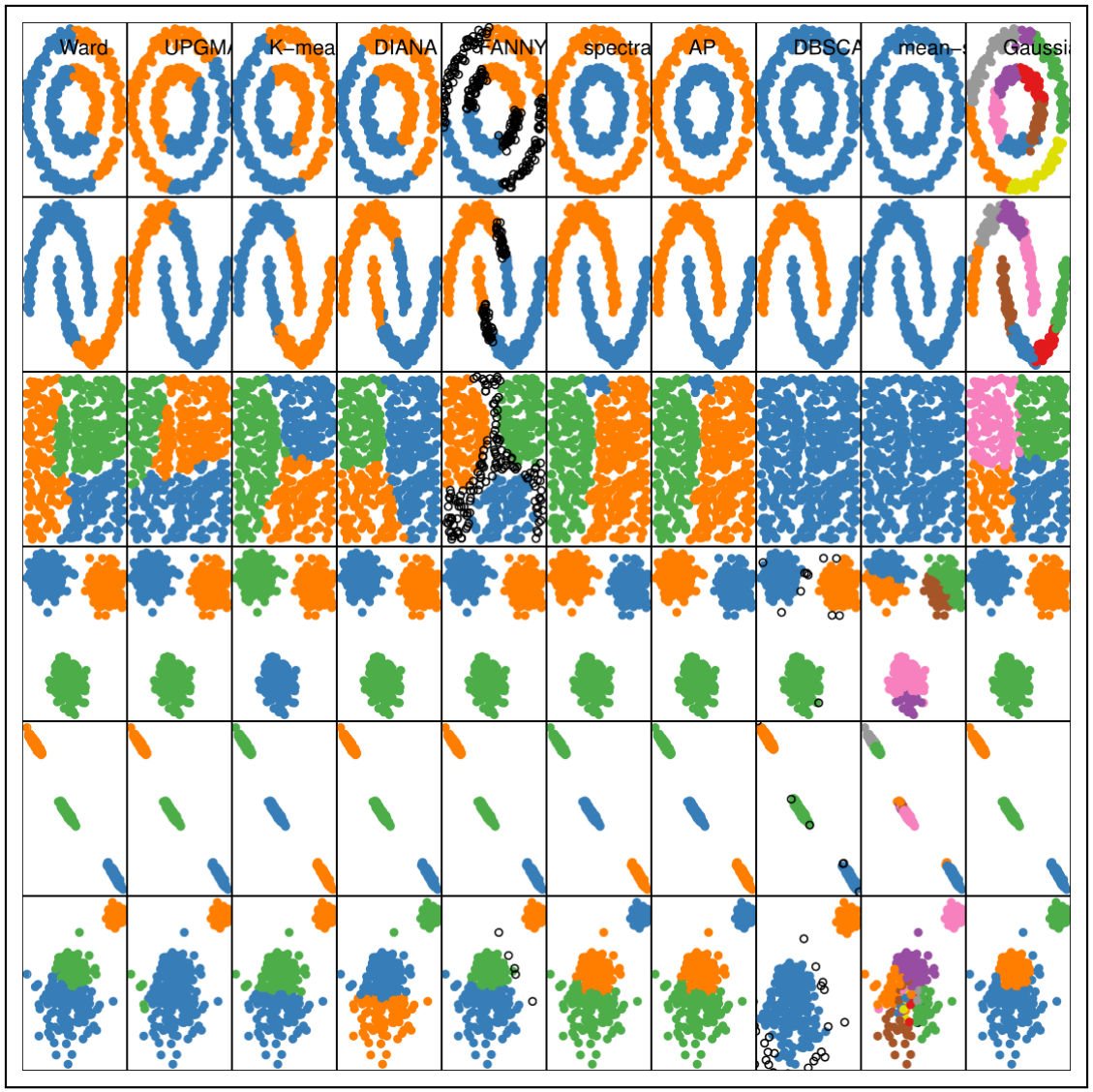
Notes and exercises



Draft, version November 29, 2017

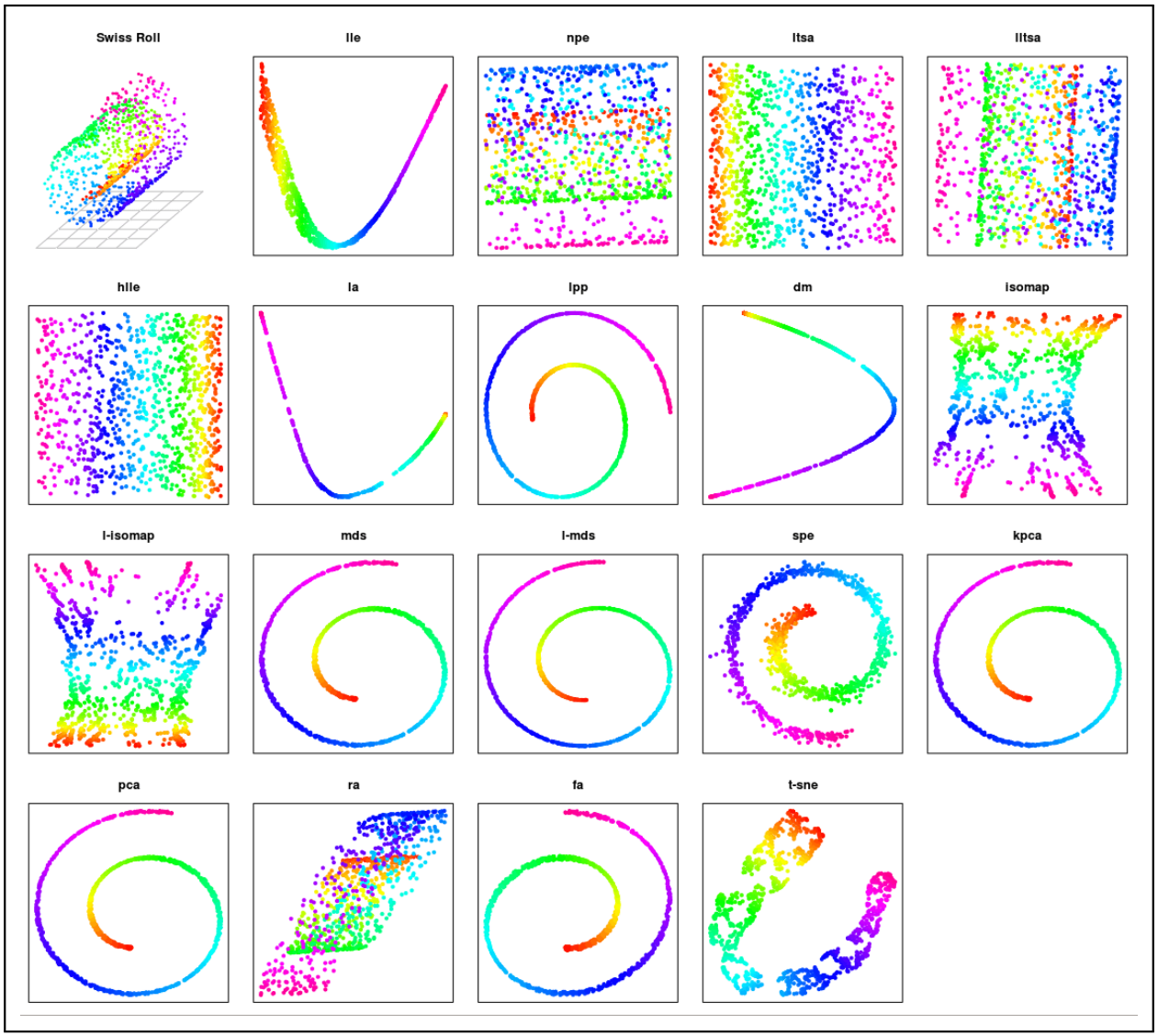
Contents

`shipunov` package for R



10 types of clusterings × 6 types of data

`tapkee` package for R



Manifold learning (dimension reduction) unfolds the swiss roll

My GitHub

Alexey Shipunov
ashipunov

http://ashipunov.info

Block or report user

Overview Repositories Projects Stars Followers Following

Popular repositories

img2djvu
Single-pass DjVu encoder based on DjVu Libre, minidjvu and ImageMagick
Shell ★ 18 3

djvupages
Shell utility to manipulate pages of DjVu file
Shell ★ 3 1

Homonym-Tools
Finding homonyms in the lists of biological names
R ★ 1

Ripeline
R pipeline: from DNA sequences to phylogeny trees
R

Rmanual
R pipeline: from species list to photographic manual

Rmanual_Jatun_Sacha
Example Rmanual: illustrated checklist of most collected plants from Jatun Sacha Reserve (Ecuador)

`https://github.com/ashipunov/`

My TEX software

https://ctan.org/author/shipunov/

Teaching projects

Hands-on Biogeography

Puerto Rico (El Yunque)

Ecuador (Mindo)

Hawaii (inside the Mauna Loa volcano)

Open botanical excursions in North Dakota

Teaching projects

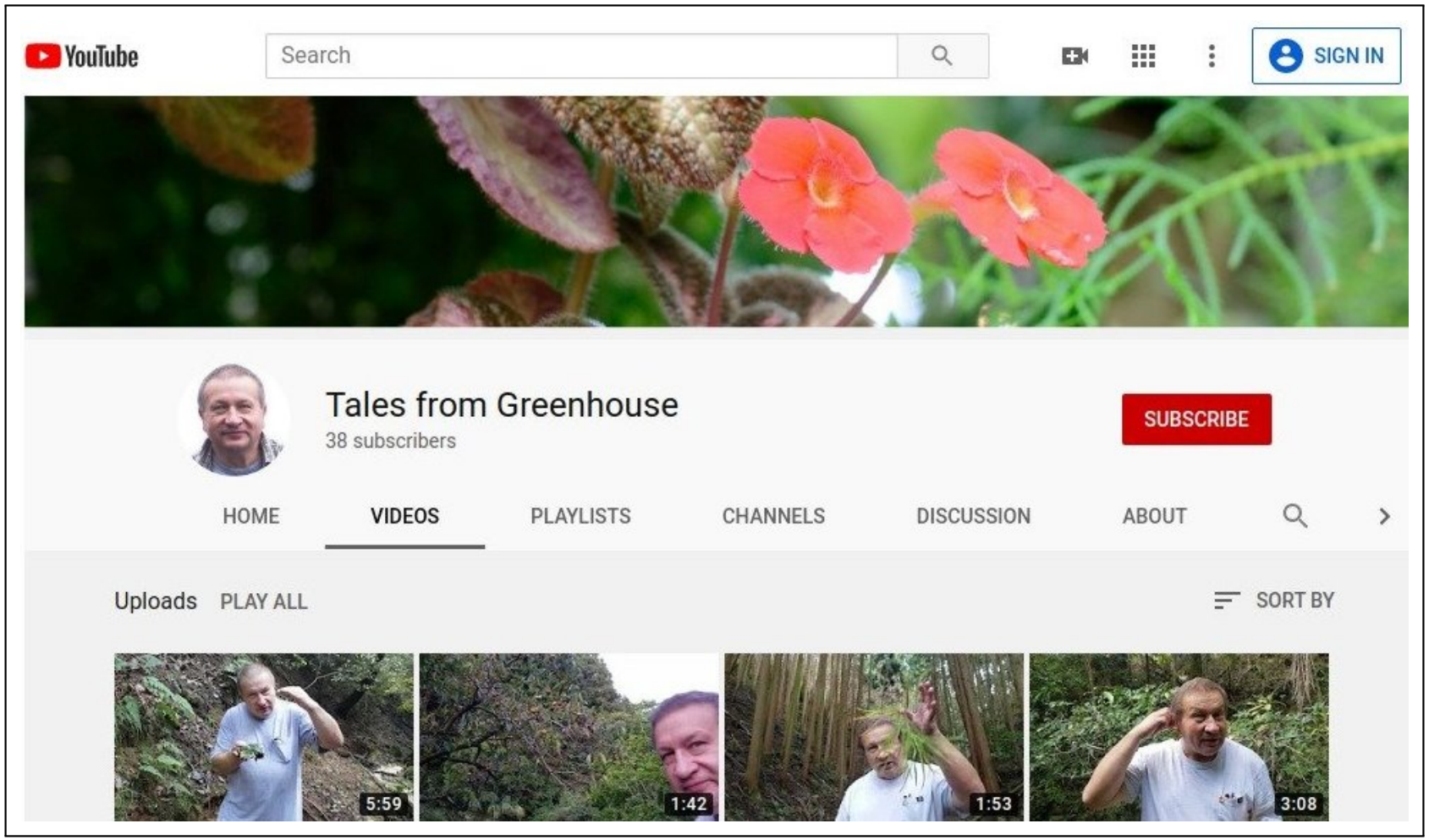
Tropical Greenhouse

Inside the greenhouse

Amborella trichopoda flowers in the greenhouse

Greenhouse video (6 min)

My YouTube channel: “Tales from Greenhouse”



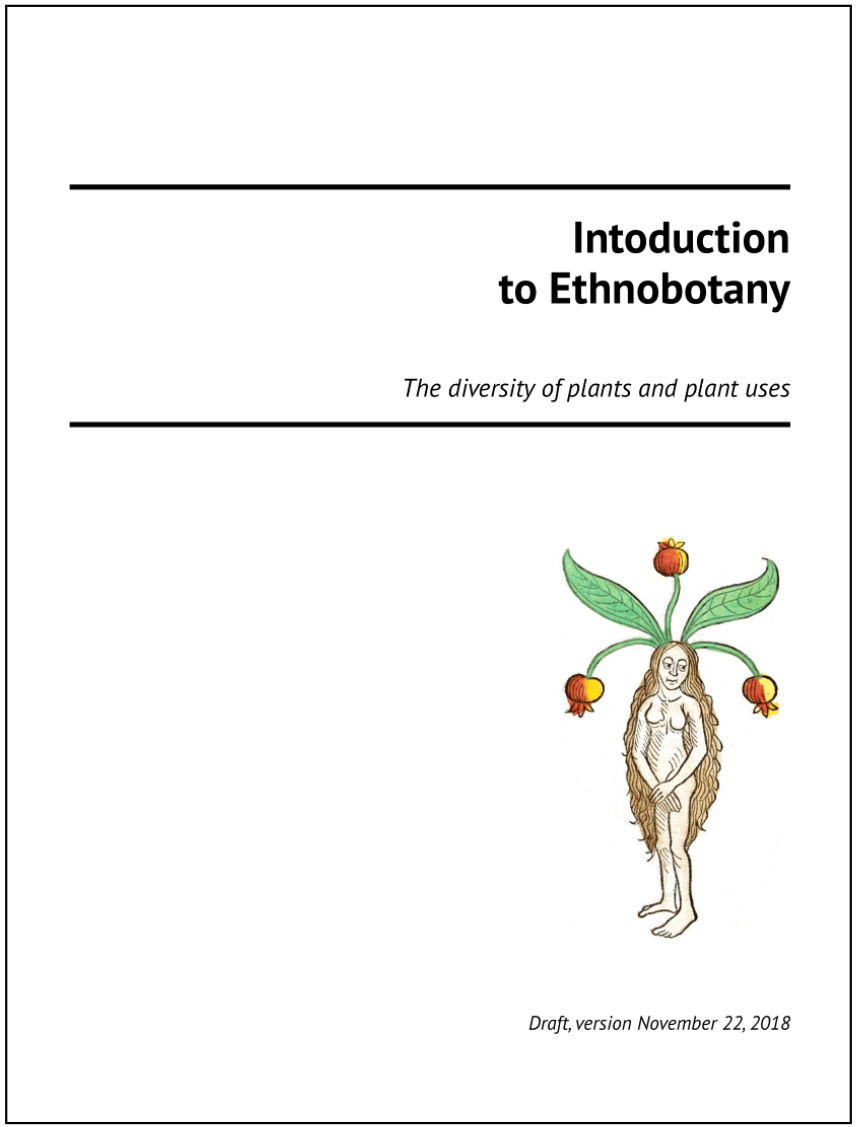
Includes many short video stories about plants,
both indoor and outdoor:

`https://www.youtube.com/channel/UCxPchT-Zp8ADvsVR9lHCRmA`

Teaching projects

Perspectives

Ethnobotany textbook



Dynamic atlas of plant families

The Family Life of Plants: Visual Key

Alexey Shipunov

September 1, 2017
Draft

Machine learning for botanists and zoologists

I would like to propose the short seminar course which concerns machine learning. 5–7 seminars are planning. We will learn:

- **basic R** such as data loading, modifications, plotting, plus simple statistical tests;
- the very basics of **multivariate plotting**, including 3D and trellis approaches;
- **non-supervised methods** including principal component analysis (PCA) and its variants (like CCA), t-SNE, self-organizing maps (SOM), various clustering techiques including k-means, DBSCAN and mean-shift;
- **geometric morphometry** methods available in R;
- various **supervised methods** like recursive trees, bagging (RandomForest) and boosting ensemble learning, proximity learning (kNN and others), and blackbox learning like support vector machines (SVM) and neural networks;
- selected **semi-supervised methods**;
- here will be also an opportunity to discuss **your own data**.

Thank you very much for the attention!

For references and links to my works, please check

`http://ashipunov.info`