

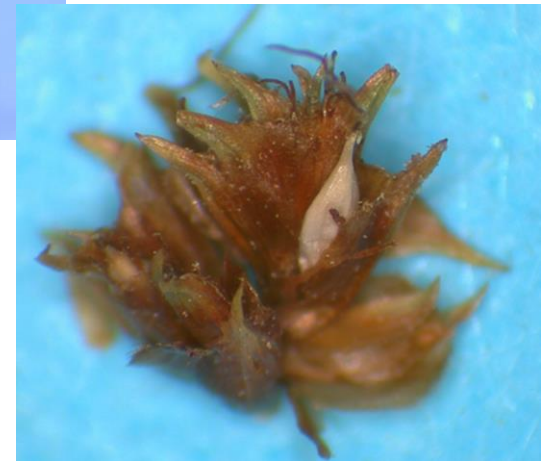
Cuban bulrush

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**CENTER FOR AQUATIC
AND INVASIVE PLANTS**

- Perennial aquatic sedge
- Origin: Trop. Americas, Africa
- Observed as emergent clumps, yet grows from stolons, submersed and rooting nodes, entwining on themselves and other floating plants
- Leaves V-shaped, stems 3-sided
- Flower heads globose, terminal, w/long subtending bracts
- Congested spikelets of female and male flowers, enclosed in many scales



Dense stands often very shiny



Cuban bulrush Taxonomic History

- Named *Scirpus cubensis* - 1837, Cuba
 - First good name given. Known from northern SA, CA, Mexico, and Africa at that time.
- 1965 study of embryo shape in Cyperaceae kicked plants out of *Scirpus*. Its aberrant morphology (spiral glume arrangement, flattened achenes) led to monotypic genus name, *Oxycaryum cubense*.
- 2009 molecular evidence *Oxycaryum* fits somewhere within the genus *Cyperus* and the same weird glume and achene morphologies actually had evolved several times in *Cyperus*.
- 2011 named *Cyperus blepharoleptos* following more DNA analysis as well as finding C3 anatomy and embryo shape both comparative to *Cyperus*. Relationship to an African species of *Cyperus* revealed.



1830s isotype by C. Wright, Cuba

While spirally arranged scales are tough to discern in identifying this species...

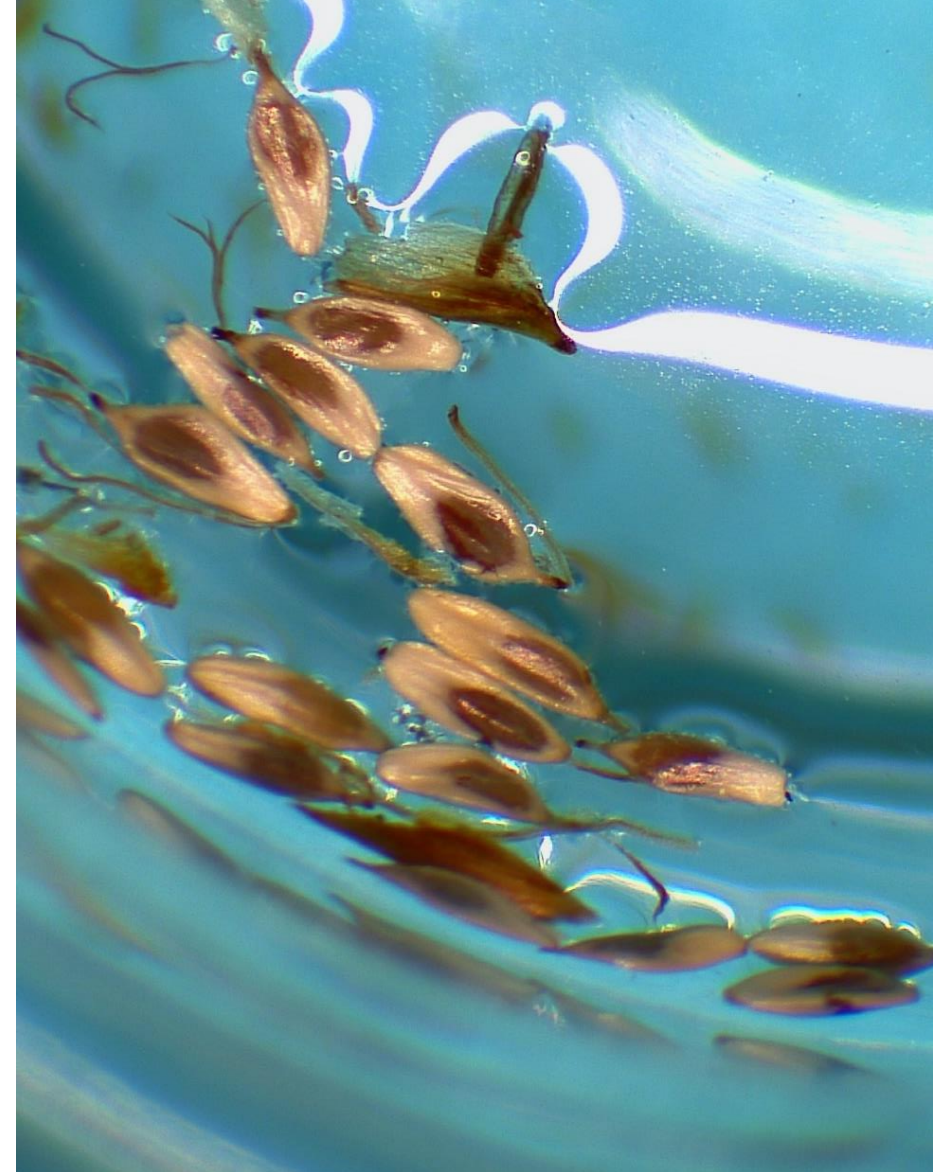
Distinctive to **Cuban bulrush** are the bracts and scales of the flower head which are:

- Tipped with a spine
- Edged with a fine dark fringe along the top margin



Cuban bulrush achenes

- Are dry fruits containing a single seed
- Achenes are convex on both sides yet flattened
- Achenes coalesce with the style base
- Styles are two-pronged (stigmas)
- The light colored portion of achene is a tough, leathery coating providing seeds buoyancy, long time floatation in water



Cuban bulrush in North America

Distribution defined by two forms:

- Single headed plants occurring in NW Florida, southern AL, MS, LA, and se TX and now spreading northward and into GA
- *Oxycaryum cubense* forma *paraguayense* (1935, 1995)
- Multiple headed plants occurring in peninsular Florida expanding in extent and frequency within the peninsula
- *Oxycarum cubense* forma *cubense* (1935,1995)



Cuban bulrush in North America – Earliest SE Gulf Coast

- 1882 Mobile, AL (*Mohr*)
- 1889 New Orleans, LA (*Chapman*)
- Historic specimens demonstrated both forms, present day populations are single headed!



Joe Jernigan, LAWD



Cuban bulrush in North America – Earliest FL Peninsular

- 1940 Lake Co., roadside
- 1945 Glades Co., Moorehaven, canal
- 1948 Osceola Co.
- 1958 Okeechobee Co., Kissimmee River



To this day the Caribbean maintains populations of both single and multiple headed forms

Dr. Jacono's hypothesis: The disparate geographical distribution and widely disjunct inception dates of the two forms suggest repetitive natural introduction events from the Caribbean or southern Americas to the Gulf Coast States.

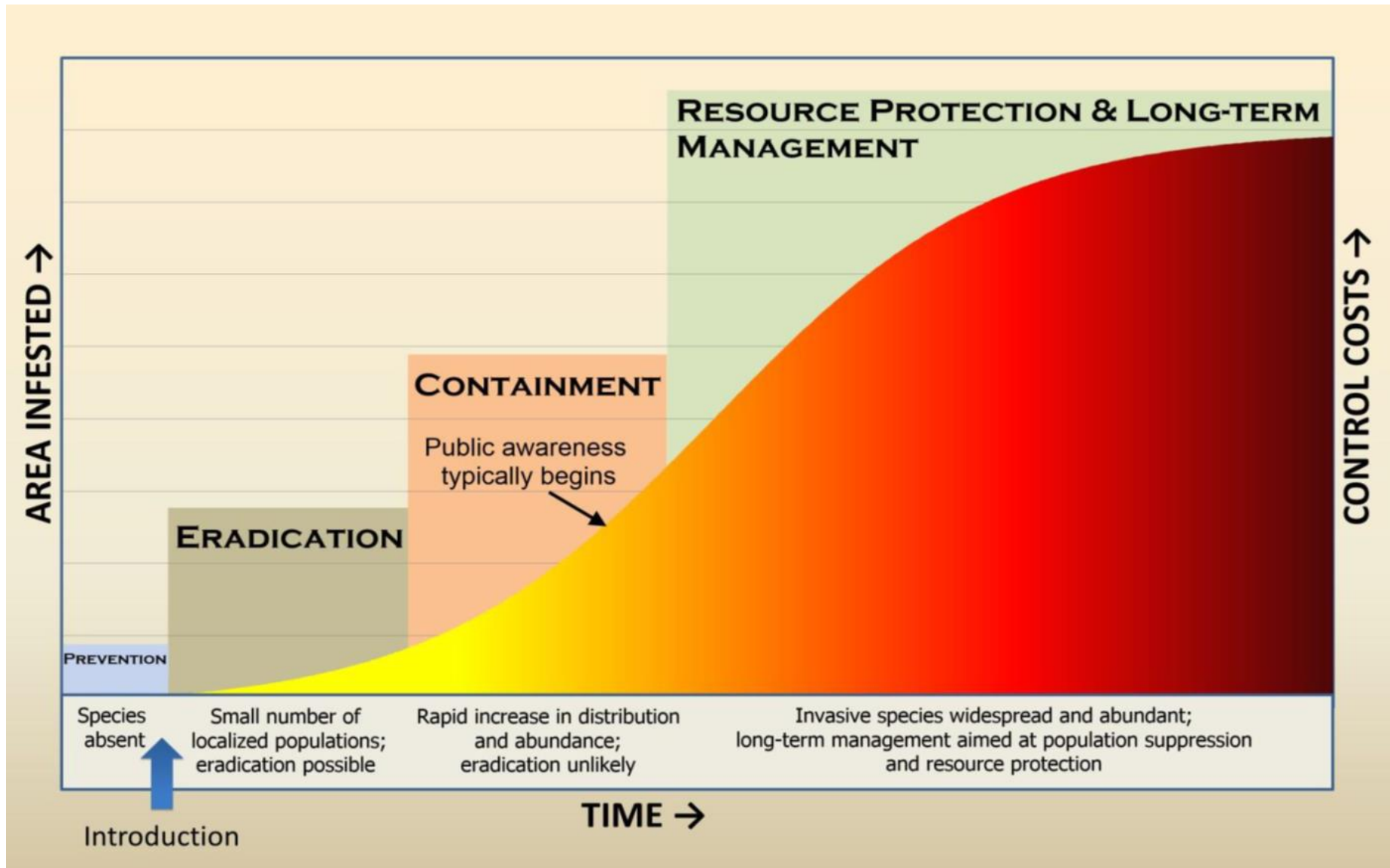


1830s isotype by C. Wright, Cuba



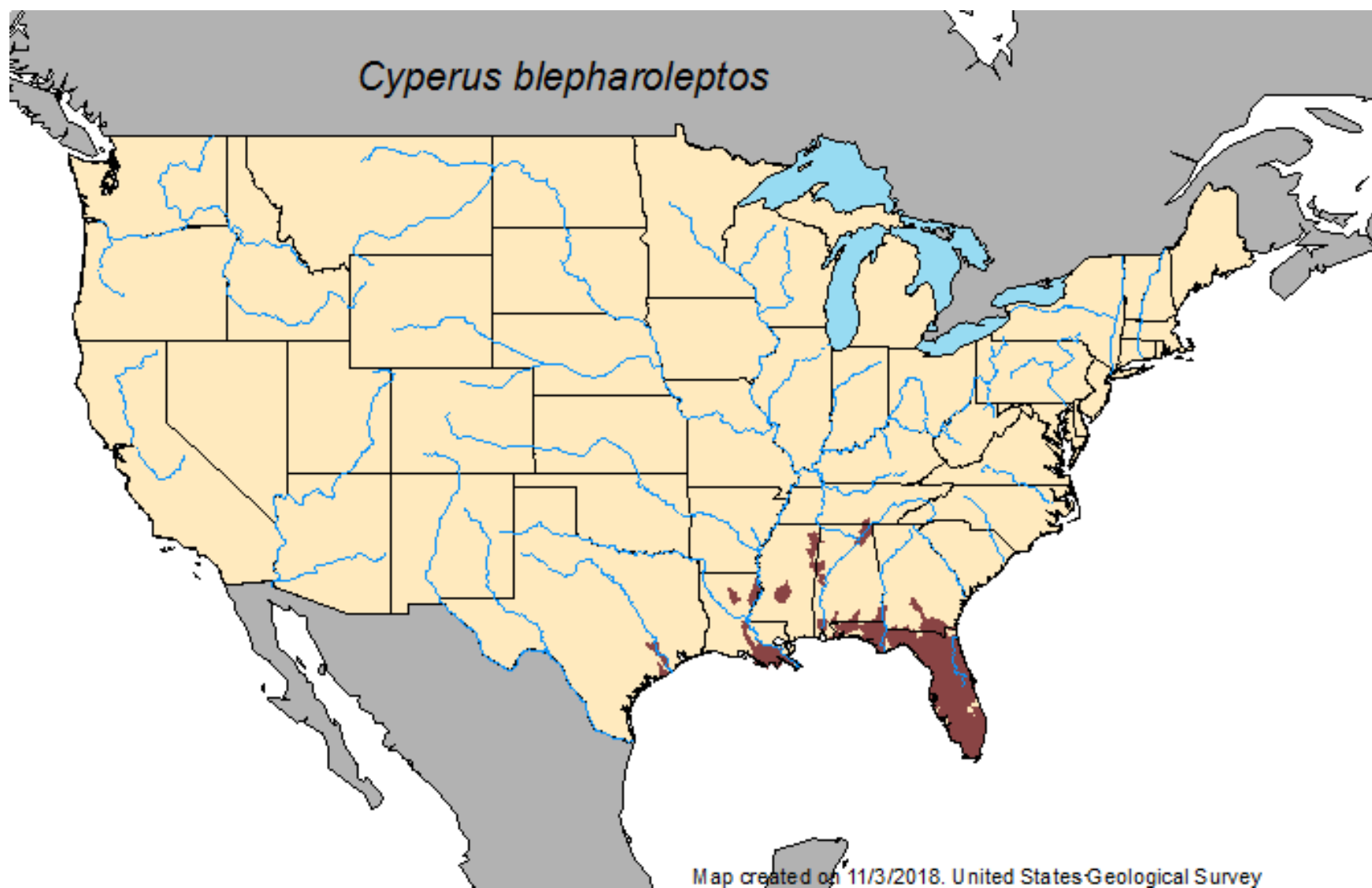
2012 collection by W. W. Thomas, Cuba

Where is Cuban bulrush on the invasion curve in FL?



“In the southeastern United States, *O. cubense* is found *sporadically* in Florida (Anderson 2000, 2007; Chapman 1889; Clewell 1985; Mallison et al. 2001; Wunderlin 1998)...”

Bryson, C., Maddox, V., & Carter, R. (2008). Spread of Cuban Club-Rush (*Oxycaryum cubense*) in the Southeastern United States. *Invasive Plant Science and Management*, 1(3), 326-329.

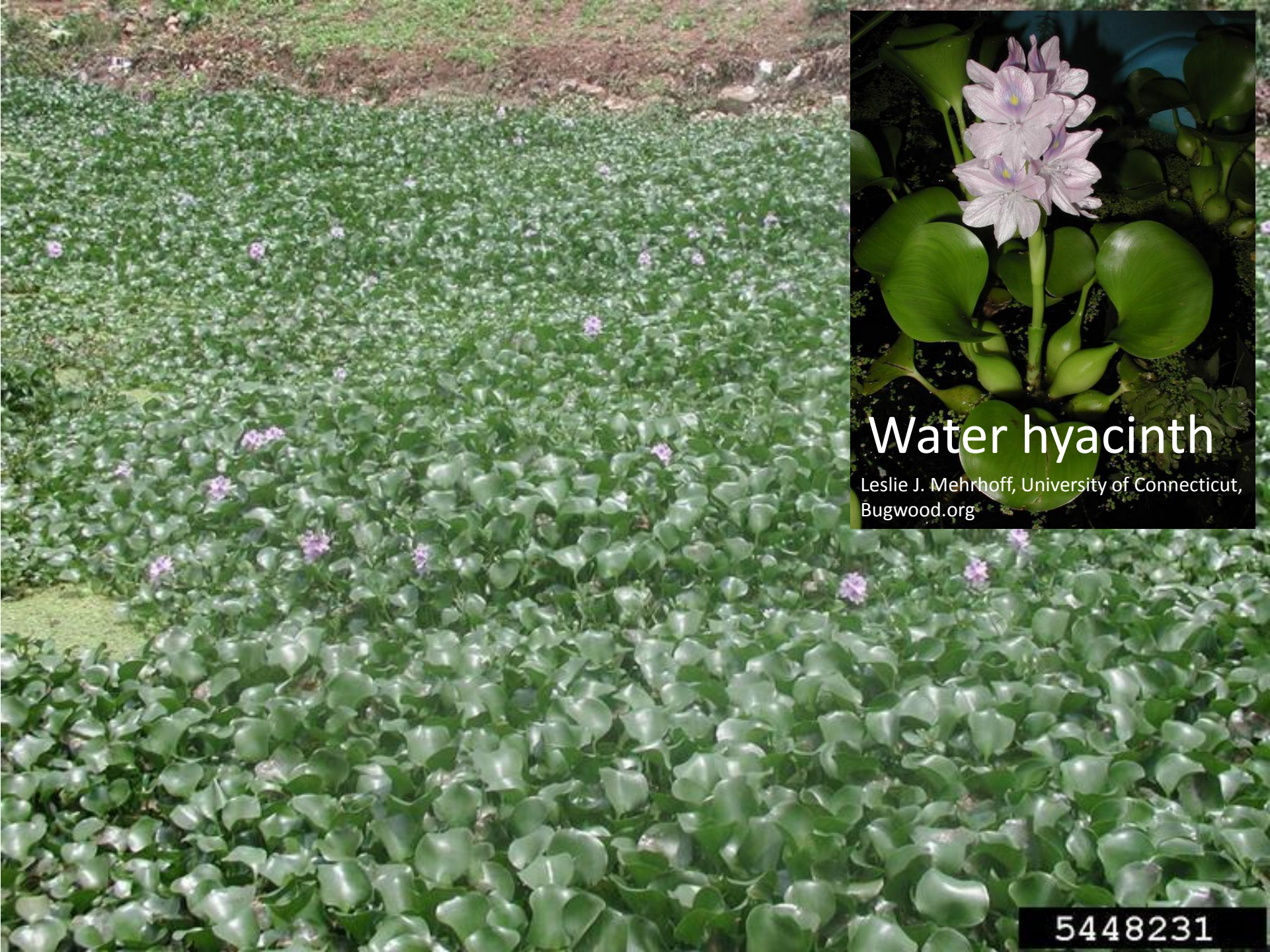


Listing Status

- IFAS Assessment
 - Not previously assessed. Issue of nativity is still debated
- FLEPPC
 - Petition for Category II status in process
- FDACS Noxious status
 - No
- FDACS Prohibited aquatic plant list
- USDA Noxious Weed List
 - No

“Large floating rafts (in excess of 50 m long and 20 m wide [ca. 165 ft long and 65 ft wide]) of *O. cubense* in association with *Eichhornia crassipes* (Mart.) Solms and *Salvinia minima* Baker were observed...*Hydrilla verticillata* (L.f.) Royle, *Hydrocotyle ranunculoides* L.f., *Ludwigia leptocarpa* (Nutt.) H. Harra, *Myriophyllum aquaticum* (Vell.) Verdc., *M. spicatum* L., *Potamogeton nodosus* Poir., *Proserpinaca palustris* L., and *Utricularia gibba* L. were recorded in association with one or more populations of *O. cubense*.”

Bryson et al. (2008)



Water hyacinth

Leslie J. Mehrhoff, University of Connecticut,
Bugwood.org

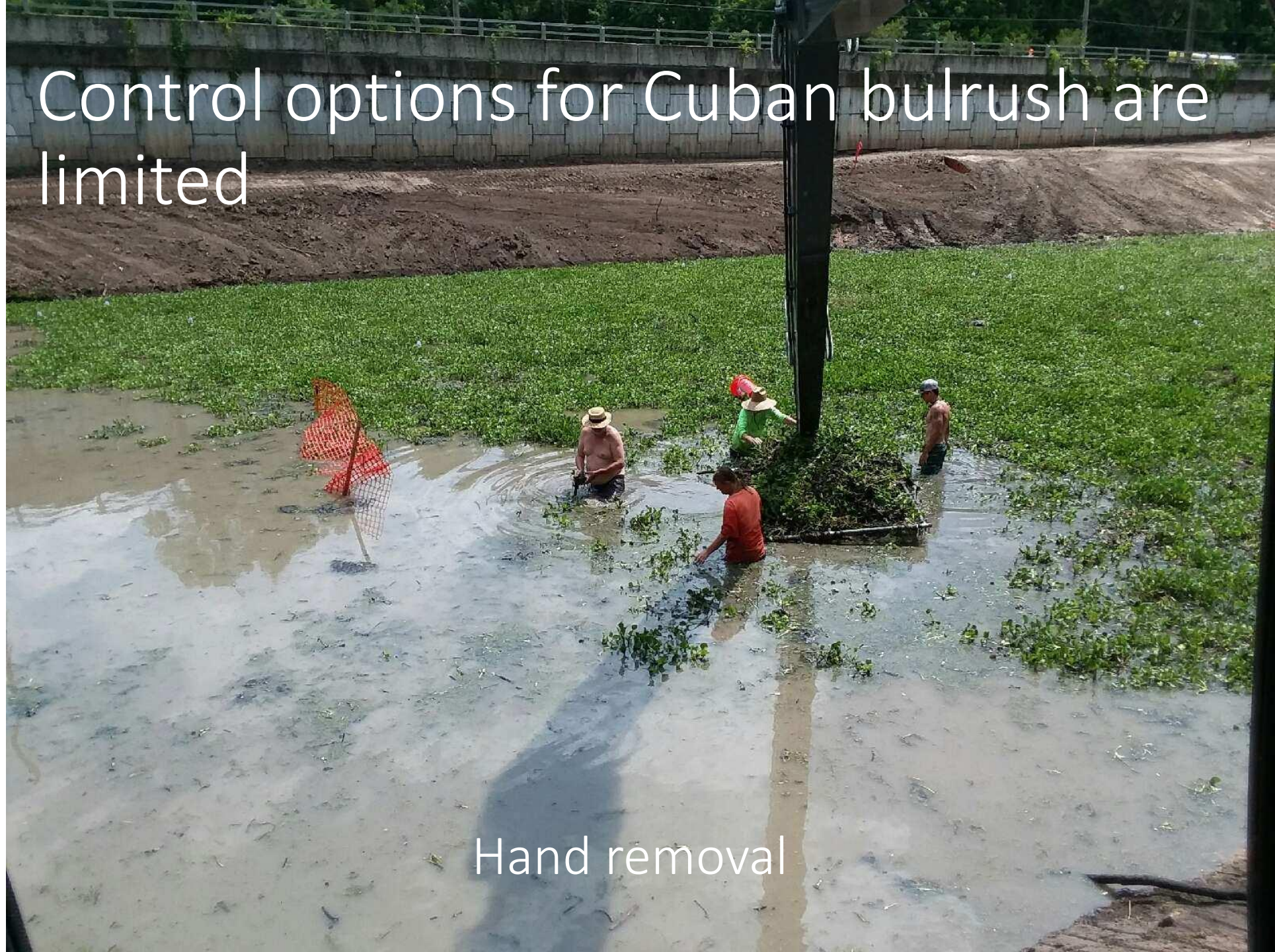
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Water Lettuce
Pistia stratiotes
Photo by Dr. Bill Haller
© 2007 University of Florida

Water lettuce



Control options for Cuban bulrush are limited



Hand removal

Mechanical harvesting



What about grass carp?



What About Classical Biocontrol?



Agasicles hygrophila
Alligatorweed flea beetle
Copyright 1997 USDA-ARS

Table 1. Established arthropod biological control agents of invasive weeds in Florida. For higher classification and authors of scientific names of the natural enemies, see Julien and Griffiths (1998), Cuda et al. (2006, 2007), and Frank and McCoy (2007).

Weed	Agent	Type	Origin	Date ¹	Impact
Air potato	<i>Lilloceris chenii</i>	Beetle	China	2011	Widespread
★ Alligatorweed	<i>Agasicles hygrophila</i>	Beetle	Argentina	1964	Widespread
	<i>Amynothrips andersoni</i>	Thrips	Argentina	1967	Local
	<i>Arcola (= Vogtia) malloi</i>	Moth	Argentina	1971	Local
Brazilian peppertree	<i>Megastigmus transvaalensis</i>	Wasp	South Africa	Adventive	Widespread
Hydrilla	<i>Hydrellia pakistanae</i>	Fly	India	1987	Widespread
	<i>Cricotopus lebetis</i>	Midge	Louisiana	Adventive	Local
	<i>Bagous hydrillae</i>	Weevil	Australia	1991-1996	None
Melaleuca	<i>Oxyops vitiosa</i>	Weevil	Australia	1997	Widespread
	<i>Boreioglycaspis melaleucae</i>	Psyllid	Australia	2002	Widespread
	<i>Lophodiplossis trifida</i>	Fly	Australia	2008	Local
Old World climbing fern	<i>Neomusotima conspurcatalis</i>	Moth	Australia, Southeast Asia	2008	Local
	<i>Floracarus perrepae</i>	Mite	Australia, Southeast Asia	2008	Local
Salvinia	<i>Cyrtobagous Salviniae</i>	Weevil	Brazil	Adventive	Widespread
Tropical soda apple	<i>Gratiana boliviana</i>	Beetle	Argentina	2003	Widespread
Waterhyacinth	<i>Neochetina bruchi</i>	Weevil	Argentina	1974	Widespread
	<i>Neochetina eichhorniae</i>	Weevil	Argentina	1972	Widespread
	<i>Niphograpta albiguttalis</i>	Moth	Argentina	1977	Local
	<i>Orthogalumna terebrantis</i>	Mite	--	Native	Local
	<i>Megamalus scutellaris</i>	Bug	South America	2010	Local
Waterlettuce	<i>Neohydronomus affinis</i>	Weevil	Brazil	1987	Local

¹Date of first release or discovery. Adventive means that the species arrived in Florida from somewhere else by any means. Others were introduced (deliberately).

★ The most effective aquatic biocontrol we have



Graminicides: Grass specific herbicides

“FOPS” and “DIMS”

- Fluazifop (Fusilade)
- Fenoxaprop (Acclaim)
- Sethoxydim (Poast, TIGR)
- Clethodim (Select)

THEY DO NOT WORK ON CYPERACEAE

What about turfgrass/ornamental herbicides for sedge control?

<u>Common Name</u>	<u>Trade Name(s)</u>	<u>Noncrop use?</u>
bentazon	Basagran T/O	yes
flazasulfuron	Katana	turf sites
halosulfuron	Sedgehammer	limited
imazaquin	Image	turf sites
sulfosulfuron	Certainty	turf sites
trifloxysulfuron	Monument	turf sites

- NOT LABELED FOR USE IN AQUATICS. DO NOT USE!

Herbicides that work

- 2,4-D, diquat, imazapyr, imazamox, glyphosate, and triclopyr highly effective on pre-flowering Cuban bulrush in mesocosm studies
 - Fernandez and Madsen 2012
- Pre-flowering treatment more effective than post-flowering for 2,4-D
- Glyphosate + flumioxazin tank mixes effective
 - Floating mat control for multiple species

Summary

- Taxonomic changes slow to be accepted
 - Oxycaryum to Cyperus
- Nativity can be debated
- The two forms are out there and up for discussion
- We know little about seed biology and recruitment
- The rapid spread increase over the last decade strongly supports the need for management
- Maintenance control is largely herbicide based with mechanical as an option for large rafts