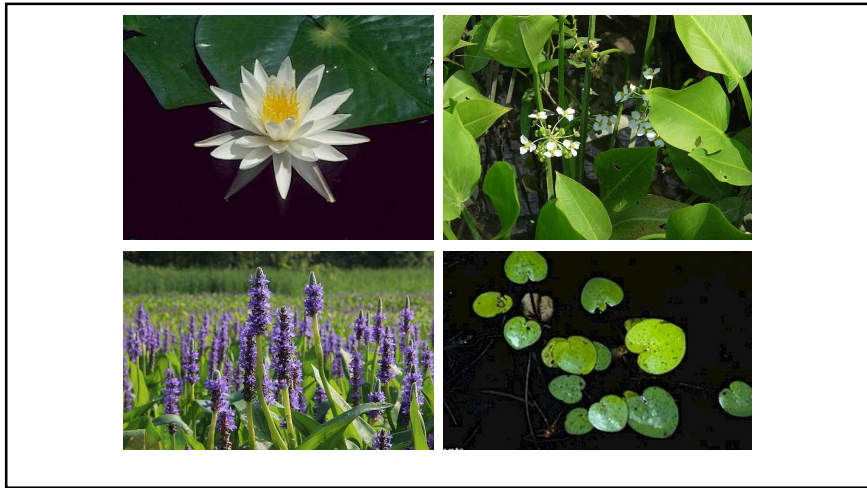


Aquatic weed management

Megan Reid, PhD,
Postdoctoral Research Associate,
Ft Lauderdale REC, UF/IFAS

UF IFAS Extension
UNIVERSITY of FLORIDA

1





2



3

Ecosystem impacts


- Mats inhibit freshwater flow and gas exchange with air. 
- Decomposition of mats:
 - Consumed by bacteria and fungi. 
 - Oxygen consumed and depleted.

<https://fishbio.com/breathing-under-water/>

4

Ecosystem impacts


- Outcompetes native vegetation.
- Disrupt food chain and nutrient cycles.



5

Socio-economic impacts

- Clogs water ways.
 - Increases risk of flooding.
- Inhibits recreational water activities.
- Money and time for management.
- Health
 - Breeding ground for mosquitoes.

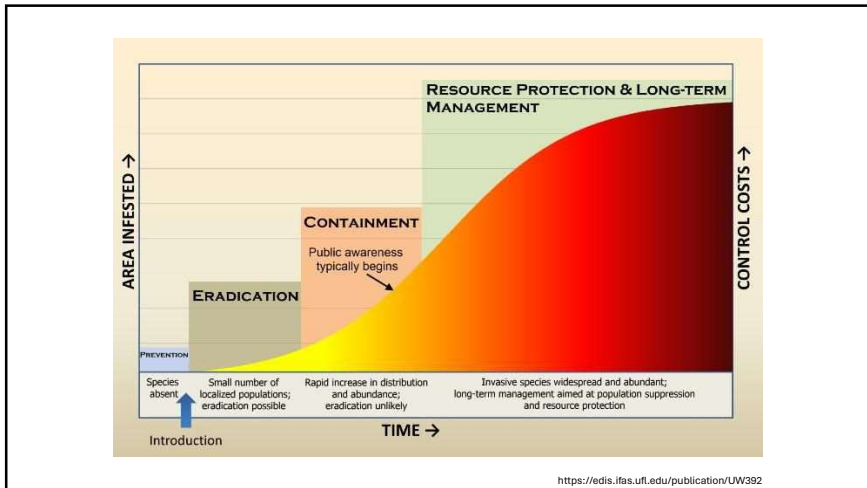


6

Climate change will make it worse!
Higher temperatures = higher growth rate!









7



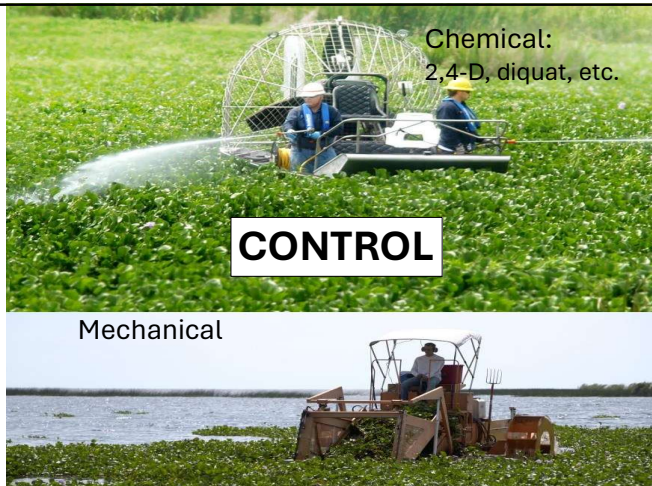
8



9

-  Minimize costs. 
-  Minimize environmental damage. 
-  Maximize effectivity. 

10




11

Mechanical removal

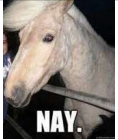


- Can be selective (depending on technique).
- Some action better than no action.
- Immediate removal not contributing to detritus/sludge.
- Not always appropriate (access).
- Expensive.
- Disposal issues.
- Bycatch.
- Not effective in long term.
- Labor intensive.

12



Chemical control



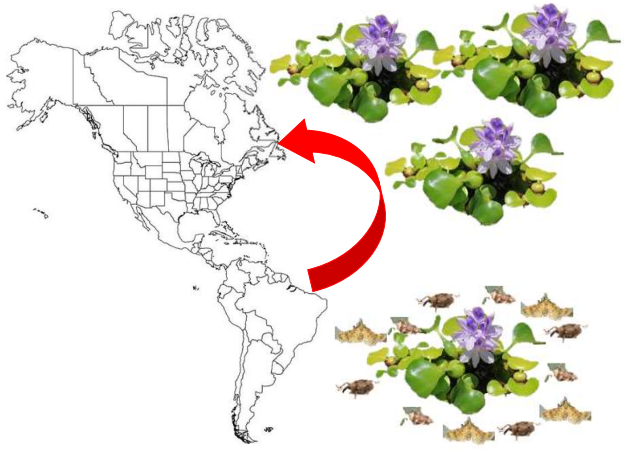
- Fast acting.
- Effective in short term.
- Used according to label reduces impacts on other organisms.
- Cheaper than mechanical.
- Requires frequent reapplication.
- Only effective in short term (regrowth).
- Can be expensive.
- Damaging to environment (nontarget impacts).
- Public outcry.

13

Classical biological control

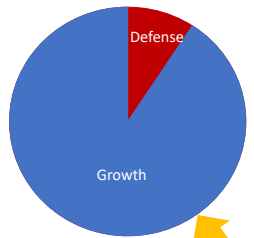


14

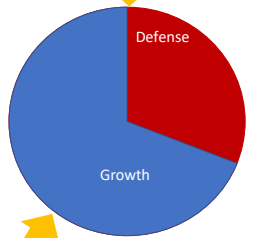


15

Without specialist herbivores



With specialist herbivores



Nutrients

16

When I run out of spoons



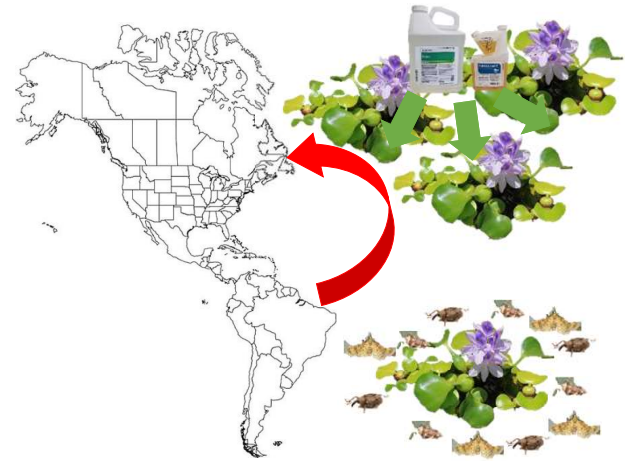
17



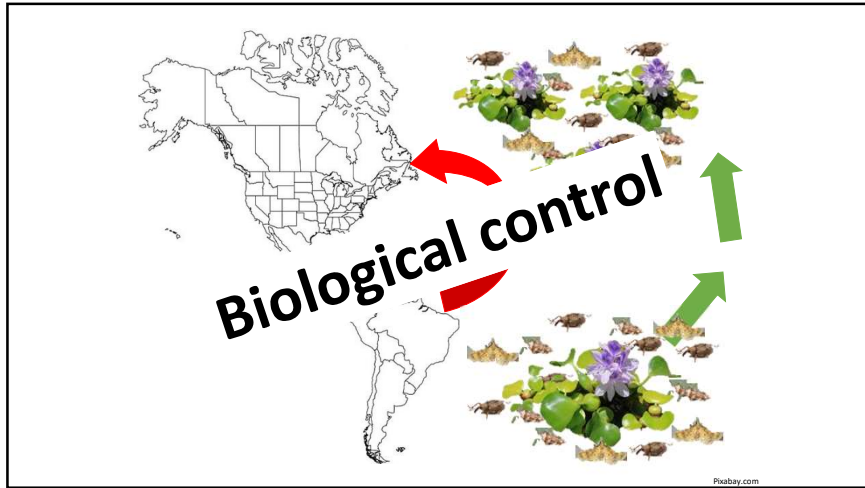
18



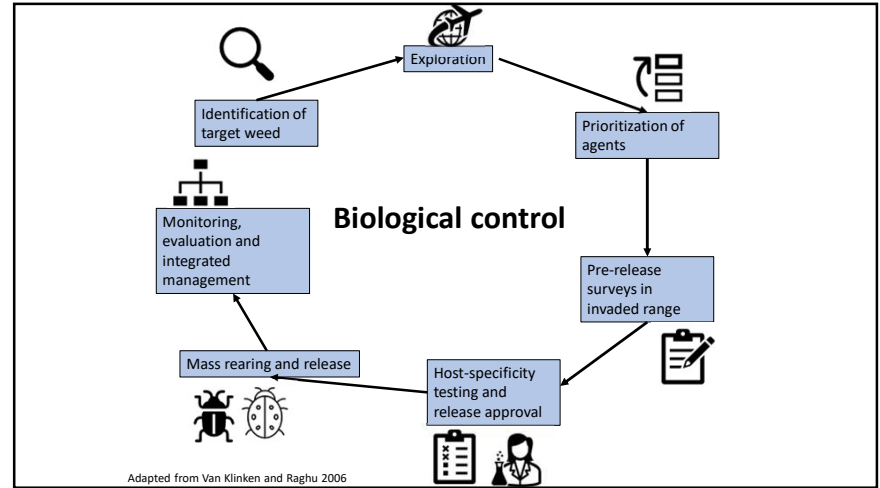
19




20



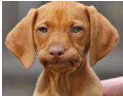
21



22

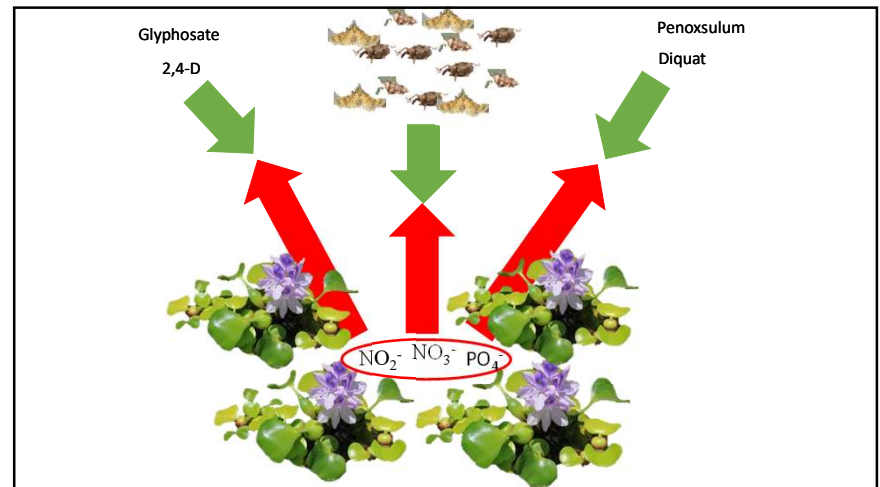


Biological control



- Environmentally friendly.
- Selective.
- Effective in the long term.
- May require less frequent introductions after establishment.
- Value of benefits outweigh financial costs.
- Takes time to research.
- Takes time for populations to establish and exert control (if they do).
- Dependent on insect densities.
- Multiple agents may be necessary for control.

23



24

Integrated pest management (IPM)



- Halve rate of herbicide use.
- Reduce costs + environmental impacts.
- Combine advantages of both methods.
- Top-down pressure on WH from multiple angles.
- Ubiquitous already.



- Takes time to research.
- Techniques need to be optimized.
- Need to make sure methods are compatible (ensure correct techniques are used).
- Agents unavailable for new releases.

25

Biology and Control of Aquatic Plants

A Best Management Practices Handbook
Fourth Edition

Lyn A. Gettys, William T. Haller and David G. Petty, editors

26



Alligatorweed
*Alternanthera
philoxeroides*

27

Control



Triclopyr, Imazapyr, Bispyribac are effective, among others.



Mechanical control ineffective, spread by fragmentation.



Biological control highly successful.

28

Alligatorweed flea beetle (*Agasicles hygrophila*)



- Introduced in 1964 from South America.
- Complete control in southern FL to southern Texas.
- Not cold tolerant, die out in winter in central/northern Gulf states.
- Augmented releases by USACE.

29



30

Thrips (*Amynothrips andersoni*)

Released 1967, attacks terrestrial form, less successful.



Moth (*Arcola malloi*)

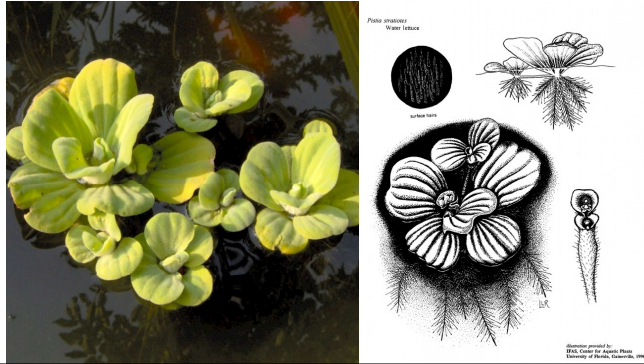
Released 1971, moderate control, important in upper Mississippi valley.

31

Very effective biocontrol,
world's first example of aquatic
weed biocontrol success.

32

Waterlettuce (*Pistia stratiotes*)



33

Control



Diquat, carfentrazone = quick damage. Systemics like imazapyr and penoxsulam = slow but effective.



Can be helpful in small waterbodies, less practical in larger systems. Disposal issues.



Negligible effect on growth.

34

Waterlettuce leaf moth (*Spodoptera pectinicornis*)




35



Waterlettuce weevil
(*Neohydronomus affinis*)


36

- Native to Argentina and Brazil.
- First introduced to US in 1987.
- Larvae bore into spongy tissue.
- Successful in SA, AUS, Louisiana.
- Populations fluctuate.



The top part of the image shows a green leaf with several brown, irregular spots of damage. Red arrows point to these spots, with the text "Weevil feeding damage" written in red below them. Below this is a close-up photograph of a brown weevil with a long snout.

37



The image contains several botanical drawings of Torpedo grass, including a full plant with roots, a close-up of the inflorescence, and a cross-section of the stem. To the right is a photograph of the grass growing in a field. The text "Torpedo grass" and "*Panicum repens*" is written in the bottom right corner.




38



The top part of the image is a close-up photograph of a grass stem with a yellowish, fibrous structure. The bottom part is a photograph of a blue metal pipe lying on a concrete pad in a grassy area with trees in the background.

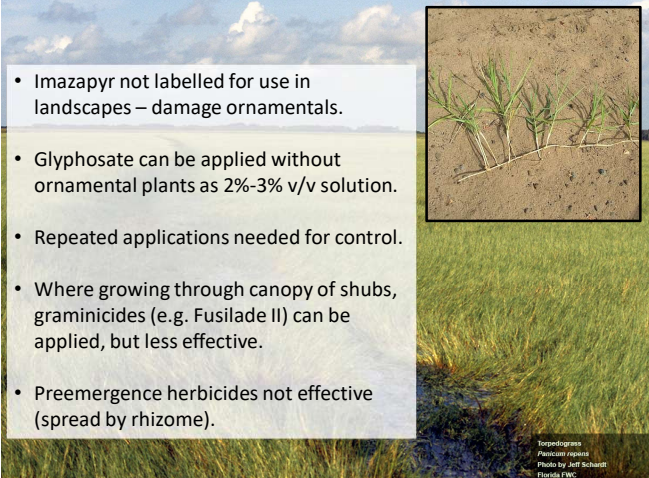
39

Control

- 
 Postemergence herbicides most common. Most effective = glyphosate, imazapyr.
- 
 Moderately effective. Digging, mowing, burning. Resprout from rhizomes.
- 
 Limited agents being studied. Palatable for cows, goats.

40

- Imazapyr not labelled for use in landscapes – damage ornamentals.
- Glyphosate can be applied without ornamental plants as 2%-3% v/v solution.
- Repeated applications needed for control.
- Where growing through canopy of shrubs, graminicides (e.g. Fusilade II) can be applied, but less effective.
- Preemergence herbicides not effective (spread by rhizome).

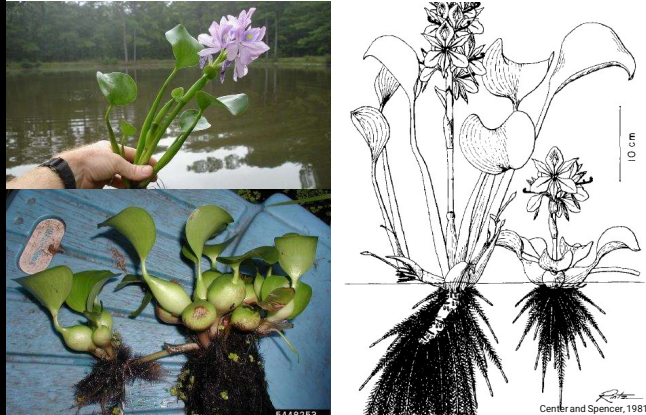


Torpedograss
Panicum repens
Photo by Jeff Schwartz
Florida FWC

41

Waterhyacinth




Pontederia (Eichhornia) crassipes



5448253
Center and Spencer, 1981

42

Control

-  2,4,D-amine, penoxsulam, diquat, imazamox, etc.
-  Mechanical harvesters can work, but short term and expensive.
-  Weevils ubiquitous, effective but IPM needed.

43

The American Hippo Bill

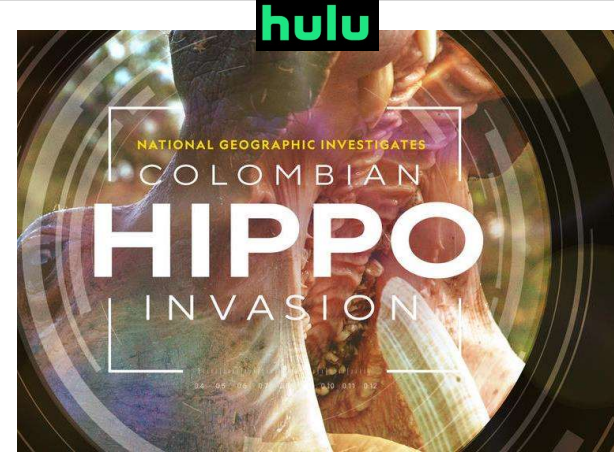


- 1910: Water hyacinth invasion + meat shortage.
- “Lake Cow Bacon”.
- Would have caused more problems!

44

- 1980s Pablo Escobar imported four hippos to Colombia.
- 1993 released.
- Now naturalized population ~90 individuals.
- 1,418 animals by 2039.

45



46



47

Neochetina eichhorniae (mottled water hyacinth weevil)



48

Neochetina eichhorniae (mottled water hyacinth weevil)

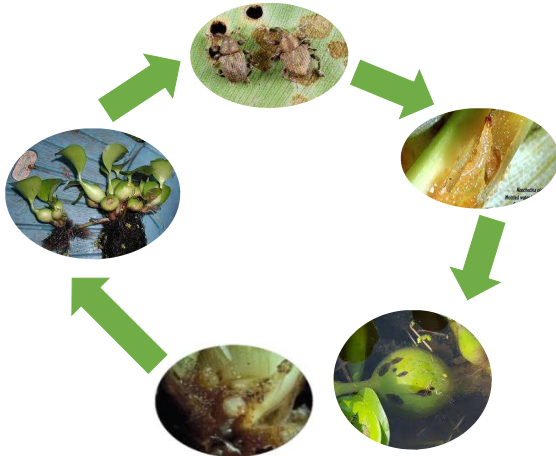
- Native to South America.
- Introduced to U.S. in 1972.
- Can result in 58.2% less biomass, 97% fewer flowers (Tipping et al. 2014).
- Plants more susceptible to infection, sinking, herbicides.



49



50



<https://www.tsu.edu/departments/entomology/assets/waterhyacinthweevilfinal.pdf>

51

Neochetina bruchi (chevroned water hyacinth weevil)

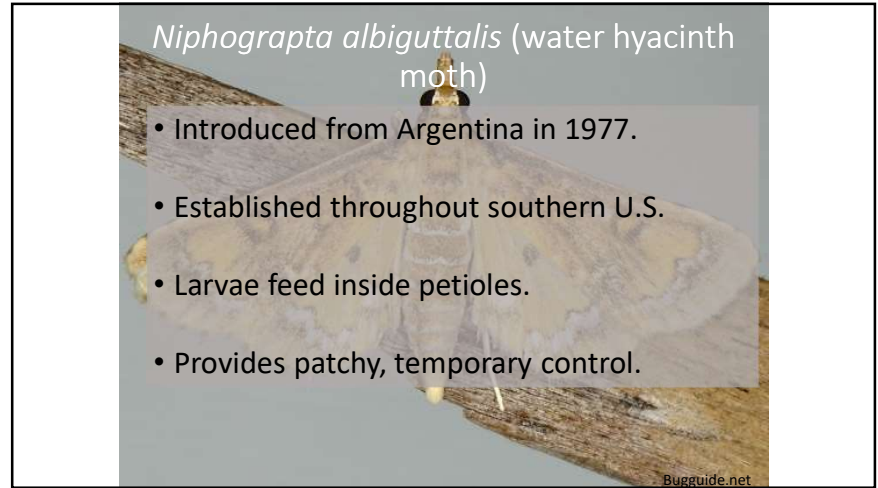


- Introduced to U.S. in 1974.
- Lower prevalence in Florida.

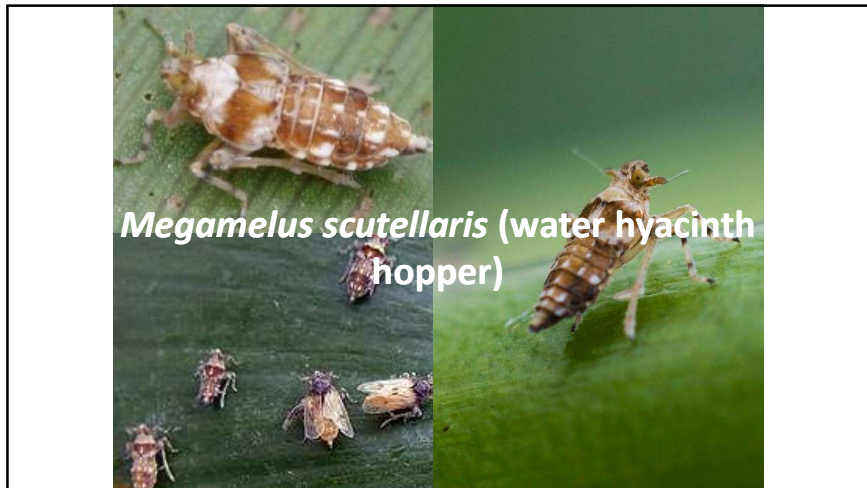
52



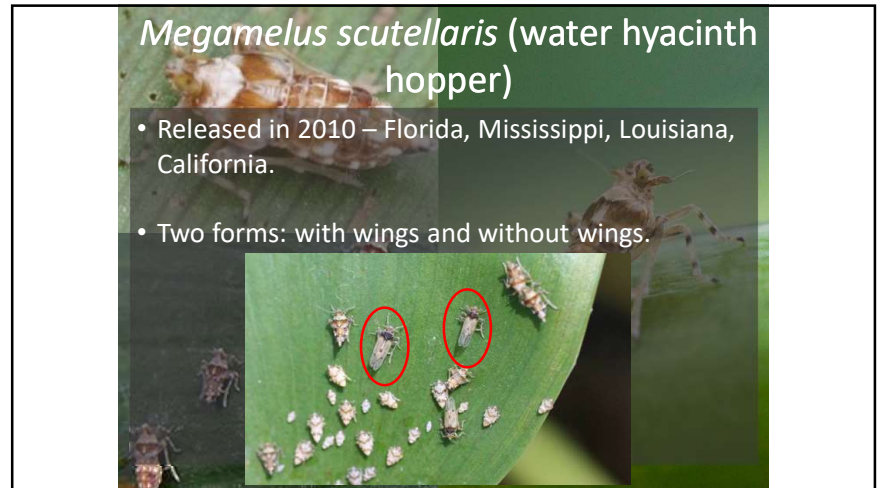
53



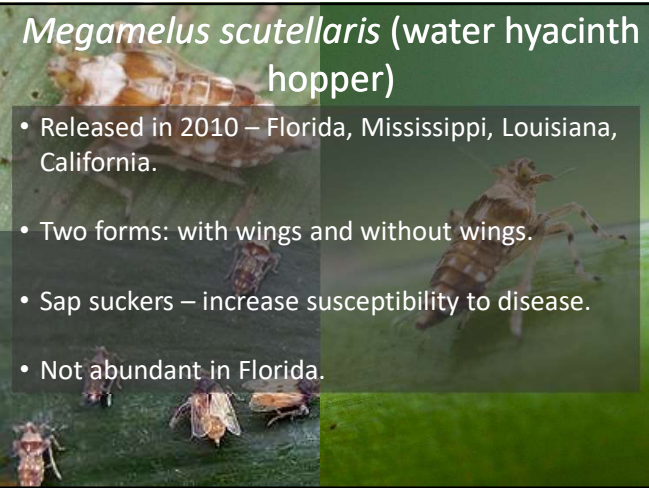
54



55



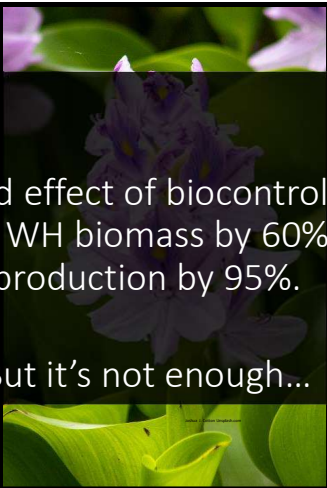
56



Megamelus scutellaris (water hyacinth hopper)

- Released in 2010 – Florida, Mississippi, Louisiana, California.
- Two forms: with wings and without wings.
- Sap suckers – increase susceptibility to disease.
- Not abundant in Florida.

57



Combined effect of biocontrol agents reduces WH biomass by 60%, seed production by 95%.

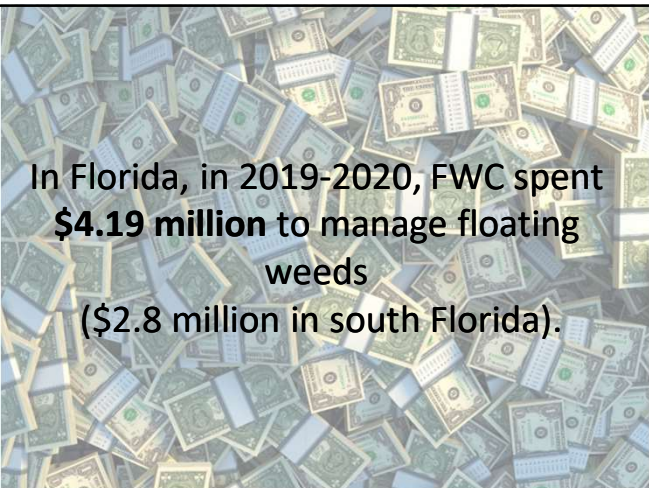
But it's not enough...

58



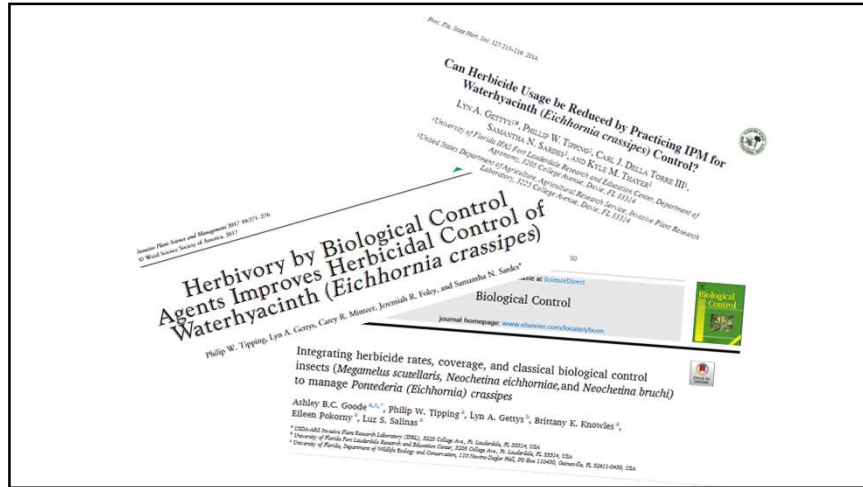
Integrated management:
because teamwork makes
the dream work!

59






In Florida, in 2019-2020, FWC spent **\$4.19 million** to manage floating weeds (\$2.8 million in south Florida).

60



61

- Operational rates of 2,4-D can be **reduced from 4qpa to 2qpa.** 
- Herbicide usage can be **reduced with similar efficacy** when integrating with biocontrol. 
- Important to leave refuges: 40-80% spray coverage equivalent to 100%. 

62

Lake Okeechobee Water Hyacinth Areawide Project

- Develop integrated management (IPM) strategies for Lake Okeechobee.
- Maximize low-cost sustainable control methods (biocontrol).
- Provide recommendations, transfer techniques to other impacted areas.

63



64



65



66

Centre for Biological Control - CBC
 5d · 🌐

In the words of [Carte Blanche](#) Carte Blanche's Govan Whittles- The key to the success comes from the residents around Harties tending to the rearing of the plant hoppers! The Success:

KORMORANT.CO.ZA

Hyacinth almost gone on Hartbeespoort Dam
 Hyacinth cover on the Hartbeespoort Dam is currently about 2% and role players around the d...

67



68



Important: methods are unlikely to result in complete eradication but will exert maintenance control.

69

70



71



72



73



74