USDA Invasive Plant Research Lab
Combating Invasive Plants in the Everglades

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U.S. Department of Agriculture
Agricultural Research Service
Invasive Plant Research Laboratory
IPRL: Who are we?

1954 – unit established to study South Florida hydrology
1957 – expanded to add alligatorweed control efforts
1959 – USDA & USACE begin joint aquatic weed efforts
1986 – melaleuca in Everglades added to targets
1994 – began designing a quarantine facility to meet stakeholder needs for expanded biocontrol research
2005 – new quarantine facility complete, quadruples capacity
2011 – began construction on CERP mass rearing facility
2014 – began operational use of mass rearing facility

The Mission of the Invasive Plant Research Laboratory (IPRL) is to address the complex and multi-faceted problems of exotic plant invasions in natural and agricultural ecosystems…

The IPRL conducts research into the impacts of exotic plants as well as the safety and effectiveness of biological control and other methods used to manage invasive plants.
Invasive Species: What are they?

An invasive species is an organism that is out of its natural environment and is causing harm to its new environment.
This comprehensive multi-agency scientific assessment determined fixing Everglades hydrology without addressing invasive species would ultimately fail restoration objectives.

Doren et al 2002  South Florida Ecosystem Restoration Task Force.
Everglades Invaders: Why are they important?

Brazilian peppertree in Everglades wetland: alters hydrology, biogeochemistry, community structure, plant recruitment, and resource competition.
Everglades Invaders: Why are they important?

Australian pine in coastal zones: alters geomorphology, biogeochemistry, community structure, plant recruitment, resource competition, and interferes with T/E species.
Everglades Invaders: Why are they important?

Old World climbing fern in tree islands and pinelands: alters community structure, plant recruitment, resource competition, fire regimes, geomorphology, and hydrology

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Everglades Invaders: Why are they important?

Melaleuca in Everglades graminoid wetland:
alters geomorphology, community structure, plant recruitment, and resource competition
Solving this conservation challenge?

No one technology can effectively & efficiently control invasive plants in all habitats and under all circumstances

Solution?

Integrated Pest Management
Melaleuca Management Plan

- May 1990 - 1st ed.
- April 1994 - 2nd ed. revised to include most recent information
- May 1999 - 3rd ed. revised to update information recommendations changed to reflect progress
Conceptual Model

Reliance

Herbicidal and Mechanical Control

Biological Control

Time

Today
Weed Biological Control

Biological control (biocontrol) is the science of re-associating natural enemies with their hosts in regions where neither the host nor the enemy naturally occurs.

The goal is to produce enough stress to the host that it no longer causes problems in its non-native range.
How does biocontrol work?

- Foreign surveys (find the critters)
- Quarantine studies (make sure they’re safe)
- Release & establishment (get them into the field)
- Long-term monitoring (determine effectiveness)
- Redistribution (move them around if necessary)
- Technology transfer (help others use the critters)
THE MULTI-GENE NATURE OF HOST USE
BY A SPECIALIZED INSECT
Host Testing Protocols

• The Centrifugal Method (Phylogenetic)
  - Species group: *Melaleuca leucadendra* complex
  - Other Congeners: *Melaleuca* spp.
  - Subfamilial relatives: Leptospermoideae
  - Other Confamilials: Myrtaceae
  - Order: Myrtales

• Habitat Associates

• Economically or Ecological Important Species
The bug *Teleonemia scrupulosa* introduced in 1902 without testing against *Lantana camara* in Hawaii.

**Alligatorweed**  
*(Alternanthera philoxeroides)*

**South America**

**Alligatorweed flea beetle**  
*(Agasicles hygrophila)*

1965

USACE herbicidal control:  
Pre-1965 - > $1,000,000/yr  
Today - ~$20,000/yr

*before*  
*after*
Waterhyacinth
*(Eichhornia crassipes)*

Previously released

Waterhyacinth moth
*(Niphograpta albiguttalis)*

1977

Waterhyacinth mirid
*(Megamellus scutellaris)*

1972, 1974

1977

Waterhyacinth weevils
*(Neochetina eichhorniae, Neochetina bruchi)*

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Waterhyacinth
*(Eichhornia crassipes)*

With biocontrol insects, waterhyacinth in the U.S. grows smaller and spreads slower than previously.

Technology transfer to other nations has helped reduce waterhyacinth infestations in their waterways, as well.

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Broad-leaved paperbark
(\textit{Melaleuca quinquenervia})

Previously released

1997

Melaleuca weevil
(\textit{Oxyops vitiosa})

2002

Melaleuca psyllid
(\textit{Boreioglycaspus melaleucae})

2005

Melaleuca gall fly
(\textit{Fergusononina turneri})

2008

Melaleuca stem-gall fly
(\textit{Lophodiplosis trifida})

Currently in quarantine

2008

Melaleuca flower weevil
(\textit{Haplonyx multicolor})

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With biocontrol insects, Melaleuca flowers less often and produces fewer flowers per tree.
Old World climbing fern
(Lygodium microphyllum)

Previously released
Brown Lygodium moth
(Neomusotima conspurcatalis)
Lygodium gall mite
(Floracarus perrepae)
Lygodium moth
(Austromusotima camptozonale)

Currently in quarantine
Lygodium sawfly
(Neostrombocerus albicomus)
Lygodium moth
(Austromusotima camptozonale)

2004
2008

Old World climbing fern
(Lygodium microphyllum)

2008
0.05 mm

Asia
Air potato
(*Dioscorea bulbifera*)

**Recently released**

Air potato beetle
(*Liliocerus cheni*)

2011

**Currently in quarantine**

Bulbil-feeding beetle
(*Liliocerus egena*)

Recently released

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Asia & Africa
Brazilian pepper or Florida holly
(*Schinus terebinthifolius*)

Currently in quarantine

- Brazilian pepper thrips
  (*Pseudophilothrips ichini*)

Recently in quarantine

- Brazilian pepper weevil
  (*Omalabus piceus*)

- Brazilian pepper gall wasp
  (*Allorhogas sp.*)
Herbicides: costly to develop, costly to use, not a panacea

$10.9 BILLION TO SETTLE ROUNDPUP LAWSUITS
Non-Hodgkin's Lymphoma Potentially Linked To Roundup.

Consumer market withdrawal planned
In July 2021, Monsanto owner Bayer AG said it would remove glyphosate-based herbicides from the U.S. consumer market by 2023 due to tens of thousands of lawsuits brought by people alleging they developed non-Hodgkin lymphoma from exposure to the company’s glyphosate herbicides, such as Roundup.
What next?

Weeds waiting in the wings:

- Lather leaf
- Lead tree
- Seaside mahoe
- Green arrowhead vine
- Caesarwed
- Black mangrove
- Cogongreass
- Water fern
- Earleaf acacia
- Over 166 spp in Florida, several dozen of which are Everglades invaders
Questions???