Biological Control Research

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Alfred Cofrancesco Ph.D.
Technical Director

What is Biocontrol?

Introduction, by man, of parasitoids, predators, and/or pathogenic microorganisms to

SUPPRESS

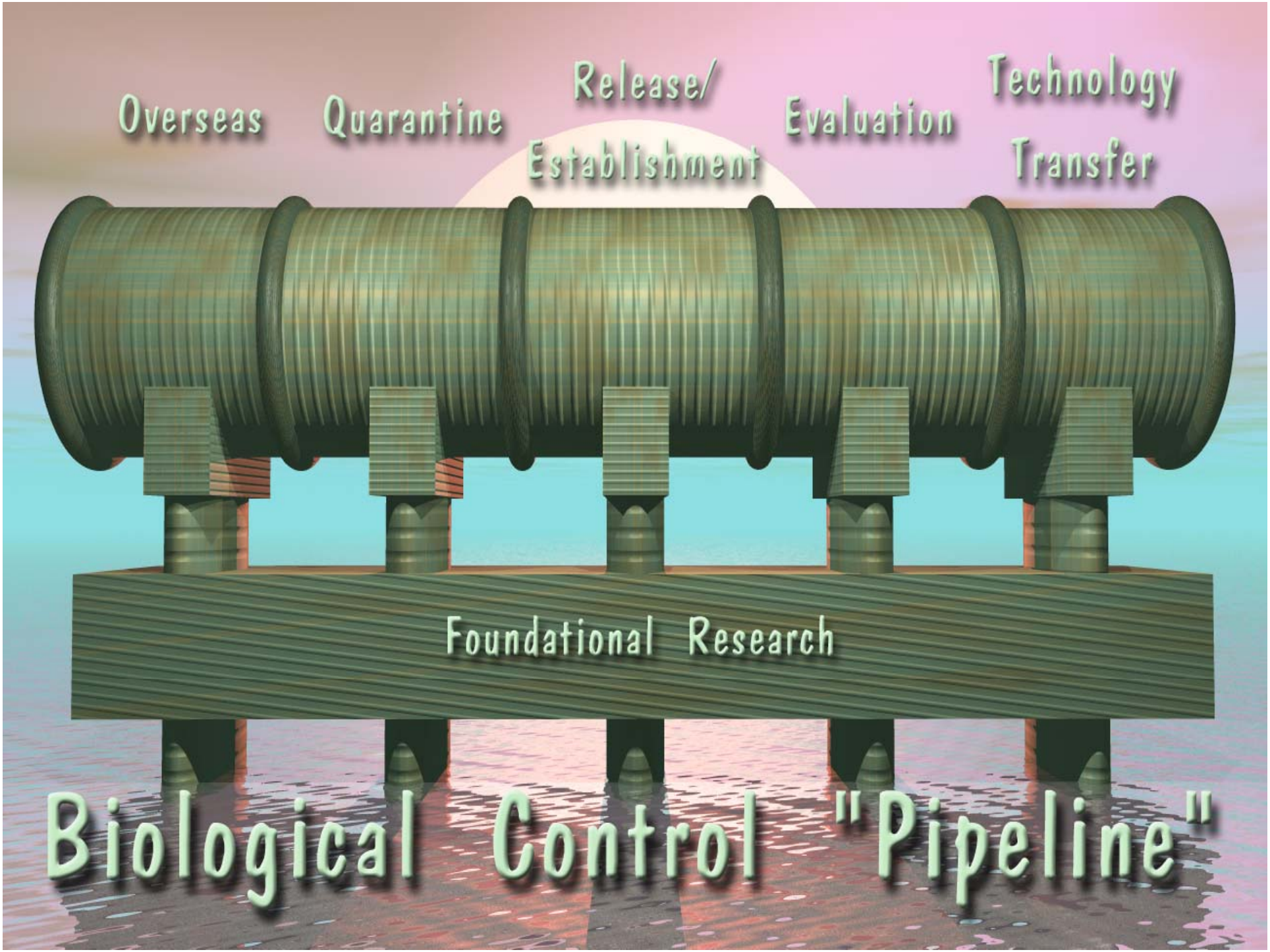
populations of plant or animal pests.

Biological Control
Two Approaches

- **Classical Biological Control**
- **Inundative Biological Control**

Classical Biological Control
Important Aspects

- Host-Specific Agents
- Target Exotic Plants
- Release Small Numbers
  - ▶ Population increase
  - ▶ Expansion in distribution
- Suppression is Key
  - ▶ Long-term process
  - ▶ Stress the target
  - ▶ Bring into equilibrium


Overseas
Quarantine
Release/
Establishment
Evaluation
Technology
Transfer
Foundational Research
Biological Control "Pipeline"

Hydrilla Biological Control Agents

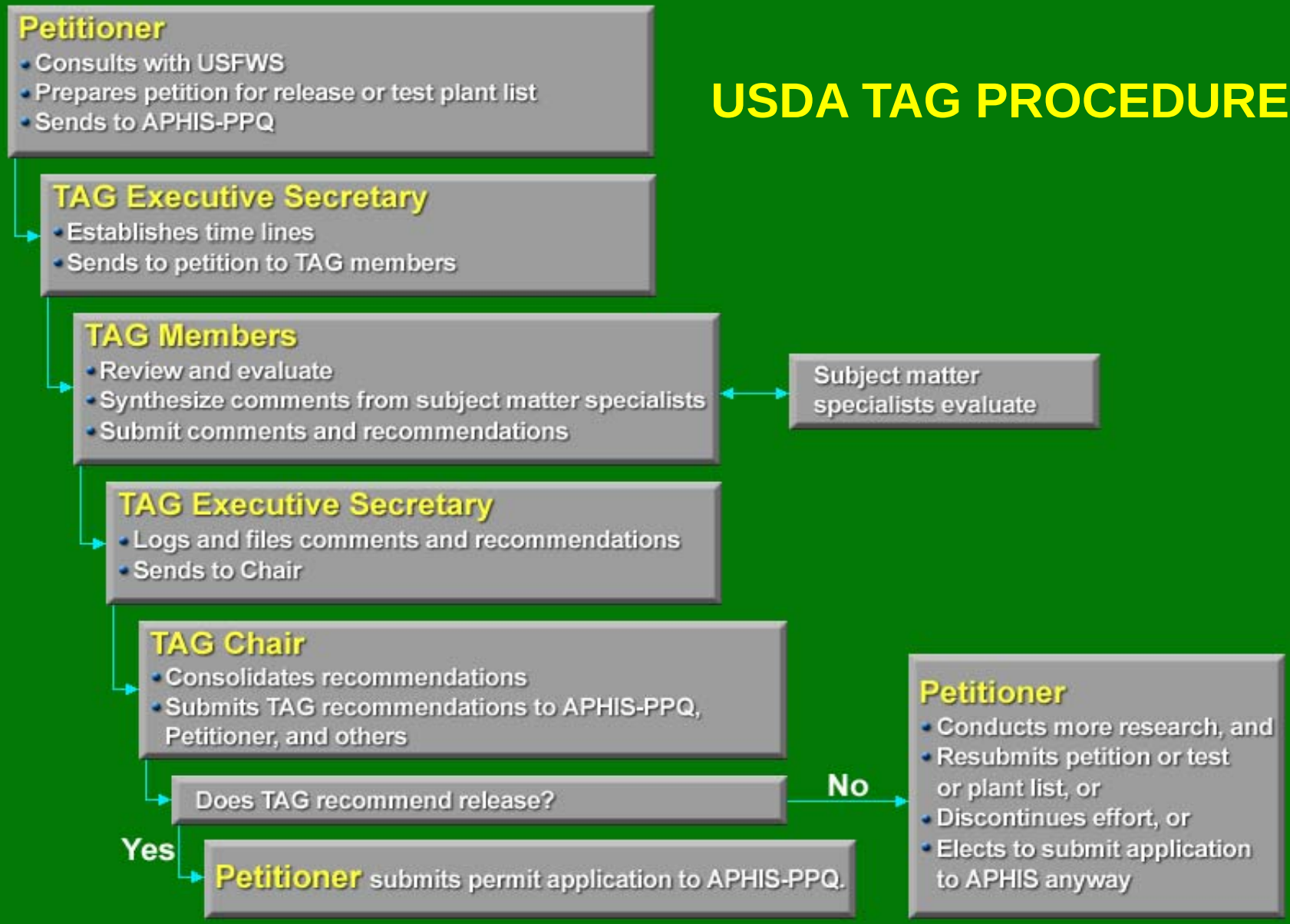
Agent	Into Quarantine	Released in US
Bagous affinis	1982	1987
Hydrellia pakistanae	1984	1987
Bagous hydrillae	1987	1991
Hydrellia balciunasi	1988	1989

Technical Advisory Group - TAG

Make Recommendations Only

- Bureau of Land Management
- Bureau of Reclamation
- Bureau of Indian Affairs
- Fish and Wildlife
- National Park Service
- National Biological Survey
- Environmental Protection Agency
- Representative for Canada
- Representative for Mexico
- USDA, ARS
- USDA, APHIS
- USDA, NIFA
- Forest Service
- Documentation Center
- Corps of Engineers
- Weed Science Society
- National Plant Board

USDA TAG PROCEDURES



Inundative Biological Control Important Aspects

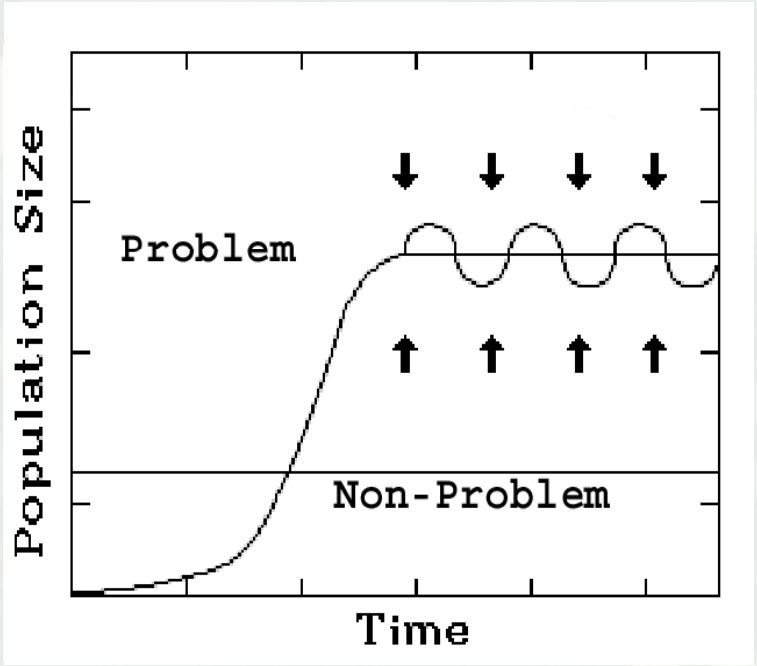
- Agents may not be Host-Specific
- Target Exotic Plants
- Release Large Numbers of Agents
  - ► Population increase
  - ► Creates Disease Levels
- Mode of action
  - ► Overwhelms Target
  - ► Stress causes secondary impacts
  - ► Agents not self-sustaining

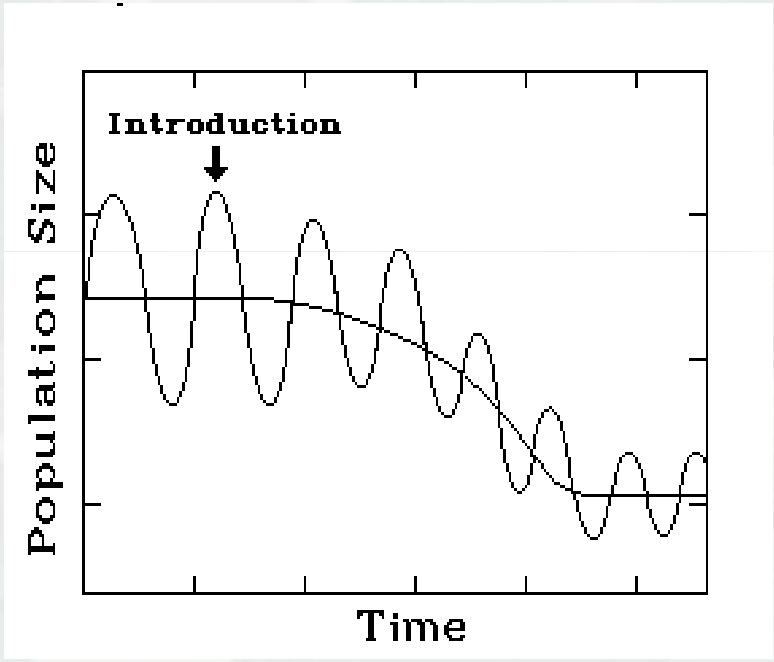
Need EPA approval for native pathogen release (Less than 1 acre or need EUP)

May need State permits to release native insect agents outside of their normal range

This approach has not been widely utilized

PLANT GROWTH





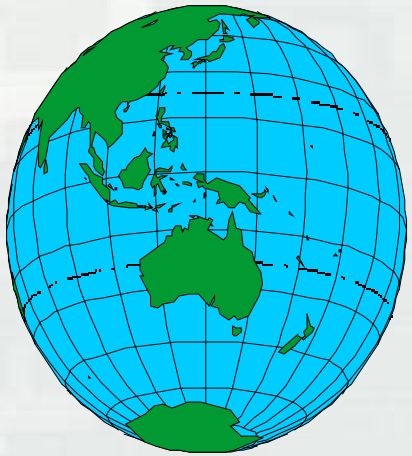
Historical

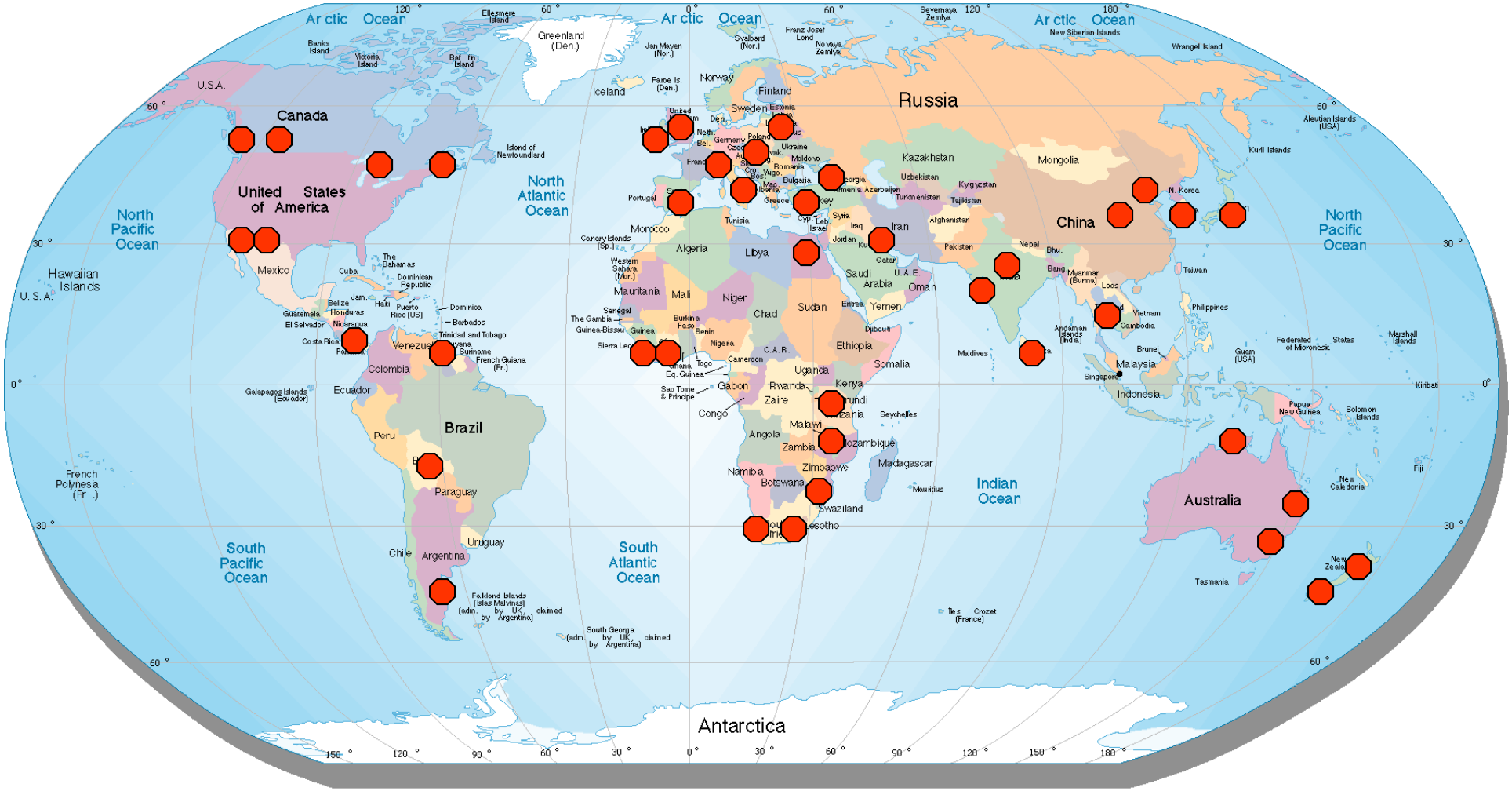
- Began in 1959
  - ► USDA and U.S. Army Corps of Engineers
  - ► Over 50 years
  - ► USACE –Aquatic Plant Control Research Program

- Directly Targeted Aquatic Plants
  - ► Alligatorweed - Waterhyacinth
  - ► Waterlettuce - Hydrilla
  - ► Eurasian Watermilfoil - Giant Salvinia
  - ► Purple Loosestrife - Melaleuca
  - ► Arundo

Historical

- Six Continents
- > 30 Countries
- Screened or Handled > 500 Insect Agents
- Six Overseas Laboratories





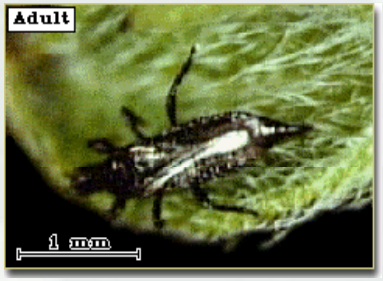
Areas outside the United States were we have conducted research or collaborated with researchers on projects in the last fifteen years

BUILDING STRONG®

Alternanthera philoxeroides (Mart.) Griseb. (Alligatorweed)

***Arcola malloi* –**
"Alligatorweed Stem Borer“
(1971)

***Agasicles hygrophila* –**
"Alligatorweed Flea Beetle“
(1964)

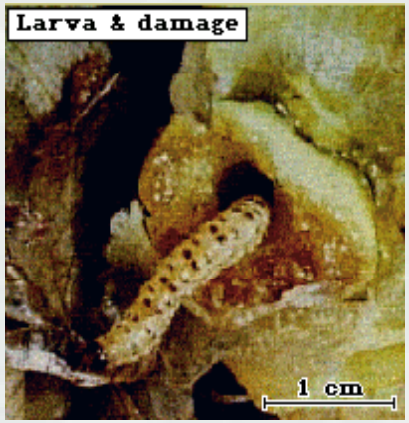


Amynothrips andersoni
"Alligatorweed Thrips"
(1967)

Eichhornia crassipes (Mart.) Solms (Waterhyacinth)

Neochetina eichhorniae
"Mottled Waterhyacinth Weevil"
(1972)

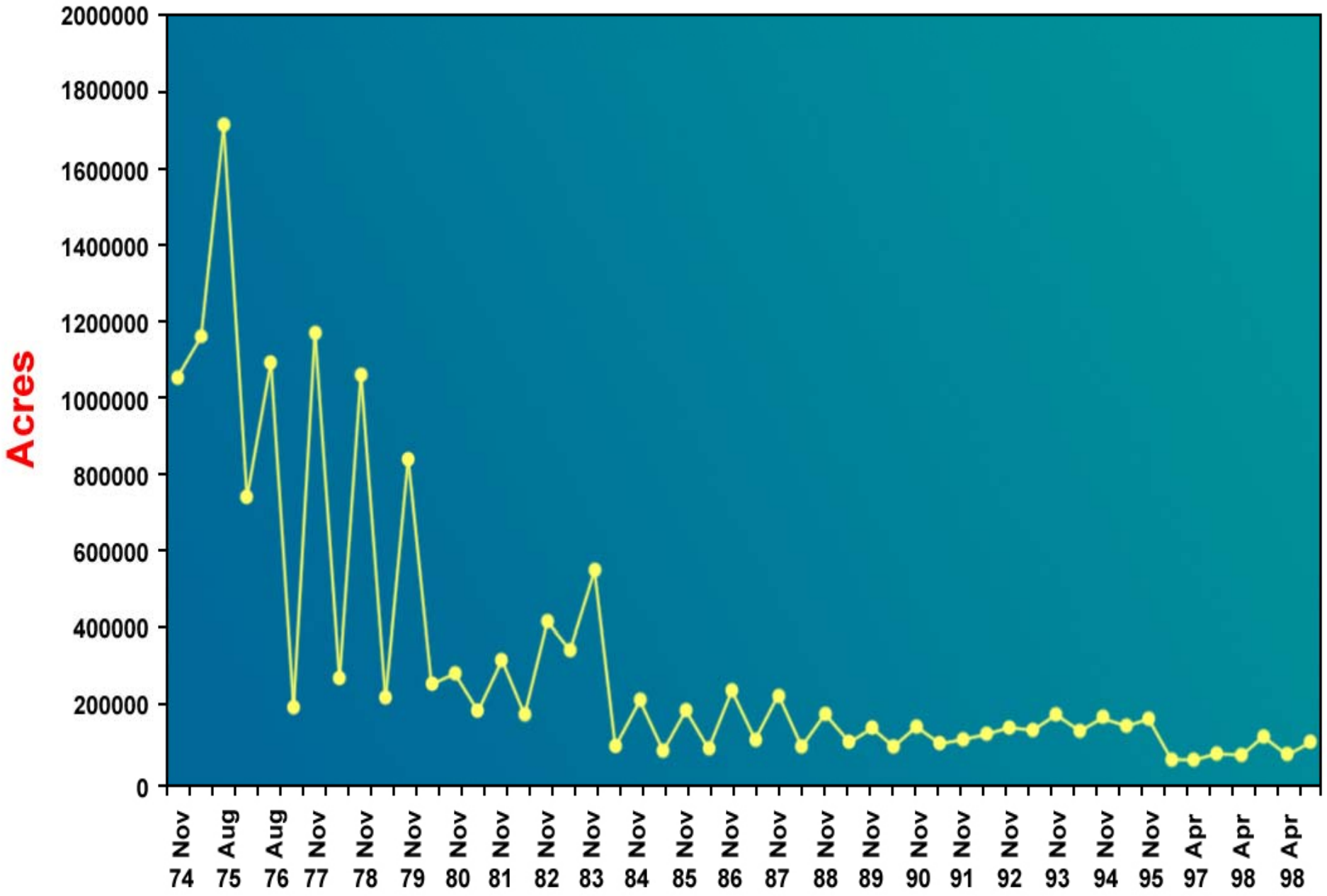
Megamelus scutellaris
(2010)



Niphograpta albiguttalis
"Waterhyacinth Moth"
(1977)

Neochetina bruchi
Chevroned Waterhyacinth Weevil
(1974)

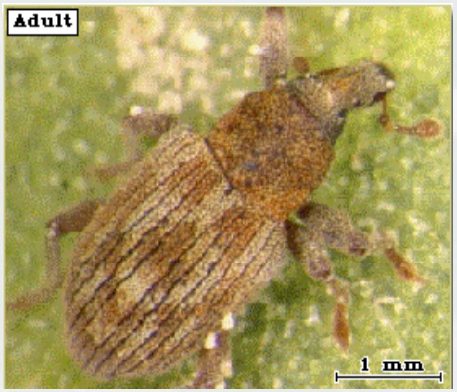
Louisiana Waterhyacinth Data

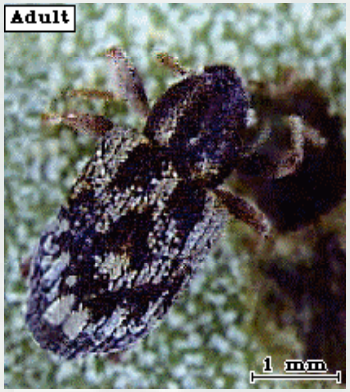


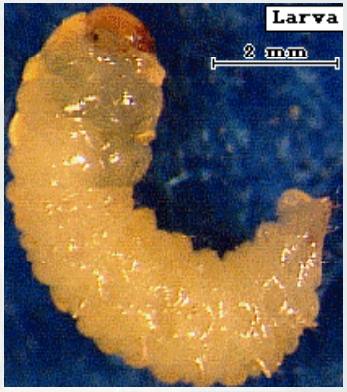
Waterhyacinth

- ***Acremonium zonatum***
- ***Alternaria eichhorniae***
- ***Cercospora piaropi***
  - ► **Patented by the U. of FL**
  - ► **Developed as a bioherbicide by Abbott Laboratories**
- ***Uredo eichhorniae (rust)***

Pistia stratiotes L. (Waterlettuce)







Neohydronomus affinis
"Waterlettuce Weevil“
(1987)

Hydrilla verticillata (L.f.) Royle (Hydrilla)

Bagous affinis

- Released but never established
- Strict environmental conditions

(1987)

Bagous hydrillae

- Released established
- Strict environmental conditions

(1991)

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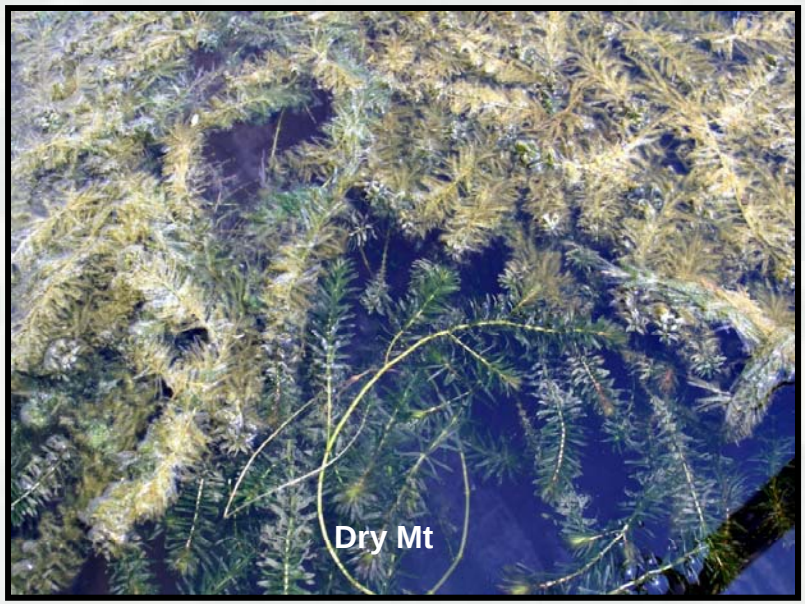
Hydrilla Agents
Leaf-Mining Flies

- *Hydrellia pakistanae (1987)*
- *Hydrellia balciunasi (1989)*
- **Established**
- **Larva Damaging Stage**
- **Feeds on Internal Leaf Tissues**
- **Widespread U.S. Distribution**

Hydrilla/Eurasian watermilfoil pathogen

- Current strain came from Texas
  - *Mycoleptodiscus terrestris* (Gerd.) Ostazeski
  - Patent – ERDC/USDA (2003)
- Bioherbicide development
  - ERDC
  - USDA

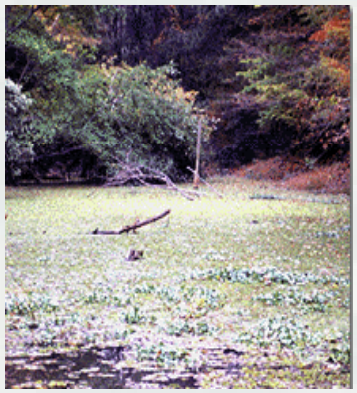
MT Impact on Hydrilla



Myriophyllum spicatum L. (Eurasian Watermilfoil)

Euhrychiopsis lecontei **(Dietz)** **Native Weevil**

Salvinia molesta Mitchell (Giant Salvinia)



Cyrtobagous salviniae - Salvinia Weevil (1999)

Melaleuca quinquenervia (Cav.) Blake (Melaleuca)

Oxyops vitiosa
(1997)

Boreioglycaspis melaleucae
Melaleuca psyllid
(2002)

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Melaleuca quinquenervia (Cav.) Blake (Melaleuca)

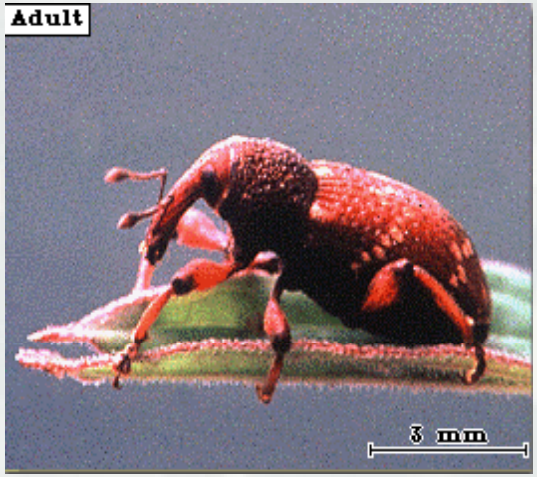
Melaleuca midge
Lophodiplosis trifida
(2008)

Melaleuca gall fly
Fergusonina turneri
(2005)

*Lythrum salica*ria L. (Purple Loosestrife)

***Galerucella pusilla* (1992)**

***Galerucella calmariensis* (1992)**



Hylobius transversovittatus
"Loosestrife Root Weevil"
(1992)

***Nanophyes marmoratus* (1994)**

Arundo donax
Giant Reed

Tetramesa romana
Arundo Wasp (2009)

Rhizaspidiotus donacis
Arundo Scale (2011)

Current USDA & Corps of Engineers Aquatic Biocontrol Activity

Hydrilla: overseas surveys and studies on monoecious hydrilla

Waterhyacinth: 1 species under study in quarantine

Waterlettuce: 1 species under study in quarantine

Giant Salvinia: nothing else planned

Melaleuca: 2 species under study in quarantine

Phragmites: 3 species under study in quarantine

Arundo: 1 species under study in quarantine

Brazilian peppertree: 2 species under study in quarantine

Chinese tallow: 2 species under study in quarantine

Aquatic Biocontrol Research
For Australian Department of Primary Industries

Listronotus sordidus **larva in root crown of** ***Sagittaria platyphylla***

Biocontrol of *Sagittaria platyphylla* (Delta Arrowhead)

Listronotus appendiculatus **Bohemon**

Hydrocotyle ranunculoides

Plants progressively damaged by *Eugaurax floridensis* and generalist insect herbivores