Control Methods for Invasive Aquatic Plants

- **Benjamin Sperry**
  - *Research Biologist, USACE-ERDC, Gainesville, FL*

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ERDC ENGINEER RESEARCH & DEVELOPMENT CENTER

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Outline

- Methods of control: Pros and Cons
  - Biological control
  - Mechanical control
  - Chemical control
  - Cultural and Physical control
  - Maintenance control
  - Do nothing method

- Integrated Plant Management

Biological Control

- Species-specific organisms (Agent) that affect target plants
- Can be animal, pathogens, insects – most are insects
- Classical
  - Introduction of natural enemies from native range
  - Limit or slow the growth, reproduction and spread of target species
- Non-classical
  - Mass rearing and periodic release of biocontrol agents to increase effectiveness
  - Repeated releases

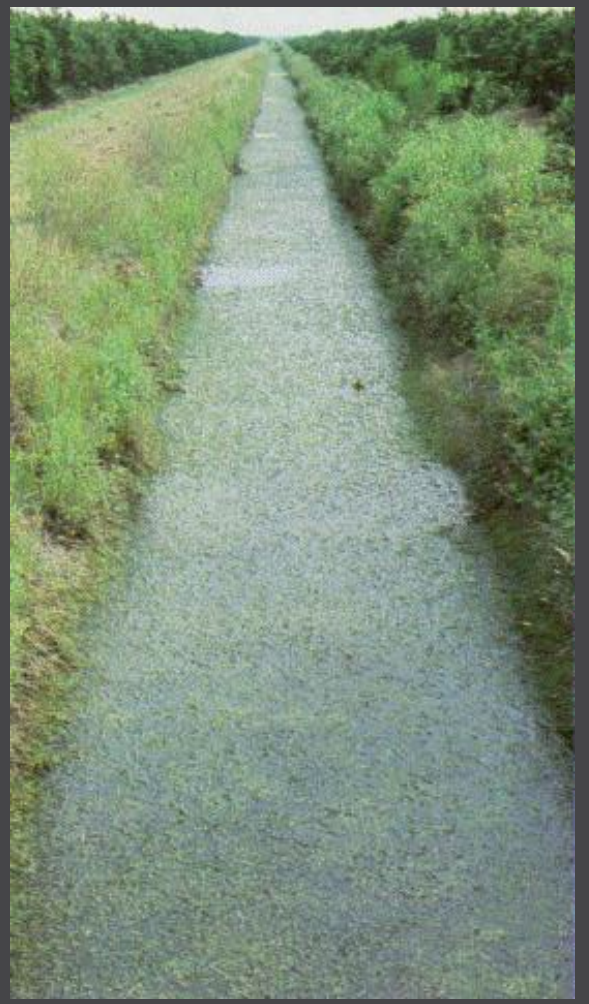
Biological Control

- Advantages
  - Inexpensive after research and development
  - Long-term
  - Can aid in suppression and keeping plant populations low
  - Can be highly effective
  - Public perception

- Disadvantages
  - Very expensive to develop
  - Takes a long time to develop
  - Most agents do not provide high-level control on their own
  - Control is not immediate – may require many years to show impacts
  - No guarantees, unpredictability
  - Agents are not available for all plant species
  - Can have issues reproducing in different climates
  - Once an agent is established, it cannot be recalled

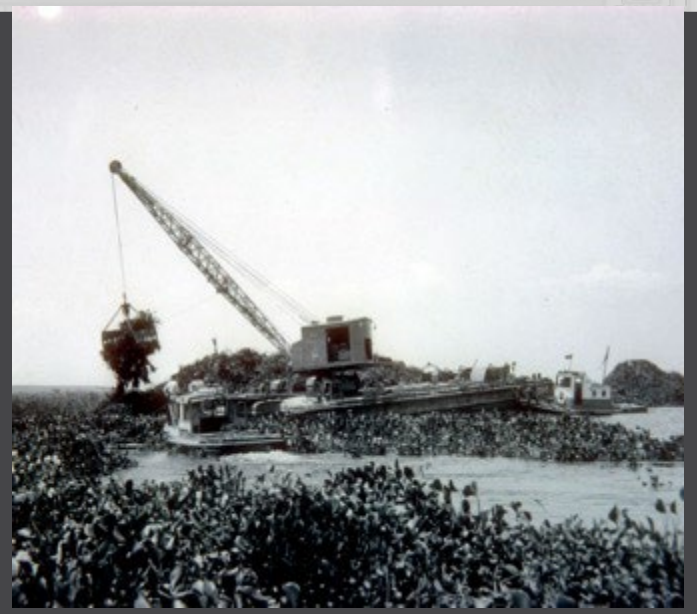
Caveat – Triploid Grass Carp

- Grass carp (white amur)
- Triploid = sterile
- Long-lived – up to 25 years (cannot be removed)
- Herbivorous
- Preferential yet non-selective
- Stocking rate and time
- Stocking size considerations
- Long term maintenance vs. heavy feeding



Mechanical Control

- Oldest method of aquatic plant control (1800s)
- Physically destroy or remove plants
- Many different types of equipment



Technology review



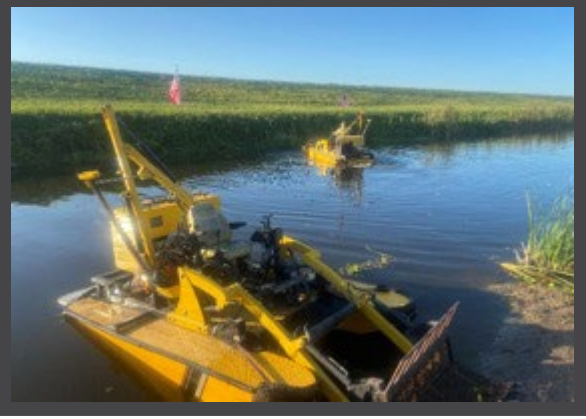













Target types

- Submersed plants
- Free-floating plants
- Tussocks/emergent plants

Target types – Free floating plants

- Waterhyacinth and waterlettuce
- Rapid growth rates
- 50 to 300 tons per acre
- Cost - $2,200 to $13,000 per acre (herbicides = $100-200/acre)

Target types – submersed plants

- Hydrilla and Eurasian watermilfoil
- 10 to 15 tons per acre
- Utilized in northern tier states
- Growing season too long in southern states
- Requires multiple harvests per season
- Cost – roughly 2 to 4X chemical control

Target types – Tussocks/Emergent plants

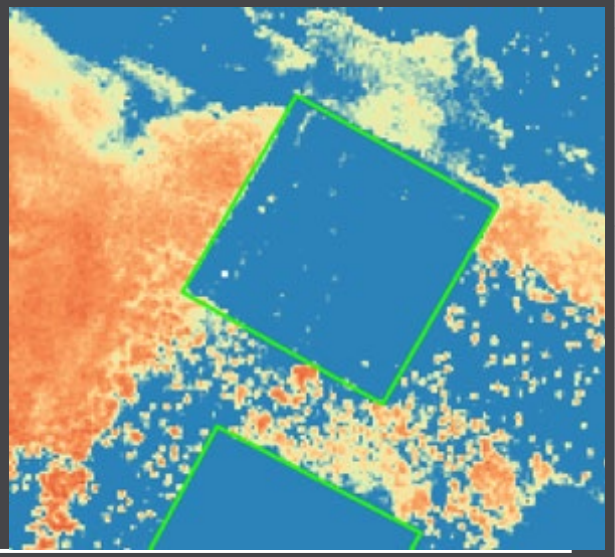
- Highly diverse mats of floating sediment and vegetation
- Variable weights
- More common in southern states
- Dominant use pattern for ~60 years
- Cost: $3 to 12K/A
- No alternatives

Site considerations

- Shoreline transfer sites
- Area to be harvested (area limitations)
- Distance from harvesting site to transfer site
- Distance from transfer site to dump site
- Disposal site fees
- Water depth
- Obstacles (e.g., stumps in reservoirs)
- Prevailing wind direction
- Water flow

Advantages of mechanical harvesting

- Nutrient removal
- Immediate results
- Sustained fish habitat
- Carbon reduction (sedimentation)
- Treatment precision (no drift or dissipation)
- Public perception (viewed as environmentally friendly)



Disadvantages of mechanical harvesting

- Reduced efficiency (plant density-dependent)
- Water quality concerns (turbidity/nutrients)
- Draft requirements (size vs. speed vs. payload)
- Selectivity concerns
- Non-target impacts (by-catch)
- Pollution risk (fuels, hydraulic fluid, etc.)
- Off-site biomass deposition
- Duration of control
- <u>COST</u>

Chemical Control

- The use of registered aquatic herbicides
- Accounts for >90% of aquatic plant management efforts in the US
- Widely employed in private and public water
- Can range in size from backpack sprayers to treat individual plants to aircraft making whole-lake treatments

Herbicide options

Herbicide	Registration date	Primary use	Formulation	Action	MOA
Copper	1950s	Submersed, Floating	Liquid and granular; sulfates and chelates	Fast-acting/contact	Plant cell toxicant
2,4-D	1950s	Submersed, floating, emergent	Liquid and granular; multiple salts	Slow-acting/systemic	Auxin mimic
Endothall	1960	Submersed, Floating	Liquid and granular; K+ and Amine salts	Fast-acting/contact	protein synthesis inhibitor
Diquat	1962	Submersed, floating, emergent	Liquid	Fast-acting/contact	PSI inhibitor
Glyphosate	1977	Floating, Emergent	Liquid	Slow-acting/systemic	EPSP inhibitor
Peroxides	1980s	Submersed, Floating	Liquid and granular	Fast-acting/contact	cell membrane disruptor
Fluridone	1986	Submersed, Floating	Liquid and granular	Slow-acting/systemic	Bleacher, PDS
Triclopyr	2002	Submersed, floating, emergent	Liquid and granular; multiple salts	Slow-acting/systemic	Auxin mimic
Imazapyr	2003	Floating, Emergent	Liquid	Slow-acting/systemic	ALS inhibitor
Carfentrazone	2004	Submersed, floating, emergent	Liquid	Fast-acting/contact	PPO inhibitor
Penoxsulam	2007	Submersed, Floating	Liquid	Slow-acting/systemic	ALS inhibitor
Imazamox	2008	Submersed, floating, emergent	Liquid	Slow-acting/systemic	ALS inhibitor
Flumioxazin	2011	Submersed, floating, emergent	Liquid and water dispersible granule	Fast-acting/contact	PPO inhibitor
Bispyribac-sodium	2012	Submersed, Floating	Wettable powder	Slow-acting/systemic	ALS inhibitor
Topramezone	2013	Submersed, Floating	Liquid	Slow-acting/systemic	Bleacher, HPPD
Florpyrauxifen-benzyl	2018	Submersed, floating	Liquid	Slow-acting/systemic	Auxin mimic

Chemical Control

- Advantages
  - Can be highly selective and effective
  - Various options for areas of high or low water exchange
  - Can be inexpensive
  - Fast-acting and slow-acting options

- Disadvantages
  - Highly regulated – many rules to follow
  - Public perception
  - Limited number of registered herbicides
  - Sometimes requires repeat applications (no silver bullet)
  - Can be complicated – often requires specialists
  - Can be expensive

Cultural/Physical Control

- Non-chemical, Non-motorized, non-biological control techniques
- Prevention
  - Boat ramp monitoring/sterilization
- Benthic barriers
- Water level manipulation – drawdowns
- Hand pulling
- Nutrient inactivation
- Shading

Maintenance Control

- Maintaining plant populations at the lowest feasible level (Pro-active management)
- Requires frequent management
- Advantages
  - Keep populations low (reduced negative impacts)
  - Use less herbicide
  - Lower management cost
  - Reduced organic matter deposition
- Disadvantages
  - Perceived as excessive

RESEARCH GUIDE

UF IFAS

Low-level Maintenance Control of Waterhyacinth

Sperry, B.P., Ferrell, J.A.

WATERHYACINTH HAS BEEN A **MANAGEMENT CHALLENGE** FOR OVER **130 YEARS**.

It impedes navigation, irrigation, and recreation while reducing water quality and sheltering mosquitoes.

Introduction

Managing waterhyacinth is critical for protecting Florida's waterways. Waterhyacinth management relies on chemical solutions; however, the public is very concerned with herbicide use.

Previous Research

A significant study done by UF researcher, Joe Joyce, was published in Aquatics magazine's 1985 winter issue. Joyce (1985) addressed the three main public concerns of using herbicides to control waterhyacinth which included: (1) the quantity of herbicide used, (2) herbicide affects on water quality, and (3) much accumulation in lake bottoms created by dying plant matter.

In order to quantify the predicted benefits of maintaining low levels of waterhyacinth, Joyce explored the relationship between all three components of waterhyacinth management (herbicide quantity, water quality, and muck accumulation).

So What?

Low-level maintenance control can help applicators and scientists bring invasive plant populations down to manageable levels through more frequent application ultimately using half as much herbicide.

1985:

Joyce found that low-level maintenance control, spraying herbicide more often with less overall chemical solution used over time, can:

1. *REDUCE THE AMOUNT OF CHEMICAL SOLUTION, OR HERBICIDE USED ANNUALLY.*
2. *PREVENT A DECREASE IN DISSOLVED OXYGEN CONCENTRATIONS.*
3. *REDUCE PLANT MATTER ACCUMULATION IN LAKE BOTTOMS.*

2020:

The UF/IFAS Center for Aquatic and Invasive Plants (CAIP) researchers are excited to scientifically recognize these results by validating findings Joyce's (1985) findings.

Do Nothing Method

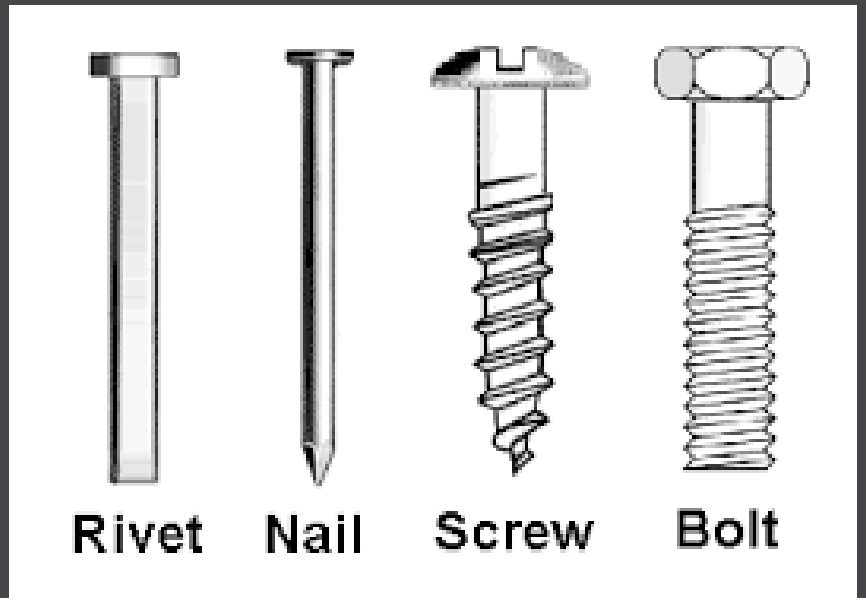
- Deciding not to take action and hoping problems go away
- Advantages
  - Don’t have to deal with disadvantages of other control methods
- Disadvantage
  - Invasive plant problems get worse
  - Ecosystem degradation
  - Limit navigation and access

Integrated Plant Management

- Use a combination of control methods
- Focus control methods implementation where the potential for success is greatest
- Requires continual ecosystem evaluation and consideration of control method pros and cons

Conclusion

- There are many tools available for aquatic plant management
- There is no perfect tool for all problems, no tool is perfect
- Doing nothing is a choice which has more disadvantages than doing something
- Proper control method selection and an integrated management approach will result in optimized weed control



Thank You

Contact:

Benjamin.P.Sperry@usace.army.mil

bpsperry@ufl.edu

cell: 352-400-2562

office: 352-392-0335

plants.ifas.ufl.edu