Why Control Invasive Aquatic Plants?

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FICMNEW Webinar 11/15/2017

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Publications

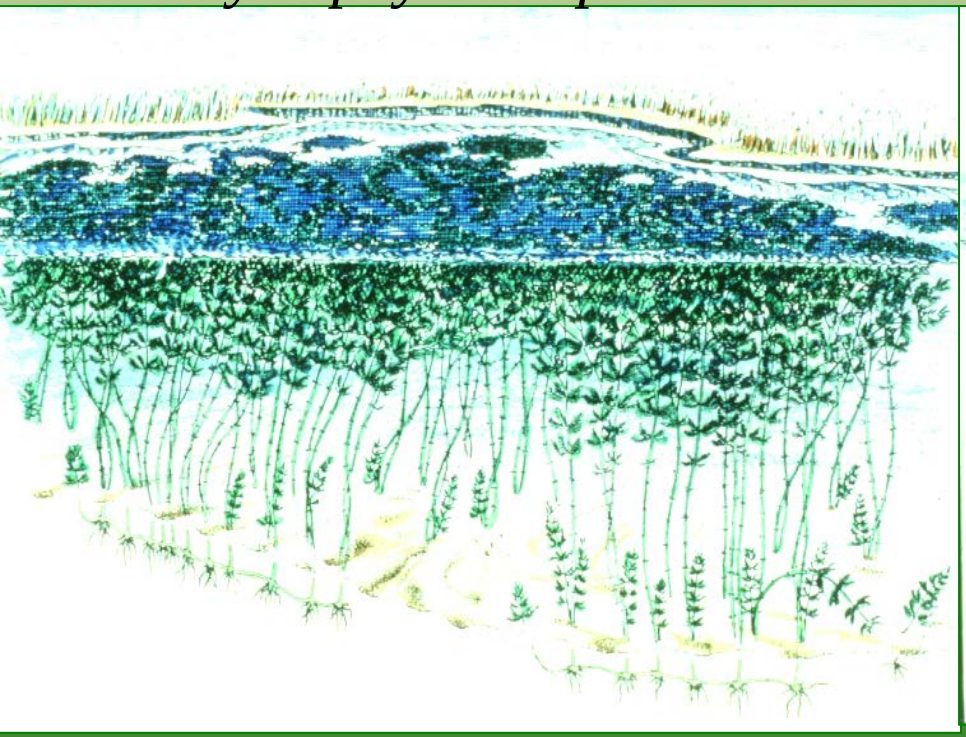
- The "Why":
  - Benefits of Controlling Nuisance Aquatic Plants and Algae in the United States. CAST Commentary QTA2014-1, July 2014. www.cast-science.org
- The "How (not a part of today's talk)":
  - BIOLOGY AND CONTROL OF AQUATIC PLANTS: A Best Management Practices Handbook. 3rd Edition, Aquatic Ecosystem Restoration Foundation, Marietta, GA. Feb 2014. http://www.aquatics.org/bmp.html

Benefits of Aquatic Plants

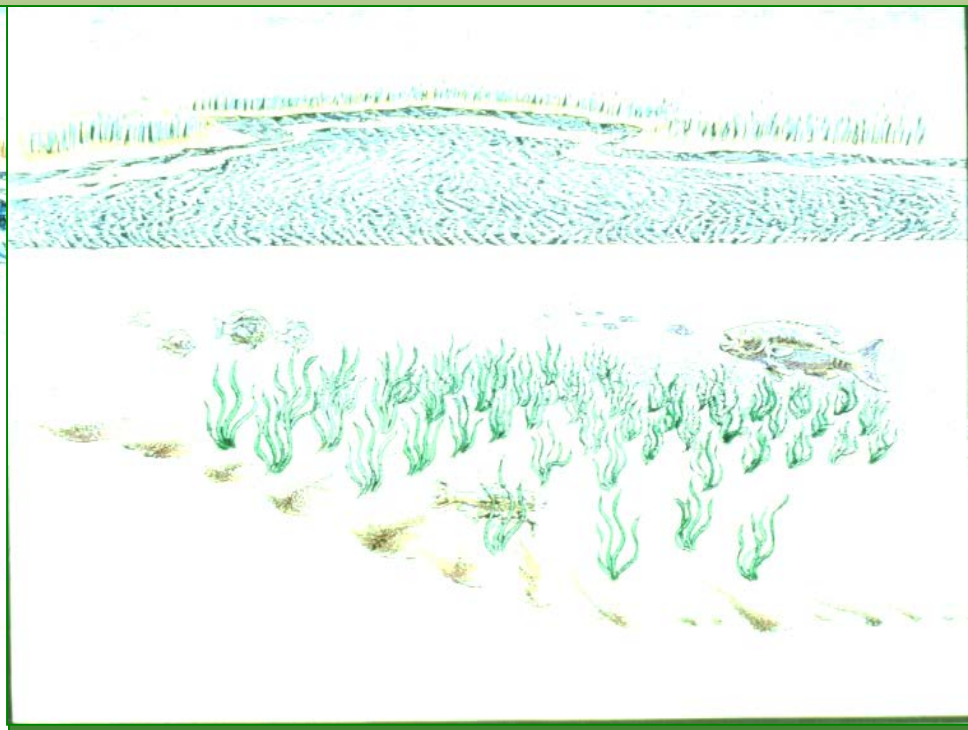
- Stabilize lakes sediments, reducing resuspension
- Increase sedimentation, reducing turbidity
- Provide habitat for insects, forage fish, fish spawning and young-of-the-year fish
- Provide food for waterfowl, other animals

Invasive vs. Native Community

Eurasian watermilfoil
Myriophyllum spicatum



Water celery
Vallisneria americana



Problematic Invasive Aquatic Plant Species

Eurasian watermilfoil
in Lake George, NY

Economic Impacts of Invasive Plants

- Commercial and Recreational Navigation
- Hydropower
- Irrigation
- Drinking water
- Flood Control
- Spread of insect-borne diseases
- Recreational impairment
- Property value
- Human health

Waterhyacinth and waterprimrose in a slough of the California Delta

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Commercial Navigation

- Freight worth $B's each year are shipped by water in Florida alone
- Invasive plants prevent the movement of barges and ships

Mats of waterhyacinth drifting in the shipping channel of the San Joaquin River

Hydropower

- South Carolina spends about $450,000 per year managing invasive aquatic vegetation
- In 1991, an invasion of the aquatic weed hydrilla shut down the St. Stephen hydroelectric plant on Lake Moultrie for weeks, costing $4 million in lost productivity and $526,000 worth of gamefish loss to mortality.

Drinking Water

- Invasive aquatic plants contribute to
  - Taste problems
  - Odor problems
  - Increase trihalomethane, a carcinogenic precursor
  - Reduced transport at drinking water intakes
  - Cyanobacteria and other algae produce toxic compounds

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Irrigation

- Invasive aquatic plants can reduce the water flow and holding capacity of irrigation canals by 75%
- Weed control in canals is often difficult due to flowing water environment and water use restrictions

Flowering rush in an Idaho irrigation canal. Nuisance aquatic plants can occlude canals and greatly reduce water flow.

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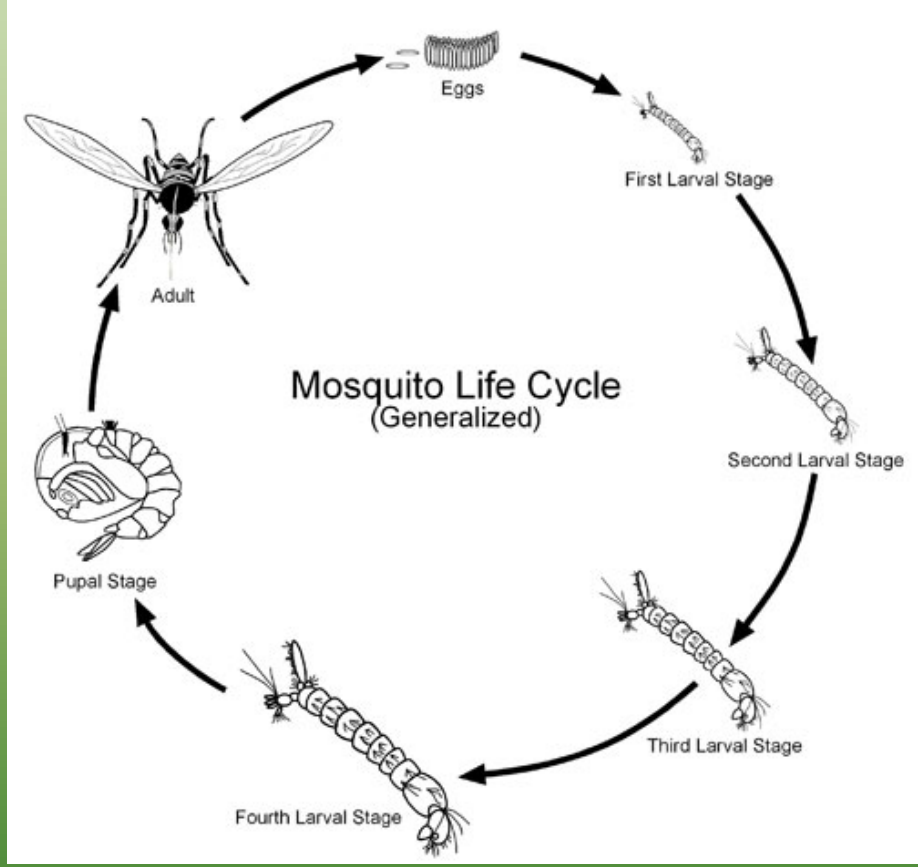
Flood Control

- Invasive aquatic plants increase the amplitude, duration, and probability of flooding
- Aquatic plant control in Florida saves an estimated $300M in potential property damage

CAIP, UFL

Spread of Insect-Borne Disease

- Numerous insects that harbor disease organisms are enhanced by dense vegetation
  - Malaria
  - Dengue Fever
  - Encephalitus
  - Yellow fever



Purdue University Extension Entomology

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Recreational Impairment

- Invasive aquatic plants interfere with:
  - Swimming
  - Boating
  - Fishing (both from bank and boat)
- Recreational use of one lake (Lake Tahoe, CA) was estimated at $30-$45M/year
- Benefit/ Cost ratios of management typically are higher than 10:1

Dioecious hydrilla clogs a boat motor on a Mississippi lake. GRI Photo.

Property Value

- Invasive aquatic plants reduce the utility of lakeside property, as well as reducing the aesthetic appeal
- One study indicates that property values declined an average of 13% in Wisconsin lakes invaded by Eurasian watermilfoil

Eurasian watermilfoil growing in Lake Hortonia, Vermont.

Florida Waterhyacinth Maintenance Management: Economic Benefit

- Florida has 1.25 M acres of freshwater
- Waterhyacinth acreage:
  - Before: 125,000 acres
  - Current: 5,000 acres
- Cost
  - In 1999: $2.5M
- Benefit
  - Recreation ($1.5B)
  - Flood Control

Source: Schardt, J. 1999. Aquatics 21(2)

Ecological Effects of Invasive Plants

- Degradation of water quality
- Reduction in species diversity
- Suppresses native plant species
- Potential impacts on endangered species
- Alters animal communities
- Alters ecosystem services

Canopy Structure

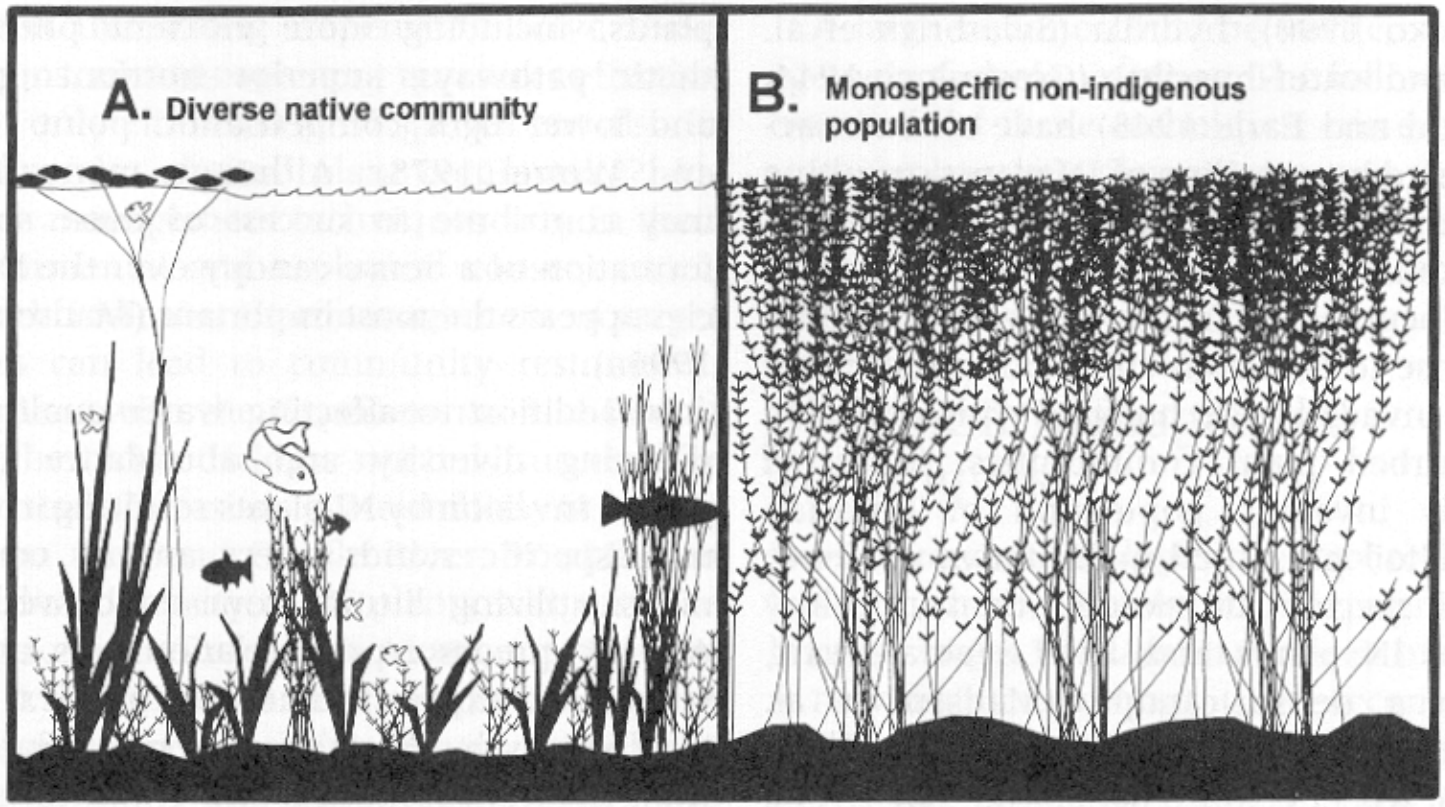
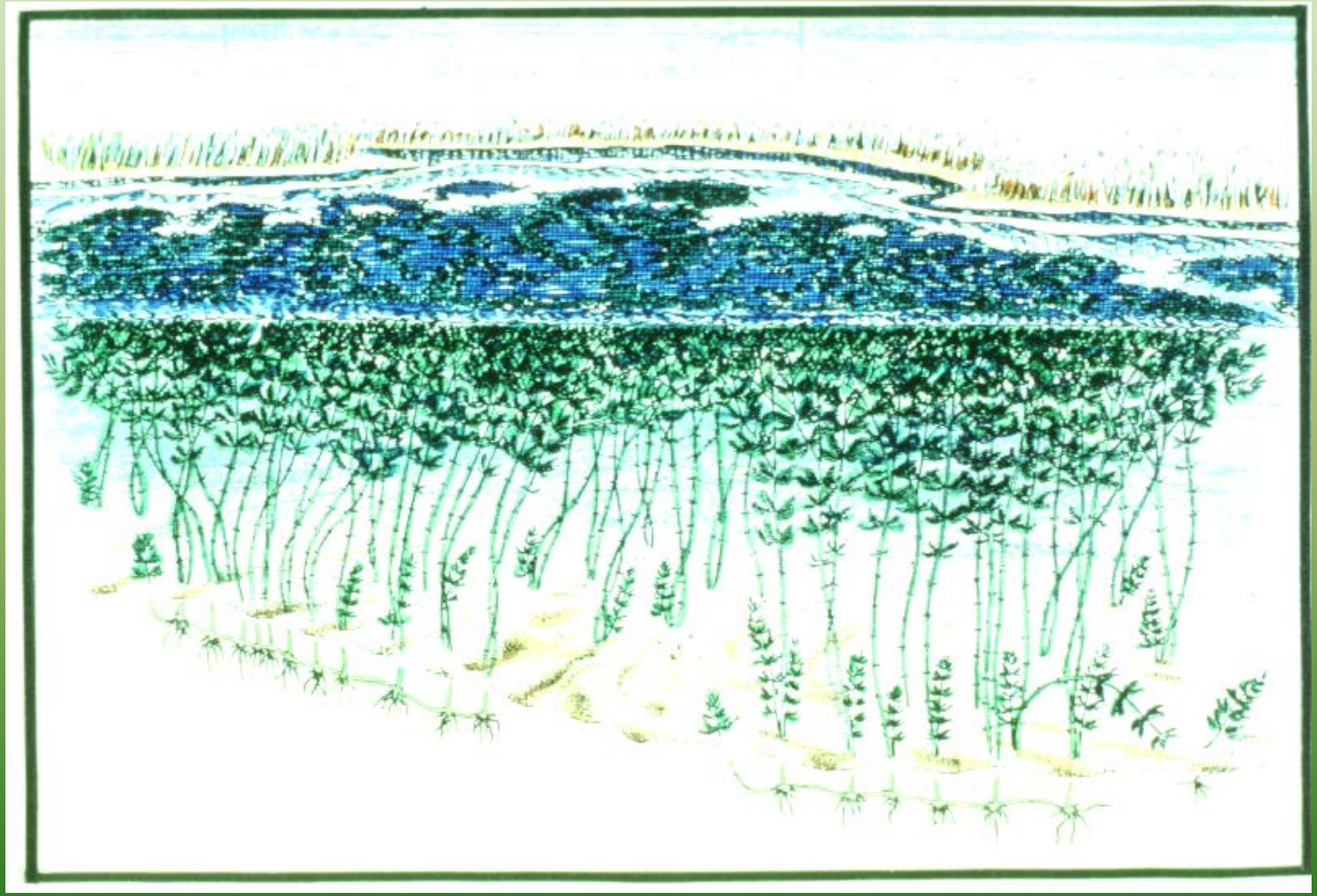


FIGURE 12.4. Schematic representation of (A) a diverse native plant community structure versus (B) community structure of monospecific nonindigenous plant population

Madsen 1997



Invasive Plants and Water Quality

- Nutrient pump of phosphorus from sediment to water column
- Decomposition releases nutrients
- Reduced oxygen, pH shift can allow release of nutrients from sediment

"Most polluted lake in the United States" – Onondaga Lake, NY

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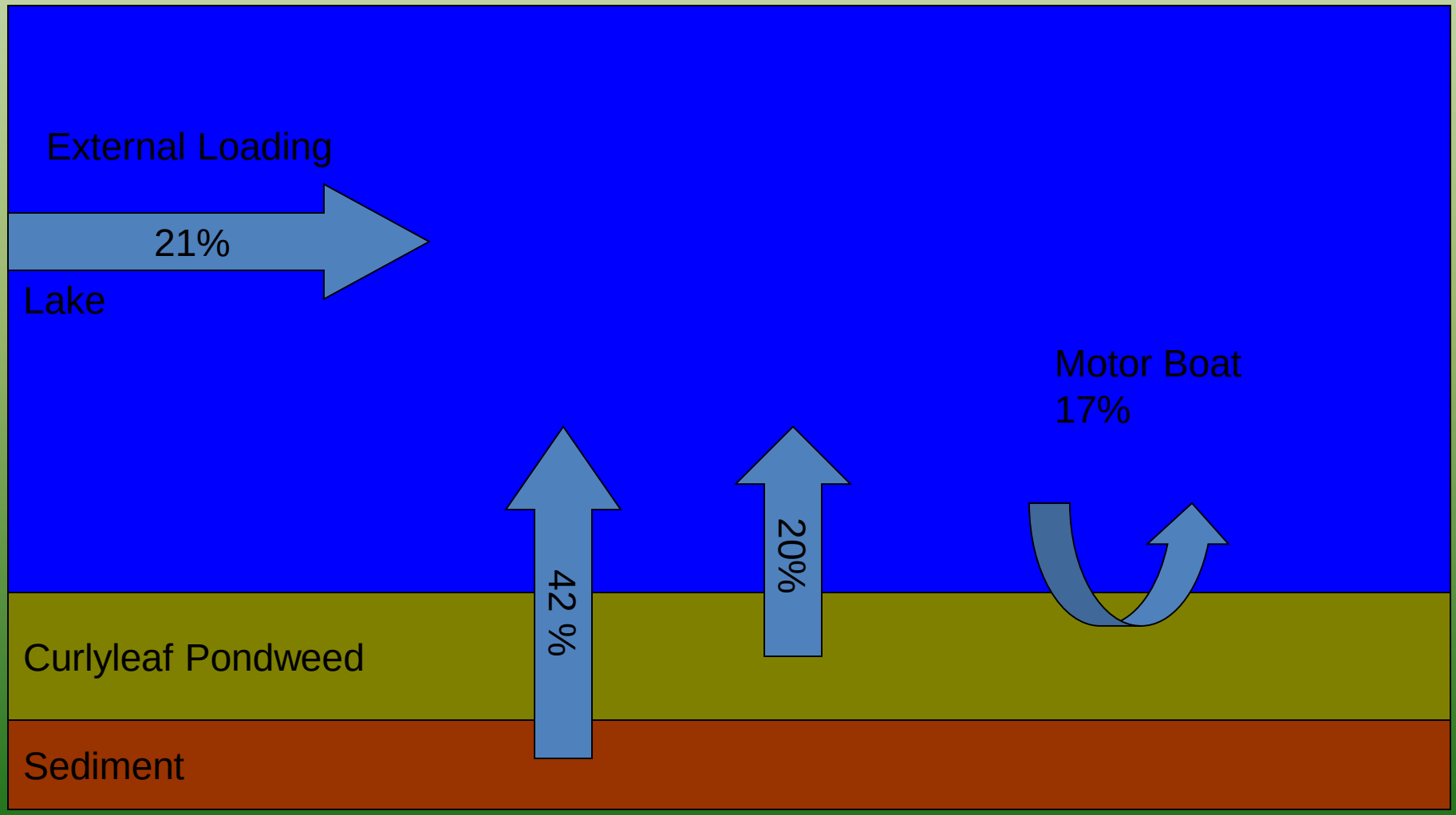
Phosphorus Loading

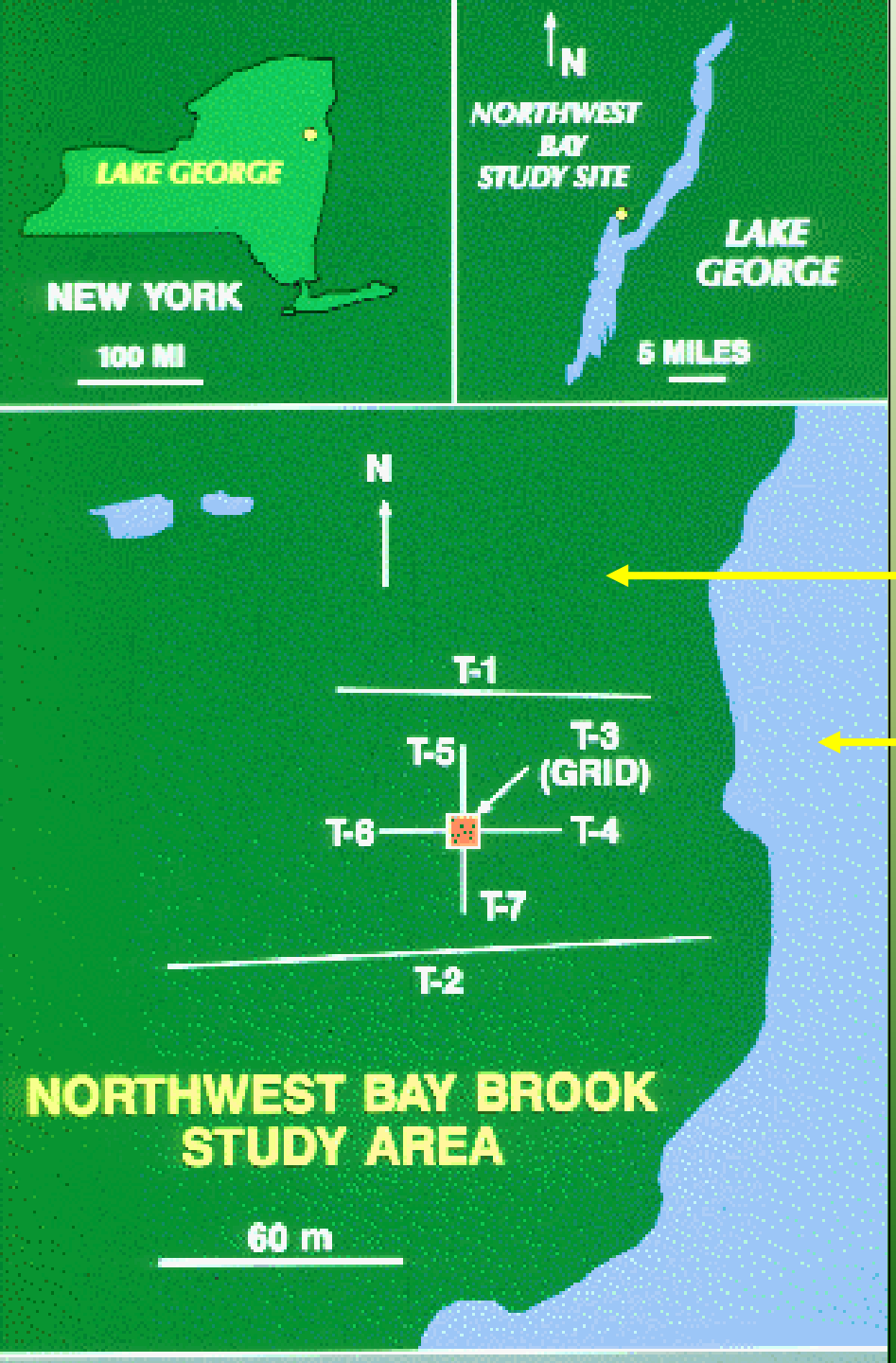
James et al. 2001



Impacts of Invasion on Native Plants

- Permanent grid and transects in Lake George, NY in 3 to 5 m water depth
- Plant cover assessed every year in July from 1987 to 1989

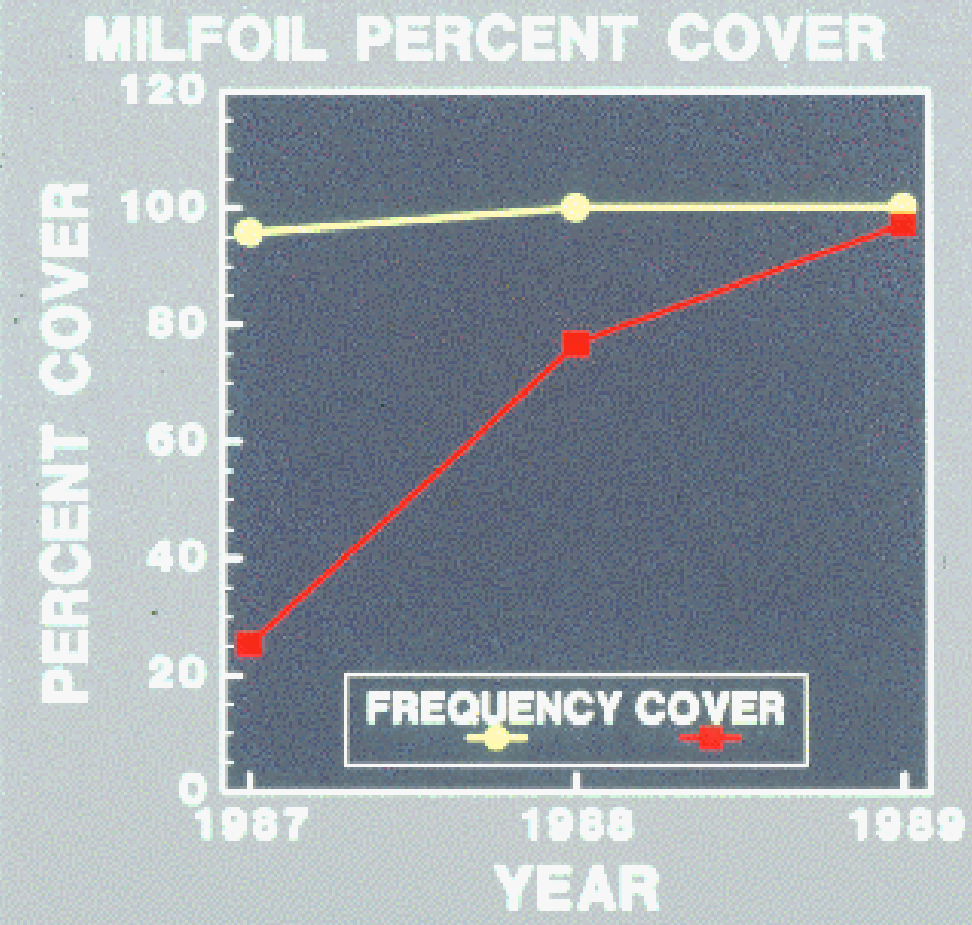
Eurasian watermilfoil vs. Native Plants

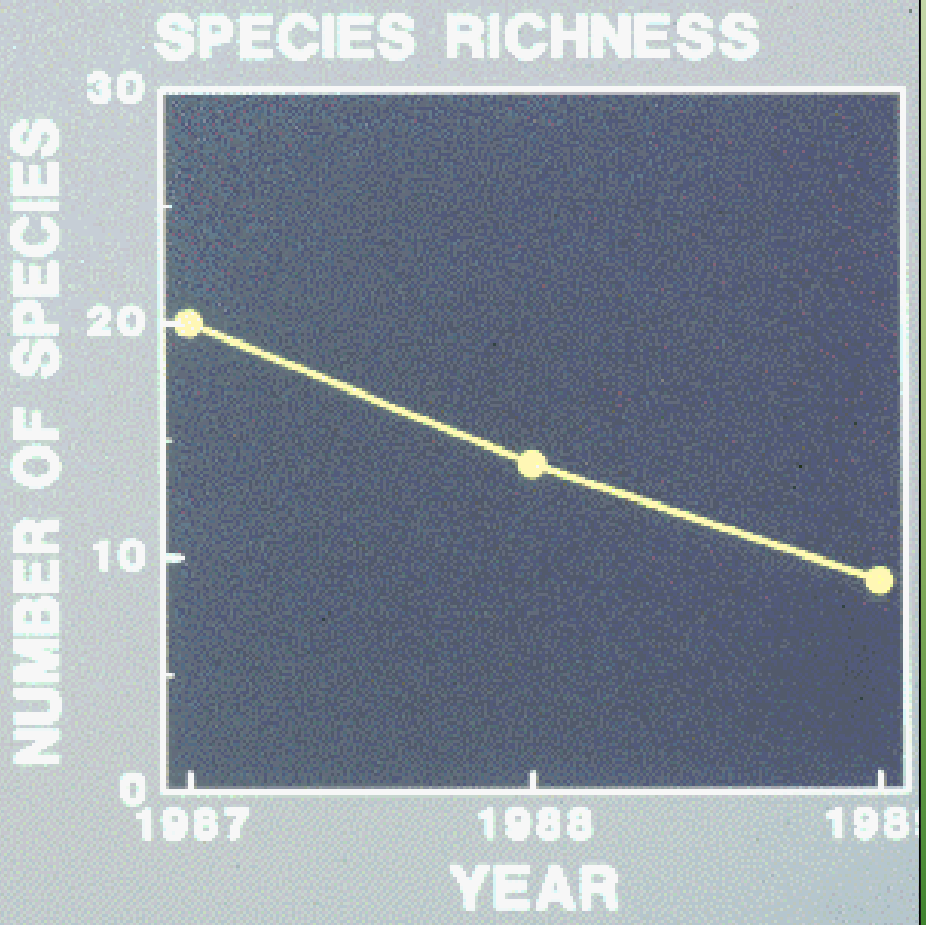


Lake is “Green”

Land is “Blue”

NORTHWEST BAY GRID





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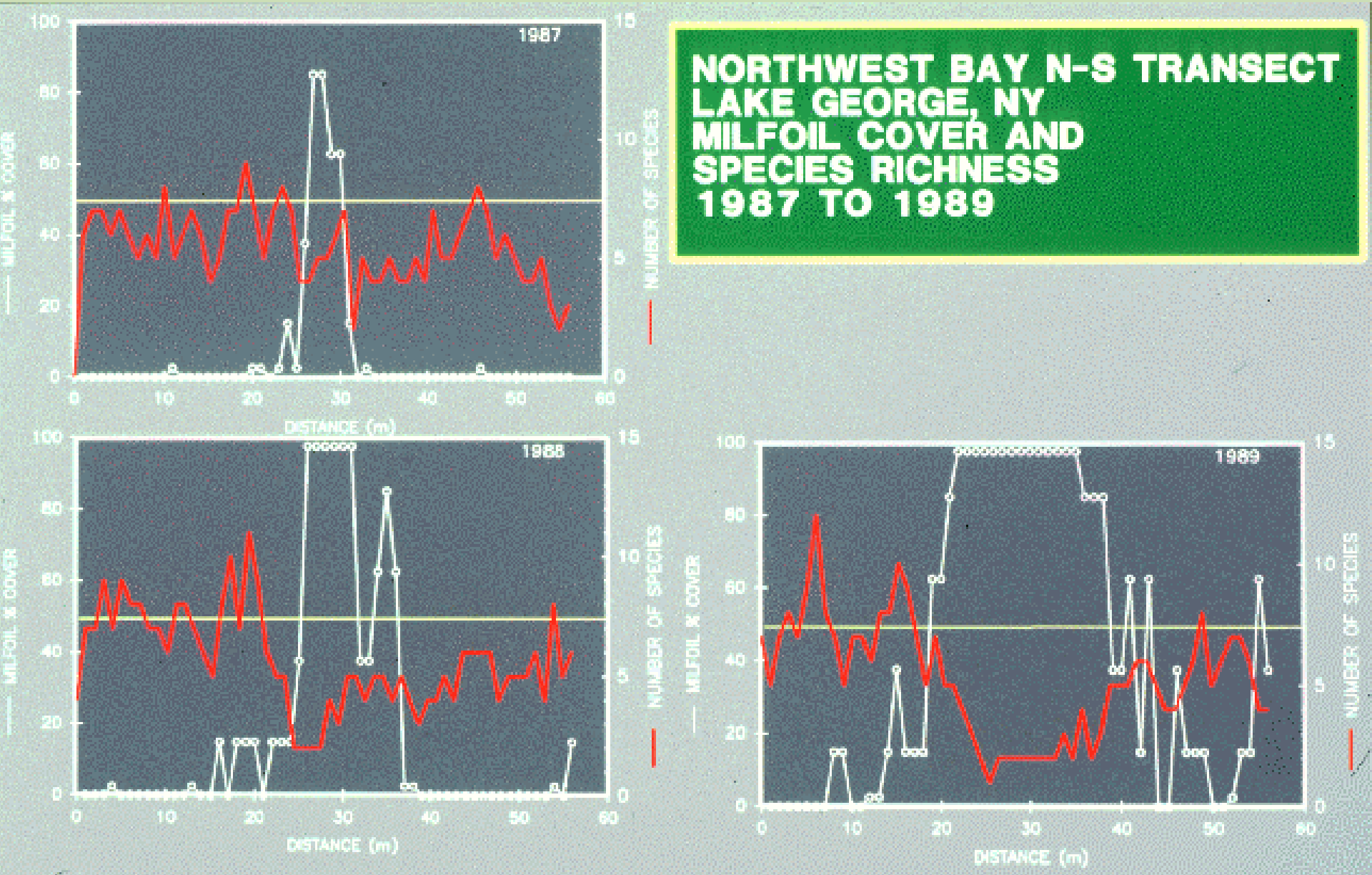
Eurasian watermilfoil and Diversity



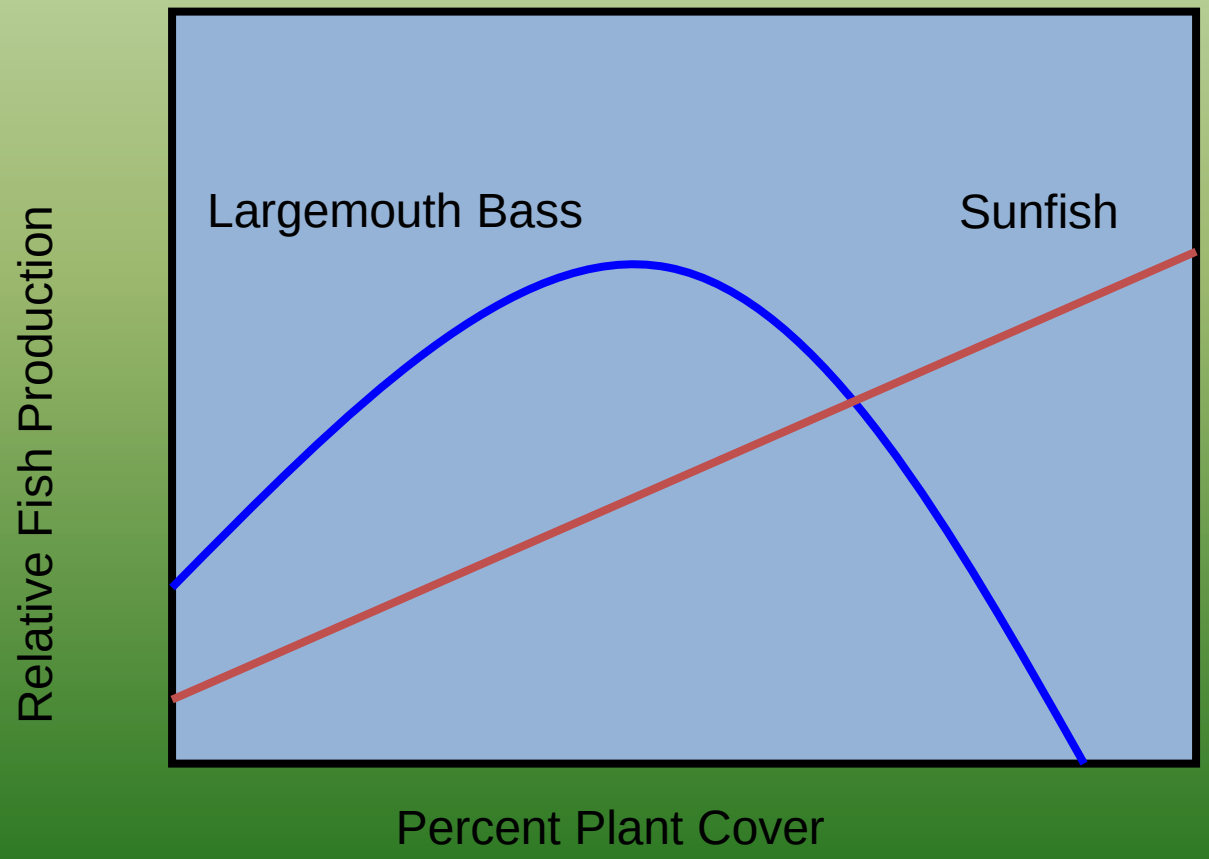
Invasive Plants vs. Macroinvertebrates

- Study consensus is that plants are better than bare sediment
- Typically, diverse plant community has higher diversity and abundance of insects than invasive plant monoculture stands.

Invasive Plants and Fish

- Alter predator/prey balance
- After time, produces large numbers of stunted, underfed fish
- Valued by fisherman, not fisheries biologists

Aquatic Plants and Predator/Prey Balance



Endangered Species

- 42% of listed species significantly impacts by invasive species
- Major cause of decline of species and significant impediment to recovery

ANS Task Force

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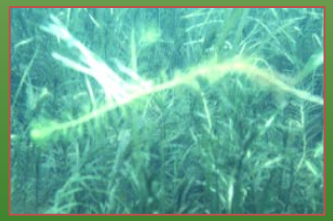
Invasion Process

Introduction



Establishment

Colony Formation

Spread of Melaleuca

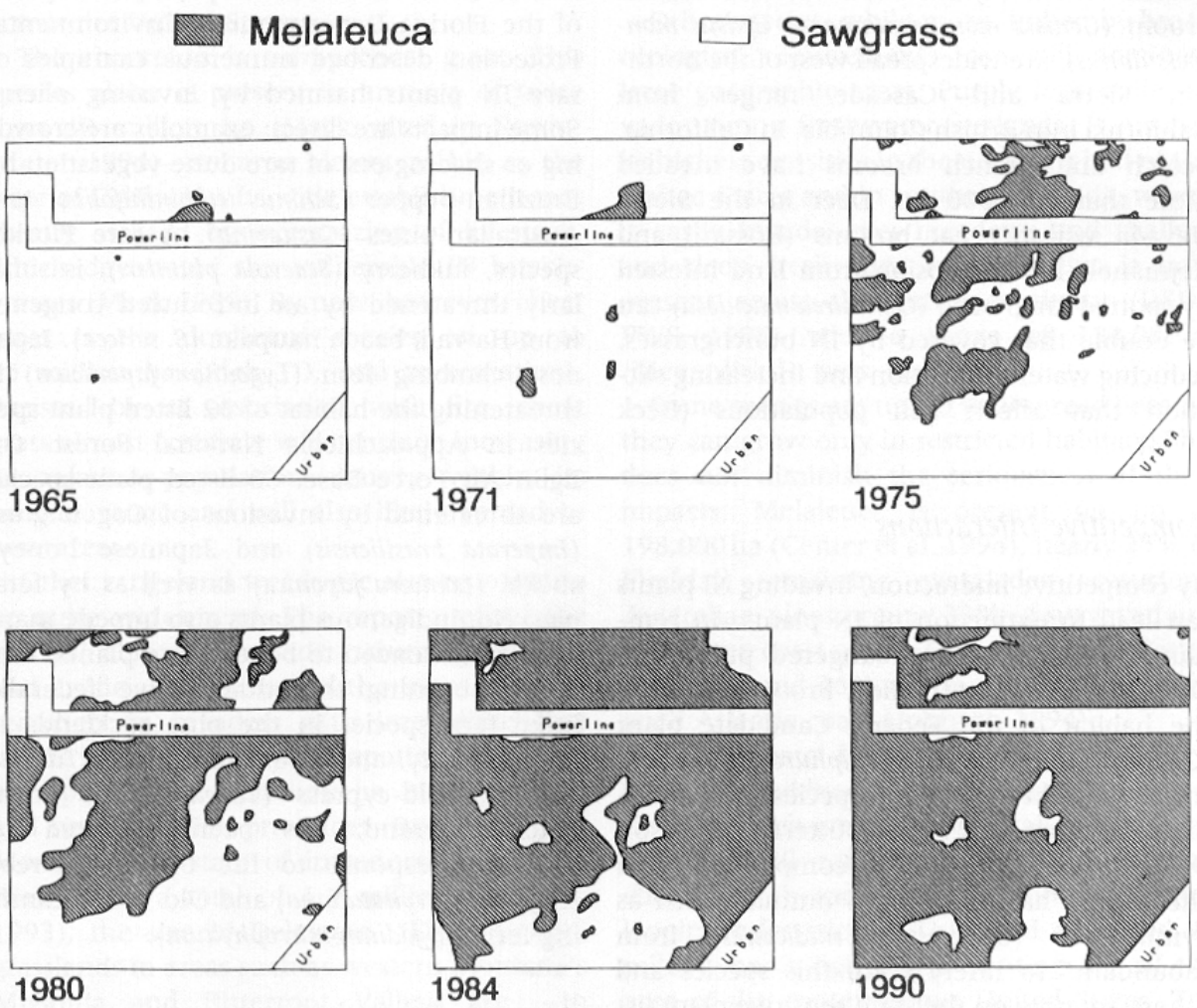


FIGURE 16.2. Areal expansion of melaleuca (*Melaleuca quinquenervia*) over a 25-year period in a 1 mile^2 section of land in Dade County, Florida. Area between parallel lines indicates a powerline corridor. Triangular area in the lower right indicates an urban area. (Data are from Laroche and Ferriter [1992])

Campbell, F.T. 1997. In: J.O. Luken and J.W. Thierot, Assessment and Management of Plant Invasions. Springer, New York

Spread of Melaleuca

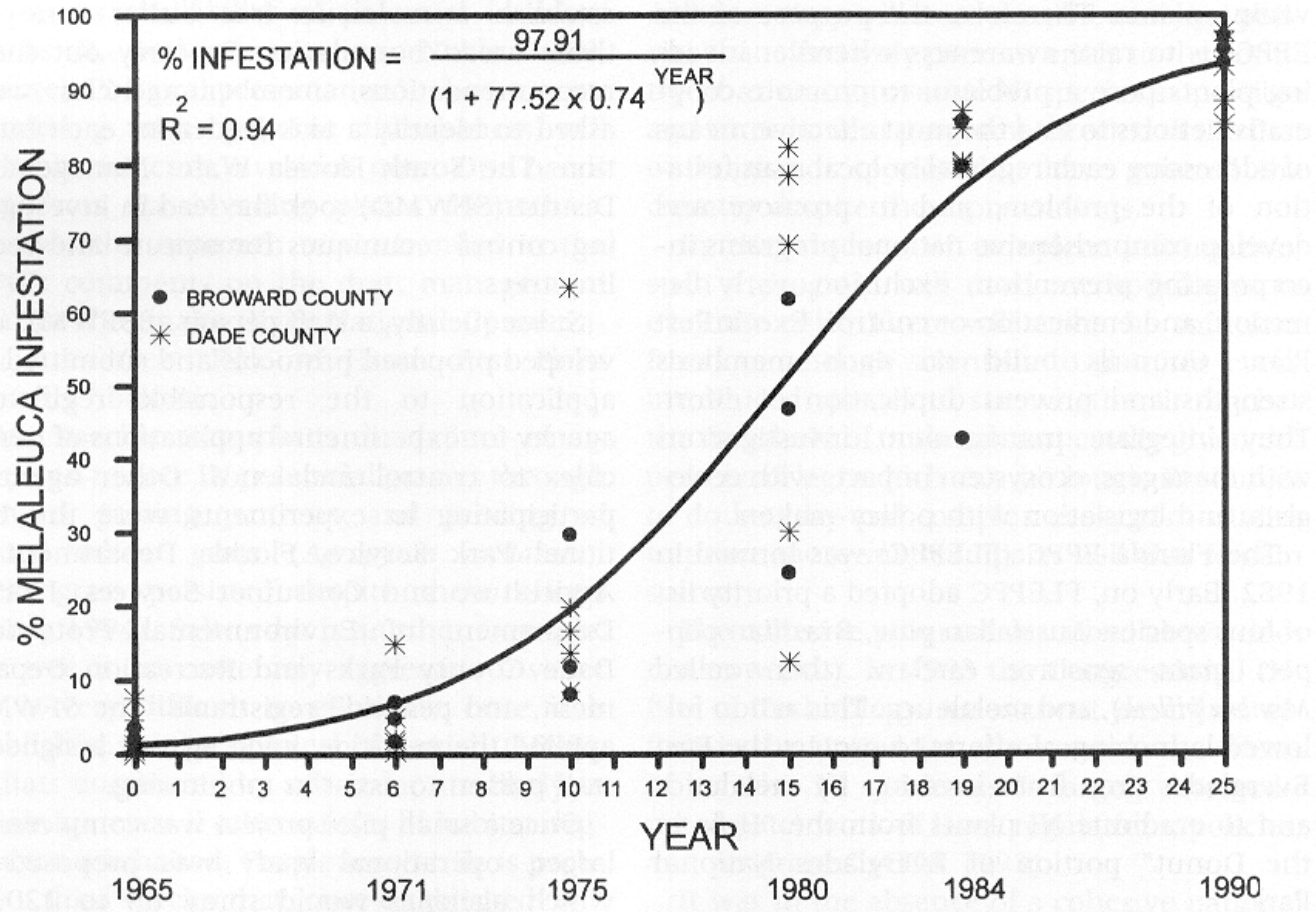


FIGURE 16.3. Rate of melaleuca (*Melaleuca quinquenervia*) expansion in permanent plots in Broward and Dade counties, Florida. (From Laroche and Ferriter [1992])

Campbell, F.T. 1997. In: J.O. Luken and J.W. Thierot, Assessment and Management of Plant Invasions. Springer, New York

Cost of Control vs Time of Intervention

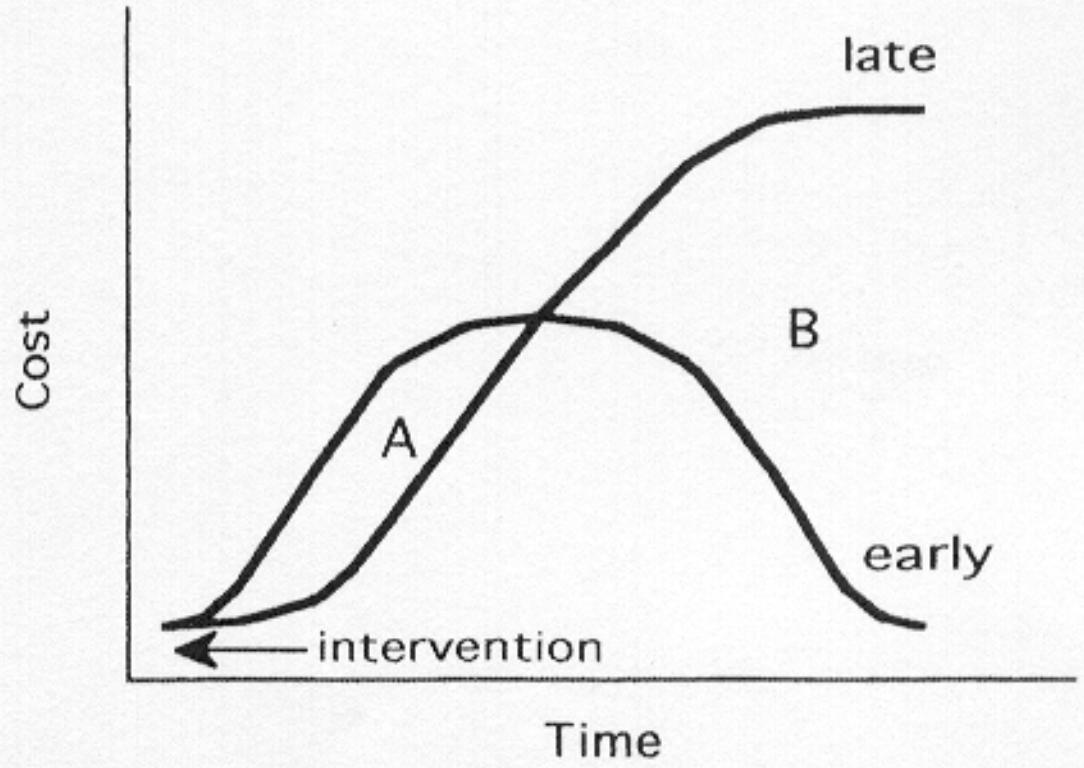


Figure 3. Total social cost of a plant invasion (incorporates the costs of damage due to the invasion and the costs of control) in relation to timing of intervention (early versus late). Costs of early expenditure (area A) and the resulting benefit (area B) (after Chippendale 1991).

Hobbs and Humphries 1995. Conserv. Biol. 9:761-770.

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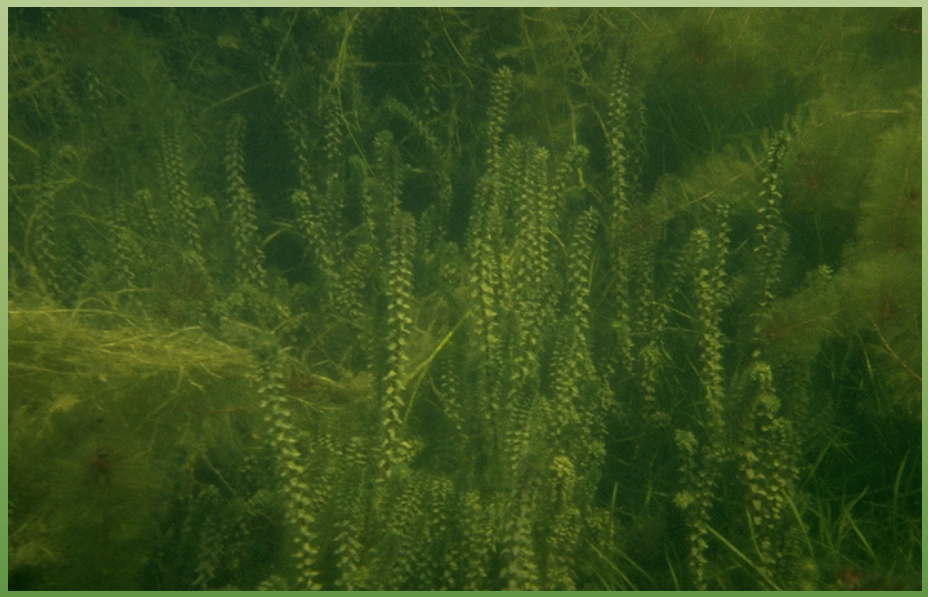
Does Management Do Any Good?

- Reduces dominance of nonnative plant
- Reduces nutrient loading from decomposition
- Allows increased diversity and abundance of native plants

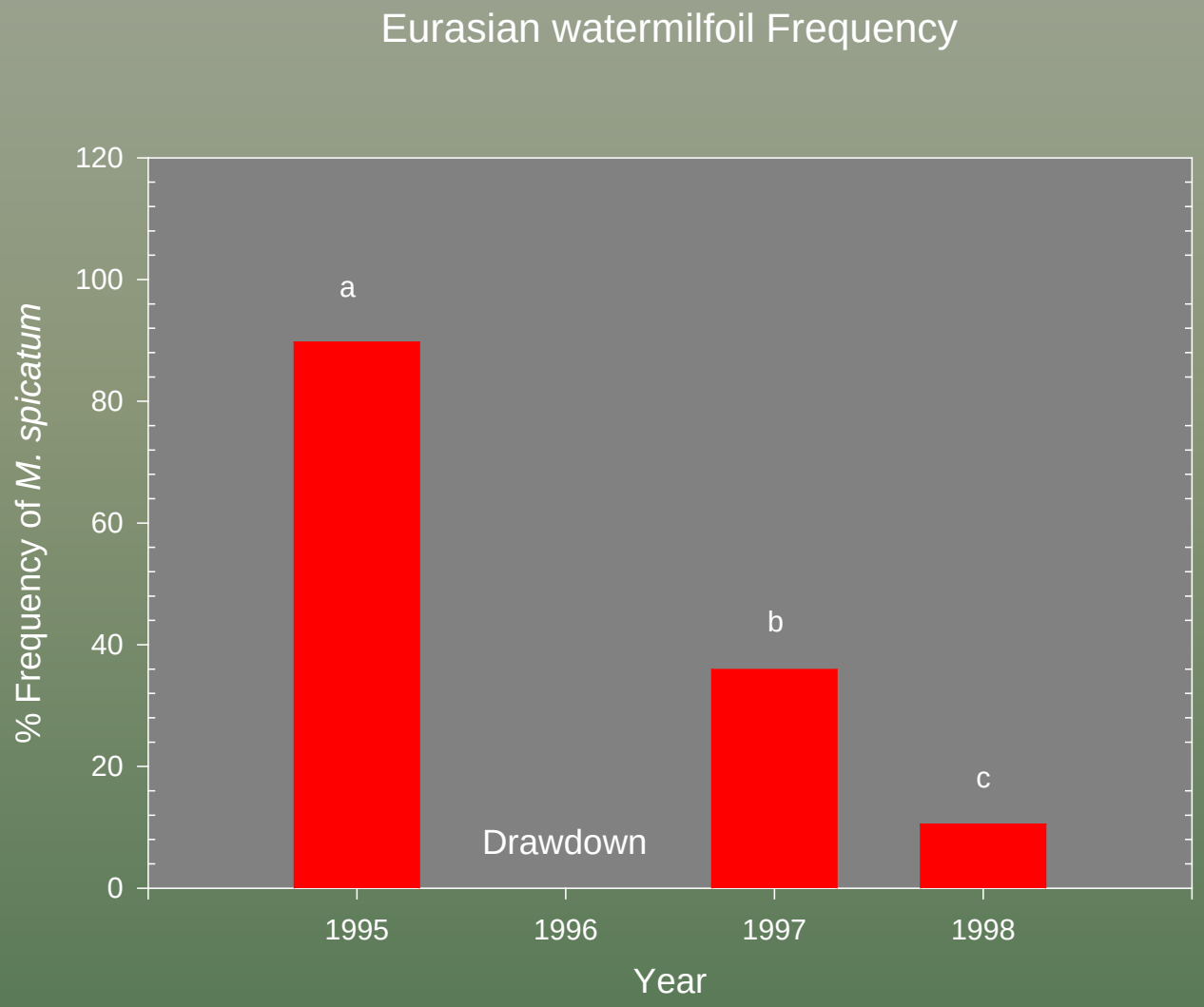


Muskego Lake Project Goals

- Monitor changes in aquatic plant community from before drawdown (1995; drawdown in 1996) and two years after drawdown (1997 to 1998)

Eurasian watermilfoil Frequency

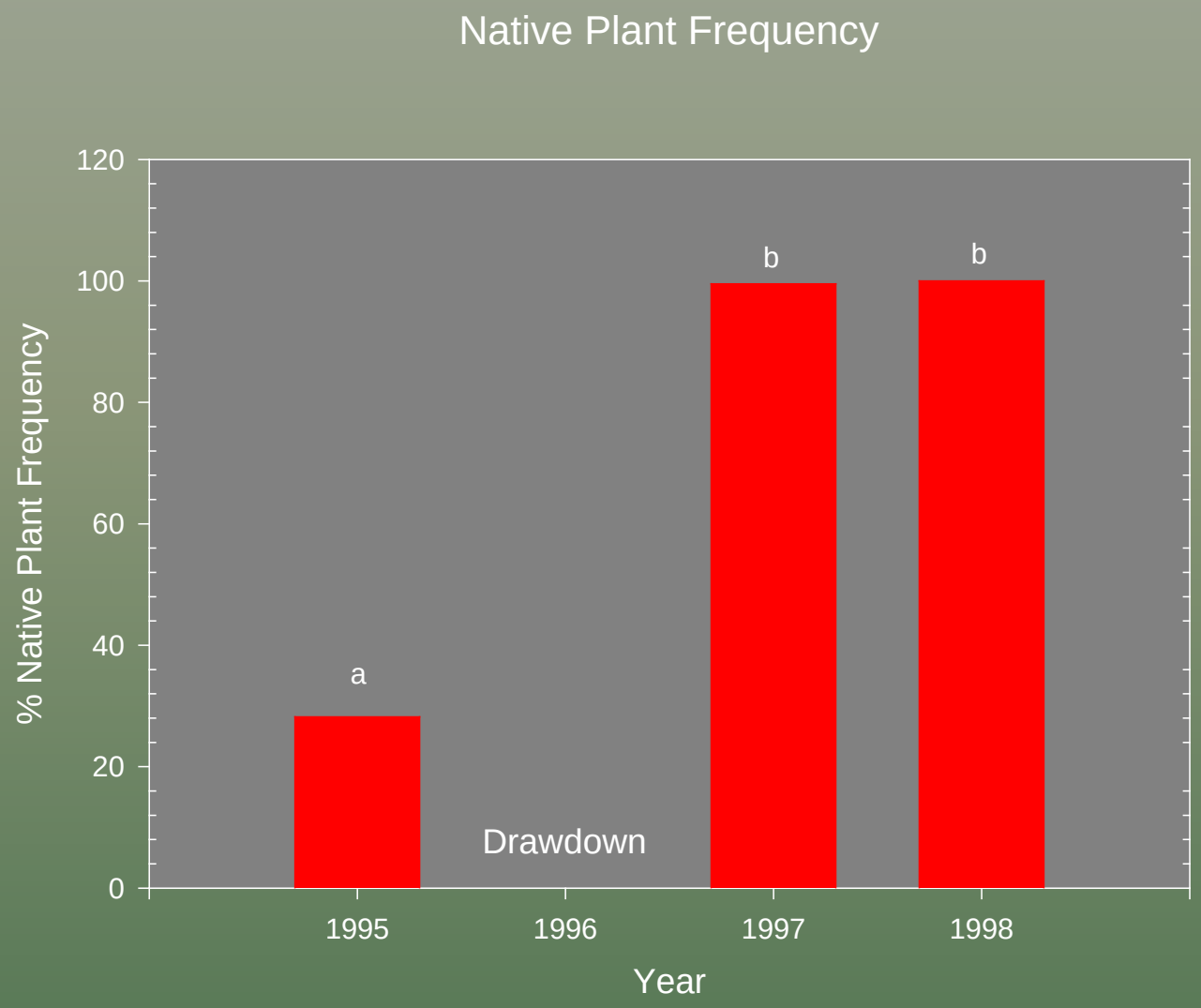
Eurasian watermilfoil decreased from 90% of points in 1995, and a dominant; to 36% in 1997 and 11% in 1998



Native Species Cover

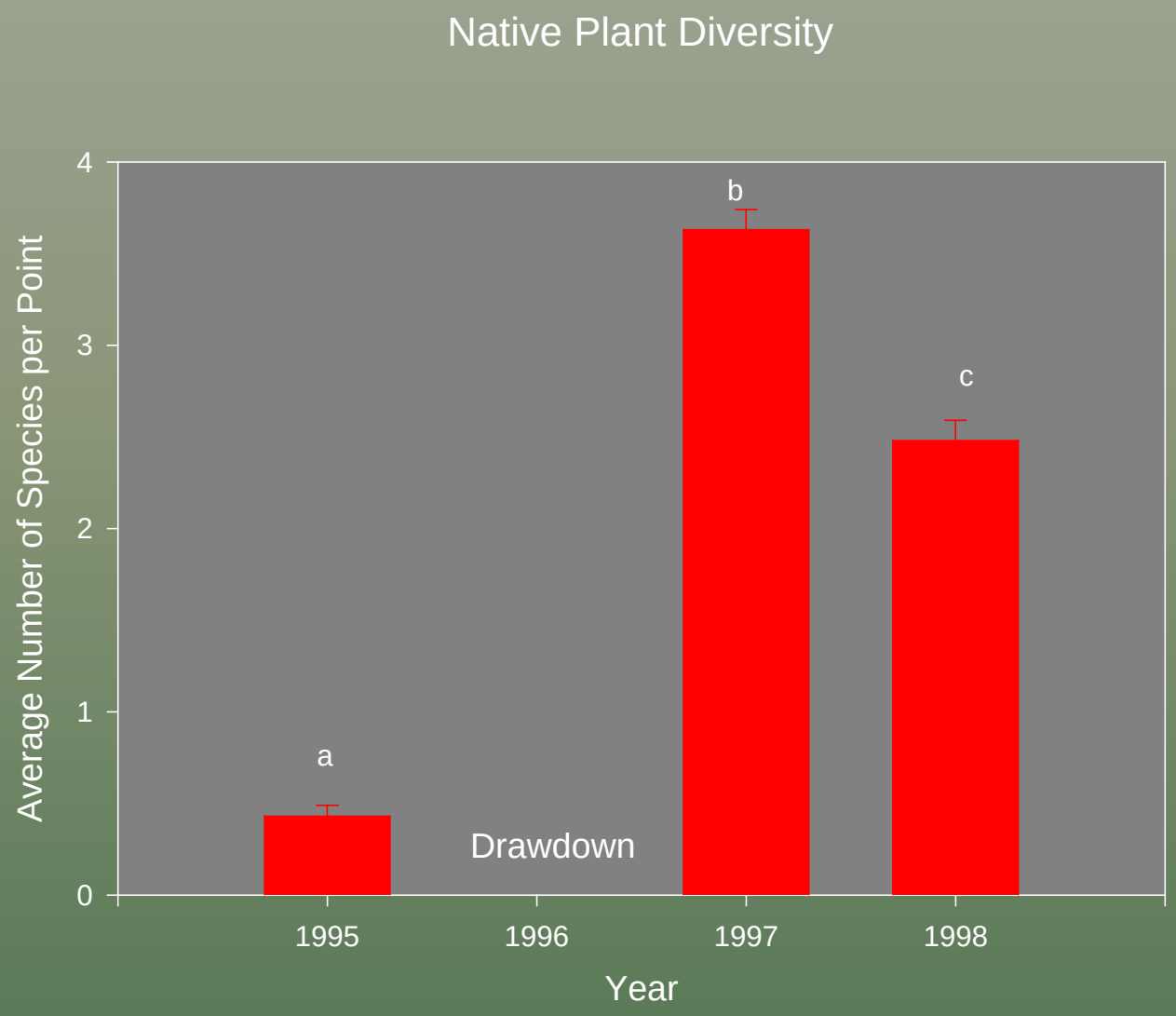
Native plants reestablished in Big Muskego Lake, from 28% of the lake in 1995 to 100% by 1997 and 1998.

A restoration success



Native Plant Diversity

Native plant diversity increased dramatically after drawdown, decreased with interspecific competition in 1998



Aquatic Plant Restoration Goal

Remove invasive plants and restore a diverse community of desirable native plant species

Carsons Bay, MN before treatment

Carsons Bay, MN after treatment

Aquatic Plant Management Society

Because you asked….

Aquatic Plant Management Society, Inc.

Mission Statement:

Promote environmental stewardship through scientific innovation and development of technology related to integrated plant management in aquatic and riparian systems.

www.apms.org

APMS History - 1960s

- ***Incorporated in 1961***
- ***Hyacinth Control Society, Inc.***
  - ***focus on Florida & SE / water hyacinth***
- ***Forum to exchange ideas***
  - ***management problems***
  - ***operational experiences***
  - ***research needs***
- ***Annual Meeting / Journal***

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Aquatic Plant Management Society, Inc.

- *Focus on research / national issues*
- *An affiliate of the Weed Science Society of America*

Seven Regional APMS Chapters

- *Focus on operations / local issues*

- Florida (1976)
- MidSouth (1979)
- South Carolina (1979)
- Midwest (1980)
- Western (1981)
- Texas (1989)
- Northeast (1999)

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$40,000 / two-year Grant

9 awarded since 1999

$374,000 total

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Journal of Aquatic Plant Management

- *Journal of Aquatic Plant Management* is published twice per year.
- The journal is the single most important effort of the society to promote the science of aquatic plant management (in my opinion).
- The Associate Editors and Reviewers are entirely volunteers; the Editor receives a small stipend
- JAPM is currently on-time with Volume 55

JOHN D. MADSEN

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2017 - Daytona Beach, FL

July 16-19, 2017

Hilton Daytona Beach

2018 - Buffalo, NY

2019 - San Diego, CA

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