Weedy or Wonderful?
What science says about water plants

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Contents

• Plants and what they do
• Water plants
• The watershed concept and pollution
• Manmade ponds and restoration
• Photosynthesis is when an organism uses energy from sunlight to combine simple chemicals into the complex molecules of life.

• Almost all life is either directly or indirectly dependent on photosynthesis.
“Plant” can refer to any organism that does photosynthesis, but not all of these are *true* plants.

- Photosynthetic bacteria
- Single-celled algae
- Macroalgae (seaweeds)
- True plants with roots, leaves, seeds, veins, etc.
Plant needs

• All plants need sunlight, water, CO2 and nutrients to photosynthesize and grow.

• But aquatic plants have different adaptations for getting those things than land plants do.
True plants are the product of billions of years of evolution

- 3.5 billion years ago, first **photosynthesis**
- 2.5 billion years ago, **oxygenic photosynthesis** becomes prevalent (cyanobacteria)
- 1.6 billion years ago, first **eukaryotic algae**
- 600 million years ago, first **multicellular algae**
- 475 million years ago, first **land plants** (true plants)
- 140 million years ago, first **flowering plants**
Some plants like seagrasses have made an “evolutionary round trip”

Water -> Land -> Back to Water
Seagrasses vs. Seaweeds
(a.k.a. “Macroalgae”)

- Evolved from land plants
- Few species, all green
- Rooted in sand or mud bottom
- Needs a lot of light (clear water)
- Like low nutrients

- Ancestors never left the water
- Many species and colors
- No roots- attach to rocks, etc
- Only needs a little light
- Like high nutrients
Classification of Water Plants

- **EAV**: Emergent Aquatic Vegetation
  - Stems protrude from the water
  - Includes most “wetland” vegetation
  - Examples: Cattails, Cypress Trees

- **SAV**: Submerged Aquatic Vegetation
  - Permanently under water
  - Examples: Seagrasses, Pond Weeds

- **FAV**: Floating Aquatic Vegetation
  - Floating leaves; roots not attached to the bottom
  - Examples: Water Lettuce, Duckweed

- Algae and Photosynthetic Bacteria
  - Phytoplankton, seaweed, and scum
Benefits of Water Plants

• Enhance biological productivity and diversity -> More fish and wildlife
• Clean water and regulate climate by sequestration of pollutants
• Aesthetics. They’re
Some Important Florida Habitats with Water Plants

• Estuarine / Marine

- **Mangroves**: Dominant in southern part of state
- **Saltmarshes**: Dominant in northern part of state
- **Seagrasses (SAV)**: Inhabit shallow waters with good clarity
Some Important Florida Habitats with Water Plants

- Freshwater
  - Hydric Flatwoods
  - Cypress Swamps
  - Sawgrass Marshes
  - Rivers
  - Lakes
  - Springs
- Manmade
  - Ponds
  - Canals
  - Ditches
You are *always* in a watershed

The “Watershed” Concept

- Water that falls on land flows downhill toward the sea, taking dirt and pollution with it.
The Role of Plants in a Watershed

Vegetated landscape stores and filters water, controls erosion, etc.

Developed landscape adds pollution and removes storage and filtration capacity.

Steady, clean output to ocean

Erratic, polluted output to ocean
How plants help in the watershed

- Foliage intercepts rainfall, reduces erosion and flooding
- Evapotranspiration “wicks” water into the sky
- Roots aerate soil, increase ability to absorb water
- Pollution absorbed
What is the MOST HARMFUL type of pollution in Florida?

• NUTRIENT POLLUTION (Nitrogen & Phosphorus)
  • Sources:
    • Fertilizer
    • Human & Animal Waste
    • Mining and Industrial Waste
    • Nitrous oxides from engines and factories
Nutrient Pollution

• Excess nutrients cause overgrowth of undesirable algae: “Eutrophication”

• Murky water, bad smells, low oxygen, toxic algae chemicals
How water plants help fight the effects of nutrient pollution

• **Resource competition**-
  • Plants and algae compete for the same nutrients.
  • When plants are allowed to grow, they *sequester* the nutrients, leaving less “fuel” for harmful algae growth.

• **Algae grazer habitat**-
  • Plants provide habitat for small animals that eat algae

• **Natural chemicals**-
  • Many water plants exude chemicals that suppress algae growth
Two reasons pollution is increasing in Florida

1. More people
   • More pollution is produced

2. Less natural land cover
   • Less pollution is absorbed by plants
   • Other “ecosystem functions” also impaired
Lee County Example
Lee County Example
Lee County Example

- The functions of this ecosystem have been seriously impaired
Watershed Restoration

Developed landscape with natural elements incorporated to reduce water quality impacts.
Manmade ponds in the watershed
Why do we have all these ponds?

• The ponds are man-made and have been required by law since the 1980s

• They are intended for two primary purposes:
  1. To reduce flooding risk
  2. To filter out pollution

• Basically, their intent is to do what forests and wetlands did prior to the land being developed
Other benefits of ponds

• Ponds can also provide:
  • Habitat for wildlife
  • Fishing opportunities
  • Increased property values
  • Aesthetic benefits

• But BEWARE: “Aesthetics first” management can cripple pond functionality and create pollution dangers
Is the water leaving a pond actually cleaner than the water entering?

- It depends on how the pond is managed
- What does a well-managed pond look like?
Eco-Logical Pond Mgmt.
Eco-Logical Pond Mgmt.

- Well-managed pond look like a wetland
- With plants, pond is able to perform its intended function of pollution removal
Eco-Logical Pond Mgmt.

Not mowed or sprayed on the slope; the slope stays natural.

Maximum summer water level in pond

Plants in “littoral zone” control erosion and filter pollution out of runoff.

Water plants remove excess nutrients and prevent algae blooms; also provide habitat.
Aesthetics-Driven Pond Mgmt.

- Looks “clean,” but water leaving is more polluted than the water entering.
- Folly of applying indoor intuitions about cleanliness to outdoor environments.

Dr. Serge Thomas, FGCU Water School
Aesthetics-Driven Pond Mgmt.

- Turf grass on slope = lawn chemical runoff
- Dependence on chemicals to prevent algae growth
- Bare dirt because of herbicide use = erosion problems
- Algae growth is chemically suppressed, but water is loaded with nutrient pollution that will cause blooms down the line
Pond Restoration Case Study: Fairwinds HOA, Bonita Springs, FL
Fairwinds HOA Pond

(Picture from August, so most of littoral zone is under water)
Initial Problems with the Pond

- Invasive Torpedo Grass
- Mowed to edge
- Frequent herbicide spraying
- Eroding banks
- Just a few clumps of wetland plants
1. Establish “Zone of Responsibility”
   • No mowing or spraying within 2’ of summer high water line
   • Allows plants to regrow in “littoral zone”
2. Plant and water quality monitoring by FGCU scientists and students
3. Selective weeding; manual removal of non-native torpedo grass and replacement with native spikerush
Plant surveys at Fairwinds Pond

Transect of quadrats along the littoral zone
• Landscapers adopted no-mow zone quickly, but lake managers still sprayed RoundUp one time before HOA got the message through
• 37 species of plants
  • 25 Native
  • 12 Non-Native

• Spraying killed both native and non-native and left the littoral zone bare
Natural revegetation of littoral zone in progress
Diverse, native plants forming ground cover

Honeybee, *Apis mellifera*

Oakleaf Fleabane, *Erigeron quercifolius*
Weeding and replanting experiment

- Half the pond is being left alone
- The other half is being manually manipulated
  - Torpedo grass removed
  - Native spikerush planted
Boy Scouts removing torpedo grass
Removed torpedo grass composted at FGCU “Food Forest” to recycle nutrients
Clumps of spikerush transplanted from a healthy pond on the FGCU campus

Eagle Scout Jack Boldrin
Water Quality Monitoring

- Water clarity, algae, and nutrient levels are being monitored.
- We expect plant growth to improve water quality, but there may be some growing pains.
Beyond Fairwinds

- We want to use this example to jumpstart more eco-logical pond management in the area.
Recommendation 1- Standards

• Make landscaping rules and standards based on functionality, not just aesthetics

• Change Default Mode of pond landscape management from one that contributes to pollution to one that lessens pollution
Recommendation 2- Science

• Require **water quality testing** to make sure ponds are working and to target dysfunctional ponds for restoration

• Ensure data sharing to track progress and inform scientists and the community
Recommendation 3 - Education

- People need environmental knowledge to ask for the right things from Lake Management and Landscaping contractors.

FGCU Water School and Env. Organizations

HOA leaders and local officials

Lake Management and Landscaping Contractors

Science

Ponds
Final thought- The Watershed is the Whole Landscape, Not Just Ponds

• Apply the “let plants grow” strategy to other parts of our landscape.
  • **Dry** Detention Ponds
  • Ditches and Canals
  • Roadsides

Dry Detention Ponds are usually mowed like this, but they would clean water better if allowed to grow
Plant considerations

• When it comes to pollution control, ANY PLANTS are better than no plants.
• That said, native plants are preferred, and many species combined (a “biodiverse assemblage”) performs better than a single species.