

Aquatic Plant Identification and Management



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AQUATIC PLANT MANAGEMENT

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Presentation Outline

1. Aquatic Plants and the Environment
2. Management and Control Options
3. Review of Plant ID for North Carolina Ponds

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Benefits of Aquatic Plants

- Food, shelter, and breeding habitat for fish and wildlife
- Protection from erosion
- Oxygenation of water
- Aesthetics



How Do Aquatic Plants Spread?

- Human activities (wildlife plantings, boating, fishing enhancement, aquarium dumping, water gardens, dredging, mechanical harvesting)
- Animals (wading birds, aquatic mammals)
- Water movement
- Transport by wind and rain (seeds, spores)

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ARIZONA AQUATIC GARDENS

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January 22, 2007

AQUARIUM

- Plants
- Habitat Packages
- Fish
- The Algae Squad
- The Shrimp Factory
- Snails
- Picotopes
- Driftwood
- Tools
- CO2 Systems
- Lights
- Additives/Supplements
- Fertilizers
- Substrates/Heater
- Filters & Pumps
- Test Kits
- Food
- Medications
- POND**
- Plants
- Lilies & Lotus
- Koi & Other Pond Fish

1	remove	Anacharis-XLG FORM	1	\$2.49	\$2.49
2	remove	Egaria najas	1	\$1.98	\$1.98
3	remove	Cabomba, Green	1	\$1.58	\$1.58
4	remove	Glossostigma	6	\$1.98	\$11.88
5	remove	Parrot's Feather	2	\$0.98	\$1.96
6	remove	Brazilian Pennwort	1	\$1.98	\$1.98
7	remove	Rotala, Indica	2	\$0.98	\$1.96
8	remove	Temple Plant	1	\$1.98	\$1.98
9	remove	Water Velvet or Salvinia	1	\$6.99	\$6.99
10	remove	Floating Heart	3	\$2.98	\$8.94
11	remove	Snowflake, Large White (loose)	3	\$6.99	\$20.97
12	remove	Water Hyacinth	1	\$0.00	\$0.00
13	remove	Water Lettuce	1	\$1.98	\$1.98
14	remove	Water Poppy	3	\$2.99	\$8.97
15	remove	Aquatic Morning Glory	3	\$4.59	\$13.77
16	remove	Golden Mystery Snail	1	\$1.99	\$1.99
17	remove	Apple Snail	1	\$3.99	\$3.99
18	remove	Giant Striped Colombian Ramshorn Snail	1	\$1.79	\$1.79
19	remove	Mosaic Plant	1	\$4.99	\$4.99

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Why Are Some Aquatic Plants Invasive?

- Large areas of clear, shallow water
- High levels of nutrients, especially N and P
- No natural enemies (introduced weeds)
- Characteristics which make them more competitive than native plants
 - Adapted to low light or CO₂
 - Adapted to intense sunlight and high temperatures

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Why Manage Aquatic Weeds in the Carolinas?

- Irrigation
- Drainage
- Flood control
- Water supplies
- Power generation
- Aesthetics
- Aquaculture
- Transportation
- Mosquito control
- Fishing/Recreation

Why Manage Aquatic Weeds?

- Prevent/reduce impacts to multi-purpose reservoirs



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Alligatorweed in drainage ditch

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Giant Salvinia

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Hydrilla in Impoundments / Lakes

Yellow Floating Heart





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Formulating Weed Management Decisions

- Use of the body of water
 - Irrigation, consumption, livestock, etc.
- Plant identification
- Fish and wildlife populations
- Water quality
- Physical, environmental, and economic limitations

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Approaching Management

- **There is no silver bullet or “one-size fits all” approach**
- Every waterbody is distinct and each needs to be clearly defined
 - Natural systems are more complex than impoundments
 - Impoundments are inherently artificial
- What are goals?
- Eradication is a big word with promises attached
- Technical advisory committees are very helpful
 - Due diligence
- Public input is necessary for many systems
- Public outreach is necessary for all systems

Linking Plant Biology to Management

- Each weed species will have different biological characteristics regarding growth, reproduction, etc.
- Management techniques need to reduce growth and interfere with reproduction
- Poor timing can make management fail
- Tools that look good in the short term may not hold up on a year-to-year basis



Linking Plant Biology to Management

- Species that produce propagules are more difficult to manage than those that don't
- Hydrilla may require 10 years of treatment to deplete the turion bank
- Egeria /Lagarosiphon do not produce seed or turions
- Understanding species biology is important for targeting sensitive areas in the life cycle



Appendix E – Arkansas Farm Pond Management Calendar

Managing a pond for good fishing is a year-round task and timing is often critical to the success of management activities. This calendar can help pond owners schedule management activities for the entire year. Not all of these activities need to be performed every year, and some may not be appropriate for all ponds. Dark-shaded areas are the months when management activities should be performed. Lightly-shaded areas indicate when management activities may be performed during years with abnormal weather. Drawdowns should begin around October and begin refilling around February.

Timing management activities is critical for successful results

Management Activity	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Apply lime	Dark									Dark	Dark	Dark
Fertilize			Light	Dark	Dark	Dark	Dark	Dark	Dark			
Check planktonic algae bloom			Dark	Dark	Dark	Dark	Dark	Dark	Dark			
Drawdown and refill	Dark	Dark	Dark	Dark								
Treat aquatic plants			Dark	Dark	Dark	Dark	Dark					
Stock fish	Dark	Dark	Dark								Dark	Dark
Check fish population balance					Light	Dark	Dark	Dark	Dark			
Feed fish				Dark	Dark	Dark	Dark	Dark	Dark	Dark		
Harvest fish	Dark	Dark	Dark	Dark	Dark	Dark	Dark	Dark	Dark	Dark	Dark	Dark
Inspect dam for holes	Dark	Dark										Dark
Trim vegetation from dam					Dark	Dark	Dark	Dark	Dark	Dark		

<https://www.uapb.edu/sites/www/Uploads/SAFHS/MP360.pdf>

Control Options

Prevention***

Biological: (e.g., Grass carp [*Ctenopharyngodon idella*]; flea beetle [*Lysathia ludoviciana*]; alligatorweed beetle [*Agasicles hygrophila*])

Cultural/Physical: (e.g., Prevention; Hand removal; Benthic barriers)

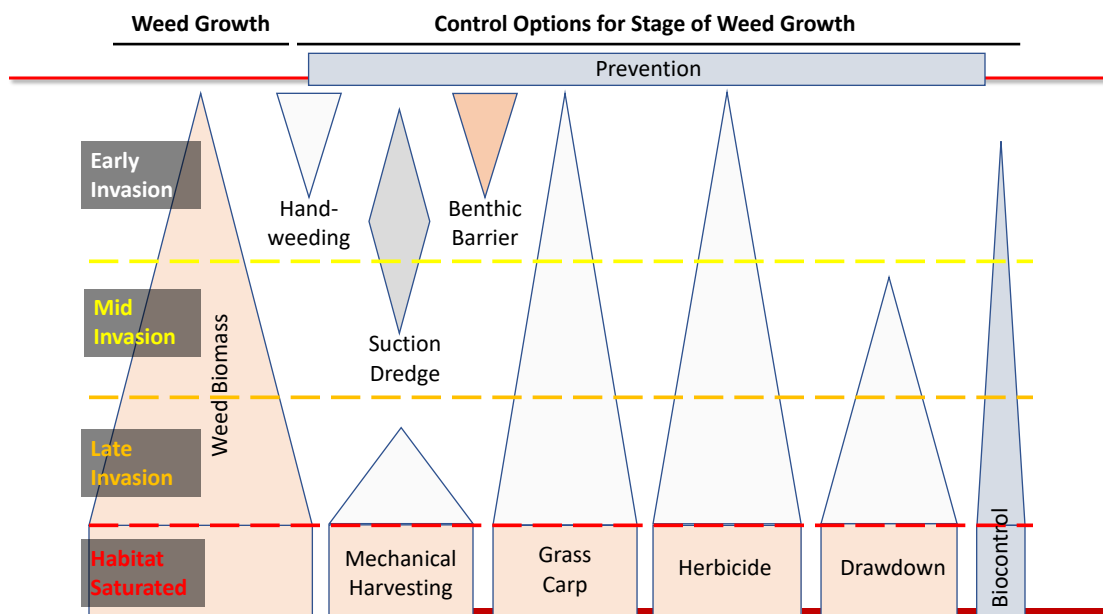
Mechanical: (e.g., Cutting equipment)

Chemical: (e.g., Herbicides)

- Most common; economical, effective, and selective tool utilized (Hussner et al. 2017)



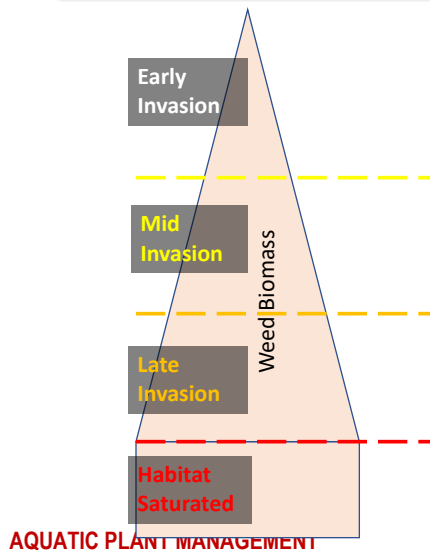
Selecting Control Options



Selecting Control Options

Weed Growth

Control Options for Stage of Weed Growth



Prevention

- Often too late...

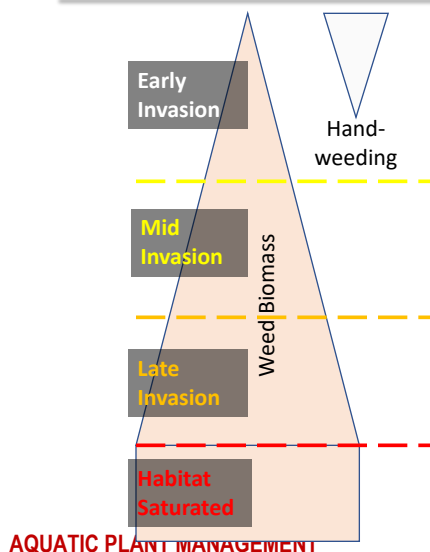


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Selecting Control Options

Weed Growth

Control Options for Stage of Weed Growth



Handweeding

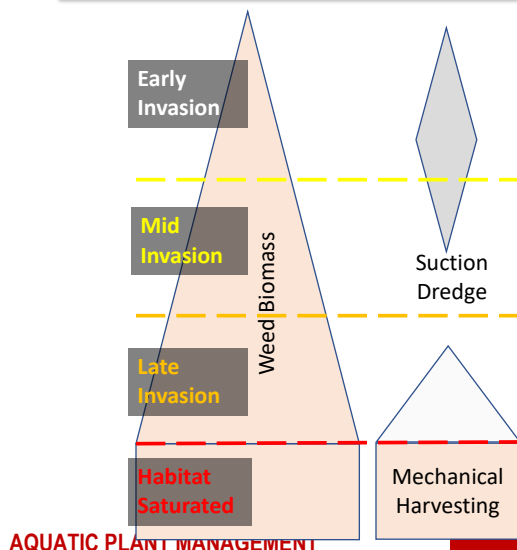
- Most common management form
- Generally for special situations with no other options
- Highly labor intensive/inefficient
 - Aquatic plants may be up to 98% water
 - Volunteers are cost effective, but limited
 - Liability: back injury, risk of heart attack or stroke
- Plants may reproduce as fast as removed
- Pulling will disturb soil and may disturb native species

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Selecting Control Options

Weed Growth

Control Options for Stage of Weed Growth



Mechanical Techniques

- Short term control only
- Produces many fragments that can spread infestation
- Can be very destructive to non-target species
- Can you access all areas?
- Not always viable



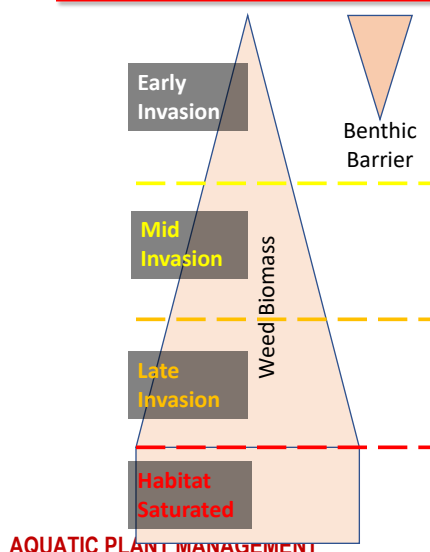
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Selecting Control Options

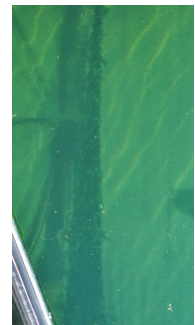
Weed Growth

Control Options for Stage of Weed Growth



Benthic barrier

- Woven fabric placed along sediment
- Prevents weed growth from sediment
- Ineffective once sediment deposits on top
- Used on flat bottoms
- Impacts to non-target organisms?
- Not selective



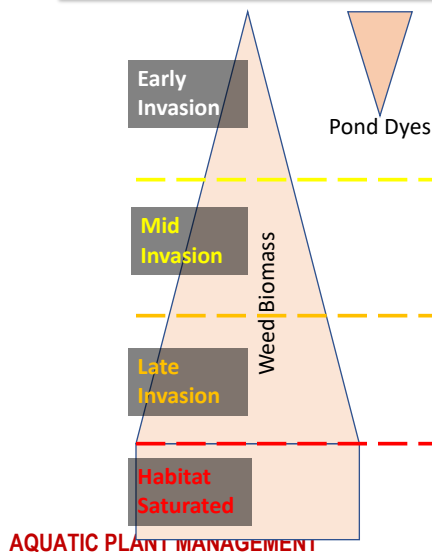
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Selecting Control Options

Weed Growth

Control Options for Stage of Weed Growth



Pond dyes

- Work by blocking sunlight
- Not effective on vegetation within 18" of waters surface
- Must be applied early season
- Concentrations must be maintained
- Water flow reduces effectiveness



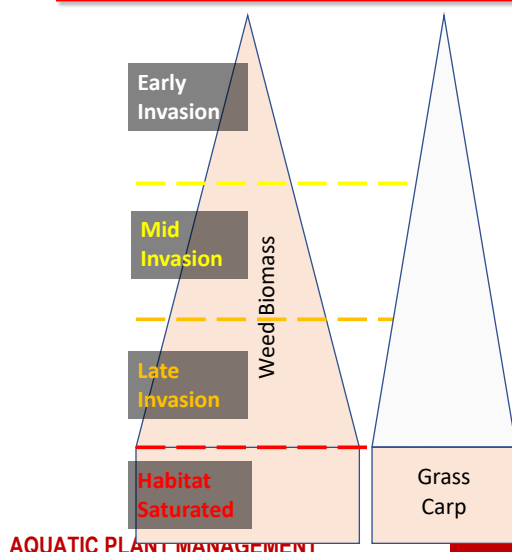
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Selecting Control Options

Weed Growth

Control Options for Stage of Weed Growth



Triploid Grass Carp

- Introduced from Asia
- Sterile version may be stocked
- Permits may be needed; will not be permitted in all waterbodies
- Feeds on plants only
- Generally a non-specific herbivore although they do like hydrilla
- Do not prefer to eat milfoils
- Stocking rates based on past experience



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Grass Carp's Closest Living Relative



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Mortality



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Aquatic Weeds & Triploid Grass Carp

- Most emergent and floating plants
- Filamentous algae
- Planktonic algae
- Eurasian watermilfoil

NOT PREFERRED

Aquatic Weeds & Triploid Grass Carp

Duckweeds	Watermeal
Aquatic Grasses	Water Pennywort
Milfoils (not EWM)	Azolla
Mosquito Fern	Coontail

INTERMEDIATE PREFERENCE

Aquatic Weeds & Triploid Grass Carp

Naiads	Fanwort
Coontail	Pondweeds
Bladderwort	Chara
Widgeongrass	Egeria
Creeping Rush	American Elodea
Proliferating Spikerush	



HYDRILLA

PREFERRED

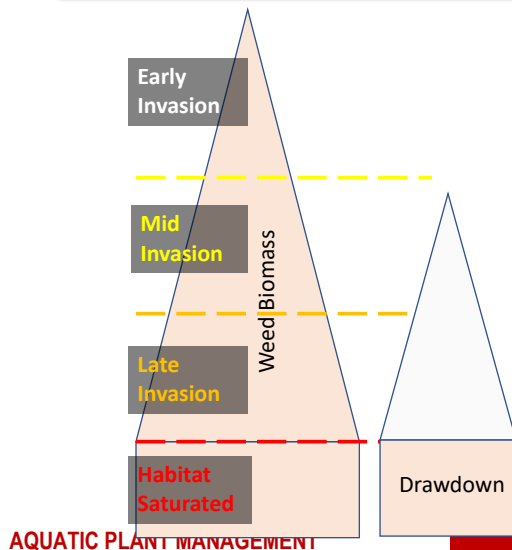
GC Management in Small Impoundments

- Generally straight forward:
 - 15 triploid grass carp per acre of pond for control
 - Increase or decrease based on weed density and species
 - 5 triploid grass carp per acre of pond for prevention
 - Restock periodically as needed (assume 20-30% annual mortality)
- Reasons for lack of success:
 - Grass carp were stocked years ago and only 1-2 remain
 - Grass carp stocked months ago and have not had time
 - Weed species present are not preferred

Selecting Control Options

Weed Growth

Control Options for Stage of Weed Growth



Drawdown

- Inexpensive; may supplement other strategies
- Impacts to non-target species?
- Effect based on plant biology/reproduction

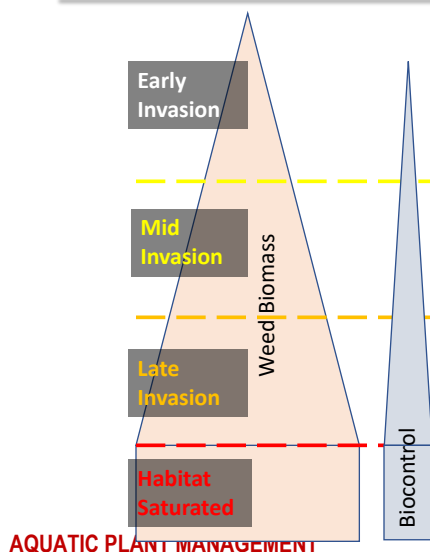


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Selecting Control Options

Weed Growth

Control Options for Stage of Weed Growth

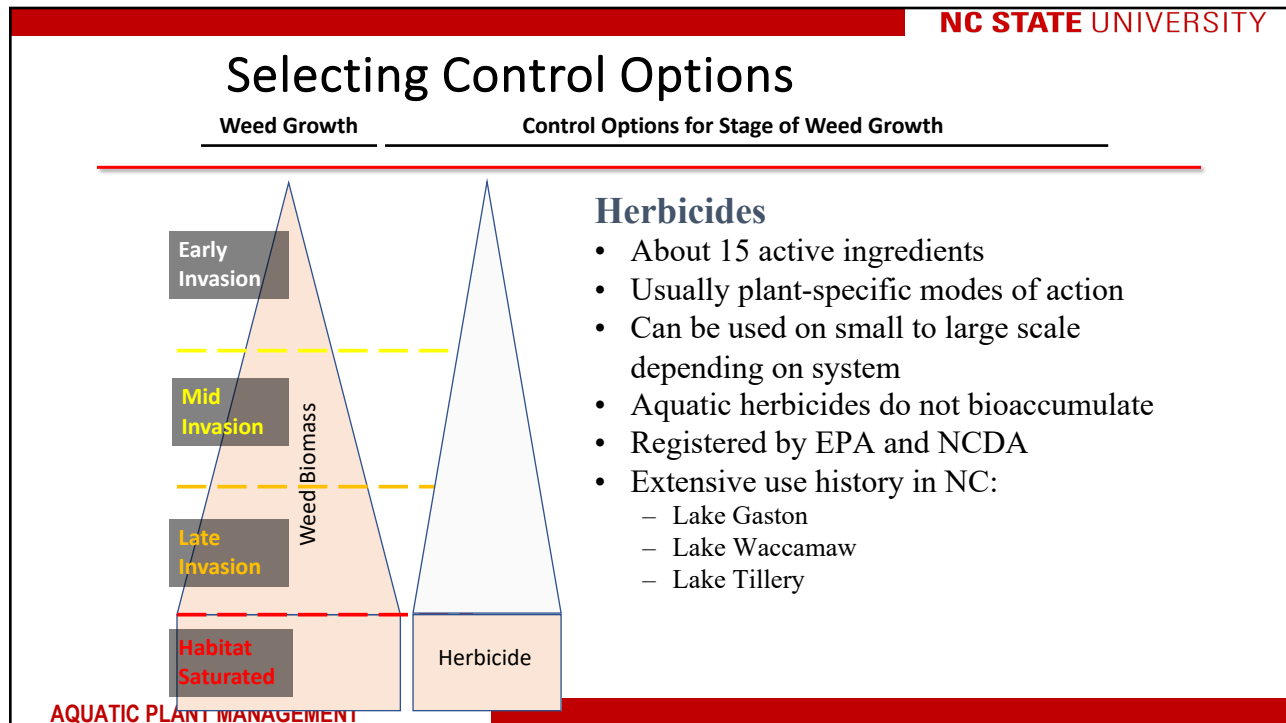


Host specific biocontrol

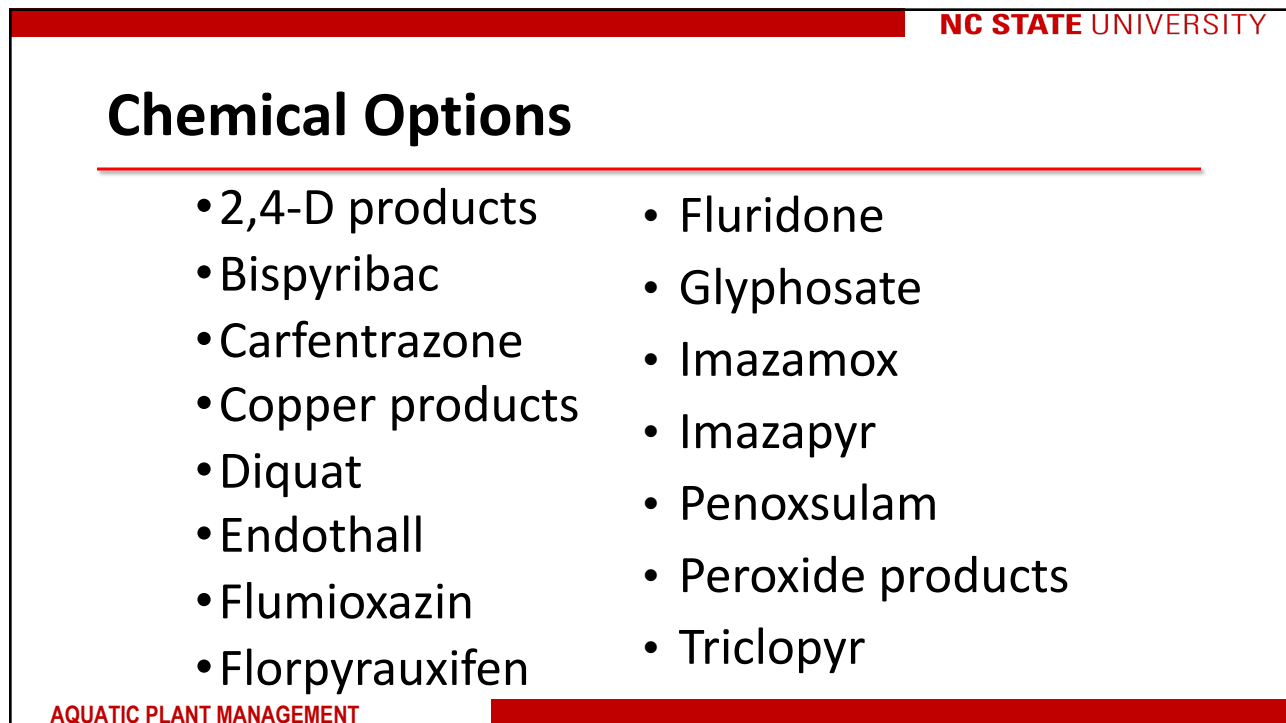
- Several agents released in Florida
- Most require the host in order to overwinter
- Minimal options for NC climate
- Alligatorweed flea beetle may overwinter near Wilmington



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Herbicides - Overview

- Aquatic herbicides are applied to water
- EPA considers this to be a “food use”
- Major considerations:
 - Off-target movement (water flow-through)
 - Irrigation
 - Drinking
 - Fishing
 - Swimming/recreation
 - Livestock use
 - Fish kills

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Herbicides - Overview

Table 6. Types of herbicides commonly used for controlling aquatic plants.

Types of Herbicides	
Contact	Systemic
Copper and Copper Products	2,4-D
Diquat	Glyphosate
Endothall	Fluridone
Carfentrazone	Triclopyr
Sodium Carbonate	Imazapyr
Peroxyhydrate	Imazamox
Flumioxazin	Penoxsulam
	Bispyribac Sodium

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Herbicides - Label

- The label is the law – always check
- Be extra cautious with:
 - 2,4-D
 - Glyphosate
 - Diquat
 - Copper products
- Some formulations not labeled for sites used for irrigation, watering, etc.



Many different brands
with different use
patterns and restrictions

Herbicides – Water Use Restrictions

- Fishing: consumption of fish or use for fish meal
- Swimming: any activity which immerses the body
- Irrigation: including use for preparation of agricultural pesticide sprays
- Livestock watering: may include humidification of poultry houses
- Domestic drinking water supplies: a setback distance also may apply

Herbicides – Irrigation Restrictions

- Includes water use for preparation of agricultural pesticide sprays
- Restrictions on:
 - 2,4-D (21 & check label)
 - Carfentrazone (to 14)
 - Diquat (3 to 5)
 - Endothall (0 to 25)
 - Fluridone (to 30 days)
 - Imazapyr (120)
 - Triclopyr (120*)
*0 for established grass
- Clearcast <50 ppb: no restrictions
- Galleon >1ppb: no irrigation
- Testing can be done to determine levels

Herbicides – Fish Kills



- Most fish kills (> 99%) due to oxygen depletion
- Application of copper products at incorrect rate or to too large of an area
- Fish kills by oxygen depletion when:
 - Herbicide treatments are too late in the season
 - Too much weed growth treated/killed at once



Potential Environmental Concerns

- Lowered dissolved oxygen and warm water
 - Whole vs. Partial treatment
 - Fish mortality may result
- Nutrients released
 - Increased turbidity (algal bloom)
- Crop/landscape damage due to irrigation
 - Choice of herbicide
 - 1/2 life, sensitivity of non-target plants
 - Posting requirements
 - Time, Setback Distance, Concentration



Factors Influencing Aquatic Weed Control

- pH (carfentrazone, flumioxazin)
 - Acid < 7=neutral > basic
- Hardness/alkalinity (copper)
 - Soft < 50 ppm CaCO_3 > Hard
- Turbidity (diquat)
 - Organic
 - Inorganic



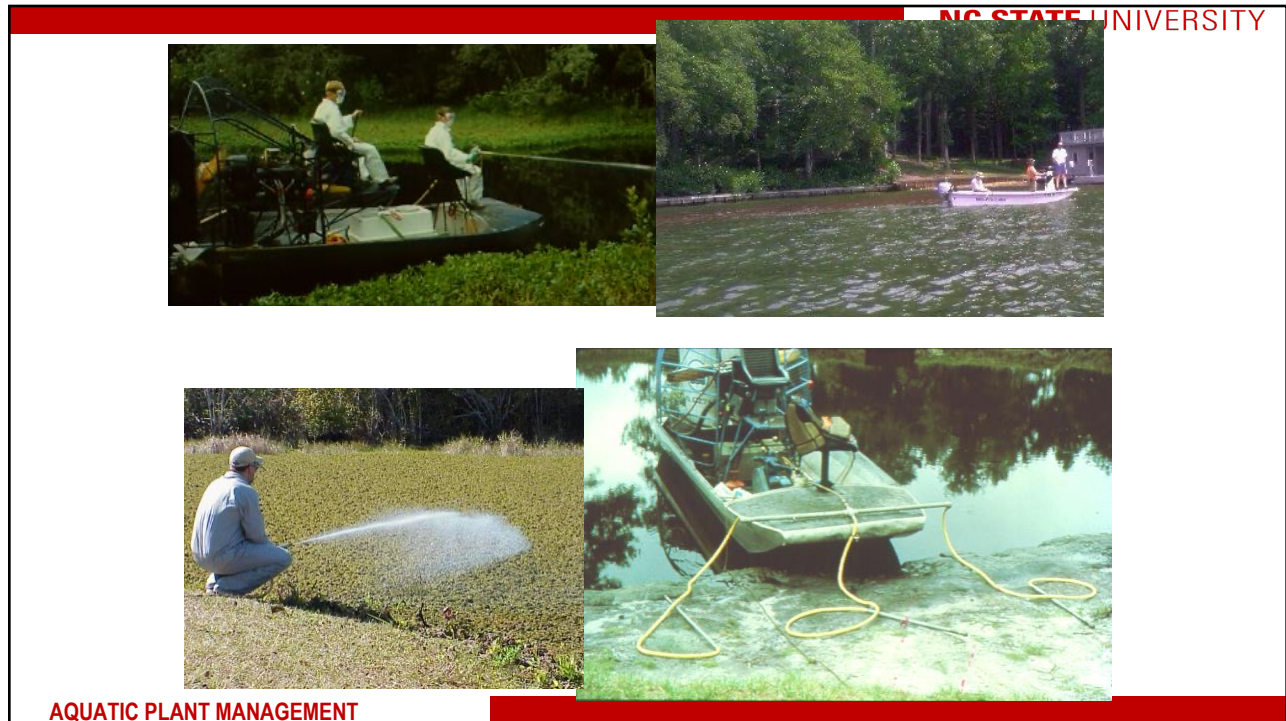
Factors Influencing Aquatic Weed Control

- Thermal Stratification
 - Drop hoses
 - Handgun
 - Pellet formulations
- Water movement
 - Slow release formulations
 - Metered/sequential applications
- Growth stage/time of year/plant maturity
- Adequate herbicide coverage/distribution



Aquatic Herbicide Application Techniques

- Direct pouring of undiluted or (preferably) diluted product into the water
- Surface application (spraying over surface)
- Foliar application (for emergent vegetation)
- Dilute injection beneath water's surface
- Direct metering into water column
- Granular spreader (centrifugal or blower)



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Hillsborough:
before and
after
treatment



August conditions at Pleasant Green: 2011 before management (top)
and 2016 post two years of treatment (bottom)

Accurate Plant Identification is Key

- Native or exotic?
- Understand plant growth potential
- Determine appropriate control methods
- Accurately quantify species diversity



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Common Aquatic Plant Species in the Carolinas

Emergent		Floating Leaved		Submersed	
Creeping Water Primrose	<i>Ludwigia hexapetala</i>	Duckweed	<i>Lemna spp.</i>	Hydrilla	<i>Hydrilla verticillata</i>
Alligatorweed	<i>Alternanthera philoxeroides</i>	Watermeal	<i>Wolffia spp.</i>	Elodea	<i>Elodea canadensis</i>
Water Willow	<i>Justicia americana</i>	Mosquito Fern	<i>Azolla caroliniana</i>	Brazilian Elodea	<i>Egeria densa</i>
Parrot Feather	<i>Myriophyllum aquaticum</i>	Spatterdock	<i>Nuphar lutea</i>	Bladderwort	<i>Utricularia spp.</i>
Dayflower	<i>Murdannia keisak</i>	Fragrant Waterlily	<i>Nymphaea odorata</i>	Coontail	<i>Ceratophyllum demersum</i>
Rushes	<i>Juncus spp.</i>	American Lotus	<i>Nelumbo lutea</i>	Fanwort	<i>Cabomba caroliniana</i>
Sedges	<i>Carex spp.</i>	Watershield	<i>Brasenia schreberi</i>	Milfoils	<i>Myriophyllum spp.</i>
Cattail	<i>Typha spp.</i>	Floating Hearts	<i>Nymphoides spp.</i>	Tape Grass	<i>Vallisneria americana</i>
Lizard's Tail	<i>Saururus cernuus</i>	Pondweeds	<i>Potamogeton spp.</i>	Naiads	<i>Najas spp.</i>
Pickerelweed	<i>Pontederia cordata</i>				

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COMMON EMERGENT SPECIES

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American Water Willow*Justicia americana*

NATIVE



Reproduces by
flowers, rhizomes

Jointed, strong stems



Leaves elliptic, linear

Opposite leaf arrangement

Purple, bilateral flowers



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COMMON EMERGENT SPECIES IN NC

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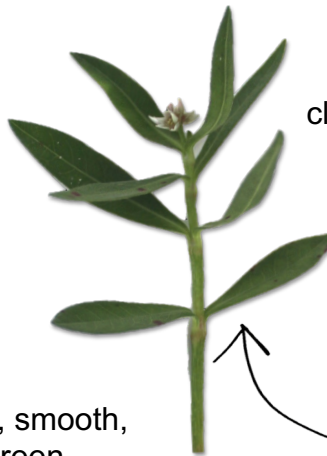
Alligatorweed*Alternanthera philoxeroides*

NON-NATIVE

leaves elliptic, entire



stems hollow, smooth,
pink or green



opposite leaf arrangement

clover-like, papery
inflorescence



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Creeping Water Primrose

Ludwigia grandiflora spp. *hexapetala*

NON-NATIVE



Leaves lanceolate or ovate depending on growth stage (vegetative/flowering)



Alternate leaf arrangement



Flower yellow, 5-petaled