

Approaches to Invasive Species Control



Aquatic Nuisance Species
Program

Pond Management– What's your goal?

- Recreational fishing
- Swimming & boating
- Wildlife habitat / aesthetics
- Livestock water supply
- Aquaculture
- Storm water management



Basic Types of Control

- Biological – living organisms; pathogens, insects, fish.
- Chemical – specially designed and approved herbicide products.
- Physical – mechanical devices; cookie cutters, harvesters, rakes, etc; lake level manipulation; drawdowns.
- Integrated – one or more of the above



Aquatic Plant Control – Physical

- Benthic barriers
- Drawdown
- Mechanical removal
- Dredging
- Dyes

Mechanical Harvesters



Mechanical Harvesters

- Advantages

- Site selective control
- Removes plants from water
- Immediate relief of problem plants
- Perceived as environmentally safe

- Disadvantages

- Very expensive (\$600-1,000/ac)
- Provides only short-term control
- Spreads plant fragments
- Captures fish and other aquatic organisms
- Extremely slow (1-2 ac./day), so limited control
- Requires disposal site



Lake Level Drawdowns



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Drawdowns

- Advantage
 - Proven effective on some submersed vegetation
 - Provides moderate to long-term control
 - Controls plant growth over a large area
 - Very inexpensive (little or no cost)
- Disadvantages
 - Limits recreational uses (boating and swimming)
 - Impairs homeowner access to lake or pond
 - May require removal of larger boats from pond
 - Requires advanced planning



Sterile Grass Carp - *Ctenopharyngodon idella*



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Sterile Grass Carp

- Advantages

- Long-term control
- Relatively inexpensive (\$60-90/ac initial; \$12-16/ac after 5 years)
- No water use restrictions
- Can control plant growth over large areas
- Do not reproduce

- Disadvantages

- Slow control response
- Impact non-target plant species
- Difficult to regulate amount of control
- Cannot control feeding location
- Difficult to contain in water body



Alligatorweed Flea Beetle - *Agasicles hygrophila*



Alligatorweed Flea Beetle

- Advantages

- Long-term control
- Relatively inexpensive
- No Impact to non-target plant species
- No water use restrictions
- Can control plant growth over large areas

- Disadvantages

- Slow control response
- Difficult to regulate amount of control
- Cannot control feeding location
- Can be killed off by colder temperatures



Aquatic Plant Control – Chemical



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Aquatic Plant Control – Chemical

- Identify the problem plant
- Use only EPA registered and approved products
- Read and follow all label directions
- Timing
 - late spring, early summer
- Temperature
 - Over 65°
- Retreat?

Aquatic Herbicides

- Advantages

- Effective on a range of plants
- Provides site selective control
- Limited water use restrictions
- Most are approved for drinking water supplies
- Can control relatively large areas (~80 ac/day)

- Disadvantages

- Controls some non-target species
- May be toxic to fish
- Some are slow acting
- Control level variable
- Limited effectiveness in deep water (>6 ft)



Water Use Restrictions

(For the treated area of the lake or pond)

Common Name	Human Use			Livestock	Irrigation	
	Drinking	Swimming	Fish	Watering	Turf	Crops
copper sulfate ²	0	0	0	0	0	0
copper complexes	0	0	0	0	0	0
2,4-D	*	*	*	*	*	*
diquat	2-3	0	0	1-3 ³	2-3	5
endothall ⁴	7-25	1	0	7-25	7-25	7-25
glyphosate ⁵	0	0	0	0	0	0
fluridone ⁶	0	0	0	0	7-30	7-30
triclopyr	#	0	0	0	0 ⁷	120 ⁸
imazapyr	@	0	0	0	120 ⁹	120 ⁹
SCP	0	0	0	0	0	0



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Recent Advancements in Herbicides



Recent Advancements in Herbicides

- Hardball, Sinkerbull - Liquid 2, 4-d
 - \$30-40 per gallon
 - Up to 5 gallons per application (\$200)
- Vs granular
 - \$2.50-3.50 per pound
 - 150-250 lbs per acre per application(\$875)



- **Renovate 3** - triclopyr
- Triclopyr, rapidly enters through the target plant's leaves and stems, interfering with plant metabolism, and providing systemic control of susceptible plant species. The herbicidal power of Renovate impacts most dicot (broadleaf) plants, while having little to no impact on most monocots (grassy type species), providing an excellent tool for aquatic ecosystem restoration programs.
- Renovate carries no restrictions on recreational use such as swimming and fishing, or on livestock consumption of water from the treatment area. Renovate can be used near active potable water intakes.



- **Galleon SC** - Penoxsulum
- Key target aquatic weed species: hydrilla, water hyacinth, water lettuce, salvinia species, frog's bit and duckweed.
- Multiple forms of application give flexibility to choose best management option:
- Injection for large-scale, in-water treatment of submersed and floating species
- Foliar sprays via ground, boat, or aerial application for targeted treatments of floating and emergent species
- Direct application to exposed littoral sediment for pre-emergence control following drawdown or other low water events.



- **Clearcast - Imazamox**
- Cost - \$175 per gallon
- **Recommended Rates – Cattails**
- 64 ounces/acre broadcast
- Use rates 32-64 ounces/acre broadcast
- 1% solution spot spray
- **Recommended Rates – Chinese tallow**
- 64 ounces/acre broadcast
- 2% v/v solution spot spray
- 50% v/v solution hack & squirt
- 50% v/v solution cut stump



- **Clearcast Benefits**
- Applications can be made near desirable hardwood vegetation
- Controls the entire plant, including root system
- Minimal soil residual allows for re-colonization of desirable species
- Minimal irrigation restrictions
- Labeled for golf course waters used for irrigation



Integrated Control



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Common Problems



DUCKWEED

Scientific Name - *Lemna minor*

Common Name – Duckweed

Distribution and Habitat

Duckweed is found statewide but most commonly in the piedmont, midlands and coastal plain. It thrives in quiescent ponds and backwaters where little water movement is present. The rapid rate at which duckweed can reproduce may result in total coverage of the pond's surface in a short period of time. It is often associated with ponds having high levels of organic nutrients such as those found in livestock or swine feed lots or waste treatment facilities.

Duckweed is a very small floating aquatic plant, usually light green in color. The individual leaf or frond of duckweed is oval or elliptic in shape, 1/10 to 1/8 inch long and less than 1/10 inch wide. These may be solitary or in groups of 2-4. Each frond has a small hair-like rootlet extending beneath it 1/8 to 1/4 inch in length. This small plant is sometimes mistaken for algae.



Recommended Control Methods

1. Diquat

Product Name: Reward/Weedtrine D/Aqua-Clear

Approximate Cost: \$90.00 - \$100.00/gal.

Application Rates: 1-2 gal./surface acre

Application Methods and Tips: Early detection and treatment will result in more successful control of duckweed. Diquat must be applied as a spray application to duckweed. The herbicide should be mixed with enough water to ensure even coverage of the treatment area. Higher rates will be required in situations of dense growth. It is often difficult to effectively target all the plants with a single treatment, therefore follow-up applications may be necessary at 14 day intervals. This herbicide should not be applied in muddy water as it will be inactivated. Certain water use restrictions apply to the use of this herbicide.



Recommended Control Methods

2. Fluridone

Product Names: Sonar As/Avast

Approximate Cost: \$275.00 - \$300.00/qt.

Application Rates: .50 - 1.25 qts/surface acre

Application Methods and Control Tips: Sonar AS is labeled for the control of duckweed when applied as a surface spray. Plants may not show evidence of herbicidal exposure for four to twelve weeks after treatment. This product should not be applied to ponds with short retention times (high volume turnover). Sonar AS should be mixed with enough water to ensure uniform coverage of the area to be sprayed.



FRAGRANT WATER-LILY

Scientific Name - *Nymphaea odorata*

Common Name - White water-lily

Distribution and Habitat

This aquatic species is found statewide but most frequently in the upper and lower coastal plain. Water lilies prefer older established ponds with thick organic "muck" or silt bottoms. It may be found rooted in depths of six to eight feet in clear water conditions, although generally thrives in shallower waters. The prolific nature of this plant often causes considerable problems.

The water lily is a rooted aquatic species possessing a single, large heart-shaped leaf 6"-10" wide which lies flat on the water surface. The plant is supported by a long fibrous stem and is rooted by means of a thick, fleshy rhizome buried within the bottom sediments. Numerous leaf veins radiate out from the point of attachment of the stem on the underside of the leaf. The plant produces a fragrant, white flower 3"-5" wide during the warmer months.



Recommended Control Methods

1. Granular 2, 4-D

Product Name: Aqua-Kleen/Riverdale/Weedtrine II

Approximate Cost: \$1.80/lb - \$90.00/50lbs.

Application Rates: 100 - 150lbs/acre

Application Methods and Tips: Granular 2, 4-D is most effective against water lilies during early season growth before the plants mature. The product should be applied in a broadcast fashion by the use of a fertilizer or seed spreader to ensure uniform coverage of the treatment area. Control will generally be confined to those areas where the herbicide is applied. Higher rates will be required in areas of dense growth, water greater than five feet deep or ponds with a short retention time (high volume turnover). Care should be exercised when treating heavily vegetated ponds to prevent oxygen depletions due to decomposing plants. No more than one-third of the pond should be treated at once, allowing 14-21 days between applications. Certain water use restrictions apply to the use of this herbicide.



Recommended Control Methods

2. Fluridone

Product Names: Sonar AS/Sonar 5P/Avast

Approximate Cost: liquid \$300.00/quart - granular \$600.00/40lbs.

Application Methods and Control Tips: This product should not be applied to ponds with short retention times, (high volume turnover). Sonar AS should be mixed with water (1 qt to 30 gals. water) and applied evenly over the treatment area. Sonar 5P may be broadcast by the use of a fertilizer or seed spreader to ensure even coverage. Best results are obtained when plants begin active growth in the spring. Herbicidal affects may not be noticeable until 6-12 weeks after treatment.

Application Rates:

Average water depth	Liquid	Granular
Less than 3 feet	.50 - .75 quarts/acre	10 - 15 lbs/acre
3 feet - 5 feet	.75 - 1.0 quarts/acre	15 - 20 lbs/acre
Greater than 5 feet	1.0 - 1.5 quarts/acre	20 - 30 lbs/acre



ALLIGATORWEED

Scientific Name - *Alternanthera philoxeroides*

Common Name: Alligatorweed/Gator Grass

Distribution and Habitat

It is a very aggressive plant and will grow where wet or moist conditions exist. It often forms dense mats which impair access and use of a water body.

Alligator weed is a creeping vine-like plant whose stem may reach 4 feet in length. The leaves and ends of the stems are generally emergent but lower portions of the stem may be submerged, where they root extensively. These stems are hollow, 1/4 inch or less wide and vary from dark green to pink or dull reddish-purple. The leaves of alligator weed are located opposite one another on the stem.



Recommended Control Methods

1. Glyphosate:

Product Name: Rodeo/Eagre/Glypro

Approximate Cost: \$50.00 per gallon

Application Rates: 6 pints/acre as a broadcast spray or as a 1 1/4 percent solution with hand-held sprayer

Mixing rates for 1 1/4% spray solution

Desired Volume	Amount of Glyphosate
1 gallon	1.60 ounce
25 gallons	1.25 quarts
100 gallons	5.00 quarts



Recommended Control Methods

2. Imazapyr:

Product Name: Habitat

Approximate Cost: \$135.00/gallon

Application Rates: 24 to 96 ounces/acre as a broadcast spray or as a 1 percent solution with hand-held sprayer.

Mixing rates for 1 % spray solution

Desired Volume	Amount of Habitat
1 gallon	1.30 ounce
25 gallons	1.00 quarts
100 gallons	1.00 gallons.

