Clearcast™ Herbicide Technical Information

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- Clearcast received its full section 3 label in April of 2008

- In 2003 imazamox received an exemption from tolerance designation from the US EPA, <u>It is the only organic herbicide that is exempt from all tolerances.</u>

- No restrictions on fishing, swimming, drinking, and no live stock watering restriction

- No irrigation restrictions when residues fall below 50 ppb

- Labeled for use on golf course irrigation ponds with a 24 hour irrigation restriction

History and Development

- **Clearcast** is part of the imidazolinone family of chemistry; discovered in 1969.
- Imazamox, the active ingredient in **Clearcast,** was first approved for use in 1997 on soybeans and is currently used on 15 different crops on a global basis.
- BASF has conducted its aquatic research in conjunction with University Cooperators, US Army Corp of Engineers and consultants.
- Excellent results have been achieved with foliar treatments on floating and emergent species.

Clearcast Herbicide Formulation

- **Clearcast** is a liquid (water based) formulation containing 1.0 pound of active ingredient per gallon of product
- **Clearcast** does not contain a surfactant
  - Foliar applications require the addition of an appropriate adjuvant for aquatic sites
- **Clearcast** is non-volatile and does not contain any petroleum solvents

Clearcast Application Tips

- Good coverage is important for optimal control
- Surfactant is always required for emergent and floating species
- For best results, use a MSO or MSO/silicone blend
- Applications can be made around desirable hardwood vegetation

Mode of Action

- **Clearcast** inhibits a plant specific enzyme (AHAS) that is essential to the production of three amino acids.
- Sensitive plants stop growing within 24 hours after treatment and then slowly senesce as food and energy reserves are exhausted. Speed of senescence will vary with plant size and growth habit.
- **Clearcast** is quickly absorbed by plant foliage and translocated throughout the plant where it concentrates in the actively growing portions of roots and shoots. This characteristic enhances the long term control of many perennial plant species.
- For foliar applications **Clearcast** is rainfast within one hour.

Environmental Fate-
Water and Sediment/Soil

Water:

- The primary means of dissipation in water is via dilution and photolytic breakdown
- Photolytic breakdown in water results in a 10 to 14 day half life
- Photolytic half life will vary based on water clarity, depth, vegetative cover and light intensity
- **Clearcast herbicide** does not bioaccumulate in aquatic organisms

Sediment/Soil:

- **Clearcast herbicide** does not partition into or accumulate in the hydrosoil/sediment
- Under aerobic soil conditions (terrestrial), **Clearcast** is degraded by soil microorganisms
- The half life of **Clearcast** in soil is approximately 12-days, depending on environmental and soil conditions

Shoreline

&

Wetland Restoration

Floating, emergent, and shoreline weeds and brush

- Water hyacinth
- **Frogbit**
- **Water shield**
- **Water lily**
- Alligator weed
- Primrose
- Common salvinia
- **Lotus**
- **Parrotfeather**
- Water four leaf clover
- **Water Chestnut**

- **Pennywort**
- Pickerelweed
- **Smartweed**
- **Spatterdock**

- **Cattail**
- **Phragmites**
- **Purple Loosestrife**
- Giant reed- arundo
- Chinese tallowtree
- Brazilian pepper tree

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Purple Loosestrife Control (9 MAT) 32 oz/A

Water Hyacinth
6 weeks after treatment

Untreated

Clearcast 16oz/A

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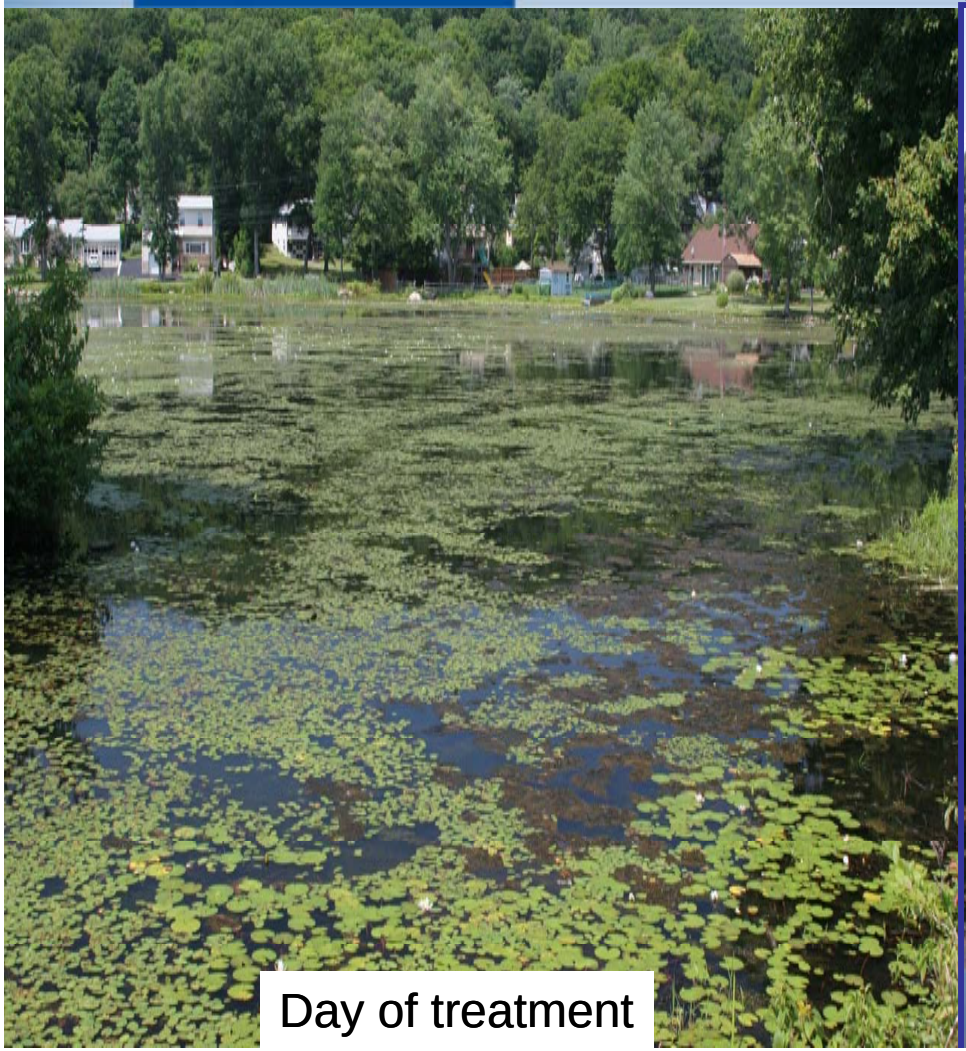
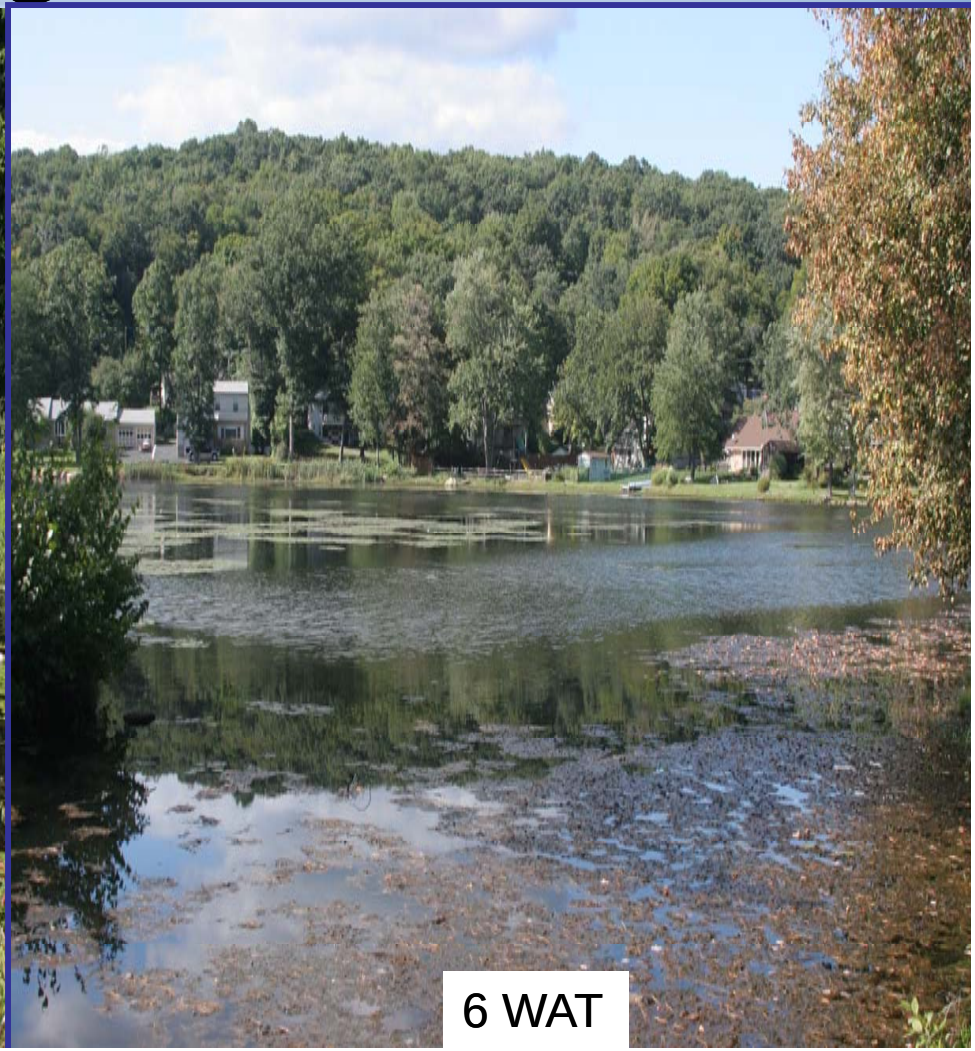
Watershield @ 64oz/ac + 1% MSO



Day of treatment



6 WAT

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Wild Taro 2% + 0.5% MSO

8/27/08 - DAT

9/03/08 – 1 WAT

10/27/08 – 9 WAT

1/08/09 – 19 WAT (almost 5 months)

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Common Salvinia in Louisiana
64 oz/A + MSO/silicone blend 1% v/v

6 months after treatment

Submerged plant work

- Florida Fish and Wildlife is currently using operationally as a **P**lant **G**rowth **R**egulator
- BASF is exploring Clearcast® as **PGR** on northern aquatic species (trials needed)

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Cattail
9 months after treatment - 32 oz/A

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Aerial Broadcast Application

Clearcast at 64 oz/A + MSO 32 oz/A (fall 2007)

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Year after application

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Cattail, Sedge and Alligatorweed 25 days after treatment - 0.5% v/v Red maple tolerance at 64oz/A

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Cattail, Sedge and Alligatorweed
63 days after treatment - 0.5% v/v

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Trees showing tolerance to Clearcast

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Species listed are results from research conducted by Jack Whetstone, Clemson University

- **Red Mulberry - *Morus rubra***
- **Salt bush, Groundsel-tree – *Baccharis halimifolia***
- **Wax Myrtle – Myrica cerifera**
- **Loblolly Pine - *Pinus taeda***
- **Southern Red Cedar - *Juniperus silicicola***
- **Sugarberry - *Celtis laevigata***
- **Bald Cypress - *Taxodium distichum***
- **Elm Species – *Ulmus spp.***
- **Chinaberry tree - *Melia azedarach***
- **Black Willow - *Salix nigra***
- **Live Oak - *Quercus virginiana***

Cypress Screening (LSU Sanders)

Study conducted by Dr. Dearl Sanders at Louisiana State University shows the tolerance of foliar applied Clearcast to cypress seedlings from rates ranging from 64oz/A to 4oz/A.

Aerial (helicopter) trial in South Carolina

- June 2006, helicopter application at 10 gpa
- Treated with Clearcast at 64 oz/A + 1% MSO
  - Targeted phragmites
  - Site had a mixed stand of hardwoods including

Selective Chinese Tallowtree and Phragmites Control

Aerial application of Clearcast applied over the top of desirable hardwoods.

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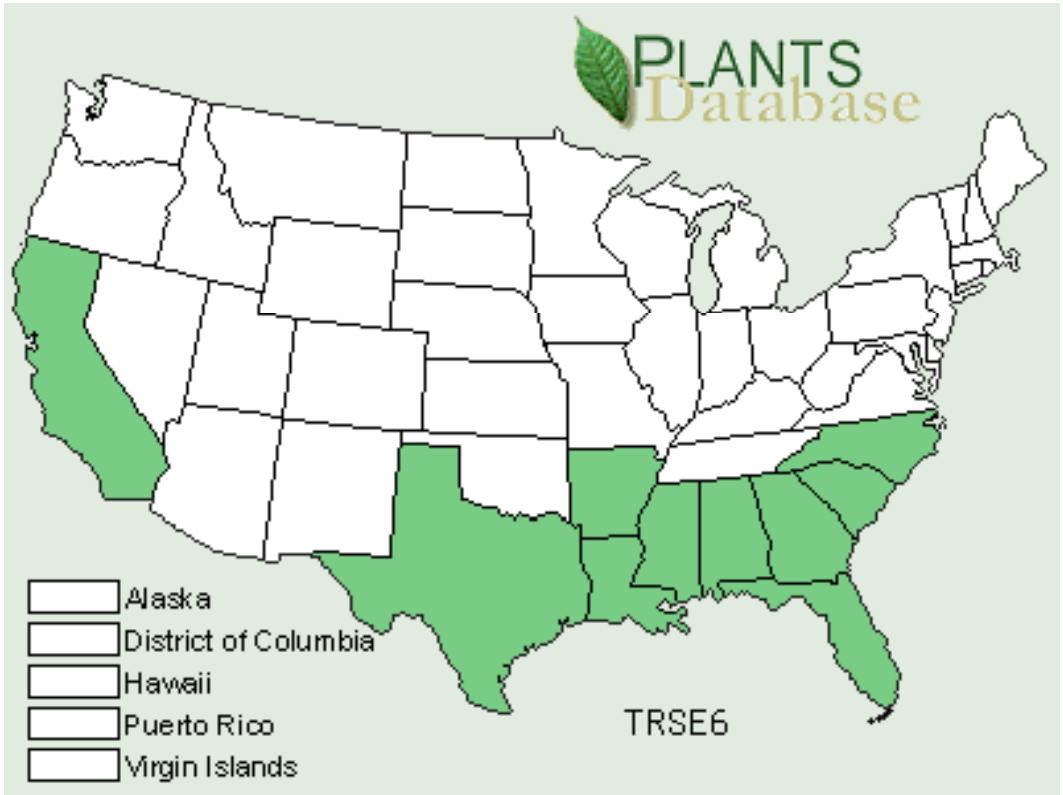
Chinese tallowtree control

- Highly invasive woody plant found in coastal states from North Carolina to Texas
- Selective control in hardwoods is difficult
  - Requires individual plant treatment



Initial discovery

- 4-19-06, Houma, LA: Clearcast at 0.5% was applied to mixed brush and hardwood species using a handgun delivering 50 gpa
  - *Broadcast rate equivalent to 32 oz/A (0.25 lb ai/A)*
  - *Included 1% methylated seed oil (MSO)*
- Although limited woody plant activity was anticipated, a single Chinese tallow tree was highly affected

Tallow tree and water oak at application 4-19-06

Initial symptoms on tallow

June 26, 2006 (10 weeks after treatment)

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- Clearcast at 48 oz/A
- Excellent selectivity on oak and cypress
  - Some leaf yellowing noticed on willow oak
  - Leaf burn noticed during application year on cypress
  - Full recovery 10 MAT
- Control of tallow estimated at 90% 10 MAT with additional mortality anticipated

Tallow tree / Hardwood screening Lafayette, LA

- Clearcast at 0.5% + 1% MSO
  - Handgun app.
- 45 days after treatment
- Control of Chinese tallow tree in sensitive sites

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Recommendation for Control

- Clearcast at 48 oz/ac
- Applied by air or by ground
- Burn the site if applicable
- Once the seeds germinate and the plants get 3-4 ft tall, either spot treat or broadcast spray the site again with Clearcast

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Tallow trees and Tallow seed banks

Botanical Inventory Results

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Summary

Control

- Highest overall diversity but lowest occurrences of native species due to tallow infestation.

32oz/acre Clearcast

- High herbaceous diversity (27 species were encountered), but the density was low due to the lack of *Rubus spp.* suppression

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Botanical Inventory Results

48 oz/acre and 64 oz/acre Clearcast

- **maintained the species diversity (26 species and 29 species were encountered respectively) and high density of some desirable herbaceous and grass species including Downy Milkpea *(Galactia macreei),* Meadowbeauty *(Rhexia virginica),* Pale Meadowbeauty *(Rhexia mariana*), Fuzzy Bean *(Strophostyles spp.),* Bushy Bluestem (*Andropogon gloweratus*), Little Bluestem (*Schizachyrium scoparium)*, Panicgrass *(Panicum spp.),* and Witchgrass *(Dicanthelium spp.***




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Botanical Inventory Results

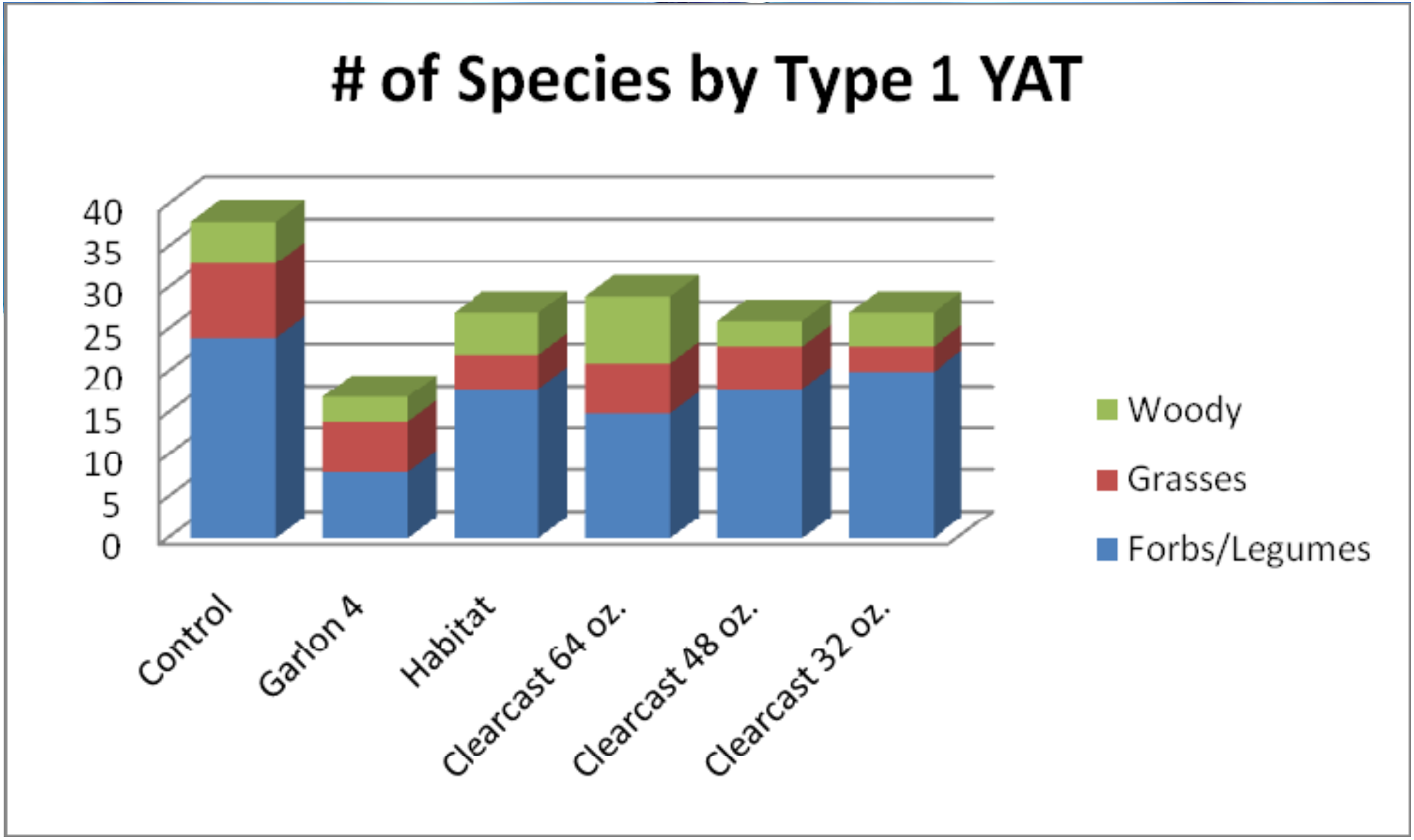
Habitat

- Drastically reduced the woody species, little long-term damage to the composition of herbaceous growth (27 total species were encountered).

- In addition, this treatment suppressed the “weedy” grass species from the treatment area including Bahia **(***Paspalum notatum***)** and Vaseygrass (*Paspalum urvillei*), but did not inhibit NWSG growth.

Garlon 4

- Exhibited the greatest decrease in plant diversity (17 species were encountered) in relation to the control, but the woody and broadleaf suppression allowed for the greatest release and the growth of NWSG.



# of species present by type at 1 year after treatment, derived from a botanical survey of the site.

Conclusion

- We only have a few products to use in aquatics; therefore, it is important to understand how each one works and behaves in the environment.
- Read and understand the label.
- Help to steward these products so we can help steward the aquatic environment.