Evaluation of Herbicides for Controlling Alligator Weed (*Alternanthera philoxeroides*) and Restoring Native Plants at Eufaula National Wildlife Refuge

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ALLIGATOR WEED (*Alternanthera philoxeroides*)

- Native to South America
- Perennial herb
- Vegetative reproduction
- Forms thick, interwoven mats

ALLIGATOR WEED

- Reduces **light penetration**
- Reduces gaseous **exchange**
- Reduces waterway **drainage**
- Displaces **native** plants

EUFAULA NATIONAL WILDLIFE REFUGE

- Northern portion of Walter F. George impoundment of the Chattahoochee River
- 2,300 hectares of open water and **managed wetlands**

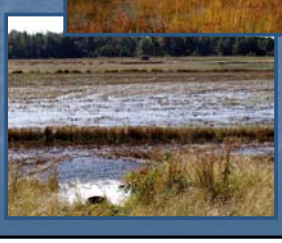
- Refuge objectives include providing **food and habitat for waterfowl and other birds**, including endangered species such as wood storks (*Mycteria americana*) and threatened species such as bald eagles *(Haliaeetus leucocephalus)*

MOIST-SOIL MANAGEMENT

- Maintenance of moist-soil conditions during growing season to:
  - **Promote growth** of desirable vegetation
  - **Control** undesirable vegetation
  - Provide **food** and **habitat**

MOIST-SOIL MANAGEMENT

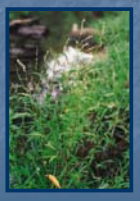
- Gradual **removal** of water from wetland in **spring** to moist soil conditions
- **Flooding** of wetland in **fall** to a depth less than 6 inches



NATIVE WETLAND PLANTS

- Sedges (*Cyperus* spp.)
- Rushes (*Rhynchospora* spp.)
- Beggar tick (*Bidens* spp.)
- Smartweeds (*Polygonum* spp.)






EUFAULA NATIONAL WILDLIFE REFUGE

- ENWR has attempted **control strategies** such as burning, discing, water-level management, mowing, biological control and numerous herbicides
- **ALLIGATOR WEED** dominates many of the managed wetlands

NORTHERN SHOVELER (*Anas clypeata*)

CHEMICAL CONTROL

- **Renovate®**
  - Triclopyr amine
  - SePro Corporation
  - Approved November 2002
  - Selective for dicots
  - Little bioaccumulation in environment
- **Habitat®**
  - Imazapyr
  - BASF
  - Approved December 2003
  - Broad spectrum (favors legumes)
  - Leaks from roots/ persistent in soil

OBJECTIVES

- **Objective 1**
  - Determine the rate and timing of RENOVATE and HABITAT application that is most effective at controlling alligator weed
- **Objective 2**
  - Determine the rate and timing of RENOVATE and HABITAT application that is most effective at restoring native wetland plants

PREDICTIONS

- Best **control** of alligator weed will occur at the **highest** application rates and at the **latest** application dates.
- Best **restoration** of native plants will occur at the **lowest** application rates and the **earliest** application dates.

METHODS

- **Randomized block design**
  - 4 blocks (15m x 30m)
    - Kennedy Unit (n = 2)
    - Bradley Unit (n = 2)
  - 18 plots/block
  - Experimental plots (5m x 5m)
- **Treatments**
  - 2 herbicides
  - 3 application rates/ herbicide
    - low, medium, high
  - 2 application dates
    - April and July 2004

HERBICIDE RATES

- **Renovate** (935L^{-ha} or 2.4L^{-plot} of water)
  - Low = 4.8L^{-ha} or 12ml^{-plot}
  - Medium = 9.6L^{-ha} or 24ml^{-plot}
  - High = 14.4L^{-ha} or 36ml^{-plot}
- **Habitat** (467L^{-ha} or 1.2L^{-plot} of water)
  - Low = 1.2L^{-ha} or 3ml^{-plot}
  - Medium = 2.4L^{-ha} or 6ml^{-plot}
  - High = 3.5L^{-ha} or 9ml^{-plot}

Rates within range recommended by manufacturer.

TREATMENT APPLICATION

- Herbicides applied with a 2L, CO_2 pressurized backpack sprayer
- 5-nozzle boom

PLANT SAMPLING

- **Quadrat sampling** ($0.5m^2$) ($n = 2$)
- **Pretreatment** (before each application date)
- **Post treatment**: 7, 14, 21 days, and 1, 2, 3 months

PLANT SAMPLING

- **Parameters measured:**
  - Alligator weed density (#stems/quadrat)
  - Alligator weed height (cm)
  - Percent cover of all species encountered
  - Soil moisture/water depth (tensiometer/cm)

GREEN WING TEAL (*Anas crecca*)

PLANT SAMPLING

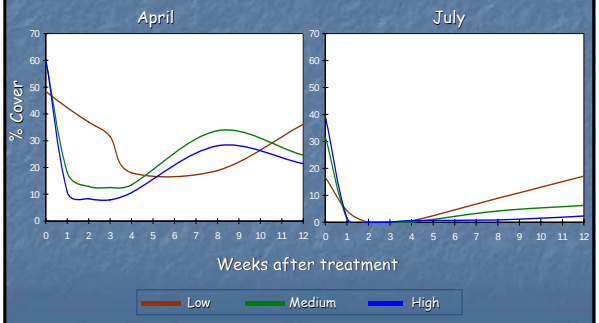
- October 2004
- Alligator weed and native plant biomass collected in subplots ($0.25m^2$) ($n = 2$) and sorted by species
- Plants dried to constant mass and weighed

STATISTICAL ANALYSIS

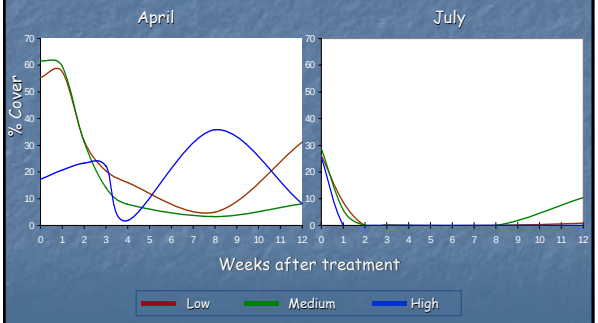
- Differences in plant biomass between herbicides, rates, and application dates were tested using PROC GLM in SAS
- Pretreatment percent cover was not correlated with biomass

AMERICAN ALLIGATOR (*Alligator mississippiensis*)

Percent cover of alligator weed after application of Renovate (triclopyr amine)



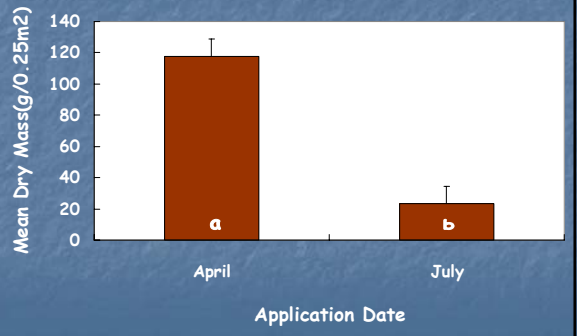
Percent cover of alligator weed after application of Habitat (imazapyr)



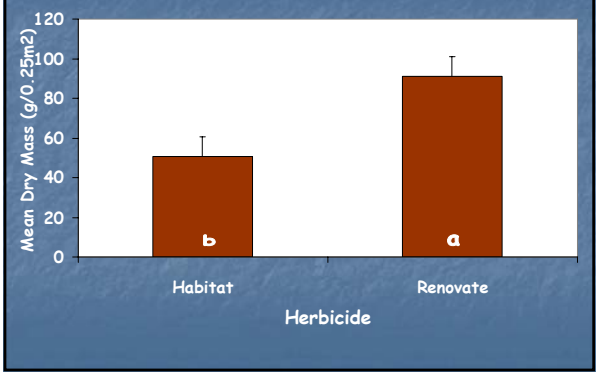
TOTAL PLANT BIOMASS

Variable	F Value	DF	P Value
Herbicide	8.61	1,33	<0.05
Rate	0.27	2,33	N.S.
Application Date	34.90	1,33	<0.001
Herbicide x Rate	0.24	2,33	N.S.
Herbicide x Application Date	0.14	1,33	N.S.
Rate x Application Date	1.23	2,33	N.S.
Herbicide x Rate x Application Date	0.88	2,33	N.S.

TOTAL PLANT BIOMASS



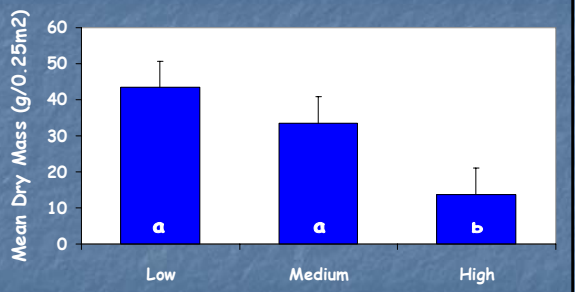
TOTAL PLANT BIOMASS



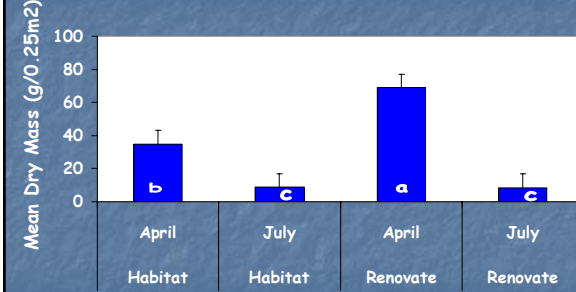
ALLIGATOR WEED BIOMASS

Variable	F Value	DF	P Value
Herbicide	4.02	1,33	0.05
Rate	4.29	2,33	<0.05
Application Date	26.45	1,33	<0.001
Herbicide x Rate	0.03	2,33	N.S.
Herbicide x Application Date	4.07	1,33	<0.05
Rate x Application Date	2.37	2,33	N.S.
Herbicide x Rate x Application Date	0.46	2,33	N.S.

ALLIGATOR WEED BIOMASS



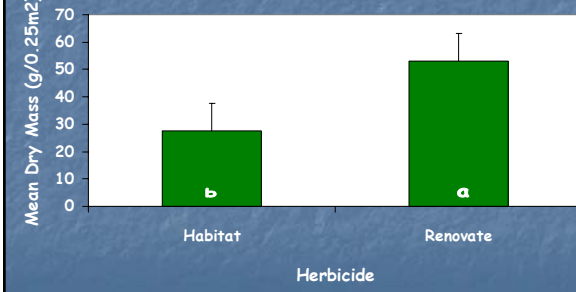
ALLIGATOR WEED BIOMASS



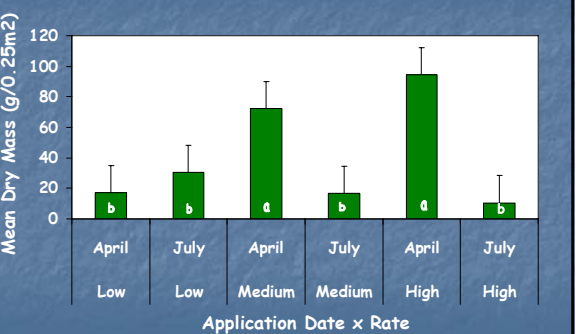
NATIVE PLANT BIOMASS

Variable	F Value	DF	P Value
Herbicide	2.83	1,33	0.1
Rate	1.28	2,33	N.S.
Application Date	7.70	1,33	<0.05
Herbicide x Rate	0.16	2,33	N.S.
Herbicide x Application Date	0.57	1,33	N.S.
Rate x Application Date	3.64	2,33	<0.05
Herbicide x Rate x Application Date	0.31	2,33	N.S.

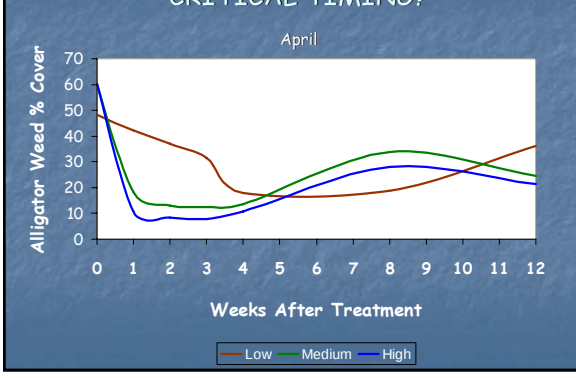
NATIVE PLANT BIOMASS



NATIVE PLANT BIOMASS



REDUCED COMPETITION AND/OR CRITICAL TIMING?



SUMMARY OF RESULTS

- Control of alligator weed:
  - High rate results in better control than medium or low rate
  - July results in better control than April
- Native plant restoration:
  - Renovate results in greater restoration than Habitat
  - April results in greater restoration than July

CONCLUSIONS

- Objectives of wetland managers will influence application of specific herbicide, rate, and timing
  - Seasonal alligator weed control
  - Seasonal native plant restoration

FUTURE WORK…

- Long-term monitoring of treatment plots will enable us to determine appropriate use of herbicides to control alligator weed and restore native wetland plants to managed wetlands at ENWR

WOOD DUCK (*Aix sponsa*)

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