Herbicidal Tolerance and Weed Control of Native Longleaf Understory Species in Nurseries, Seed Production Areas and Out-planting Sites

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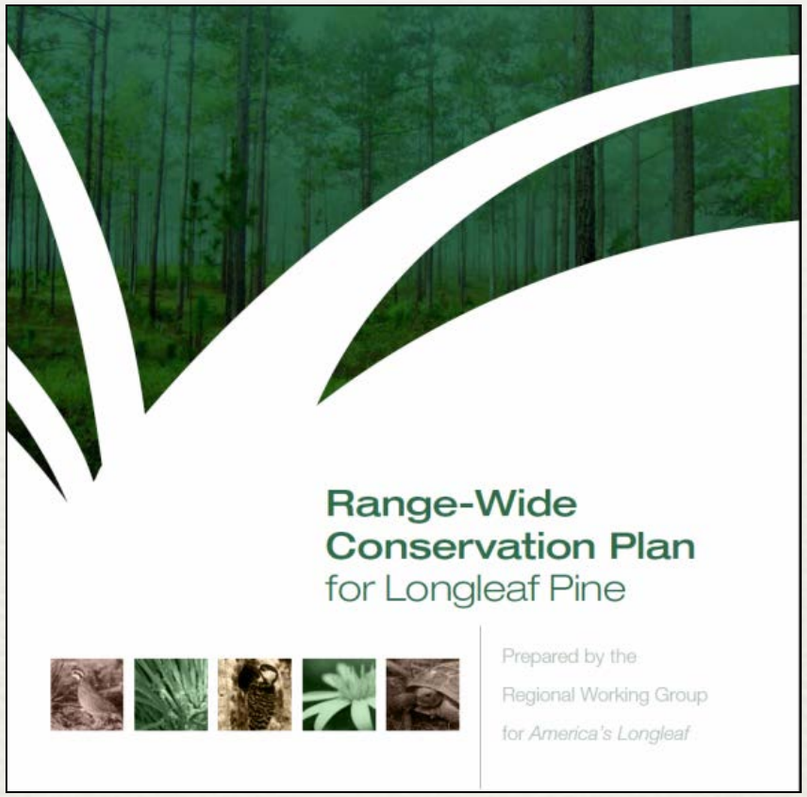
Longleaf Ecosystems

- Longleaf pine once covered 90 million acres of land, but has been diminished to about 3 million acres (nearly 3% of what it once was)
- Longleaf pine ecosystems are some of the most diverse in North America.
  - Numerous vegetative and wildlife species (most diverse ecosystems other than the tropics)

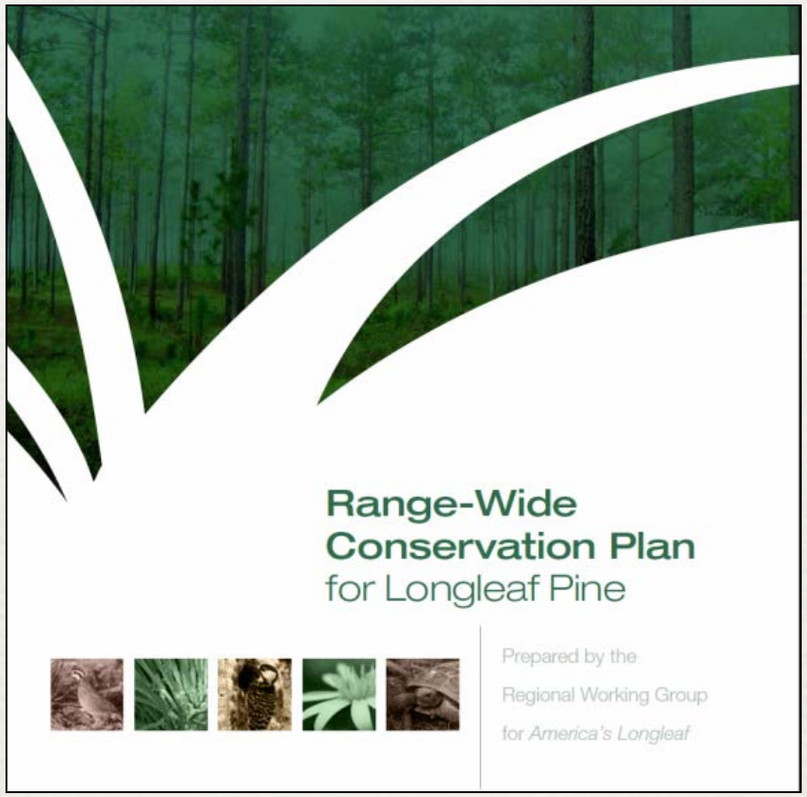
Longleaf Restoration Plan

- Launched in 2009 - Regional Working Group for America's Longleaf
- The 15-year goal for this Conservation Plan is an increase in longleaf acreage from 3.4 to 8.0 million acres.
- The plan calls to:
  - 1) Maintain existing longleaf stands in good condition
  - 2) Improve areas that are classified as "longleaf forest types" but that lack key components such as understory species and communities
  - 3) Restore longleaf pine forests to suitable sites currently in other forest types or land classifications



Identified Research Needs

- Develop the seed and plant production technologies and standards
- Guidance needed to produce understory plant materials
- Identify species important in the ground layer of the longleaf pine communities
- **Goal: to help guide development efforts for commercial production**.



Project Grant

- In 2012, Drs. Scott Enebak, and Paul Jackson and USFS received a grant to evaluate herbicides on the growth and development stages of native longleaf pine understory species.
- The purpose and goals of the grant parallel many of the goals outlined in the restoration plan.

Jackson - Summer 2012 Study

- Dr. Jackson conducted an herbicide tolerance study in Goldsboro, NC
- Tested 4 herbicides on wiregrass and muhly grass.
  - Goal 2XL, Pendulum Aquacap, Stinger, and Cobra.
- Test area: container seedlings in the nursery as well as on the wiregrass seed production area.
- Herbicides were applied at: 2 weeks post sowing and 7 weeks post sowing.

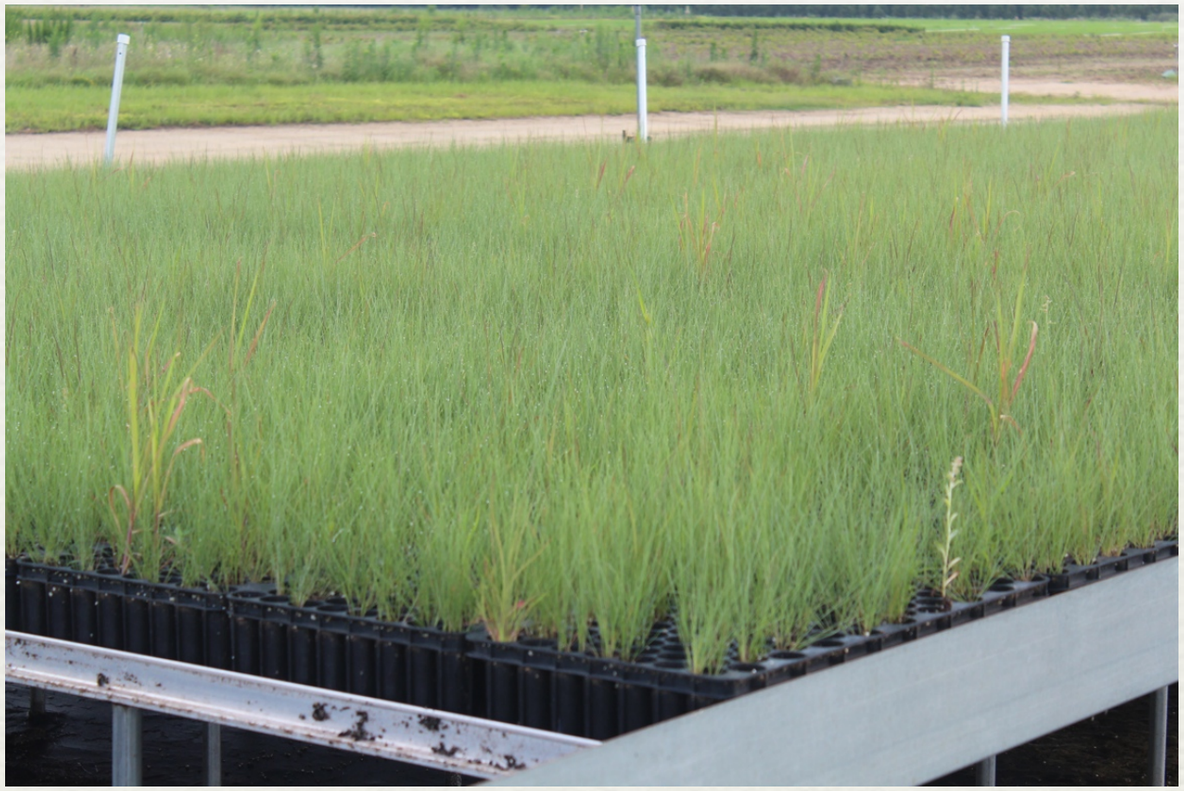
Summer 2013

- I conducted an herbicide tolerance study at the Claridge Nursery in Goldsboro, NC.
- I also tested the herbicide tolerance and weed control on wiregrass and muhly grass plants in seed production areas.
- **Species Tested**: wiregrass (*Aristida stricta*), muhly grass (*Muhlenbergia capillaris*) and Indian grass (*Sorghastrum nutans*)
- Results measured at 2, 3, 4, 6, and 8 weeks post application.

Container Seedlings

Wiregrass

Muhly grass



Indian grass

Herbicide Treatments

Herbicide	Active Ingredient	Low Rate	High Rate
No Treatment (Control)	NA	0	0
Cobra	Lactofen	4 oz/acre	8 oz/acre
Sedgehammer	Halosulfuron-methyl	0.5 grams/acre	1 gram/acre
Goal	Oxyfluorfen	8 oz/acre	16 oz/acre
GoalTender	Oxyfluorfen	12 oz/acre	24 oz/acre
Pendulum Aquacap	Pendimethalin	17 oz/acre	34 oz/acre

Seedling Evaluation Methods

- Wiregrass - 5 reps (containers) / treatment
  - Cobra, Sedgehammer, Goal, GoalTender, Pendulum Aquacap
- Muhly grass and Indian grass - 5 reps (containers) / treatment
  - Cobra and Sedgehammer
- Evaluated using an injury rating (1-9) scale
  - 1= no injury
  - 9= seedling mortality

Seedling Tolerance Results

Wiregrass
8 Weeks Post Application Results

Wiregrass	
GT Low	3.6
GT High	5.2
C Low	1.0
C High	1.0
SH Low	1.0
SH High	1.0
G Low	3.6
G High	5.0
PAC Low	1.0
PAC High	1.0

GT = GoalTender
C = Cobra
SH = Sedgehammer
G = Goal
PAC = Pendulum Aquacap

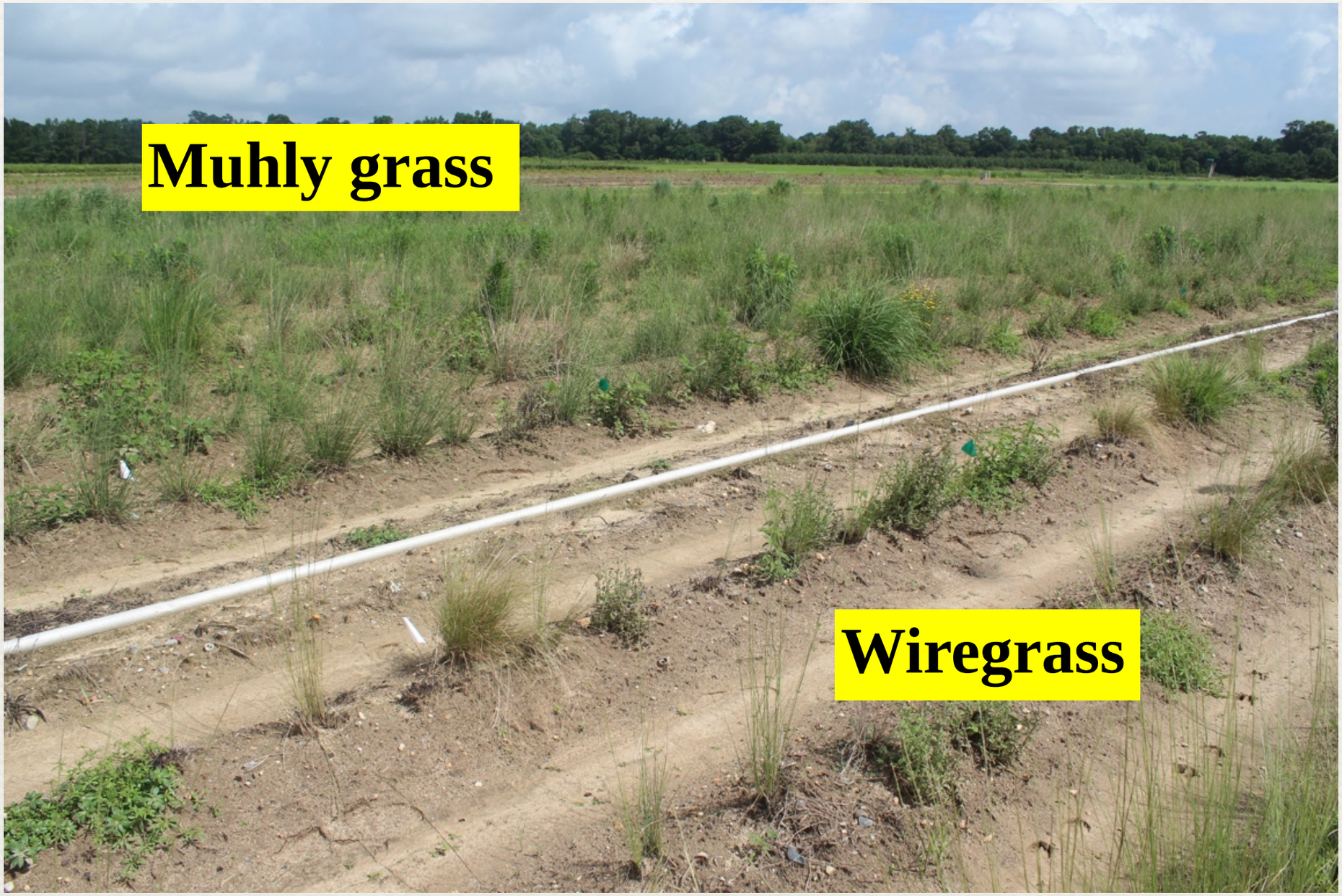
Indian Grass
8 Weeks Post Application Results

Indian Grass	
C Low	1.0
C High	1.0
SH Low	1.0
SH High	1.0

Muhly Grass
8 Weeks Post Application Results

Muhly Grass	
C Low	1.0
C High	1.0
SH Low	1.0
SH High	1.0

Seed Production Area



Seed Production Area: Evaluation and Weed Control Methods

- Low and High rate of each herbicide
- Wiregrass and Muhly grass - 5 reps (10 bed feet) / treatment
  - Cobra, Sedgehammer, Goal, GoalTender, Pendulum Aquacap
- Evaluated using an injury rating (1-9) scale
  - 1= no injury
  - 9= plant mortality

Summary of Results

- None of the herbicides had significant effects on the plants in the seed production area.
- However, neither did any of the herbicides provide adequate weed control.
- The area covered by weeds in the treatments steadily increased throughout the data collection.

2014 Experiments

- 1) Seedling Evaluation Study
- 2) Seed Production Study
- 3) Imazapyr Bioassay Study

1) Seedling Evaluation 2014

- International Forest Company - Moultrie, GA
- Follow-up to the previous seedling studies.
  - The same herbicides will be tested again, but the rates will be adjusted based on the data recorded from this past summer
- Seedling species have yet to be decided

2) Seed Production Study

- Location: Lolly Creek seed production sites near Sumner, GA
- Several understory species will be evaluated for herbicide tolerance, weed control and timing.
  - Herbicides: Oust, Arsenal, AAtrex 4L, and 2, 4-D Amine Weed Killer
- Understory species: Florida Ticktrefoil, Narrow-leaf Sunflower, and Yellow Indian Grass.
- Known weed problems include: morning glory, ragweed, and dog fennel among others.

3) Imazapyr Bioassay

- Quick and easy way to determine the toxicity in soil.
- Indicator plants determine if the herbicide concentration in the soil is safe to sow/plant longleaf.
- Indicator (test) plants: cucumber, tomato, lettuce, cabbage, radish, and sorghum seeds along with longleaf seedlings will be sown/planted in soil that has been treated with imazapyr
- When one of the possible indicator species and the longleaf both germinate and establishes root growth, it is assumed that the imazapyr levels in the soil are low enough to allow longleaf to be planted.

Questions?