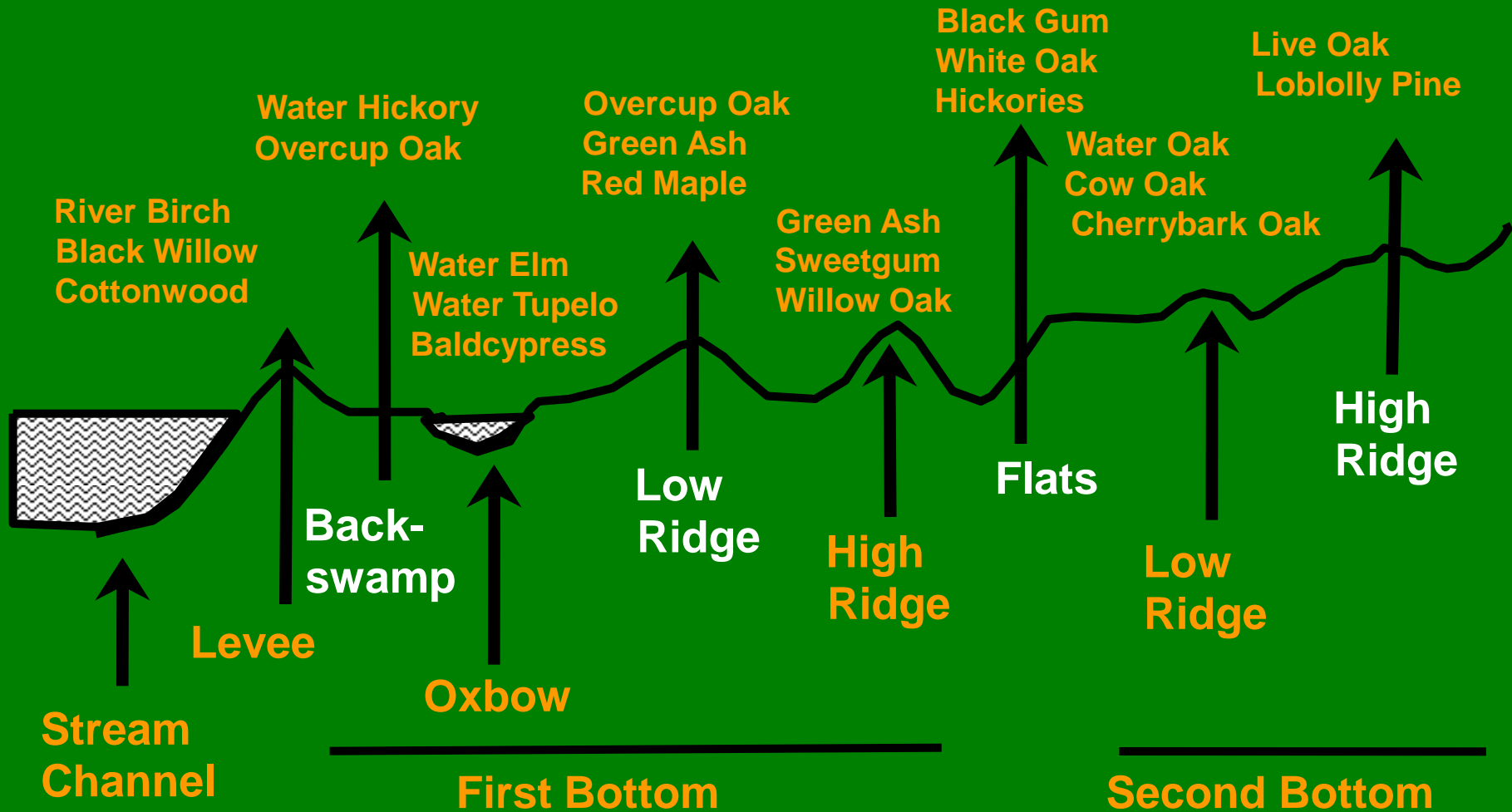


# Seasonally Flooded Hardwood Bottomlands



# Topography and Vegetation



From Conner 1994

# Natural Levee



- ✓ Coarse sediment deposition occurs here
- ✓ Often can be highest point on floodplain

# Oxbows

- ✓ Result from cutoff of meanders
- ✓ Important habitat for fish and wildlife
- ✓ Connectivity to river is important; connectivity varies with river stage
- ✓ Some may fill with sediment; others may be scoured



# Oxbows



- ✓ They are all different
  - ✓ *Water clarity, depth, bank slope, sediment deposition/erosion patterns, hydroperiod, river connectivity, and age (all greatly influence vegetation and animal communities)*
- ✓ Surrounding land use is also important

# Ridge and Swale (latter = depression)



\*Rivers erode along the outside bends & deposit material on the inside

- ✓ Formed as streams migrate across floodplain
- ✓ Deeper swales occur closer to current floodplain
- ✓ Important habitat!

# Restoration of Bottomland Hardwood Forests using High Quality Oak Seedlings from Local Seed Sources

Jason S. Maxedon

Tennessee Wildlife Resources Agency, 297 Big Cypress Road, Greenfield, TN. 38230



# Bottomland Hardwood Restoration

- Subject of considerable interest
- Success considered elusive
- Seedling survival = often low





# Old School

- Issues with Survival & Productivity
- Typically 2 species plantings
  - Results?



Difficult at best to restore *natural hydrology*

- **River & Site Hydrology Alterations**
  - COE, SCS, Neighbors....

# *Keep in Mind*

## **Bottomland Hardwood Loss**

- **Drained and cleared for agricultural production**
- **Only 5.2 million acres present in 1978**
- **4.9 million acres of forested wetlands remained in 1991**



# Forested Wetlands in Tennessee

- Regional and local hydrologic cycles changed due to river dredging and flood control practices by farming operations
- Deforestation and drainage have resulted in a loss of critical wildlife and fish habitat

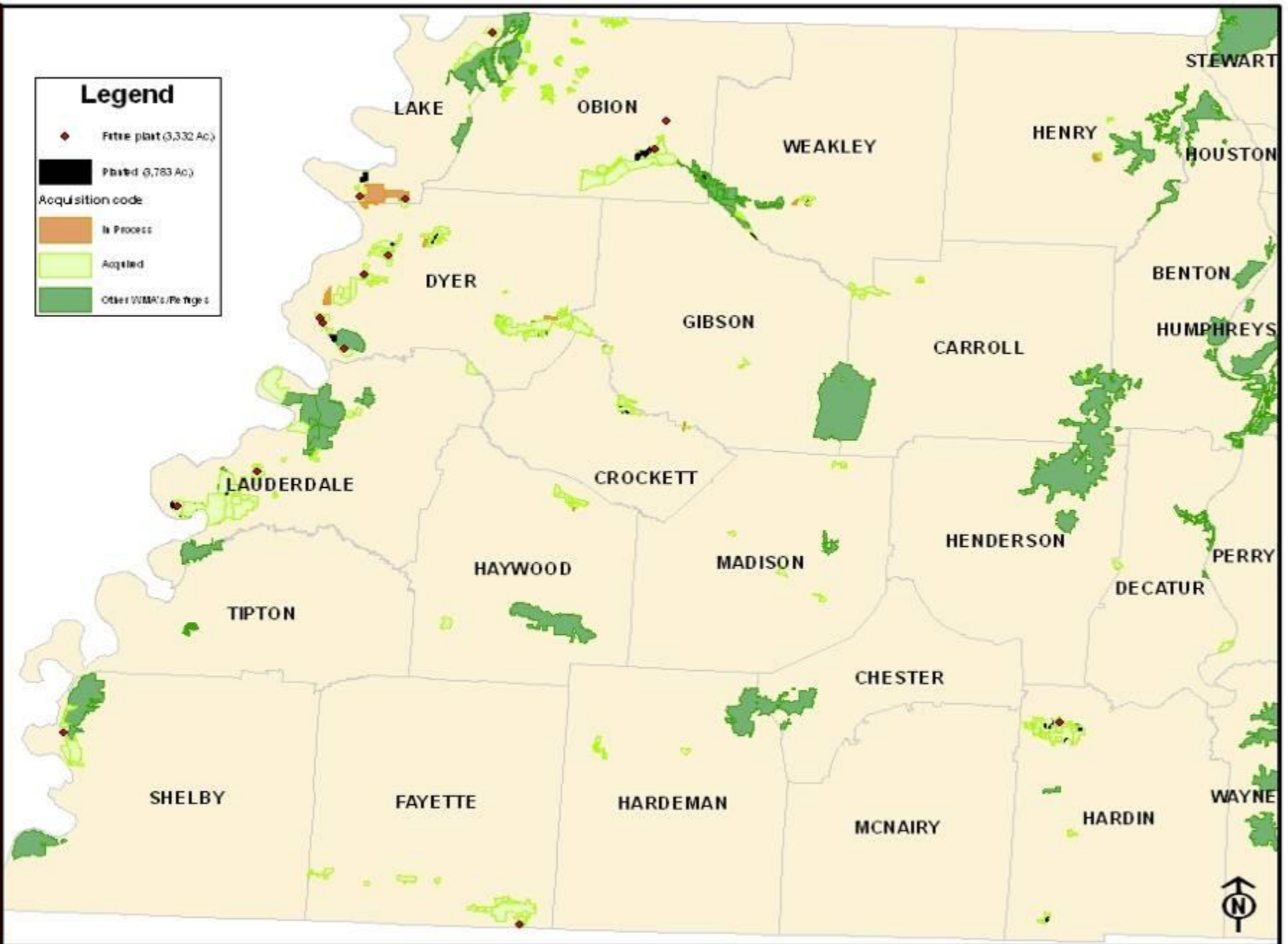


# TWRA'S Efforts To Restore Losses

- Acquiring former bottomland Ag sites for conversion to wildlife habitat
- Initiated planting program in 2000
- Restore altered hydrology
- Match species to site to overcome land alterations



# Refuges and WMAs - Region I West Tennessee



1:250,000



Generated by TWRA G.I.S.  
Lorenda Sharber 5/08

# Need for Restoration on WMA'S

- What do you think?



**TWRA** - adopted policy of using local seed sources for production of high-quality oak seedlings for restoration of forested bottomlands in west Tennessee







# METHODS



# Step 1

- Land Acquisition
- Site Selection

\$\$\$



# Hydrology Restoration

- Historical Aerial Photos
- Plug Drainage Ditches
- Restore Microtopography



# Acorn Collection

- Acorns collected each autumn, starting in 2000
- Collected from naturally occurring trees (**local seed sources**)
  - 9 oak species (willow oak, *Quercus phellos*; water oak, *Q. nigra*; cherrybark oak, *Q. pagoda*; pin oak, *Q. palustris*; nuttall oak, *Q. nuttallii*; overcup oak, *Q. lyrata*; swamp chestnut oak, *Q. michauxii*; bur oak, *Q. macrocarpa*; shumard oak, *Q. shumardii*)



# Superior Trees!



# Acorn Processing

- Seed cleaned
- Float test
- Surface dry
- Store at 36 degrees F until shipping



# Nursery Culture and Processing

- Transported to Georgia, Now TN
- Grown according to protocols developed by Kormanik and others (**Irrigate/ Fertilize**)



# Nursery Culture and Processing

- **Seedlings lifted in early February**
- **Visually evaluated (height, root collar diameter, and root system development)**
- **Transported to TWRA and placed in cooler**





# Operational Culling of Seedlings

Approximately a 20% cull rate



Minimum Acceptable Size  
For Water Oak



# 1 Year Old Seedlings!



# Side Notes

- 7ft tall shumard oak seedlings = common!
- Is this a good thing?
  - 1) can better handle long duration floods,
  - 2) can better hang with competition -- other spp.



# Site Preparation

- Typically:
  - 1) prescribed burning,
  - 2) subsoiling (“tree trench”)



# Matching Species To Site

- Soil Maps / soil types
- Surveyed Elevations
- Species Selection



# Matching Species To Site

- Contour maps developed
- Contours surveyed and marked at one-foot intervals
- Elevations marked and flagged by color to distinguish elevation and guide assignment of specific species





**259 elevation (orange)**

***bald cypress, green ash, pin oak***

**260 elevation (blue)**

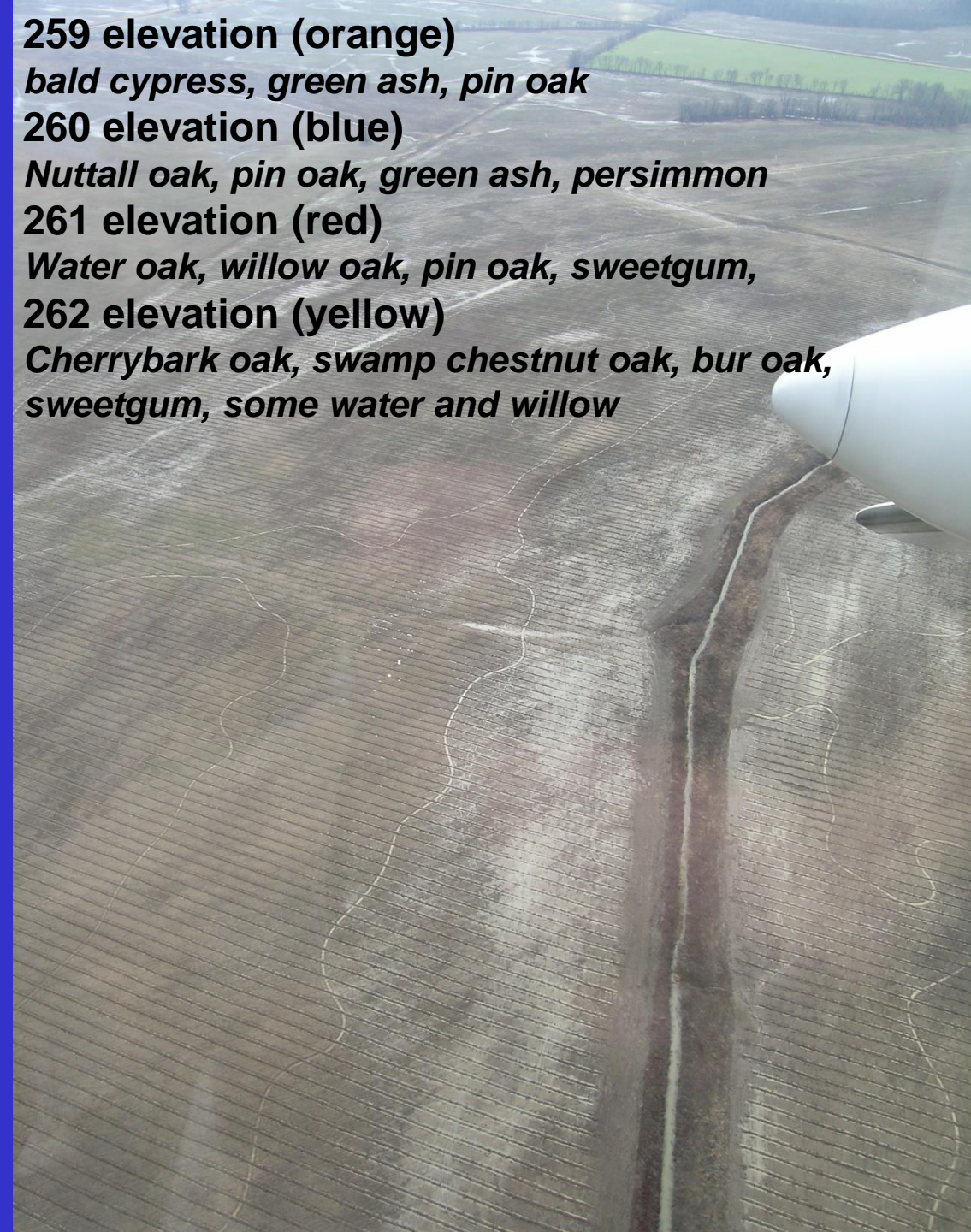
***Nuttall oak, pin oak, green ash, persimmon***

**261 elevation (red)**

***Water oak, willow oak, pin oak, sweetgum,***

**262 elevation (yellow)**

***Cherrybark oak, swamp chestnut oak, bur oak,  
sweetgum, some water and willow***





**Currently planting  
436 trees/acre of  
mixed species  
10X10 Spacing**





# Incorporating Mixed Species Plantings

- Existing bottomland forests in LMAV composed of multiple (up to 70) tree species (Devall and others 2001)
- Allen (1990) reported that oaks comprised from 20 to 50 percent of the species in historical forests
- Despite these findings, plantings on most bottomland sites have historically focused on planting a few of the most common bottomland oak species

**Combination of planting relatively few, slower-growing tree species and lack of natural recruitment has resulted in some sites being dominated by grasses and herbs**



# Essential to plant several species to ensure species diversity on restored sites



**And,  
competition can  
= increased  
vertical growth  
and better  
overall form**



**• Intraspecific competition within oaks has resulted in sparse stocking, poor timber quality, and reduced timber management options on many reforestation sites**

**Mixed species plantings have numerous benefits including:**

- > plant species diversity,**
- > structural diversity,**
- > wildlife benefits,**

**higher quality timber & greater yield**

# Supplemental species

Common Species	Supplementals
baldcypress water tupelo	buttonbush
overcup oak nuttall oak	water hickory
nuttall oak pin oak water oak willow oak	river birch persimmon green ash sweetgum sugarberry
cherrybark oak swamp chestnut oak bur oak	shellbark hickory sugarberry red mulberry blackgum pawpaw sweetgum

# The Ratio

- **65% = oaks**
- **35% = supplemental species**

# PLANTING

- Tools used
- Planting densities
- TWRA crews supervised migrant workers
- 5-man crew assigned by color
- Migrant workers instructed to mix species





# Large Root System Development

- First 3 years = Root Growth
- Then, vertical...



# Post-planting Maintenance

- **Walk Away**





# RESULTS



# Results

- **Survival**

- **Average 78.8 percent, up to 98%!**
  - **Did not decrease with time**
- **Planting requires close supervision**
  - **Most common mistake not planting root deep enough**



# BLACK SWAMP ESTABLISHED

3/28/03



**JUNE 2003**



**JUNE 2006**



**JUNE 2004**



**JUNE 2007**



**JUNE 2008**



**Maness Swamp Refuge  
Established 4/19/02**

**October 2001**



**May 2005**



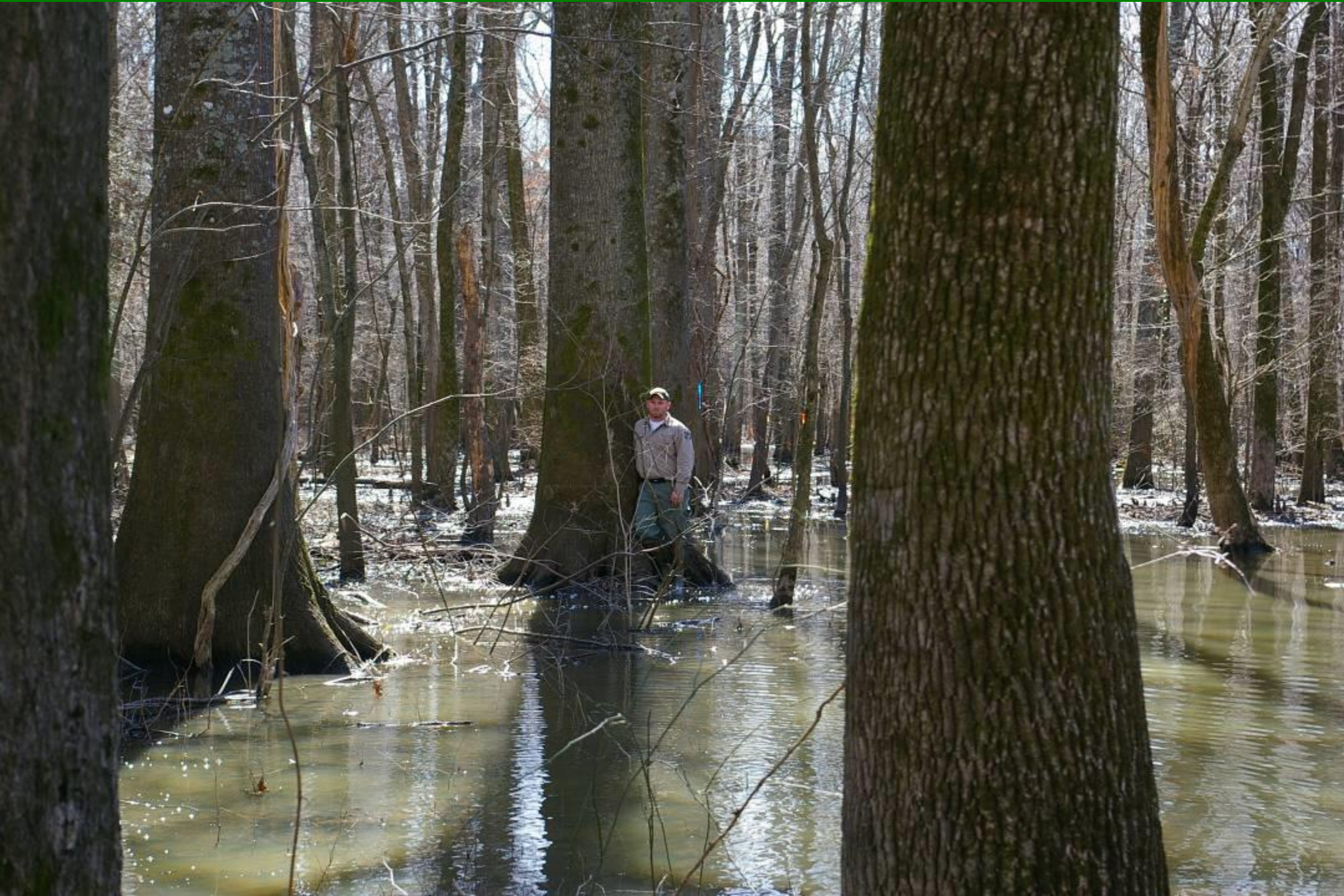
**August 2006**



**JUNE 2008**

# ERNEST RICE WMA







# Costs

- **Around \$250 per acre**
  - Includes site prep, tree costs, labor, etc.
  - 14 years on the ground and survived 2011 July/Aug Flood
- ***My Experience w/ USFWS and NRCS, Life***
  - ***Get what you pay for...***
  - ***Long-term investment***

- **Missouri, Louisiana, and Lower Mississippi Valley Joint Venture **getting on board****