Evaluation of mechanical mid-story removal as a tool to restore endangered species habitat

Principal investigators: Thomas A. Gorman[1] and Carola A. Haas[1]
Co-Authors: Kelly C. Jones[1], Houston C. Chandler[1], Brandon K. Rincon[1], and Michael A. Sisson[2]
[1]Department of Fish & Wildlife Conservation, Virginia Tech, Blacksburg, VA 24061
[2]Florida Fish and Wildlife Conservation Commission, Panama City, FL 32409

Objective

Evaluate if mechanical treatments can serve as a surrogate for fire and create vegetative conditions that are similar to high-quality amphibian breeding sites.

Primary Metrics of Success:

1. **Vegetation response**
2. Amphibian response
3. Hydrological response

Ecosystem

- Fire maintained longleaf pine - wiregrass savanna with a historic fire frequency:
  - Uplands: 1-3 years
  - Depression wetlands: 3+ years
- Effects of fire suppression in southeastern longleaf pine-wiregrass savannas have been well-documented - less is known about associated changes in wetlands embedded in this ecosystem.

- Shifting seasonality reduces the likelihood of fire creating suitable habitat conditions.

Reticulated Flatwoods Salamander
(*Ambystoma bishopi*)
Ecology

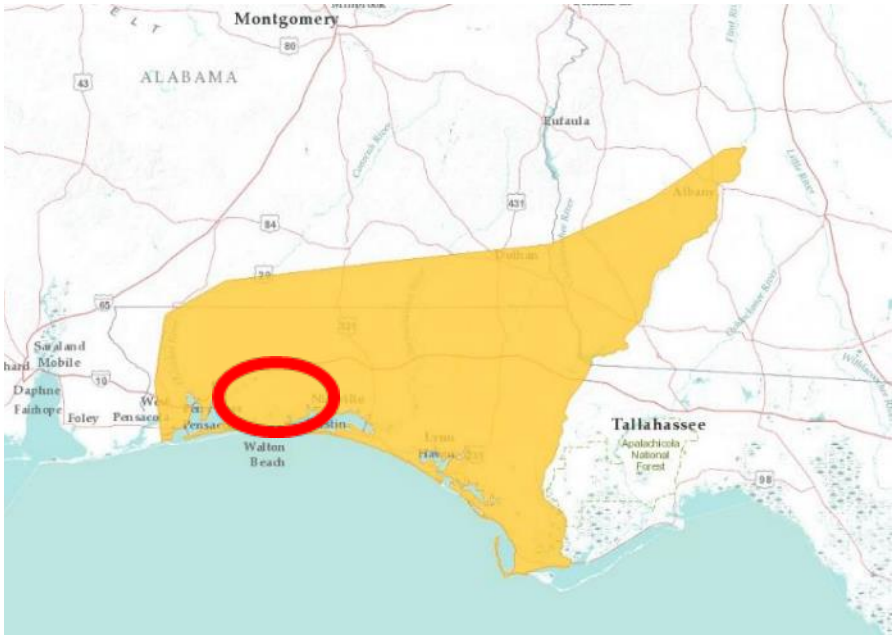
- Adults and sub-adults are fossorial.
- Fall/Winter breeder in ephemeral wetlands.
- Terrestrial courtship.
- Deposit eggs terrestrially in small groups and eggs hatch upon inundation.

Reticulated Flatwoods Salamander
(*Ambystoma bishopi*)
Ecology

- Larval period is 11-18 weeks.
- All life stages select for dense, structurally complex herbaceous vegetation.
- Egg and larval stages require this type of vegetation in areas that are inundated for a prolonged period of time, for both cover and prey.

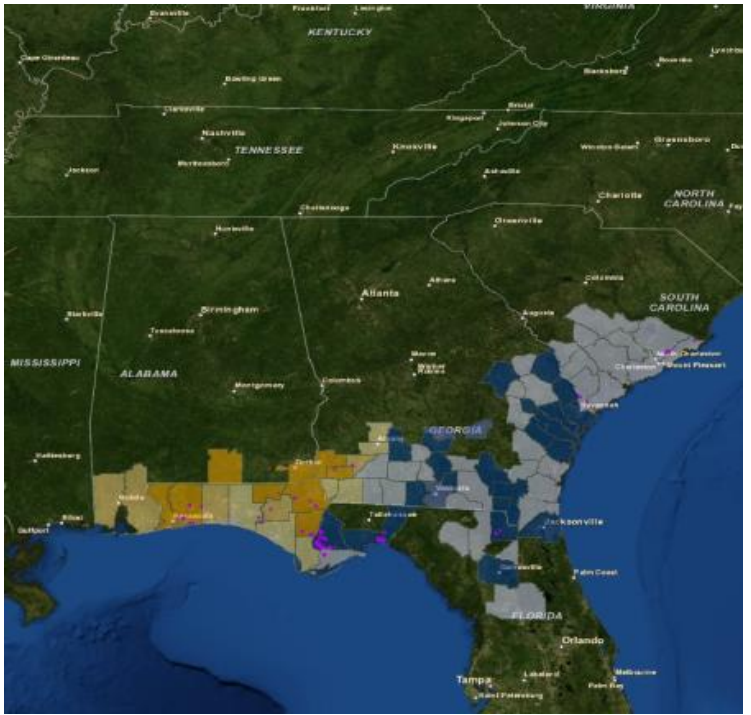
Reticulated Flatwoods Salamander Status

- Up-listed to endangered under ESA in 2009
  - Habitat alteration was primary threat considered
- 14 of 20 extant populations are a single breeding wetland
  - 4 populations have 2-3 wetlands
  - 2 populations have >3 wetlands

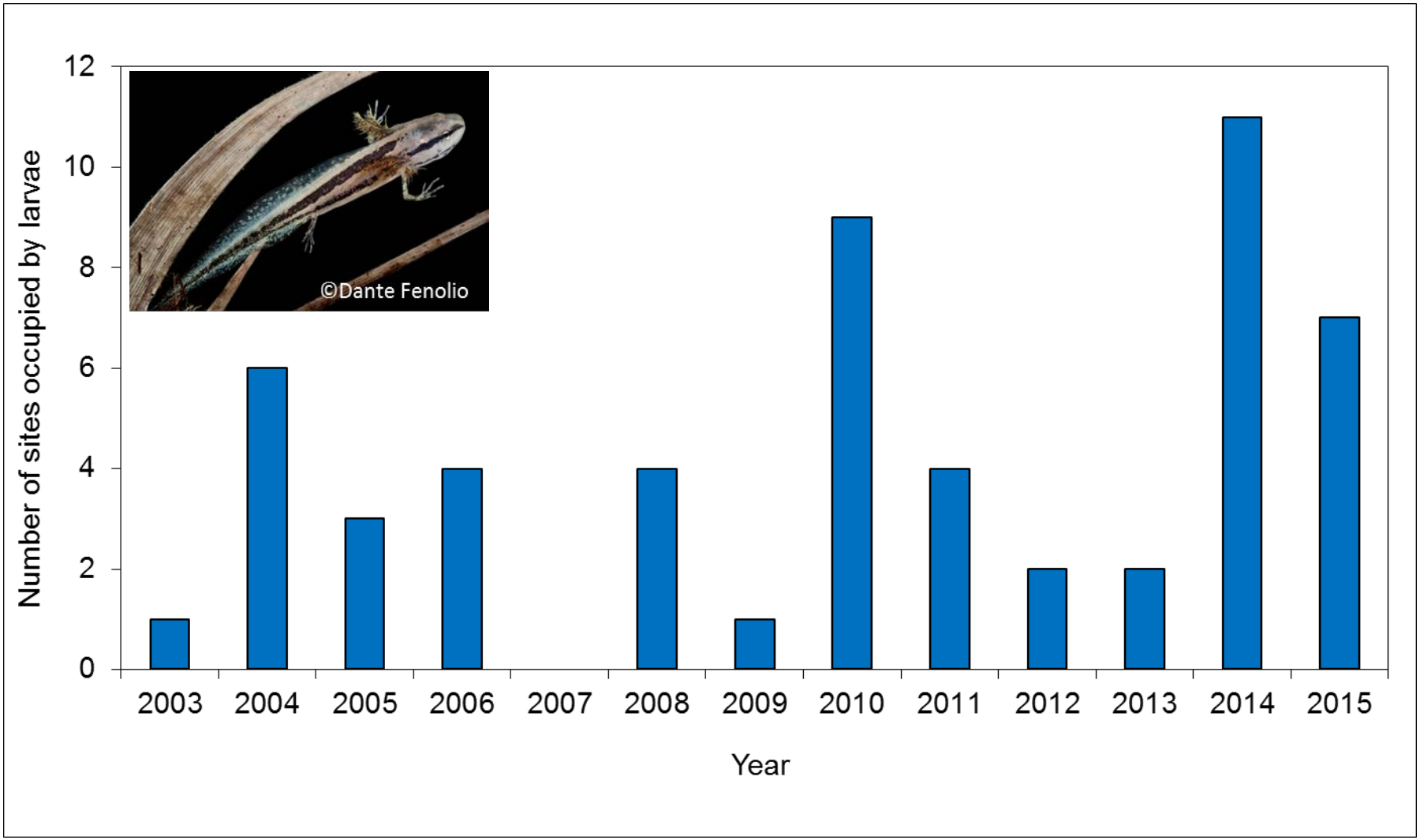


Population Declines

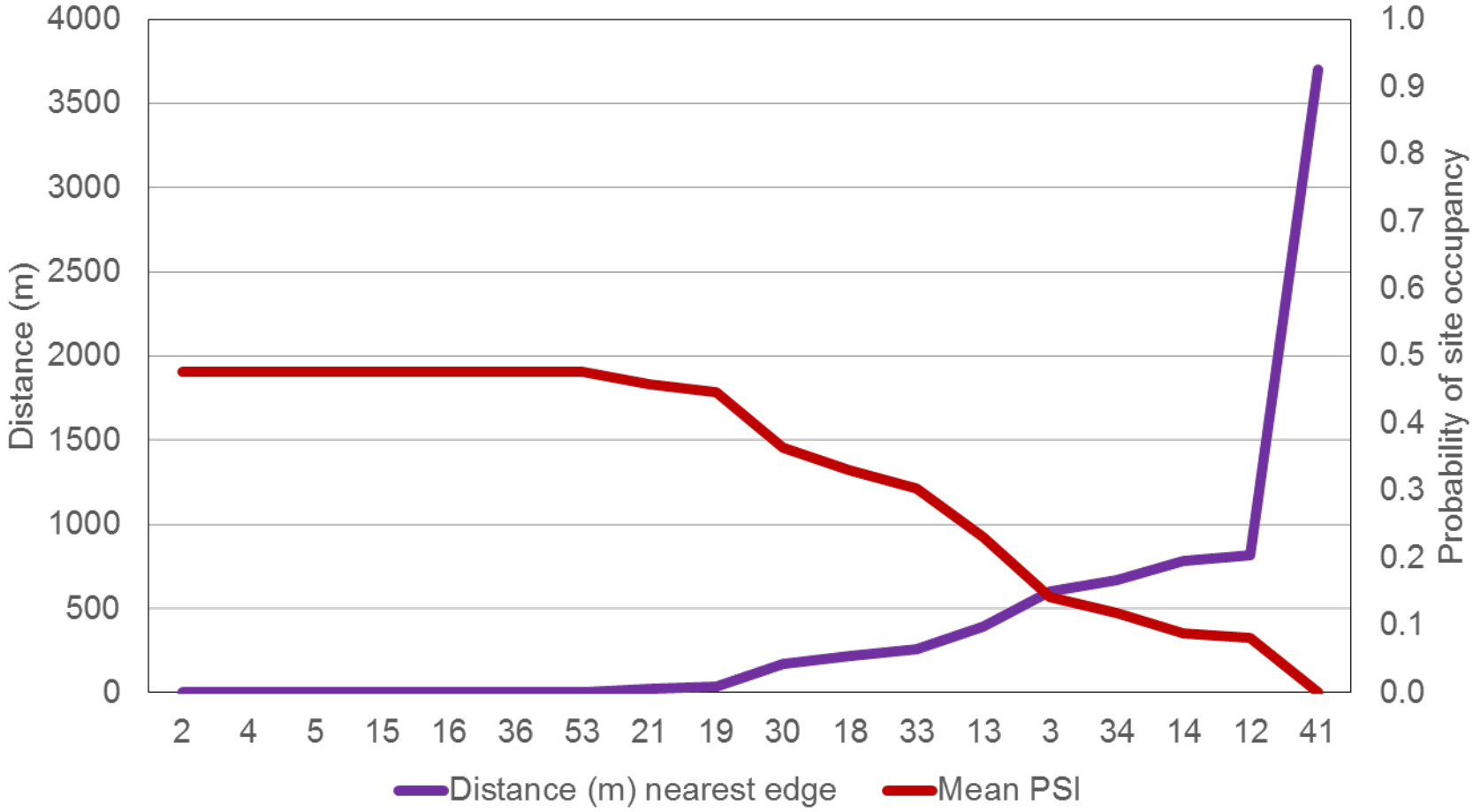
- Reticulated Flatwoods Salamanders are thought to be extirpated from Alabama.
- In Florida, only 14 breeding sites had larval detections during the 2013-2014 breeding season (11 sites on Eglin) despite ideal breeding conditions and intensive sampling.
- Frosted Flatwoods Salamanders, on the Atlantic Coastal Plain have declined precipitously since federal listing.
- The current status of many Gulf Coastal Plain populations of Frosted Flatwoods Salamanders is unknown.



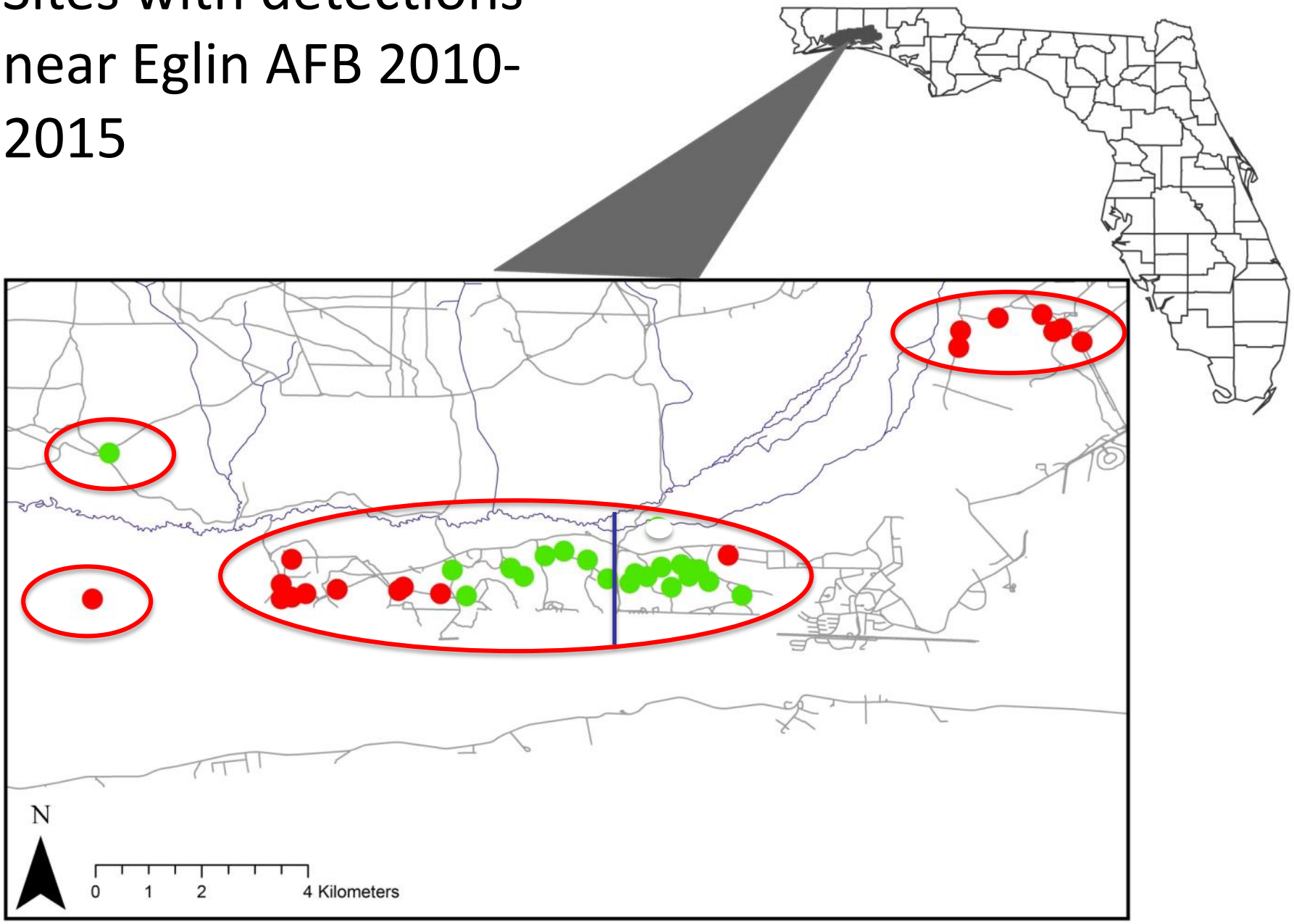
Larval Occupancy 2003-2015



Distance from nearest occupied breeding wetland



Sites with detections near Eglin AFB 2010-2015



Role of fire in wetlands

Fire reduces hardwood trees and shrubs in uplands and in the pond basin.

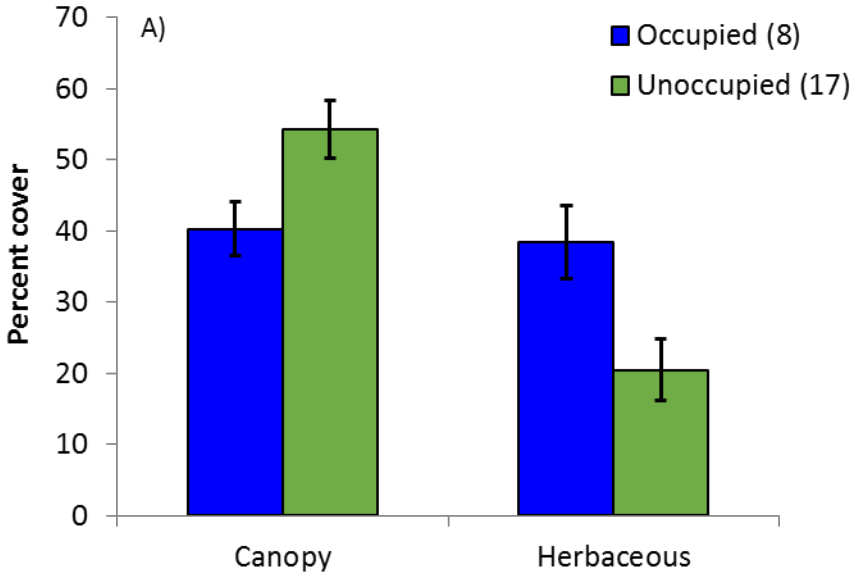
Evapotranspiration is reduced, so hydroperiod of pond increases.

Larvae have time to metamorphose.

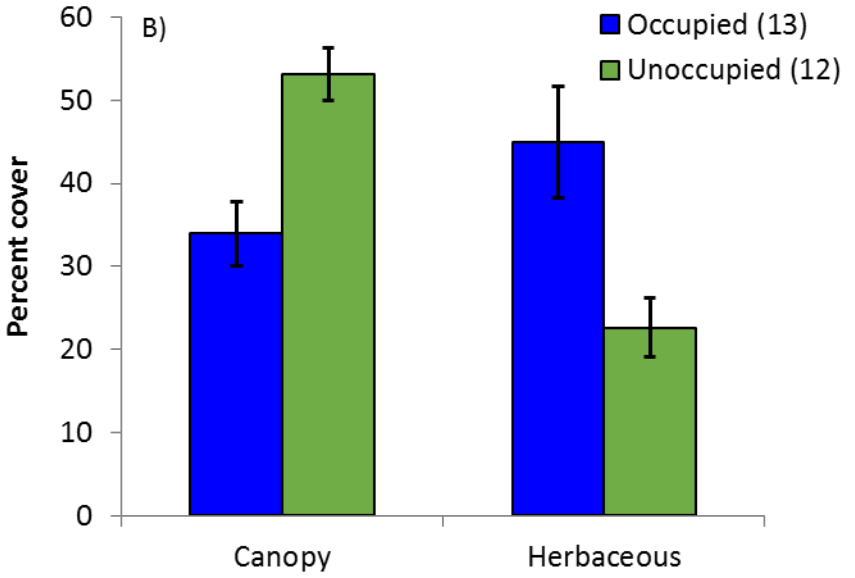
Reduced canopy cover increases solar insolation, increasing growth of herbaceous vegetation.

Increased food for prey and cover increases larval survival. Increased water temperatures speed larval growth.

Specialist Amphibians



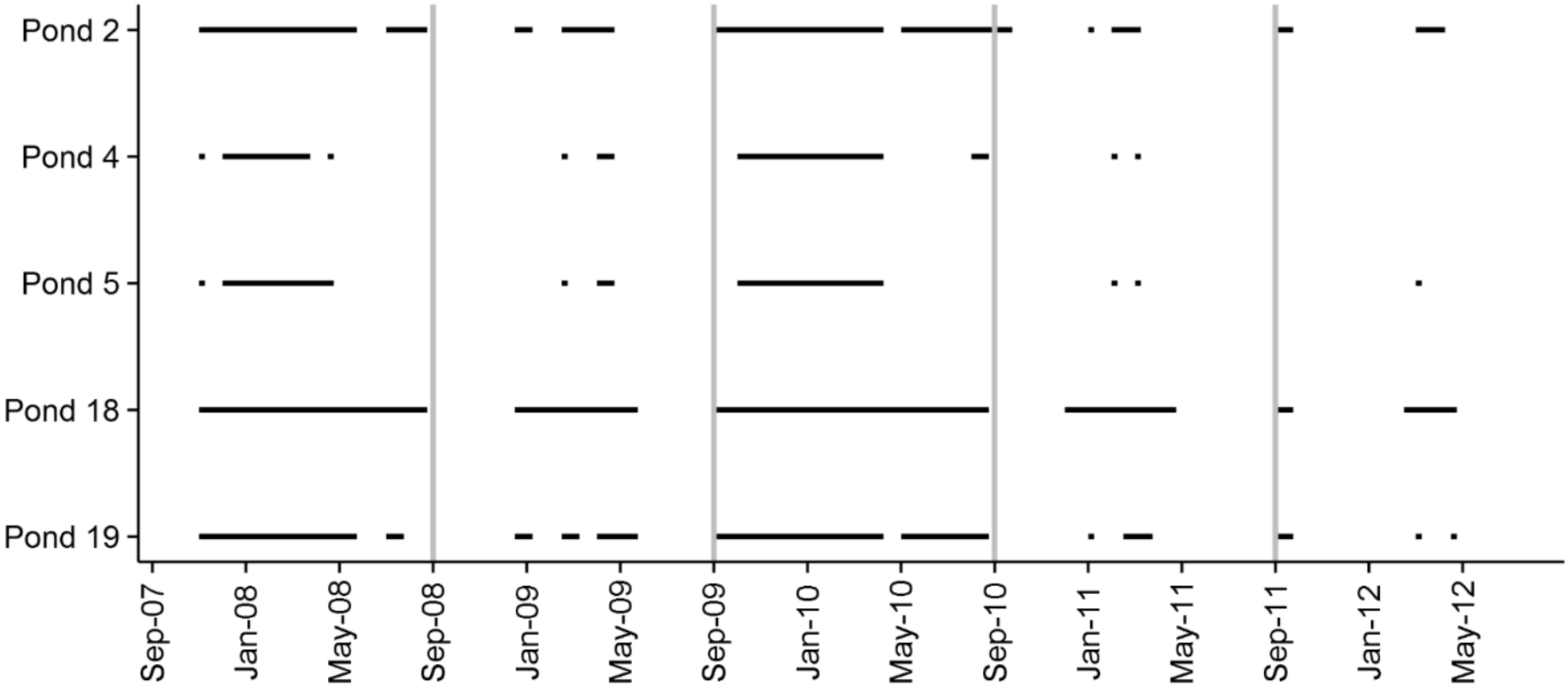
Reticulated Flatwoods Salamander



Ornate Chorus Frog

Gorman et al. 2013

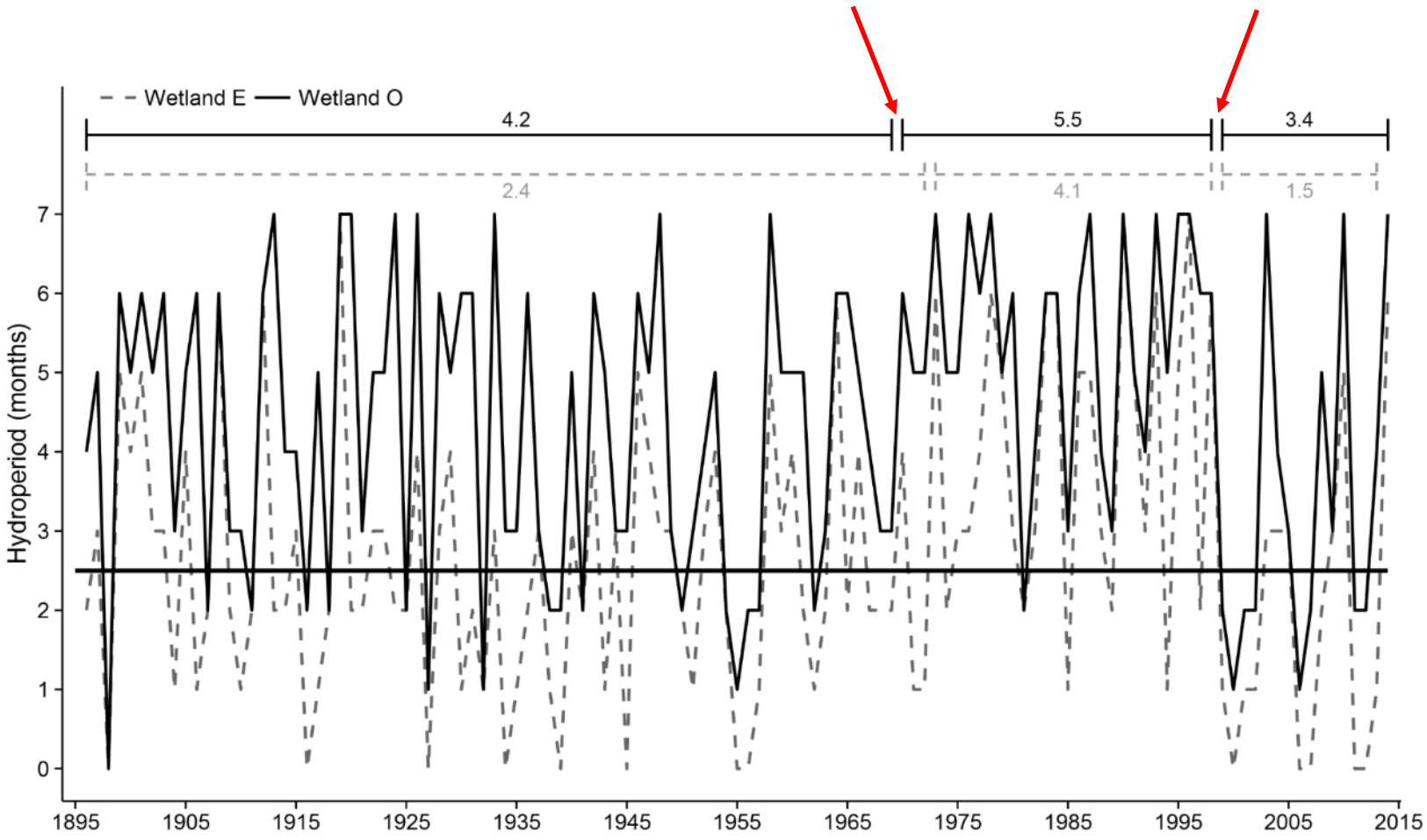
Observed Hydroperiods



Hydroperiods from 2006 – 2013 varied through time and among wetlands

Hydroperiods Through Time

Hindcasted hydroperiods from 1896 – 2013 for two wetlands.

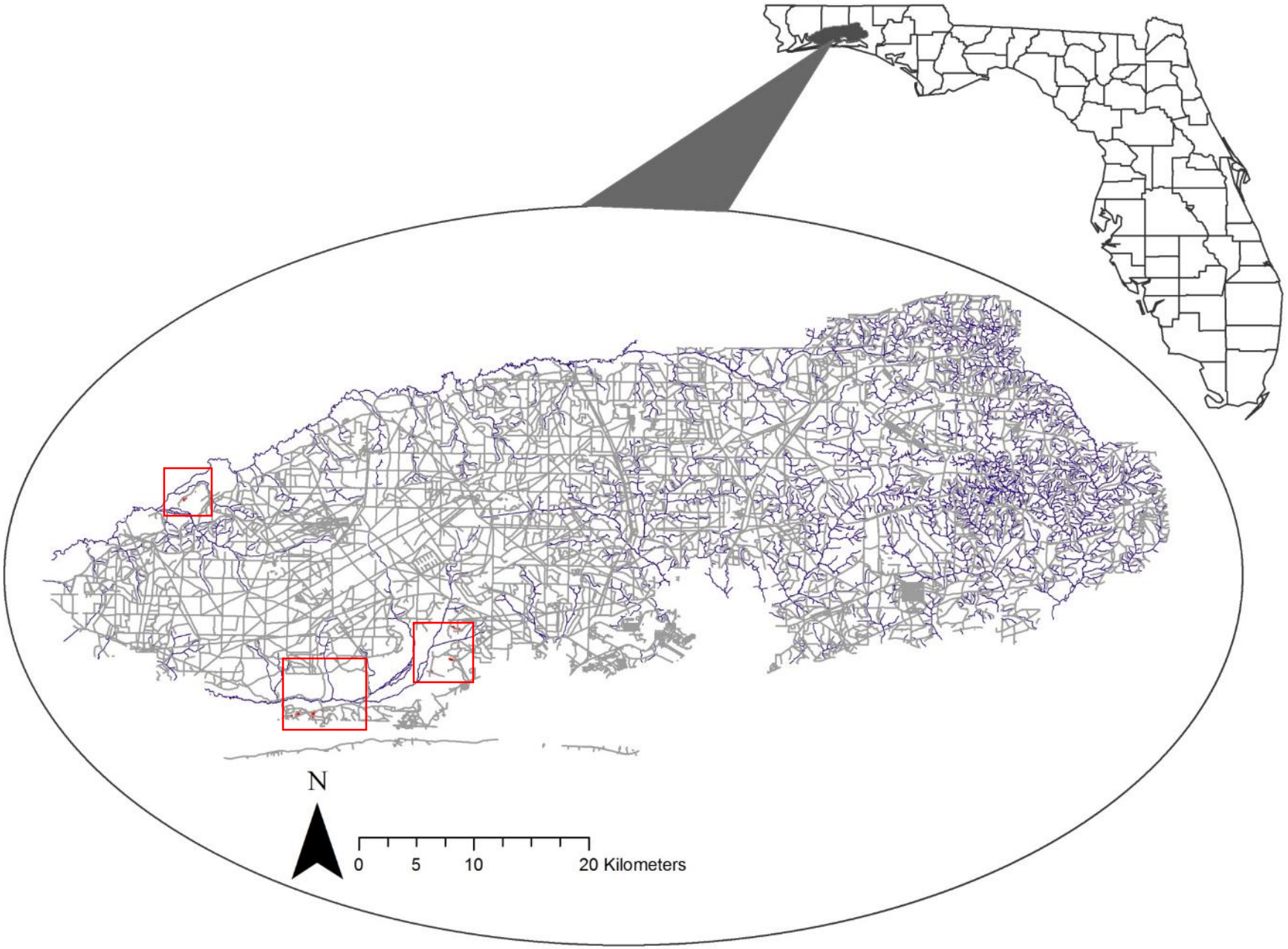


Experimental Design

- Initiated a field experiment to examine if mechanical and herbicide treatments could serve as a surrogate to fire in wetlands embedded within the longleaf pine ecosystem. *Balanced design was intended, but not easy to maintain.*
- **25 sites**
  - **21** had an overgrown midstory.
    - **5** were treated mechanically and with herbicide.
    - **5** were treated mechanically and with herbicide and fire.
    - **5** were treated with fire only.
    - **6** retained as low quality wetlands.
  - **4** additional sites with a less dense midstory and known to be recently occupied by flatwoods salamanders served as an example of high-quality sites.

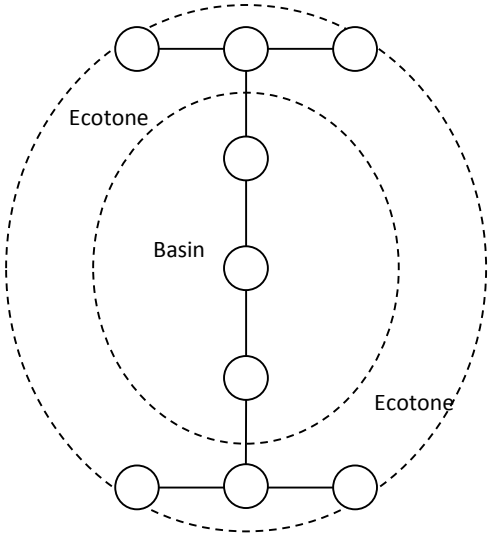
Management Techniques

- Mechanical treatments were conducted on the midstory vegetation using hand-held saws.
  - Woody vegetation with dbh < 12.7 cm, excluding only pines and cypress
  - Cut stump application of aquatically approved herbicide was used promptly after cutting
- Dragging and piling debris on the outside of the wetland was the most effective approach to disposing of cut material.
- Mechanical and initial herbicide treatments were applied by contractors secured through funding from the Aquatic Habitat Restoration and Enhancement program, Florida Fish and Wildlife Conservation Commission.
  - Current rates for this work are exceeding $3900/acre.


N
0
5
10
20 Kilometers

Monitoring Methods

- We collected pre- and post-treatment data on vegetation and amphibians in 2009-10 (pre) and 2014-15 (post).
  - Vegetation surveys are completed once/year at the beginning of the breeding season.



- Midstory mechanical/herbicide treatments were conducted in summer/fall 2010 prior to the fall/winter breeding season.

PRE

POST

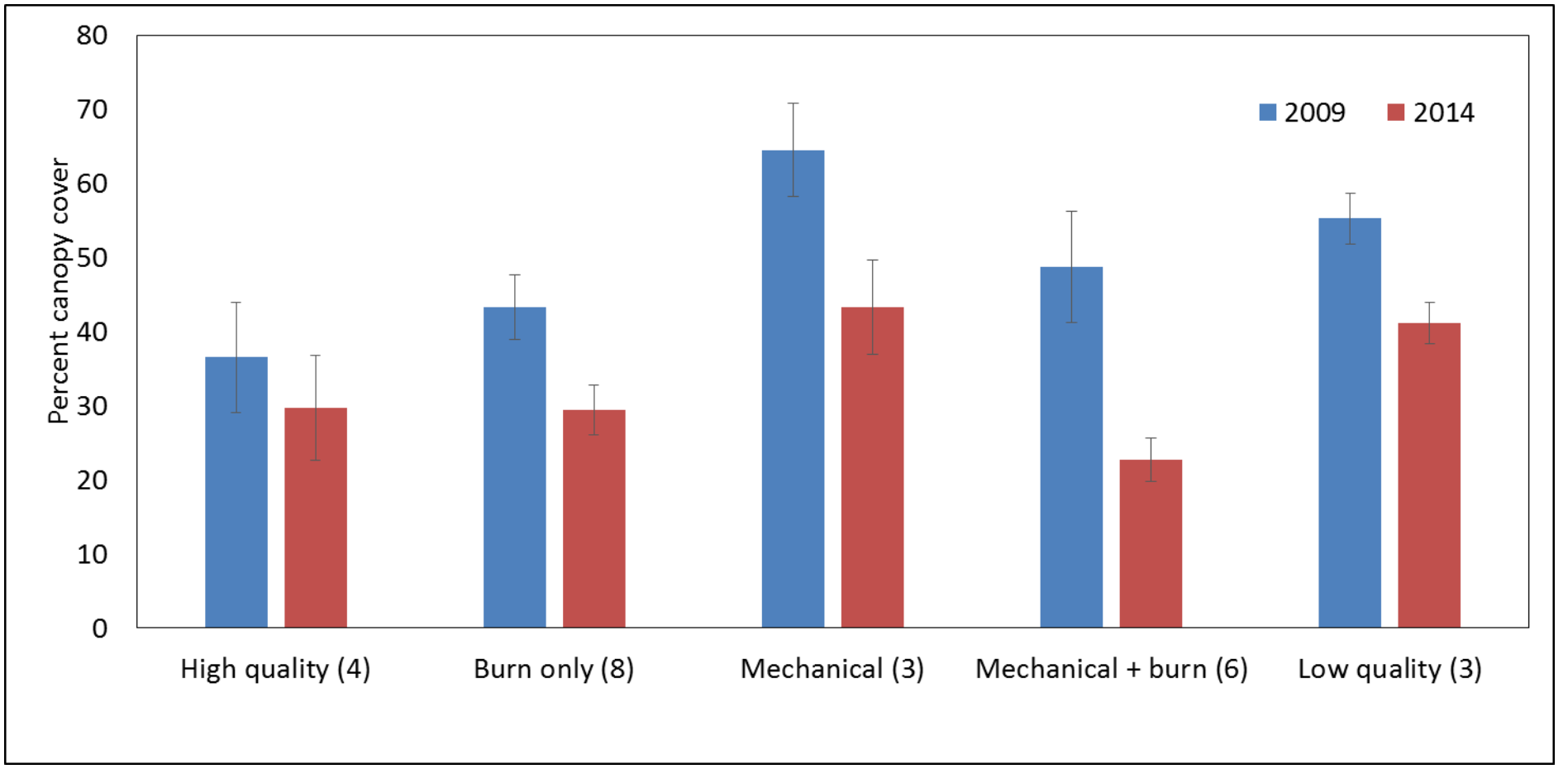
PRE

POST

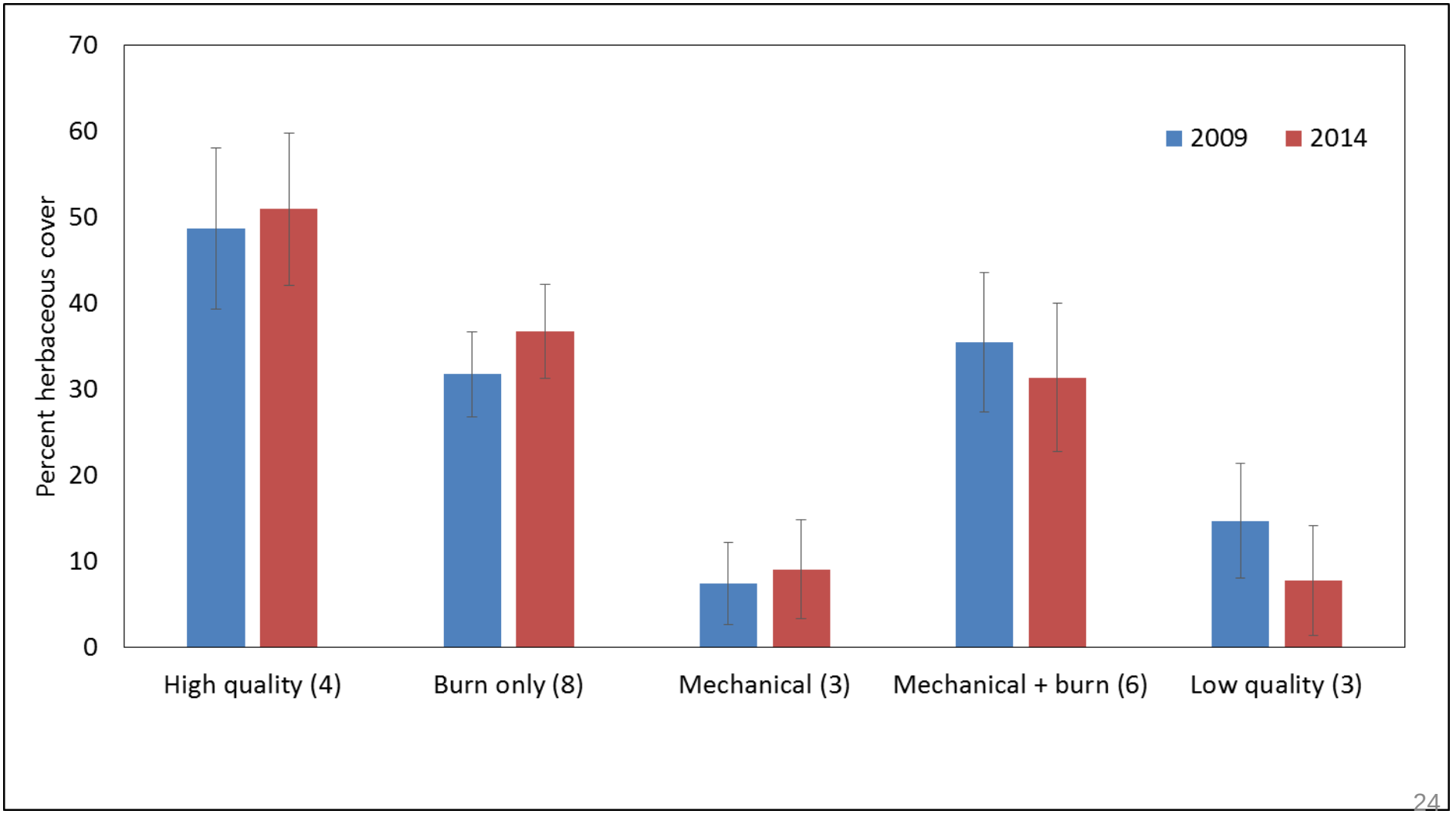
PRE

POST

Canopy Cover



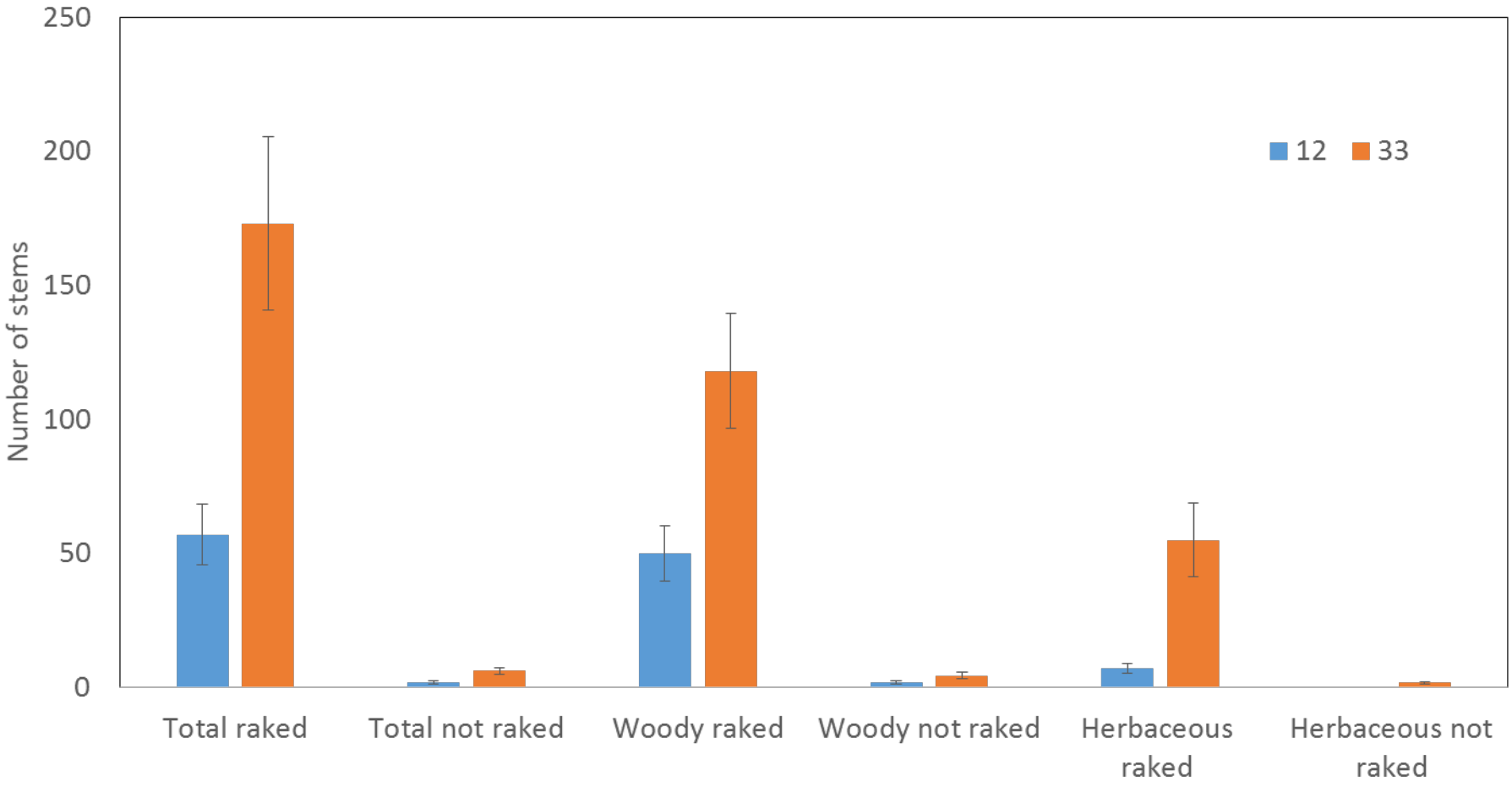
Herbaceous Cover



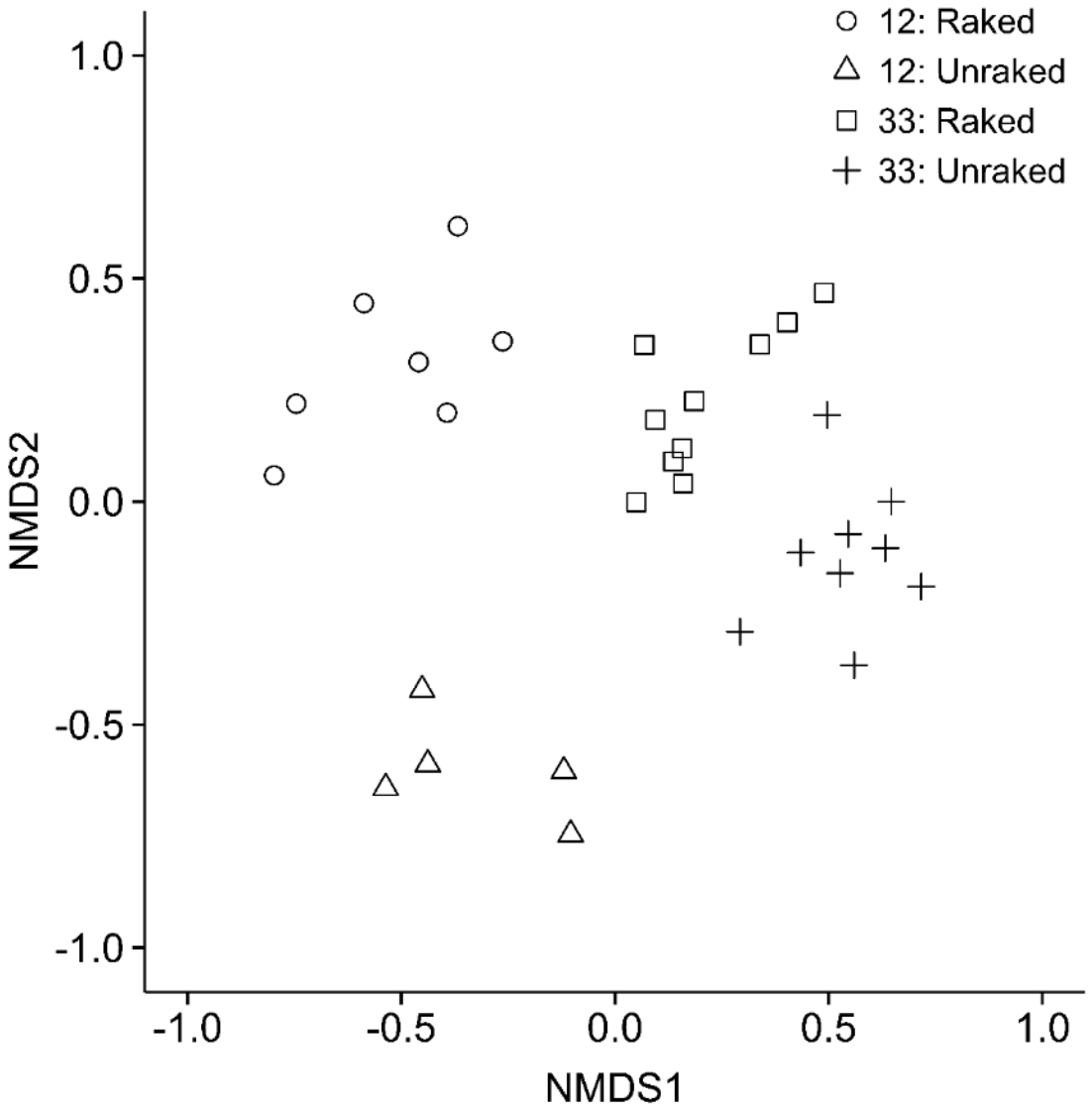
Duff Removal

- Following delayed response of herbaceous from original treatments we developed a fine-scale experiment to test the effectiveness of duff removal.
- Paired design with $1m^2$ plots
  - Burned wetland (10 raked and 10 unraked plots)
  - Unburned wetland (10 raked and 10 unraked plots)
  - No plots had herbaceous vegetation at initiation of the experiment in November 2014
  - Follow-up data were collected in May 2015

Duff Removal



Plant Species Diversity



Discussion

- Although we restored the woody midstory to desired conditions, there was a slow response of herbaceous plants.
- Raking of duff was able to increase response of sprouts and points to the need for a variety of methods to restore these complex and suppressed wetlands.
- These methods can be used as tools to resolve habitat degradation of pine flatwoods wetlands.
  - Continuing work to understand the impact of drought and spatial isolation.
  - Developing *in situ* and *ex situ* methods to increase survival from egg to metamorphosis that may also assist with repatriation efforts in the future.

Next Steps

- Expand manual duff removal to promote herbaceous cover
  - Explore seeding and/or plugs to increase herbaceous versus woody sprouts
- Continue dialogue with fire managers to promote more intense fires in breeding wetlands

Management Challenges

- Prescribed Fire
- Mechanical restoration
- Hog control (USDA APHIS)
- Hog Fencing
- Vehicle exclusion

Acknowledgements

Financial and Logisitical Support

- Jackson Guard, Eglin Air Force Base
  - Bruce Hagedorn, Kathy Gault, Jeremy Preston, and Justin Johnson
- Department of Defense, Legacy Resource Management Program
- Hurlburt Field
- Florida Fish and Wildlife Conservation Commission
  - John Himes (former), Michael Hill, Justin Davis
- U. S. Fish and Wildlife Service
  - Harold Mitchell
- Dept. of Fish and Wildlife Conservation, Virginia Tech

Field Support

Steve Goodman
Jeronimo Silva
Annamarie Saenger
Jeromi Hefner
Jill Newman
Brad O'Hanlon
Lori Blanc
Jay Parker
Sylvia Powell
Kenny Erwin
Ashley Daniels
Christine Mahmood
Steve Ritchie
Tonya Mammone
Billy Moore
Tyler Williams
Evan Ohr
Michelle Dziadzio
Angie Miner
Charlie Abeles
Anna Perez-Umphrey
April Hillman
Anthony Austermann

Questions