Amphibians and Muskrats as Potential Indicators of Ecological Change

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- Why do we need indicators?
- What makes a good indicator?
- Amphibians
- Muskrats
- Work at A.R.M. Lox NWR for developing these as indicators

Why do we need indicators?

- We can’t measure everything
- Span from site specific to system-wide
- Gain information
  - At different temporal and spatial scales
  - At different tropic levels
  - On how stressors affect things we care about
  - On how our management affects things we care about

What makes a good indicator?

- Relevant to system and management questions
- Captures complexities and easy to monitor and model
- Have known responses
- Is sensitive to stresses on the system
- Is measurable
- Feasible to implement
- Easy to communicate
- Comparable methods across the area of interest

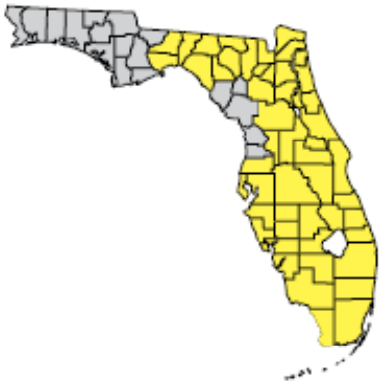
Why amphibians?

- Sensitive to hydrology, habitat, water quality, exotic species
- Important part of the food web
- Identified in conceptual ecological models for:
  - Southwest Florida Feasibility Study
  - Big Cypress
  - Loxahatchee River
  - Ridge and Slough

- Established protocol and metrics for anurans
- Stressor response model has been developed for SW Florida and is being modified for Greater Everglades

Why round-tailed muskrats?

- Dependent on freshwater emergent wetlands
- Ridge and slough- vegetation for feeding and cover
- Identified as potential umbrella species by FWS biologists



- Were present in ENP- rare or absent in areas with pythons

Steps for developing an indicator

- Define goals
- Develop conceptual ecological model
- Identify metrics to use
- Identify sampling protocol

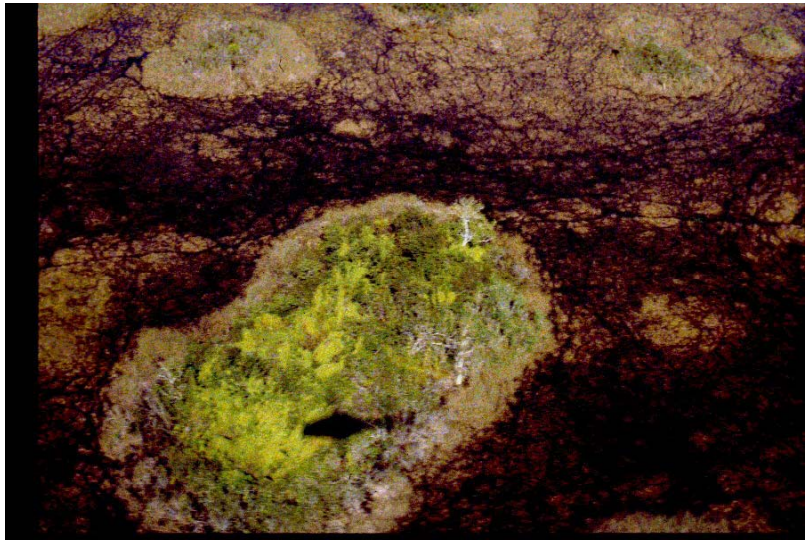
- Determine status
- Test relationships in ecological models

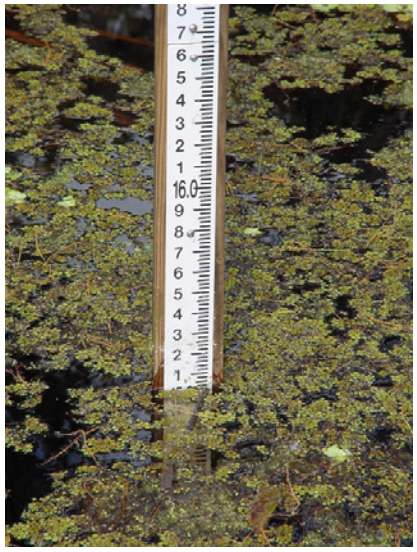
From A.R.M. Lox NWR CCP

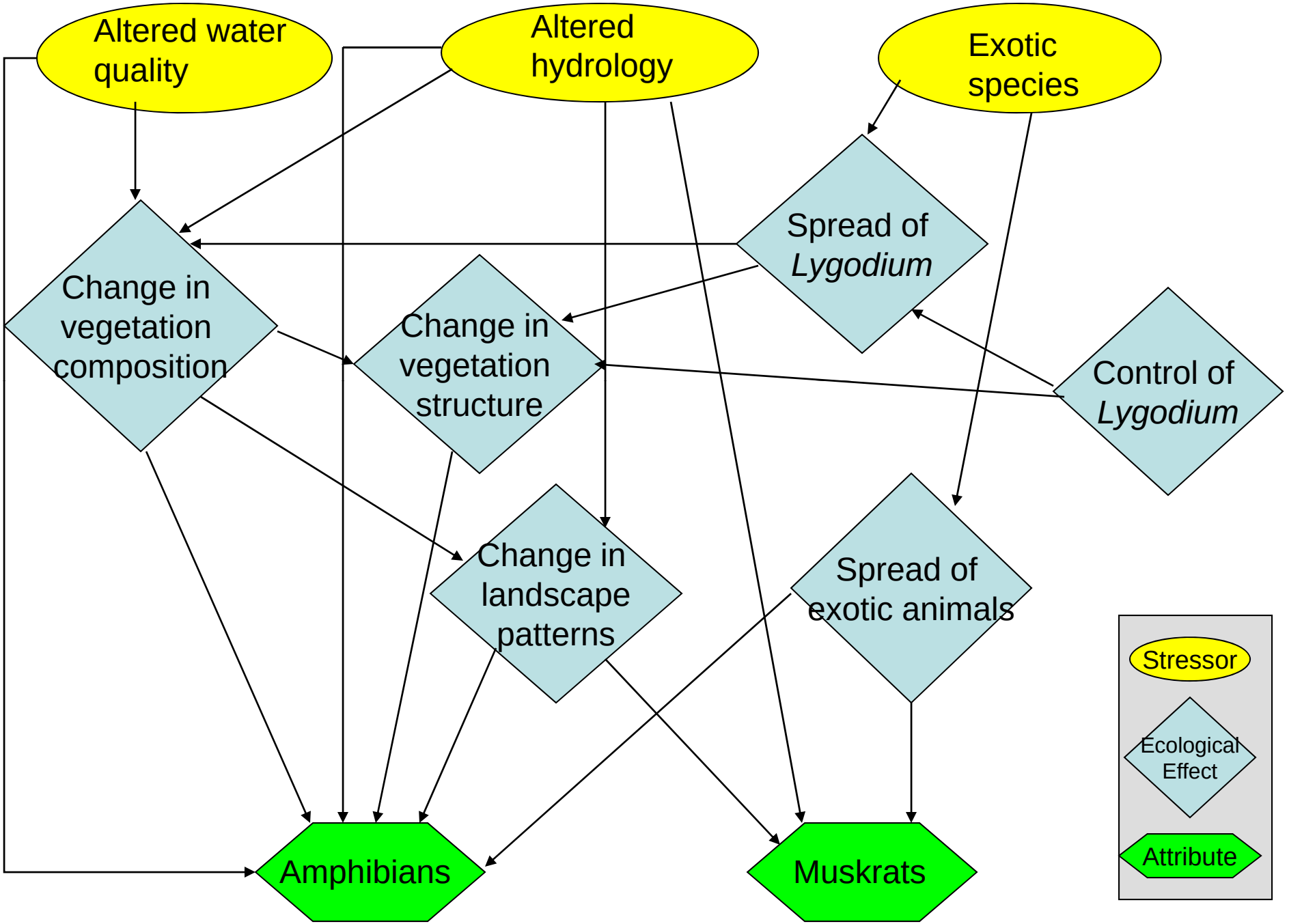
- Restore and conserve the natural diversity, abundance, and ecological function of refuge flora and fauna
  - Assess impacts of water regulation schedule
  - Develop control programs for invasive and exotic species
  - Inventory, monitor, map wildlife and habitats to guide refuge management

Management issues at A.R.M. Lox NWR

- Water quantity
- Water quality
- Invasive exotics






Altered water quality
Altered hydrology
Exotic species
Spread of *Lygodium*
Change in vegetation composition
Change in vegetation structure
Control of *Lygodium*
Change in landscape patterns
Spread of exotic animals
Amphibians
Muskrats
Stressor
Ecological Effect
Attribute

Metrics

- Amphibians
  - Presence
  - Quantification of presence/absence
  - Distribution
  - Community composition
- Muskrats
  - Presence
  - Quantification of presence/absence
  - Distribution

Sampling protocol

- Amphibians
  - Protocol follows USGS Amphibian Research and Monitoring Initiative (ARMI)
  - Night time call surveys
  - Night time visual encounter surveys (VES)
  - Proportion area occupied

Sampling protocol

- Round-tailed muskrats
  - Visual surveys for lodges
  - No standardized protocol for large wetlands

Studies in 2009/2010

Amphibians- ready to assess status and begin to address linkages

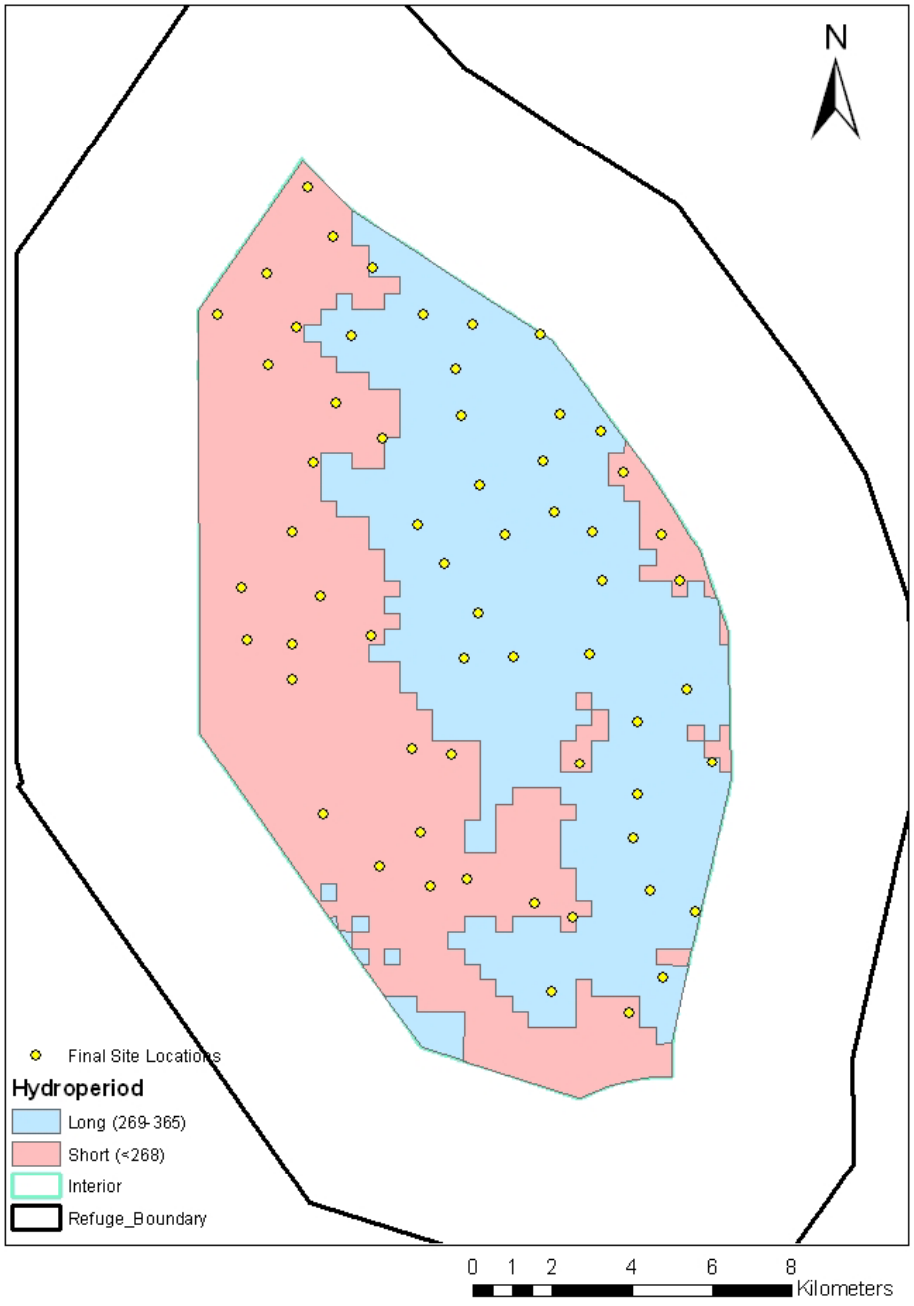
Ryan Lynch Masters Thesis: *Habitat use and amphibian response to management in the Arthur R. Marshall Loxahatchee National Wildlife Refuge*

Muskrats- need to develop standardized protocol

Pifer et. al. in prep. *Surveying for Round-tailed Muskrats in Arthur R. Marshall Loxahatchee National Wildlife Refuge, Florida*

Amphibians

- How does hydroperiod influence the occupancy rates of Anuran species in the Refuge?
- What additional site covariates influence occupancy estimates?
  - Habitat
  - Time since last exotic plant treatment
- What environmental factors influence detection probabilities?

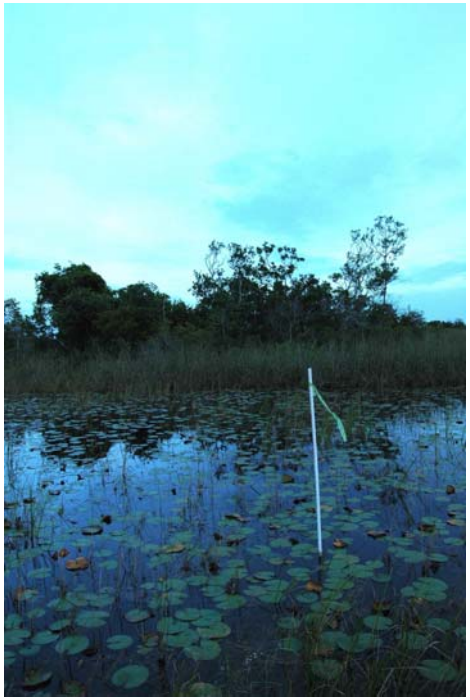


60 sites in interior zone

Night time call and visual encounter surveys (VES)

Sampled 3 times summer 2010

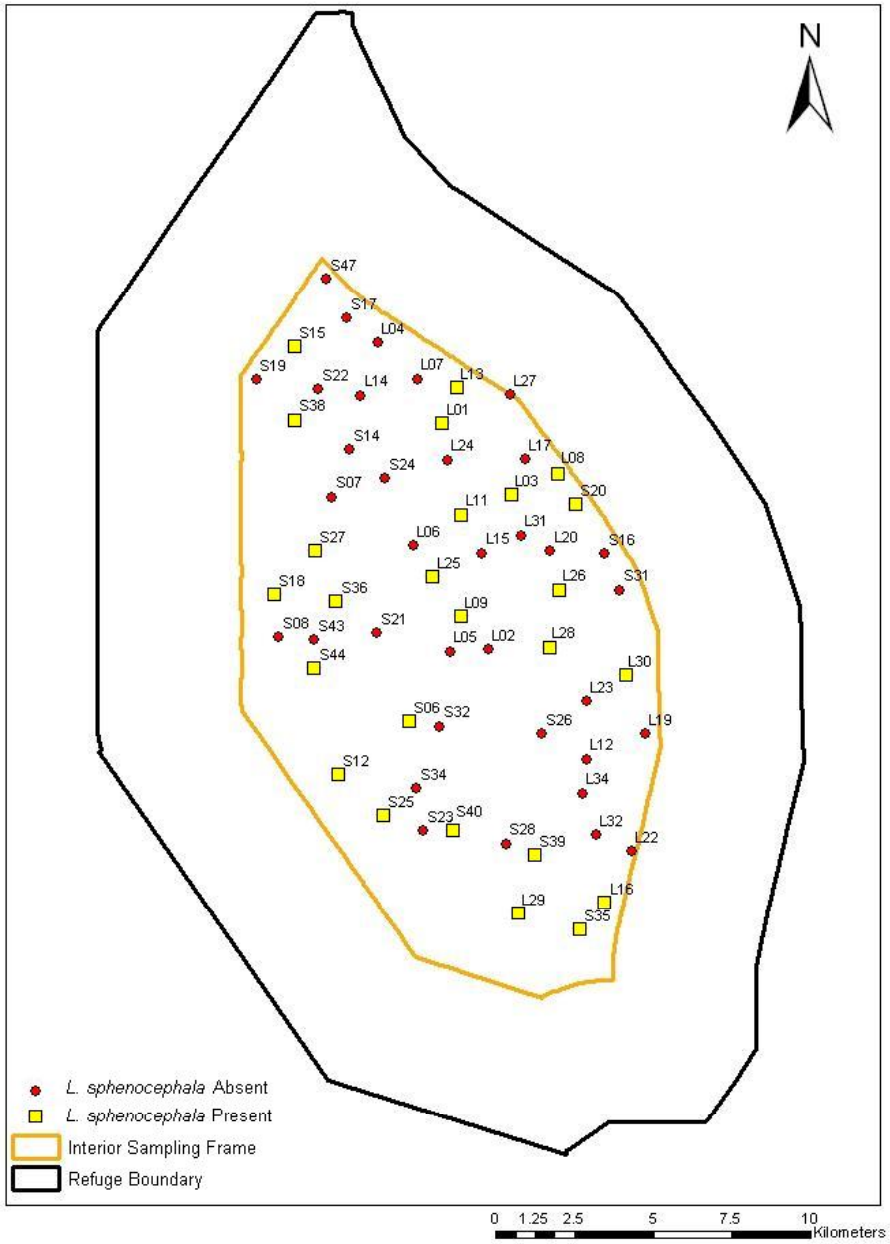
Vegetation sampling at all sites



Hydroperiod data are from EDEN for 2001 & 2007

Species list for the marsh from June 2010 sampling

- Cricket Frog (*Acris gryllus*)
- Pig Frog (*Lithobates grylio*)
- Southern Leopard Frog (*Lithobates sphenocephala*)
- Green Treefrog (*Hyla cinerea*)
- Eastern Narrowmouth Toad (*Gastrophryne carolinensis*)
- Little Grass Frog (*Pseudacris ocularis*)



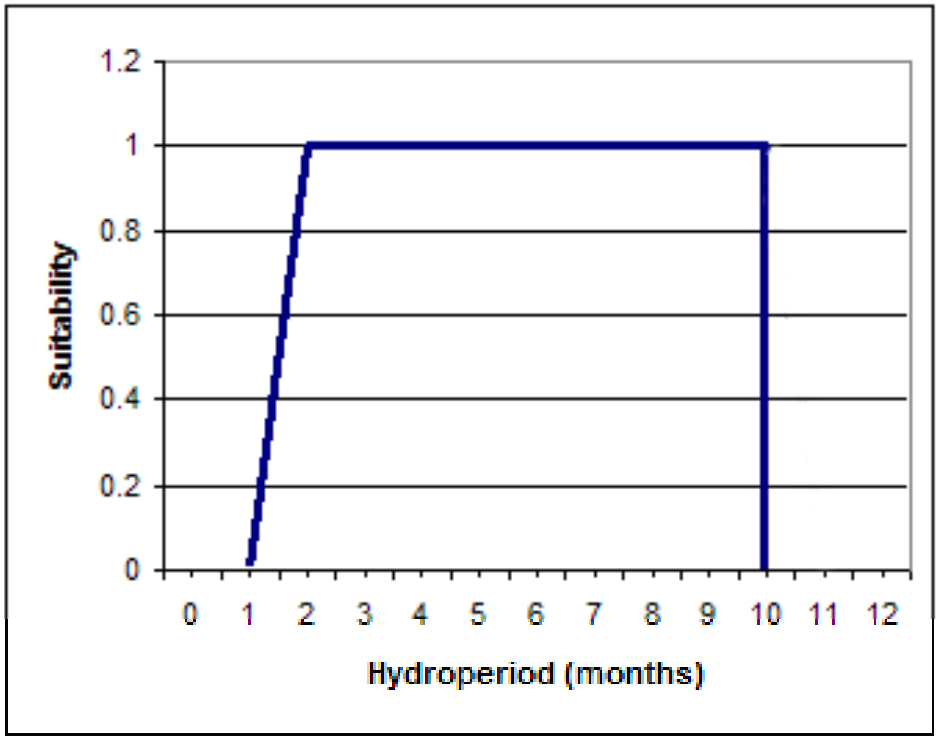
Yellow squares are presence (naive occupancy) of leopard frogs during June 2010 sampling. Red dots indicate absence.

No leopard frogs were heard calling, all were located on visual encounter surveys.

Occupancy patterns for amphibians

- Provide information on status of amphibian community
- Can help to characterize hydrologic conditions
- Evaluate short and long-term impacts of exotic control on non-target fauna
- Test/improve relationships in CEM and stressor response model

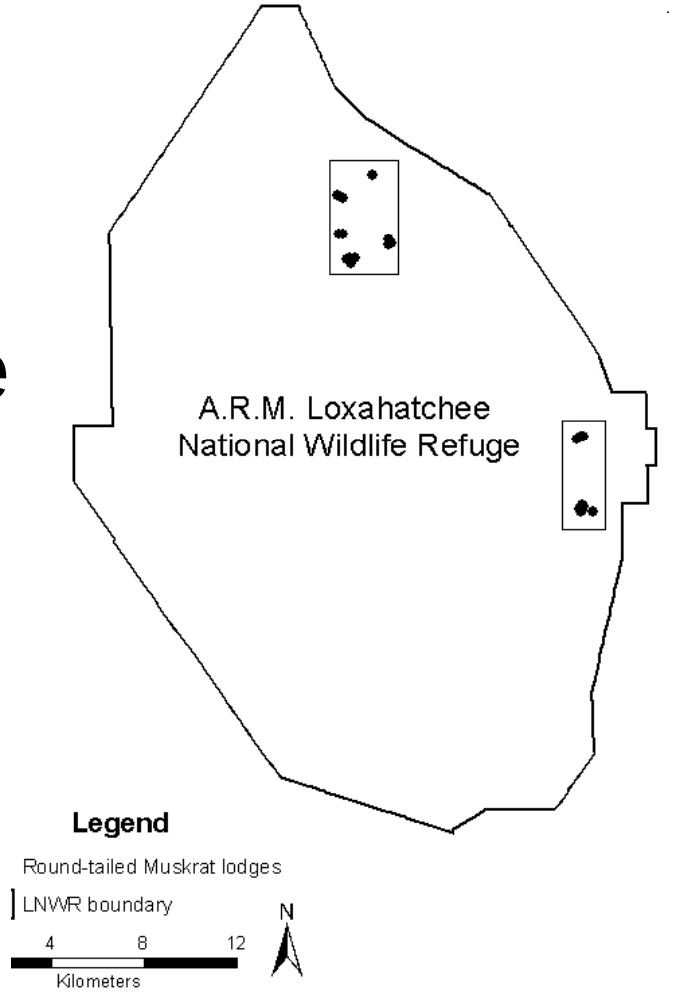
Leopard frog



From: Stressor Response Model for Southwest Florida Amphibians. Mazzotti et. al. 2008

Surveying for muskrats

- Selected two pilot areas
- Surveyed N to S transects
- Used quartered approach
- Assessed sighting distance
- Vegetation
- Lodge measurements

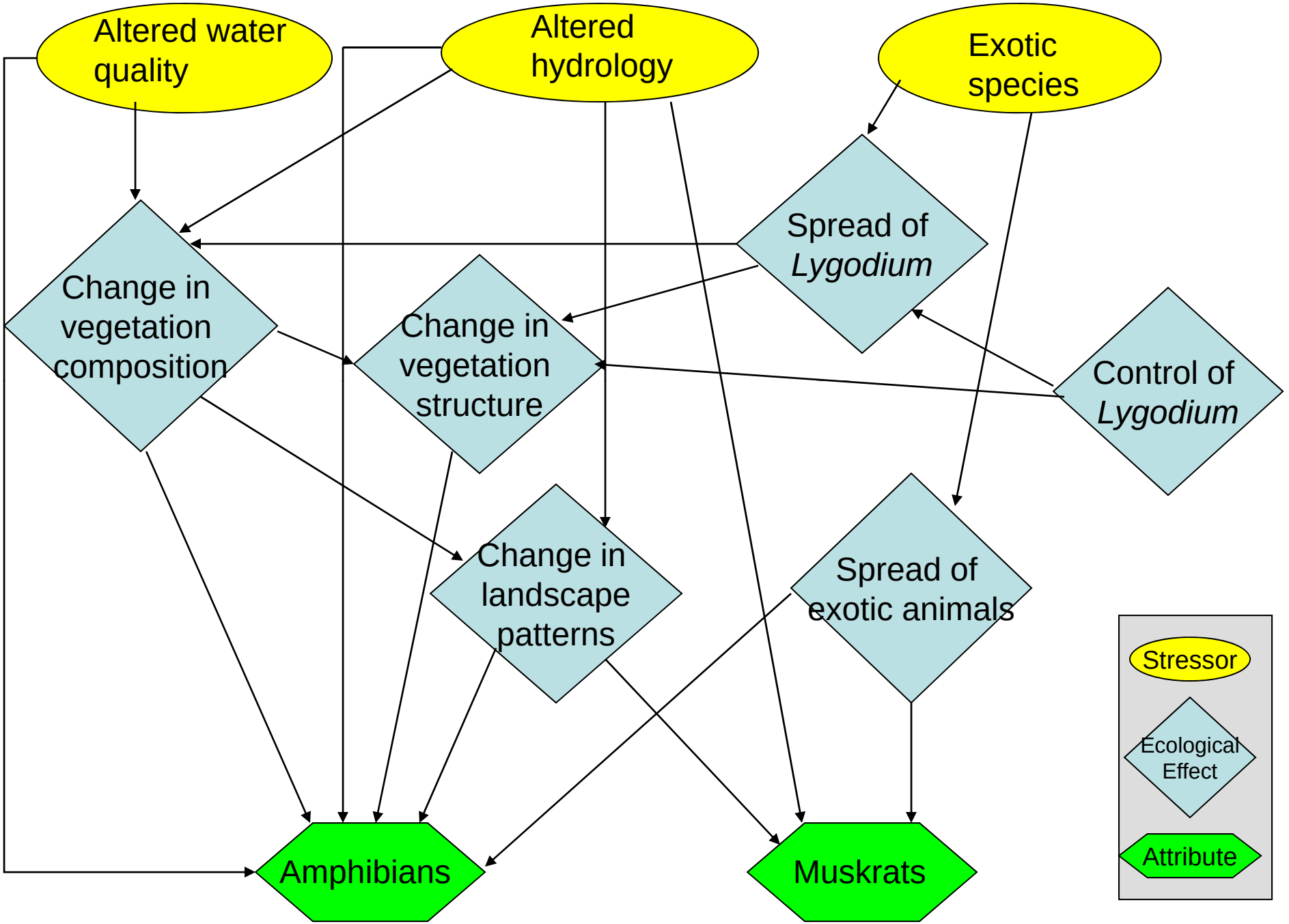


Results

- 38 lodges along 6 transects
- 9 on transects, 26 using quartered approach
- Average sighting distance < 5 m
- 37% of lodges on shrub patches
- 45% active
- Nearest neighbor distance 66 m

Results

- Understanding of challenges in surveying
- Information that will help to develop effective survey methods
  - Presence and distribution
  - Habitat relationships
- Baseline data that may be early warning for presence of pythons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