Conservation and Management of Amphibian Populations

Julia Earl
Questions: jearl@nimbios.org

Goal of the Lecture

To familiarize students with some conservation and management strategies for amphibians.

Reading Assignments:

No Required Readings

Recommended:

1. Habitat Management Guidelines for Amphibians and Reptiles of the Southeastern United States: PARC: http://www.parcplace.org/habitat_management_guide.html
2. Recommendations for Riparian Buffers: Salamanders (Crawford and Semlitsch 2007)
3. Recommendations for Wetland Buffers: Amphibians and Reptiles (Semlitsch and Bodie 2003)

Lecture Structure

1. Basic Conservation Techniques
2. Aquatic and Terrestrial Habitat Needs
3. Aquatic Environment Strategies
4. De-extinction Discussion
5. Terrestrial Environment Strategies
6. Wetland Buffers, Small Wetlands, and Roads

Success Story: Mallorcan Midwife Toad (*Alytes muletensis*)

- **Only amphibian whose status has been converted from critically endangered to vulnerable**
- Discovered as a fossil in 1977, alive adult found in 1980 in Mallorca (island off of Spain)
- Captive breeding started in 1985, 1st reintroduction in 1989
- Chosen sites w/o cattle access and with low populations of invasive snakes and frogs
- Use of cisterns- historical water holes built for mountain goats and sheep
- 25% of the population originated from captive bred and the spp has doubled its range from 1987-2000

Basic Conservation Techniques

- Habitat preservation
- Habitat improvement/connectivity
- Habitat creation/restoration
- Education and outreach
- Captive breeding/headstarting
  - Worst Case scenario
- De-extinction
  - Extra worst case scenario?

Amphibian Habitat Needs

What can we do to ensure habitat needs are met?

Aquatic Environment

Life Cycle:

- Breeding Habitat: Anurans & Salamanders
- Eggs, Embryos & Larvae
- Overwintering Sites

Concerns:

- Shoreline Vegetation
- Hydroperiod (2-3 mo)
- Water Quality & Temp
- Fish
- Introduced Species

Amphibian Habitat Needs

Terrestrial Environment

Life Cycle:

- Breeding Habitat: Salamanders, a few frogs
- Juvenile & Adult Foraging Sites
- Overwintering & Estivation
- Dispersal, Migration, Home Range

Concerns:

- Intact Vegetation
- Decomposing Logs
- Abundant Insects
- Dispersal Corridors: Connectivity

Temperature, Humidity, Predators

Conservation and Management

Aquatic Environment: Shoreline Vegetation

1) Minimize Access by Cattle
   - Electric Fence
     - Feb-August
   - Grazing Rotation
     - Needs to be Tested
     - <1 month
     - <30 head/ha wetland
   - Provide Water Troughs

2) Constructed Wetlands
   - Gradual slope
   - Do initial plantings

See Shulse et al. 2010

Aquatic Environment: Shoreline Vegetation

3) Control Exotic Plants

Hylobius

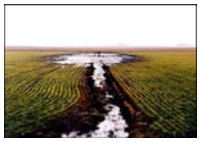
Galerucella

- Herbicides
  - 2,4-D: Broad-leaved
  - Glyphosate: Non-selective (Roundup, Rodeo)
  - Imazapyr: Non-selective, Invasive Exotics
  - When choosing- pick effective compounds that won't persist
  - Timing- extremely important!
- Biological Control

Conservation and Management

Aquatic Environment: Hydroperiod

1) Plug Ditch or Drain Tile



3) Provide Diverse Hydroperiods/Wetlands

Copeia 1999:101-113, Conservation Biology 14:414-419

2) Managed Wetlands:

•Wetland complex: ➢Ephemeral & Permanent

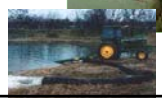
•February-August

•Multiple Species: Amphibians, Waterbirds

4) Gradual Drawdowns (>2 weeks)

Aquatic Environment: Water Quality

1. Minimize Agricultural Chemicals
   - Pesticides, Herbicides, Fertilizers
   - Apply following manufacturers recommendations
   - Watch out for chemical mixtures- synergistic effects
   - Establish a >15m buffer (still needs testing)
2. Maximize dissolved oxygen (DO)
   - Minimize Eutrophication
     - Minimize cattle access
     - Minimize fertilizers
   - Managed: flush with oxygenated water

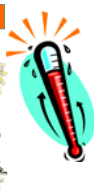


Aquatic Environment: Water Quality

3. Prevent high temperatures
   - Maintain surround tree cover
   - Maintain shoreline vegetation

34 - 42 C

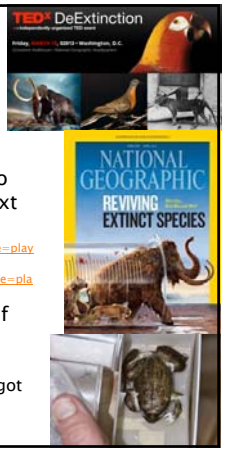
93 - 104 F



4. Maintain natural flow
   - Keeps water cool and aerated
   - Can flush out unwanted chemicals

20 C and >5 mg/L DO

De-extinction



- The hot-topic of conservation for the last month
- Uses high tech solutions to bring species back from extinction
- No solid successes, but enough to show it's feasible, likely in the next few years
- http://www.youtube.com/watch?v=TQ8TIUxiqqY&feature=player_embedded
- http://www.youtube.com/watch?v=a_hgCM8XZkk&feature=player_embedded
- Amphibians are at the forefront of this research area
  - Gastric Brooding Frog from Australia
  - Recently, implanted nuclei into eggs, got cell division

De-extinction Discussion

- Initial thoughts? Gut reactions?
- Ethics: should scientists bring back extinct species?
- Will viable populations be created?
- If de-extinction projects are successful, do you think this will affect on the ground conservation strategies or priorities?

Conservation and Management
Terrestrial Environment

1. Limit Agriculture Near Wetlands
   - Establish at least 100 m buffer
   - If haying, leave >30 cm standing stubble
   - No herbicide or insecticide in buffer
2. Perform Partial Cuts: Silviculture
   - Under extensive investigation
   - In some cases as good or better than unmanaged forest (Semlitsch et al. 2009, Bioscience)
   - However, must leave the small logs and/or slash.
   - Shelterwood cut- Cut mature trees: 50 ft^2/ac BA, leave large shade (and seed) producing trees

Return 5-10 yrs

LEAP Project

Semlitsch, Gibbons, Hunter, Gibbs, Rothermel

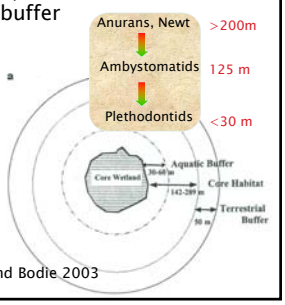
Conservation and Management
Terrestrial Environment

3. Minimize Soil Disturbance
   - Few roads/trails as possible
   - Minimize soil compaction
4. Promote Abundant Insects
   - Restore natural fire frequency, intensity and seasonality
   - Establish NWSGs in Grasslands
5. Maintain Dispersal Corridors
   - Areas of Limited Disturbance
   - Aquatic and Terrestrial Sites
   - Spatially Disjunct Wetlands

Riparian Corridors

Buffers for Amphibians: Wetlands

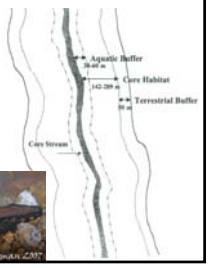
- Protects enough habitat for both aquatic and terrestrial life stages
- Protects the aquatic habitat, core terrestrial habitat with an additional buffer
- Core habitat 159–290m **(ideally 340m)**
- Frogs need greater area than salamanders
- This core habitat may be compatible with some low impact types of land use, partial cut forest, recreation.



Semlitsch and Bodie 2003

Buffers for Amphibians: Streams

- Protect both habitats, also act as corridors
- Current US Forest Service regulations require only a 9m buffer (does somewhat reduce sedimentation compared to a 1m buffer or no buffer)
- Essentially not different from no buffer for salamanders (Peterman and Semlitsch 2009:Forest Ecology and Management)
- S. Appalachians– 92.6m to protect 95% of adults (Crawford and Semlitsch 2007)

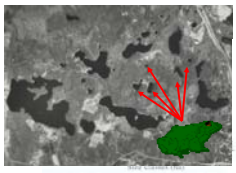


Importance of Small Wetlands

Gibbs (1993) and Semlitsch and Bodie (1998)

Gibbs (1993): Maine

- Loss of wetlands: < 4 ha
- Wetland area decreased by 19%
- Inter-wetland distance increased by 67%



Semlitsch and Bodie (1998): SC

- Loss of wetlands: < 4 ha and 1.2 ha
- Interwetland Distance:
  - 1.2 ha: increased 43% (195 m)
  - 4 ha: increased 136% (641 m)
- Decreases Probability of Dispersal

Detrimental to Rescue Effect: Sinks

- Small wetlands can be sources
- Small wetlands can be specious

Rainbow Bay (0.5 ha): 16 yr study

- 13,500 metamorphs / yr
- 27 amphibian species

Current Wetland Regulations:

- Tulloch Rule Overturned: Dredging Wetlands is Legal
- SWANCC Decision: Isolated Wetlands Not Protected

Effects of Roads

Conservation Biology 19:2004-2008 and 21:159-167, Biological Conservation 73:177-182, Herpetologica 60:45-53, Amphibia-Reptilia 28:25-31

1) Direct Mortality

- 2-18% Mortality Rates
- Mortality rate of some species increases with traffic intensity (toads)
- Distance to Wetland is the Best Predictor of Mortality Rate
- Low Intensity Impacts: 5-26 cars / hr

2) Habitat Destruction

- Loss of Wetlands
- Loss of Suitable Terrestrial Habitat
  - Road-effect Zone: 35 m
  - Maintained & Abandoned

Reduced Habitat 1/3

Effects of Roads

3) Habitat Fragmentation Marsh et al. (2004)

- Forest Roads: Deflected Movement 51% of time
- Type was Unimportant

4) Runoff and Erosion

- Petroleum and oil, other fluids
- Sedimentation, erosion, increase flash flooding

A Possible "Benefit"

5) Acoustic Interference

- Calling rate decreases at wetlands near roads

Ecological Trap?

Mitigating Effects of Roads

- Maintain only necessary forest roads; replant others
- Minimize new roads and placement of roads near wetlands
- Close roads seasonally during migrations
- Reduce speed limits or install speed bumps

Mitigating Road Effects

Monitor Migration & Population Size

Determine Mortality Rate

ACO Polymer Products, Inc.

1) Drift Fence Diversion

www.acousa.com

Polymer Concrete

2) Culverts

3) Signs

Something to Keep in Mind

- Are you managing for a particular species or a whole community?
- Different species have different needs and different susceptibilites
- Multiple species: may have to balance needs of different species
- Different areas of the country and world may have different circumstances that need to be considered