Conservation and Management of Amphibian Populations


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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

I. Aquatic and Terrestrial Habitat Needs

II. Aquatic Environment Strategies

III. Terrestrial Environment Strategies

IV. Wetland Buffers, Small Wetlands, and Roads

Aquatic and Terrestrial Needs

What can we do to ensure habitat needs are met?

Aquatic Environment

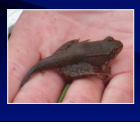
Terrestrial Environment

Life Cycle:

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

Concerns:

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



Life Cycle:

- Breeding Habitat: Salamanders
- Juvenile & Adult Foraging Sites
- Overwintering & Estivation Sites
- 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

Schmutzer et al. (2008); Burton et al. (2009)

2) Constructed Wetlands

- Gradual slope

3) Control Exotic Plants

- Herbicides
  - 2,4-D: Broad-leaved (AquaKleen)
  - Glyphosate: Non-selective (Rodeo)
  - Imazapyr: Invasive Exotics (Habitat)
- Biological Control

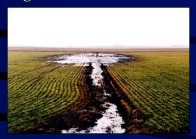
Hylobius

Galerucella

Conservation and Management

Aquatic Environment: Hydroperiod

1) Plug Ditch or Drain Tile



3) Provide Diverse Hydroperiods/Wetlands

Joel Snodgrass

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

- Wetland complex: ➢ Ephemeral & Permanent

2) Managed Wetlands:

- February-August
- Multiple Species:

Amphibians, Waterbirds

4) Gradual Drawdowns (>2 weeks)

Conservation and Management

Aquatic Environment: Water Quality

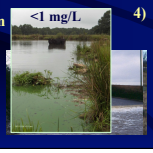
1) Minimize Agricultural Chemicals
- Pesticides, Herbicides, Fertilizers
- Apply following Manufacture Recommendations
- → Chemical Mixtures
- Establish >15 m Buffer (Needs to be Tested)

3) Prevent High Temperatures
- Maintain Adjacent Tree Cover
- Maintain Shoreline Vegetation

34-42 C
93-104 F

2) Maximize Dissolved Oxygen
- Minimize Eutrophication
  - ➢ Minimize Cattle Access
  - ➢ Minimize Fertilizers

(0.5, 2, 30 mg/L)
- Managed: Flush with oxygenated water



4) Maintain Natural Flow (lotic)

20 C and >5 mg/L

Conservation and Management

Aquatic Environment: Predators

1) Minimize Predatory Fish Population
- All Fish: Eat Eggs
- Tadpoles: Green Sunfish, Catfish, Bass, Trout
- Adults: Catfish, Bass, Trout

Options
- Electroshock or Seine Fish, Capture or Gig Frogs
- Fish Kill with Rotenone (early fall – winter)

✓Breaks down Rapidly (<1 month) ✓Closed System
✓Potassium Permanganate ($KMnO_4$; 1:1)

2) Eliminate all Introduced Species
- Amphibians and Fish

Purpose	Number acre-feet treated with 1 gallon (5%) (1 x 10 chains)	Concentration (ppm)	
		Active rotenone	5% Formulation
Normal pond renovation; no bullheads, carp, bowfin, etc.	6.0 - 3.0	0.025 - 0.050	0.50 - 1.0
Ponds with carp or bullheads	3.0 - 1.5	0.050 - 0.10	1.0 - 2.0
Ponds with bowfin, gar, largemouth bass	1.5 - 1.0 (possibly 2 applications)	0.10 - 0.150	2.0 - 3.0

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

LEAP Project

Semlitsch, Gibbons, Hunter, Gibbs, Rothermel

- Shelterwood Cut
  - ➢ Cut Mature Trees: 50 ft^2/ac BA
  - ➢ Leave Large Shade (and seed) Producing Trees

Return 5-10 yrs

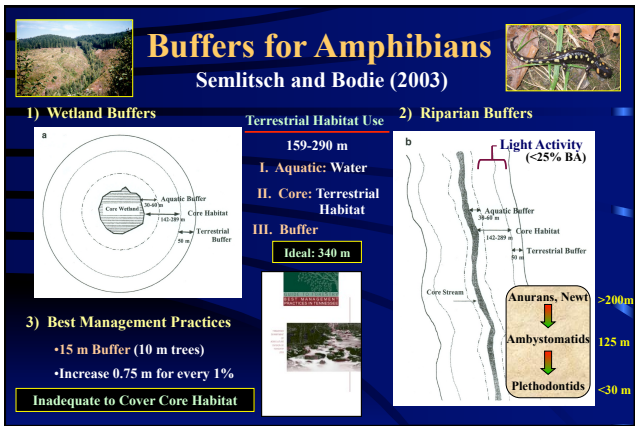
3) Leave Slash and Decomposing Logs

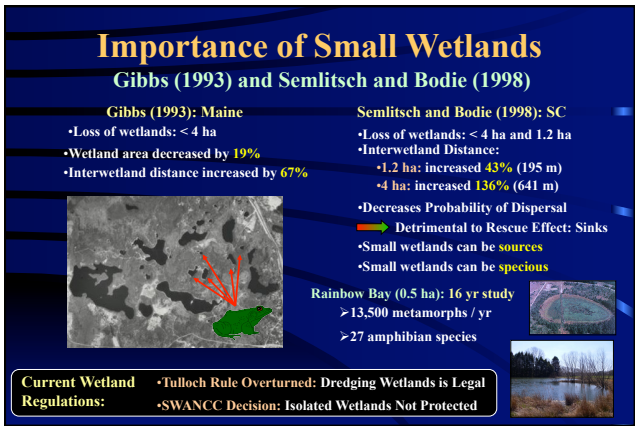
4) Minimize Soil Disturbance

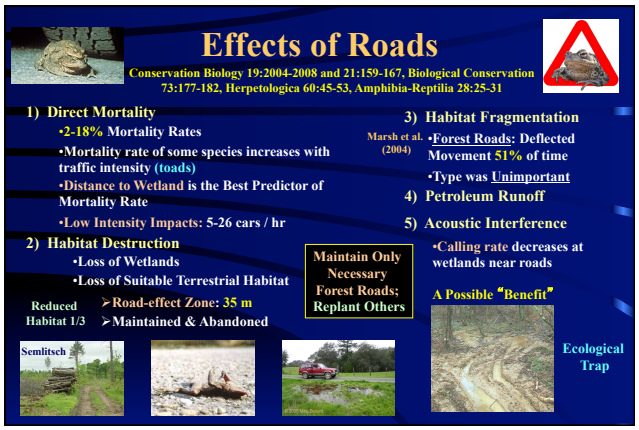
Drier, LP Tire, Skid Trails

5) Promote Abundant Insects
- Restore Natural Fire Frequency
  - ➢ Spring Burns Best for Amphibs
- Establish NWSGs in Grasslands

6) Maintain Dispersal Corridors
- Areas of Limited Disturbance
- Aquatic and Terrestrial Sites
- Spatially Disjunct Wetlands:
  - → Riparian Corridors


Buffers for Amphibians
Semlitsch and Bodie (2003)
1) Wetland Buffers
Terrestrial Habitat Use
159-290 m
I. Aquatic: Water
II. Core: Terrestrial Habitat
III. Buffer
Ideal: 340 m
2) Riparian Buffers
Light Activity (<25% BA)
Aquatic Buffer
Core Habitat
Terrestrial Buffer
Core Stream
Anurans, Newt
Ambystomatids
Plethodontids
>200m
125 m
<30 m
3) Best Management Practices
•15 m Buffer (10 m trees)
•Increase 0.75 m for every 1%
Inadequate to Cover Core Habitat


Importance of Small Wetlands
Gibbs (1993) and Semlitsch and Bodie (1998)
Gibbs (1993): Maine
•Loss of wetlands: < 4 ha
•Wetland area decreased by 19%
•Interwetland 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

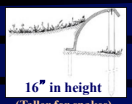

Effects of Roads
Conservation Biology 19:2004-2008 and 21:159-167, Biological Conservation 73:177-182, Herpetologica 60:45-53, Amphibia-Reptilia 28:25-31
1) Direct Mortality
•2-18% Mortality Rates
•Mortality rate of some species increases with traffic intensity (toads)
•Distance to Wetland is the Best Predictor of Mortality Rate
•Low Intensity Impacts: 5-26 cars / hr
2) Habitat Destruction
•Loss of Wetlands
•Loss of Suitable Terrestrial Habitat
Reduced Habitat 1/3
➢Road-effect Zone: 35 m
➢Maintained & Abandoned
Maintain Only Necessary Forest Roads; Replant Others
3) Habitat Fragmentation
Marsh et al. (2004)
•Forest Roads: Deflected Movement 51% of time
•Type was Unimportant
4) Petroleum Runoff
5) Acoustic Interference
•Calling rate decreases at wetlands near roads
A Possible "Benefit"
Ecological Trap
Semlitsch

Monitor Migration & Population Size

Mitigating Road Effects

Determine Mortality Rate

ACO Polymer Products, Inc.



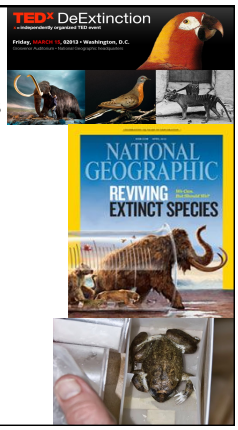
1) Drift Fence Diversion

3) Signs

2) Culverts

De-extinction

- The hot-topic of conservation
- 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=TQ8TIUxiqgY&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 (embryo survived 36 hrs)
    - http://www.abc.net.au/news/2013-03-16/bizarre-extinct-frog-brought-back-to-life/4575916



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?