WFS 533 Student Lecture

# Salamander Conservation in the Southeastern U.S.

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## Synopsis

- Geography of the Southeast
- Salamander Diversity/Habitats
- Current threats/Management
- Case examples:
  - Green Salamander
  - Eastern Hellbender
  - Junaluska Salamander
  - Shenandoah Salamander
- The future



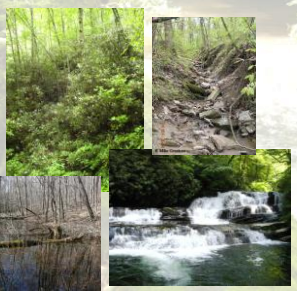
## Geography of the Southeast

- 13 states, 1 territory (USFS)
  - **12 for us (PARC Standards)(and Bill)**

Salamander Conservation

## Salamander Habitats

- Moist, humid habitats:
  - **Streams**
  - **Vernal pools**
  - **Lakes**
  - **Eastern temperate rainforests**
  - **Conifer zones**
  - **Wetlands**



Salamander Conservation

## Salamander Diversity

- 535 Species worldwide
- Appalachia=14% of worldwide distribution

Salamander Conservation

## Salamander Diversity

- Appalachian origin (plethodontids)
- GSMNP: most abundant vertebrate (nps.gov)
- Diversity (TN):
  - **6 Ambystomatids**
  - **1 Amphiumid**
  - **1 Cryptobranchid (complex)**
  - **App. 46 Plethodontids:** 1 *Aneides*, 16 *Desmognathus*, 6 *Eurycea*, 3 *Gyrinophilus*, 1 *Hemidactylium*, 17 *Plethodon*, 2 *Pseudotriton*
  - **1 Proteid**

Salamander Conservation

## Current Threats/Issues

- Habitat changes/loss
- Acid rain/fog
- Natural/Invasive species
- Pollution (little understood)
- Fish stocking
- Mining
  - **Mountaintop removal (Appalachia)**
  - **Acid mine drainage**
  - **Strip mining**
- Over-collection for pet stores, etc.
- Climate change (possible—not enough data)

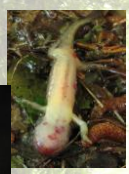


Salamander Conservation

## Current Threats/Issues

**Ranavirus:**

- Spp. Infected, no Mortality:
  - **At least 14 (8 *Desmognathus*, 4 *Eurycea*, 1 *Plethodon*)**
  - **1 Complex (*Plethodon glutinosis*)**
- Species w/mortality:
  - ***Ambystoma maculatum***
  - ***Ambystoma tigrinum***
  - ***Ambystoma opacum***




**Viruses 2011, 3: 2351-2373**

Salamander Conservation **Species Case Examples**

## Green Salamander

(*Aneides aeneus*)

- Plethodontidae
  - **Complex of species**
- 8-14cm TL
- Habitats:
  - **Rock crevices**
  - **Tree trunks nearby**
  - **500-1300m elev. (BRE)**
- Status:
  - **IUCN Near Threatened**
  - **TN Imperiled/Vulnerable**
  - **Sensitive in several other states**


Salamander Conservation **Species Case Examples**

## Green Salamander

(*Aneides aeneus*)

Salamander Conservation **Species Case Examples**

## Green Salamander

(*Aneides aeneus*)

**Tolerate drier living conditions than many other eastern salamanders—VERY SPECIALIZED**

Corser 2001, Brodman 2004

Salamander Conservation **Species Case Examples**

## Green Salamander

(*Aneides aeneus*)

- Potential Threats:
  - **Habitat loss (deforestation)**
  - **Overcollection?** (Brodman 2004)
- Challenges:
  - **Disjunct, isolated relicts**
  - **Obligate species**
  - **Low fecundity/dispersal**
  - **Philopatric**
  - **Crashes and recolonization**

Salamander Conservation | Species Case Examples

## Green Salamander

(*Aneides aeneus*)

Conservation:

- **Recommended forest buffers (100m)**(Brodman 2004)
- **Early decay classes (cavities) Sufficient old growth** (Wilson 2003)
- **Research and Monitoring:**
  - **Population ecology**
  - **Dispersal**
  - **Life history strategies**
  - **Metapopulations?**
  - **Colonization/recolonization**
  - **GIS Modeling?**

Salamander Conservation | Species Case Examples

## Eastern Hellbender

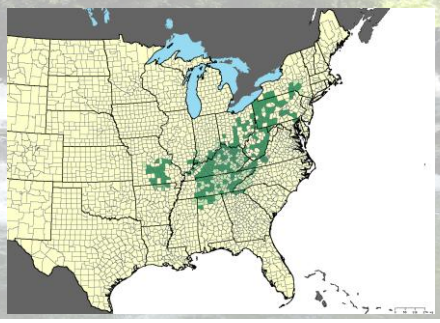
(*Cryptobranchus alleganiensis alleganiensis*)

- Cryptobranchidae
- 30-74cm TL
- Habitats:
  - **Fast-flowing, cold, clear streams**
  - **Rocky bottoms**
  - **High dissolved $O_2$**
- Status:
  - **TN "Vulnerable" and "Deemed in Need of Management"**
  - **IUCN Vulnerable**


Salamander Conservation | Species Case Examples

## Eastern Hellbender

(*Cryptobranchus alleganiensis alleganiensis*)



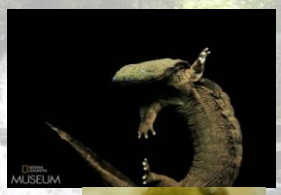
Salamander Conservation — Species Case Examples

## Eastern Hellbender

(*Cryptobranchus alleganiensis alleganiensis*)

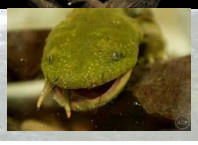
Threats:

- Timber/Mining/Agriculture
- Stream alteration
- Overcollecting
- Angler mortality



Challenges:

- Slow development
- Habitat specialist
- Sensitive/Intolerant of changes
- Isolated populations



Salamander Conservation — Species Case Examples

## Eastern Hellbender

(*Cryptobranchus alleganiensis alleganiensis*)

Conservation:

- CITES Appendix iii (Interstate trade)
- Need better regulations
- Public outreach
- PIT tag tracking (VA)
- Monitoring and research
- NY:
  - Stones
  - Hatcheries
  - Head-start program


Salamander Conservation — Species Case Examples

## Junaluska Salamander

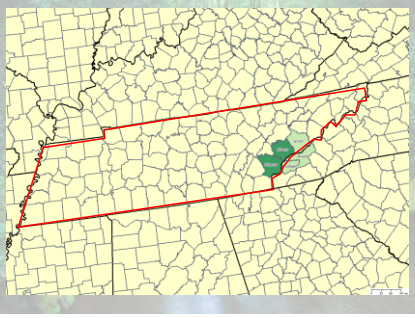
(*Eurycea junaluska*)

- Plethodontidae
- Distribution:
  - E. TN/W. NC (5 counties)
- 7.5-10cm TL
- Habitats:
  - Clear, generally rocky streams (Gutzke 2001)
  - Surrounding forest
- Status:
  - IUCN Vulnerable
  - TN "Imperiled" and "Deemed in Need of Management"

Salamander Conservation | Species Case Examples

## Junaluska Salamander

(*Eurycea junaluska*)



Salamander Conservation | Species Case Examples

## Junaluska Salamander

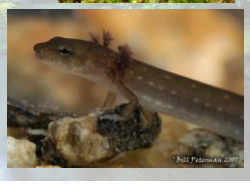
(*Eurycea junaluska*)

Threats:

- **Sedimentation**
- **Disruption during breeding season**

Conservation Challenges:

- **Habitat specialist**
- **Disjunct populations**
- **Rare (esp. adults)**
- **Sensitive to changes**



Salamander Conservation | Species Case Examples

## Junaluska Salamander

(*Eurycea junaluska*)

Conservation:

- **Presence surveys**
- **Monitoring**
- **Life history research**
- **Hybridization research?**

## Shenandoah Salamander

(*Plethodon shenandoah*)

- Plethodontidae
- Distribution:
  - Shenandoah NP, VA
  - 3 mountaintops
- 7-10cm TL
- Habitats:
  - Forested, high-elevation talus
  - 800m+ elev.
- Status:
  - Federally Endangered 1989 (ESA)
  - State Endangered (Virginia)
  - IUCN Vulnerable 2004 (stable pops.)

Salamander Conservation | Species Case Examples

## Shenandoah Salamander

(*Plethodon shenandoah*)

Known Threats:

- Competition (*Plethodon cinereus*)
- Dry conditions—sensitivity

Possible Threats:

- Acid rain deposition (lower pH)
- Woolly adelgid (defoliation)
- Gypsy moth (defoliation)
- Human/Mgmt activities

Conservation Challenges:

- Habitat specialist
- Minute range
- Ecologically sensitive

Salamander Conservation | Species Case Examples

## Shenandoah Salamander

(*Plethodon shenandoah*)

Conservation:

- No restoration/increase
- Park educational efforts
- Continual monitoring
- Locate new areas
- Minimize human impacts:
  - Trails
  - Firelines
  - Burns (timing/intensity)
  - Timber harvesting
  - Public disturbances

## Why Conserve Salamanders?

Plethodontidae: (Welsh and Droege 2001)

- Long-lived
- Abundant vertebrate
- Highly sensitive to small-scale changes
- Good "surrogate" for forests

Familiar fact:

- Important to trophic web in many areas

(Course lecture, Sutton 2012)



## What's Next?

- Still know little about many salamanders
- Need for more research
  - Life history
  - Occurrences/abundance
  - Reproductive success
  - Human impacts
  - Efficient management

- Inform public/managers
  - Tours, Seminars, Training, Field Trips
- Prominence in management



## Questions to Consider

- What are some common traits we see in southeastern species of concern?
- What kinds of factors limit or enhance salamander diversity and occurrence?
- What are some of the conservation values for salamanders?
- How would you, as a biologist, explain or convince people about the importance of salamander diversity?

# Literature Cited


- **Brodman, R.** 2004. R9 species conservation assessment for the green salamander, *Aneides aeneus* (Cope and Packard). Saint Joseph's College, Rensselaer, IN, 17pp.
- **Bruce, R. C.** 1968. The role of the Blue Ridge Embayment in the zoogeography of the green salamander, Aneides aeneus. Herpetologica 24(3):185-194.
- **Chattin, E., D. C. Forester, and J. W. Snodgrass**. 2007. Distribution of a rare salamander, Eurycea junaluska: implications for past impacts of river channelization and impoundment. Copeia 4:952-958.
- **Corser, J. D.** 2001. Decline of disjunct green salamander (*Aneides aeneus*) populations in the southern Appalachians. Biological Conservation 97:119-126.
- **Gordon, R. E.** 1961. The movement of displaced green salamanders. Ecology 42(1):200-202.
- **Gratwicke, B.** (ed). 2008. Proceedings of the Appalachian Salamander Conservation Workshop. IUCN/SSC Conservation Breeding Specialist Group, Apple, Valley, MN.
- **Gutzke, W.** 2001. Final report on the status of the Junaluska salamander (*Eurycea junaluska*) in North Carolina with particular interest on the Cheoah River below Santeetlah Dam and recommendations as to management of the flow rates of this river. University of Memphis, Dept. of Biology, 3pp.
- **Hall, H. D.** 1998. Memorandum to the Director of the U.S. Fish and Wildlife Service: Ninety-day administrative finding on a petition to list the Junaluska salamander as Endangered with critical habitat. Atlanta, GA. 10pp.
- **International Union for the Conservation of Nature and Natural Resources. 2011**. IUCN red list of threatened species. http://www.iucnredlist.org. Accessed 12 April 2012.
- **Miller, D., M. Gray, and A. Lee**. 2011. Ecopathology of ranaviruses infecting amphibians. Viruses 3:2351-2373.
- **New York State Department of Environmental Conservation**. 2012. Conservation and restoration of the eastern hellbender. http://www.dec.ny.gov/public/73572.html. Accessed 12 April 2012.
- **Niemiller, M. L. and R. G. Reynolds** (eds). 2011. The amphibians of Tennessee. University of Tennessee Press, Knoxville, TN.
- **Ryan, T. J.** 1997. The status of the Junaluska salamander (*Eurycea junaluska*) at Snowbird Creek, Nantahala National Forest (Annual Report). Savannah River Ecology Laboratory, Aiken, SC. 5pp.
- **U.F. Fish and Wildlife Service.** 1994. Shenandoah salamander (*Plethodon shenandoah*) recovery plan. Hadley, MA, 39pp.
- **U.S. Fish and Wildlife Service**. 2012. Summary of the rule to list the Ozark hellbender as endangered. http://www.fws.gov/midwest/endangered/amphibians/ozhe/ozheSummary2011FinalRule.html. Accessed 12 April 2012.
- **U.S. Forest Service**. 2003. Conservation assessment for Ozark hellbender (*Cryptobranchus alleganiensis bishopi Grobman*). Mark Twain National Forest, Rolla, MO, 48pp.
- **Virginia Department of Game and Inland Fisheries**. 2012. Eastern hellbender web page. http://dgif.virginia.gov/hellbender>. Accessed 12 April 2012.
- **Waldron, J. L. and W. J. Humphries**. 2005. Arboreal habitat use by the green salamander, Aneides aeneus, in South Carolina. Journal of Herpetology 39(3):486-492.
- **Welsh, H. H. Jr. and S. Dredge**. 2001. A case for using plethodontid salamanders for monitoring biodiversity and ecosystem integrity of North American forests. Conservation Biology 15(3):558-569.
- **Wilson, C. R.** 2003. Woody and arboreal habitats of the green salamander (*Aneides aeneus*) in the Blue Ridge mountains. Contemporary Herpetology.