




Woodland Salamander Distribution and Response to Forest Disturbance



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Who am I

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- M.S. Candidate | Earth and Planetary Sciences
- Vegetation Monitoring
 - Great Smoky Mountains NP
 - BLM in Vernal, UT
- SEND HELP



Outline

- Woodland Salamanders
- Distributions
- Eastern Hemlock Habitat
- HWA
- Impacts
- Great Smoky Mountains
- Thesis



Plethodontidae

- Ectothermic urodelian vertebrates
- Southern Appalachians and Neotropics
- Lungless
 - Increases importance of microclimate
- Parental Care



Woodland Salamanders

- Plethodontidae
 - *Plethodon*
- Fully Terrestrial
- Mesophytic Forests
- Habitat
 - CWD
 - Leaf litter



Terrestrial Lifestyle

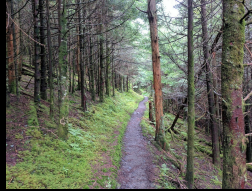
- Direct Development
- Small body size
- Rounded Tail
- Hyobranchial prey-capture
 - Macroarthropods



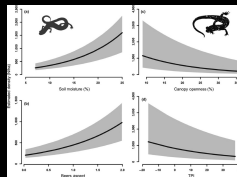
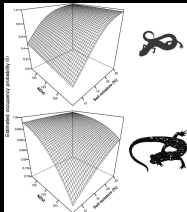
What Makes Good Mander Habitat?

- Temperature
- Soil Moisture
- Canopy Cover
- Woody debris cover
- Soil pH

(Baecher and Richter 2018)



Distribution



(Baecher and Richter 2018)

Foundational Species


- "[Species] that locally stabilize conditions for other species as well as modulate fundamental ecosystem processes" (Dayton 1972)



Eastern Hemlock

- *Tsuga canadensis*
 - Pinaceae
- Temperature and Light Availability
 - Evergreen
 - Shade tolerant
- Soil Moisture
 - Low but constant transpiration rates
- Soil Chemistry
 - Low pH
 - Low Nitrification

(Lantschauer and Ellison 2012; Kizilinski et al. 2003; Orwig et al. 2008)



Sympatric Organisms


- Tolerance
 - Conditions more extreme for plants
- Understory Vegetation
 - Less dense
 - Fewer species (Rogers 1980)
- Feedback
 - Greater number of hemlock seedlings (D'Amato et al. 2008)



T. canadensis

Decline

- Hemlock Woolly Adelgid
- Elongate Hemlock Scale
- Climate Change



Joe Buge, Old Dominion

Succession

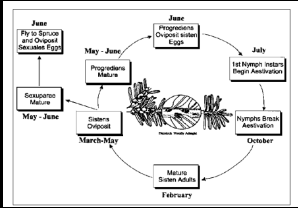
- Replaced by deciduous species
 - *Betula lenta*
 - *Acer rubrum*
 - *Liriodendron tulipifera*
 - *Quercus* spp.

Hemlock Woolly Adelgid

· Hemiptera : *Adelges taugae* (HWA)

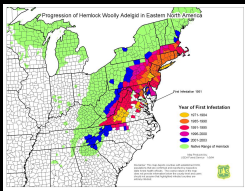


HWA



HWA

- Asia
- Invasion: 1950s
- Spreading throughout the U.S.: 1980s
- Few natural predators
- No evolutionary defenses



Changing Microclimate

- Temperature
 - More extreme; Warmer Summer Temps
- Soil Moisture
 - Fluctuates; increase followed by a decrease
- Light availability
 - Canopy gaps
 - Deciduous species/Leaf off
- pH
 - Increasing
- CWD
 - High abundance of low decay class

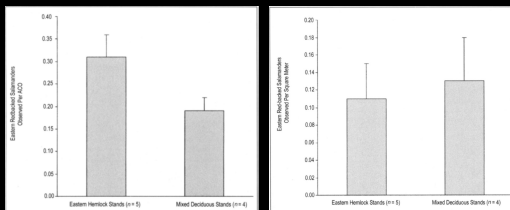


P. cinereus Response

- Northeastern U.S.
- Mathewson- Higher abundance in hemlock stands
- pH?
- Cover?
- (Mathewson 2009)



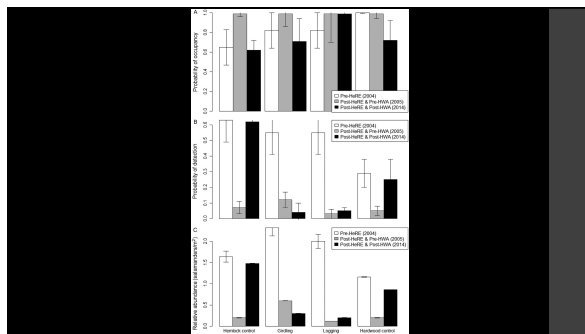
P. cinereus Relative Abundance



N. viridescens (Red-eft stage) Response

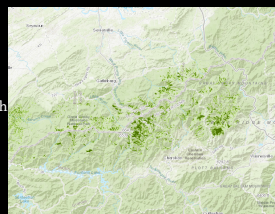
- Northeastern U.S.
- -4.5 Celsius in Summer
- 4.1 : 4.4 pH
- Higher abundance in hemlock
- Thicker keratinized skin
- (Mathewson 2014)





GRSM

- 18,000 acres of *T. canadensis* dominated forests
- Over 700 acres of old growth *T. canadensis*
- HWA first spotted in 2002



Management

- Imidacloprid
 - Tree injections
 - Soil drenching
- Foliar Sprays
- Biotic Controls
 - *Laricobius* beetles



GRSM Salamanders

- Highly oxygenated low order streams
- Elevational gradient
- 31 observed species
- Center of beta diversity



Thesis

- What's the environment of Southern Appalachian/GRSM hemlock forests?
- How does it differ from historically hemlock dominated/successional mixed hardwood forests?
- What are the salamander communities in hemlock and historically hemlock-dominated forests?
- Is prey availability different?
- Can we predict salamander occupancy within hemlock forests and how it might change?

Environment

- Microclimate
- Substrate
- Canopy



Prey



- Macroinvertebrates
- What's there?
- Differences?
- What are the salamanders eating?

Salamanders

- NCO Survey
- Woodland Salamanders
 - *P. jordani*
 - *P. teyahalee*
 - *P. glutinosus*
 - *D. aeneus*
 - *D. imitator*



Summary

- Salamander Distribution
- Eastern Hemlock declining
- Effect on salamander distribution in Northeastern U.S.
- How is the environment changing in SE Appalachia?
- Is there an effect on salamanders and their prey?
