Land snail community diversity in the Driftless Region of Wisconsin

Chris Lynum, Rachelle Amundson, & Kathryn E. Perez
Department of Biology, UWL, kperez@uwlax.edu
UW-Stout: Matt Kuchta, Amanda Little, Nina Borchowiec; WDNR: Terrell Hyde; UNM: Jeffrey Nekola; UWL: Jim Theler

Introduction

The terrestrial snails of North America are a diverse and threatened group, but conservation status of the majority of species is uncertain. There are ~100 species of land snails in Wisconsin and several habitats are known to have globally significant levels of land snail species richness, however, most are minute (<5 mm, see Fig.1) and their distributions and ecologies are poorly known[1]. The Driftless Area of Wisconsin was free of ice during the last glaciation. We are surveying land snails in the Driftless region to address land snail community ecological questions as well as conservation questions.

Questions:

1. ***What are the variables driving land snail community diversity and distribution in the Driftless region?***
2. ***Are these variables similar to those affecting land snail community structure in other regions or does the unique geological history of the Driftless region result in stronger influence of historical biogeographical factors?***
3. ***21 land snail species have been identified by WDNR as species of greatest conservation need. Where are populations of these species located?***

Approach:

1. Build a database of all previous land snail collections in Wisconsin.
2. Using the database of previous land snail collections and GIS overlays of geology and vegetation build a predictive model of priority land snail habitats.
3. Sample habitats identified as high priority for land snails that are on public lands. Sampling includes all major terrestrial habitat types in the region.
4. Gather quantitative habitat data in each vegetative community.
5. Use the quantitative data and land snail diversity and abundances to answer our 3 questions and test our initial predictive model.

References

1. Nekola, J.C. 2003. Large-scale terrestrial gastropod community composition patterns in the Great Lakes region of North America. Diversity and Distribution. 9:55-71.
2. Clarke, K.R., Gorley, R.N. 2006. PRIMER v6: User Manual/Tutorial. PRIMER-E, Plymouth.

Figure 1. Size of microsnails. Photos and design by Jeffrey C. Nekola.

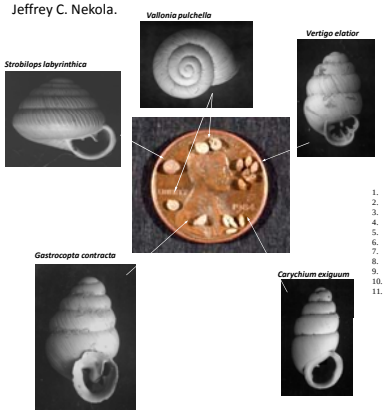


Figure 2. Locations sampled. UWL sites in maroon. UW Stout sites in Blue.

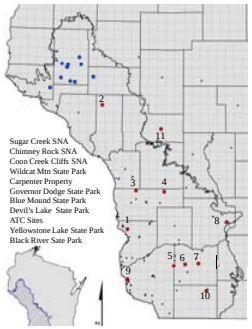


Figure 3. Example of sampling scheme. Mississippi Valley Conservancy location in Iowa Co., WI. At each location several vegetation types are surveyed.

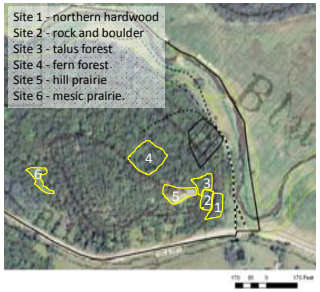
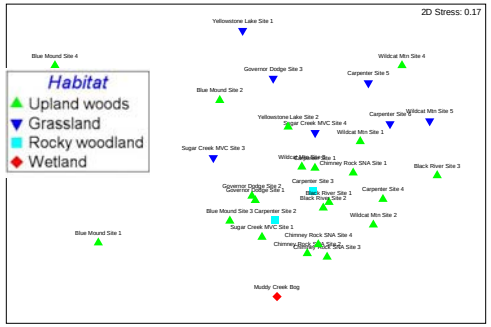


Figure 4. L: Chris searching for macrosnails at Chimney Rock SNA in Trempealeau CO, R: Rachelle in the lab searching for microsnails in the litter.

Figure 5. Nonmetric multidimensional scaling (NMDS) plot of abundance data from leaf litter samples.



Materials and Methods – Year 1

Database: 4,418 Wisconsin land snail records were gathered and identities were confirmed by KEP from national and regional museum collections.

Predictive Model: Georeferenced museum records were used to create a GIS model. This model incorporates sites with high gastropod richness with environmental information such as: climate; WISCLAND landcover database and historical vegetation. Areas identified by the GIS model as highest priority were targeted for surveys. A few low priority areas were surveyed to ground-test the model.

Materials and Methods – Year 2

Surveys: Within each vegetation type (Fig. 2 & 3), such as Northern hardwood forest or Hill Prairie the following were carried out:

1. Snails
a) Timed searches. At least 30 minutes of searching for macrosnails (Fig. 4L).
b) Leaf litter sampling: Using a 0.5 m^2 quadrat at least 2 m^2 of leaf litter and organic layer are gathered in each habitat.

2. Environmental data: At 3 quadrat sites within each sampling habitat the following quantitative data are gathered: slope, aspect, % cover of vegetation, moss, woody debris, rocks, bare soil, litter, litter depth & composition, canopy cover, tree identity and diameter at breast height (dbh) in 4 directions.

Methods – continued

Leaf litter processing: Leaf litter was washed to remove fine sediments and wash snails off of large vegetable matter. Samples are sieved through a #40 US Standard Sieve to remove large soil and vegetative debris. Larger snails visible on sieve are collected. Samples are then air-dried for ~2 days and sieved again to remove finer vegetative matter. After drying, each sample of litter is sorted twice under a low-power dissecting microscope (usually ~40X) (Fig. 4R). All microsnails are collected, sorted, and identified to species.

Analysis: Abundance data from leaf litter samples and presence absence data which included both snails found in leaf litter and timed searches were analyzed in Primer 6[2]. The abundance dataset was square root transformed and a Bray Curtis similarity matrix was constructed. A nonmetric multidimensional scaling (NMDS) analysis was performed on this matrix. This process was similar for presence absence data except a presence-absence transformation was used.

Results

Question 1 (Figure 5):

- There is a significant difference in land snail community when comparing habitat areas with different dbh. 0 to 10 dbh (p=0.028).
- There is a significant difference in land snail community when comparing habitat areas with different % canopy cover. 100% to 25% (p=0.007) and 100% to 75% (p=0.047).
- There is a significant difference in land snail community when comparing habitat areas with different % cover of growing vegetation in quadrats. % vegetation. 100% to 50% (p=0.029) and 100% to 25% (p=0.007).
- There is a trend towards differences among habitats, but these were not significant (p=0.058). These are probably affected by encroachment of forest on grassland habitats.

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