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Bio 862 Spring 2008

Topic: Invasive plants and their effect on amphibians or reptiles

Papers read:

1. Valentine LE, Roberts B, Schwarzkopf LIN (2007) Mechanisms driving avoidance of non-native plants by lizards. Journal of Applied Ecology 44: 228-237.

This paper is trying to understand the mechanisms that drive habitat selection in the native skinks. Lizards are able to chose which vegetation they prefer. They chose native leaf vegetation over the invasive plants. The authors hypothesize the lizards prefer native vegetation because the invasive leaf litter has a cooler surface temperature, and less arthropods than native plants. Another theory is that invasive plants were shorter and differently shaped making lizards more obvious and easier to detect by predators. Conclusions: invasive vine less optimal.

2. Downes S, Hoefer AM (2007) An experimental study of the effects of weed invasion on lizard phenotypes. Oecologia 153: 775-785.

Hatchlings were raised with high, moderate, low weed invasion to understand how an invasive weed affects the basking and activity of a lizard. The invasive periwinkle blocked sunlight, making floor temps lower than preferred body temp, so lizards climbed plants to reach optimal body temp. This made lizards grow longer hind limbs, therefore they sprint faster. But these lizards hid more often, they were lighter in body mass, and had lighter clutch masses and offspring. The next step I think the authors should take would be to raise the hatchlings this study produced and see if the different substrates affected the lizards in future generations.

3. Maerz JC, Brown CJ, Chapin CT, Blossey B (2005) Can secondary compounds of an invasive plant affect larval amphibians? Functional Ecology 19: 970-975.

Bufo americanus and *Hyla versicolor* tadpoles were raised on high-quality diets in aqueous extracts of leaves from native vegetation and invasive vegetation. *B. americanus* survived less in the invasive plant extracts while *H. versicolor* was not affected, implying that these plant compounds found in this exotic plant are detrimental to some native fauna.

Other papers on reptiles/amphibians and invasive species:

4. Valentine LE (2006) Habitat avoidance of an introduced weed by native lizards. Austral Ecology 31: 732-735.

This short paper must have been Valentine's prelude to the more complete study he did a year later. This paper quantified the use of the invasive rubber vine versus the native vegetation in lizards. He found that the invasive plant was used significantly less than the native vegetation suggesting there are suboptimal characteristics in the invasive rubber vine.

5. Noland R, Ultsch GR (1981) The roles of temperature and dissolved oxygen in microhabitat selection by the tadpoles of a frog (Rana pipiens) and a toad (Bufo terrestris). Copeia 1981: 645-652.

This paper was very interesting and tied in to the criticisms I had about the Maerz et al. (2005). In the Maerz paper, they pointed to the fact that the dissolved O2 levels went down in the loosestrife extracts. In this paper the authors find that *Bufo terrestris* tadpoles were found in warmer, more highly oxygenated microenvironments than *Rana pipiens*. They also found critical thermal maximum was higher in *Bufo* than in *Rana*. This seems to support my ideas that the oxygen will have a bigger effect on *Bufo* tadpoles. In addition, the temperature might play an important part too, but the temperature the experiments in the Maerz et al. (2005) paper are unknown. I liked that this paper supported experiments with field data.

6. Nagy KA, Henen BT, Vyas DB (1998) Nutritional Quality of Native and Introduced Food Plants of Wild Desert Tortoises. Journal of Herpetology 32: 260-267.

Desert tortoises (*Gopherus agasizii)* were penned up and given either invasive forbs and grasses or native forbs and grasses. Their intake was measured as an indicator nutritional quality. It was determined that native and invasive grasses have the same nutritional quality, while both forbs were more nutritional for desert tortoises.

7. Jellinek S, Driscoll DA, Kirkpatrick JB (2004) Environmental and vegetation variables have a greater influence than habitat fragmentation in structuring lizard communities in remnant urban bushland. Austral Ecology 29: 294-304.

In Hobart, Tasmania, Australia, lizard richness and abundance was not significantly influenced by the remaining fragment size of habitat, but rather the composition of the fragment. Lizard species richness was significantly lower is sites that had a high ratio of exotic plant species to native plants species. If these native lizard species are able to persist in these small fragments, it is better for them to have native vegetation.

8. Brown CJ, Blossey B, Maerz JC, Joule SJ (2006) Invasive Plant and Experimental Venue Affect Tadpole Performance. Biological Invasions 8: 327-338.

This article examines the impacts of the invasive Eurasian purple loosestrife and the native cattails on survival of *Bufo americanus* tadpoles. Tadpoles developed slower in the invasive plant extract compared to the native plant. It is hypothesized this happens because of an alteration of tadpole food quality and quantity which leads to the reduced tadpole performance.

9. Newbold TAS (2005) Desert horned lizard (Phrynosoma platyrhinos) locomotor performance: The influence of cheatgrass (Bromus tectorum). The Southwestern Naturalist 50: 17-23.

Cheatgrass is invasive in western North American deserts. The horned lizard (*Phrynosoma platyrhinos)* avoided areas with cheatgrass cover. The adult and juvenile sprint capabilities of the lizards was tested in the presence and absence of cheatgrass and it was found that in the presence of cheatgrass, speeds decreased suggesting cheatgrass has negative effects on horned lizard mobility.

10. Bilcke J, Downes S, Buscher I (2006) Combined effect of incubation and ambient temperature on the feeding performance of a small ectotherm. Austral Ecology 31: 937-947.

This study studied the effects of incubation temperature and ambient temperature on offspring performance in the skinks. The exotic plant *Vinca major* reduces temperatures in the soil and environment. Therefore, it is hypothesized that skink hatchlings incubated in these conditions will have worse performance than other offspring that were incubated under the native vegetation. They did find that incubation and ambient temperature interacted to affect a lizard's mobility, the time it took to capture, subdue and handle a prey, and the number of handling errors that it made while foraging. This study was important because it showed that exotic species lowers the foraging performance of the skinks, and presumably, fitness, of ectothermic animals. One criticism I have for this article are that the different behaviors are very difficult to distinguish, and so I find it hard to believe many of the behavior distinctions. Also, they did not measure or weigh the lizards, so I do not think they can tell if there is any difference between them. If they took longer, but still had the same size and weight of their counterparts, then it might not have as big an effect on fitness.

Invasive species reviews:

11. Sakai AK, Allendorf FW, Holt JS, Lodge DM, Molofsky J, et al. (2001) The Population Biology of Invasive Specie. Annual Review of Ecology and Systematics 32: 305-332.

This paper outlines the life history and demographic models that allow invasive species to spread. This is important to identify the life history stages where management will be most effective in controlling invasive species. There are several life history characteristics of invasive species, including the ability to reproduce sexually and asexually, rapid maturity, phenotypic plasticity, and high tolerance to environmental heterogeneity. Also important is r-selected life histories, dispersal ability, large clutch size, competitive ability, and a close association with humans. Genetics and evolutionary processes may also be a key feature in determining whether invasive species establish and spread. This paper also tried to elucidate the susceptibility of communities to invasion. Some factors include, high current levels of disturbance, or local species diversity. Regardless of how a species becomes invasive, there are many ecological and evolutionary consequences of invasions on communities. There are direct ecological interactions (predation, herbivory, parasitism, competition, mutualism) or indirect (habitat alterations, apparent predation, cascading trophic interactions). Invasive species might also cause evolution of native species, contribute to their demise, or hybridize with native species. In conclusion there are many synergistic effects of invasive species.

12. Vellend M, Harmon LJ, Lockwood JL, Mayfield MM, Hughes AR, et al. (2007) Effects of exotic species on evolutionary diversification. Trends in Ecology & Evolution 22: 481-488.

This review gives an excellent look at what effects exotic species have on evolutionary diversification. This review is particularly useful because it is not just about the

detrimental effects invasive species have but also goes into the evolutionary consequences of exotic species.

13. Sax DF, Stachowicz JJ, Brown JH, Bruno JF, Dawson MN, et al. (2007) Ecological and evolutionary insights from species invasions. Trends in Ecology & Evolution 22: 465-471.

This paper was a good review of six insights given from studying invasive species. 1) Competition, unlike predation, seldom causes global extinction. 2) Community assembly often occurs by ecological sorting or "fitting." This question deals with whether species assemblages with novel combinations of species (both native and invasive) function the same way as native assemblages with a shared evolutionary history. Though this question is still not able to be fully answered, it is clear that communities can be comprised of most or all exotic species. 3) Adaptive genetic change can occur rapidly. Using exotic species, there many examples now of documented evidence of evolutionary changes to populations in response to exotic species. 4) Severe population bottlenecks do not preclude rapid adaptation. Often successful invasions have not experienced a significant loss of genetic diversity as is predicted. 5) Climate envelope approaches might be inadequate for many species. The predicted distribution of a species is often modeled using climate variables from the native range. Using exotic species it is possible to evaluate the accuracy of these projections. These seem to be ill-suited for predicting the responses of species. 6) Variation in patterns of specialization influences invasibility.