We used individual-based, spatially explicit simulations to explore the effects of roadkill and road avoidance on wildlife genetic diversity. Genetic evidence is mounting that roads have detectible effects on the genetics of many types of wildlife populations (Balkenhol & Waits, 2009). However, most of what we know of road effects concerns genetic fragmentation without regard to its mechanism(s), which can be road avoidance, roadkill, or both.

Little is known about the specific effects of roadkill on genetic diversity. A spatial simulations have indicated that low levels of population decline can have a major effect on population genetic diversity (Jackson & Fahrig, 2011). However, no tests have been done to discern the effects of road avoidance and roadkill on genetic patterns in an individual-based, spatially explicit framework. We tested the hypothesis that roadkill and road avoidance lead to genetic differentiation and eventual loss of genetic diversity, but that roadkill may lead to a direct loss of genetic diversity due to loss of individuals.

Results

1) contrary to our expectations, roadkill leads to higher levels of genetic diversity in neighborhoods nearest to a road, but lower genetic diversity overall; 2) road avoidance leads to distinct differences in genetic diversity from one side of a road to the other; 3) genetic patterns due to roadkill and road avoidance are clearly discernible in landscapes with high heterogeneity in resistance to movement.

Figure 3: Under the isolation by distance scenario, a) when there is no road, higher genetic diversity tends to accumulate in the center. b) when populations are separated by avoidance only, patches of genetic diversity accumulate. c) when populations are separated by roadkill, higher genetic diversity accumulates in the region near the road.

Discussion

Our results dealing with road avoidance are congruent with non-spatial simulations in demonstrating that genetic diversity drops only at the highest levels of avoidance. However, our result of no significant effect of mortality on overall genetic diversity, and higher genetic diversity near roads may be due to high dispersal and reproduction rates. Our methods may provide a means for assessing the genetic consequences of various road types.

Future Work

We plan to vary dispersal ability and reproduction rate to understand the relationship between road effects and genetic diversity. We will also pair our simulations with empirical studies on a variety of species to provide a basis for inferring the relative effects of roadkill and road avoidance.

References


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