Effect of Fragmentation on the Time to Extinction of Prairie Vole Populations in Tallgrass Prairie

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Ecological studies have produced a wealth of data on the physiology, behavior and life history for a large number of animal and plant species. Data often exist on all aspects of a species biological characteristics. These data are not well utilized by traditional models, simplified to the extent of being analyzable by available mathematical analytical approaches. However, the rapidly developing computer power and technology of the modern world can and should be combined with the existing vast data available in the field of ecology to resolve practical problems.

Examples, although still not very abundant, of successfully combining data and computational modeling methodology in the form of individual-based models do exist, though in this short abstract it is not reasonable to mention a title or two and omit others, probably equally valuable. These models require extensive research on the modeled species, careful selection of the features to be included, verifying the data from several sources if possible, validating the model in some reasonable limits and conducting extensive Monte Carlo type experiments.

We can compare this type of modeling to building a virtual field laboratory where virtual experiments can be used to investigate questions about the persistence of species under various conditions.

We present a modification of a previously reported, [1] spatial, individual-based model of herbivore population dynamics which includes a more accurate accounting of the caloric exchange between herbivore

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and the environment. Predation and dispersion mechanisms have been also newly incorporated in the model. The model is parameterized for the prairie vole, *M.Ochrogaster* in a tallgrass prairie environment. Prairie vole data are exteremely abundant, [2] and some of it has been used to parameterize the model. Vegetation growth rates, constructed using real climatic data from Tulsa airport and the package Century 4, are incorporated in the model together with estimates of its caloric content. Currently, we are using the model to study the relationship between habitat fragmentation and time to extinction of the vole populations.

We conducted 30-year simulations in our virtual field lab to compare the average time to extinction between different experimental conditions. Average time to extinction is defined as the mean time to extinction in a given number (usually greater than 100) of computer experiments initiated with a random distribution of animals for which the simulated vole population does not persist during the whole 30-year experiment.

Habitat fragmentation caused by human activities such as buildings and oil wells and the connecting roads or gas collection pipes introduces new spatial restrictions on the movements of small mammal populations. These can decrease or increase the time to extinction of the populations.

We shall present the results of a study on the time to extinction of virtual prairie vole populations in relation to habitat fragmentation caused by simulated oil exploration activities in the Tallgrass Prairie Preserve in Oklahoma.

References

[1] Kostova, Tina Carlsen and Jim Kercher, Individual-Based Spatially-Explicit Model of an Herbivore and Its Resource: The Effect of Habitat Reduction and Fragmentation, submitted to C.R. Biologie, 2003

[2] Tamarin, R. (editor),New World *Microtus*, Special publication No. 8 of The American Society of Mammalogists