

A Multi-disciplinary Approach to Modeling the Impacts of Land Use Change on Vernal Pool-breeding Amphibians (51)

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Vernal pools, seasonal wetlands that do not support fish populations, are critical habitat for several species of amphibians. Due to their limited size and intermittent existence, however, they have received little protection. Land-use change is thought to be a serious threat to vernal pool-breeding amphibians. As a result, some states, including New Jersey, Massachusetts, Connecticut and Maine, have recently begun to afford them some protection. More research is needed, however, to assess the actual impact of land-use change on vernal pool-breeding amphibians, as well as to estimate the effectiveness of conservation efforts. Economists have well-developed methods for understanding the anthropogenic forces that cause land-use change. Ecologists have well-developed methods for understanding the response of animal populations to the landscape. However, relatively little work has integrated the methodological approaches of these two fields.

This paper develops a multi-disciplinary/integrated approach to exploring the impacts of land-use change on vernal pool-breeding amphibians in Falmouth, Maine, USA. It begins with a spatially explicit parcel-level economic model of residential land-use change. Attributes of a parcel that may influence the likelihood of development may include the parcel's geophysical characteristics (e.g. steep slopes or hydric soils), proximity to amenities or disamenities (e.g. major employment centers, major commuting roads, or the coast), neighboring land uses, and zoning or other local regulations. By using parcel-level data, it is possible to model the decision-making process of individual landowners and to identify the significant drivers of land-use change. Future land-use change is then predicted under three different growth management scenarios, a continuation of current trends, a "development scenario," and a "conservation scenario."

Next, a spatially explicit population model (SEPM) is developed for two species of vernal pool-breeding amphibians, spotted salamanders (*Ambystoma maculatum*) and wood frogs (*Rana sylvatica*). SEPMs model the birth, dispersal, and mortality of a population on a given landscape and estimate the probability of extinction for the population. The three landscapes generated from the three different growth management scenarios in the land-use model are used in the SEPM to provide relative rankings of the probability of extinction for each species under different growth management policies. Results will identify the level of threat faced by the two species as well as the relative impacts of the different growth management policies on the two species.