

PREDICTION OF RABIES SPREAD & EVALUATION OF CONTROL STRATEGIES AMONG URBAN ILLINOIS RACCOONS

Farello C¹, Hungerford L², Gehrt S³ & Hannon B¹

¹ University of Illinois, Urbana, IL 61802; ² University of Nebraska, Clay Center, NE, 68933; ³ Max McGraw Wildlife Foundation, Dundee, IL, 60118.

The adaptability of raccoons to urban and suburban areas poses an increased risk to humans for transmission of rabies. Urban and suburban raccoon densities in Illinois pose a serious dilemma for the Chicago area as the raccoon rabies epidemic spreads westward from the mid-Atlantic region. The primary objective of this project was to develop a dynamic simulation model of the potential spread of raccoon rabies in Cook County Illinois, based on raccoon ecology and landscape characteristics, and to evaluate the projected effect of control strategies such as oral baiting and trapping. This descriptive study generated hypotheses and identified gaps in current rabies knowledge.

A STELLA™ model was created based on raccoon population biology, rabies virus pathogenesis, raccoon movements to the adjacent territory, and potential control strategies. To produce a spatial model of the movement of the epidemic, this dynamic STELLA™ model was linked to the Spatial Modeling Environment (SME) by Geographical Resources Analysis Support System (GRASS) and a Geographical Information System (GIS). Layers entered into SME included habitat, rabid, barrier, and intervention maps. Effects of contact rate, raccoon density and herd immunity due to oral baiting were examined in sensitivity analyses.

Most patterns of the epidemic showed a wave that traveled west northwesterly, 3-4 miles per year during the first 6 years and 5-10 miles the remaining 9 years. Habitat heterogeneity affected raccoon densities and rate of spread. The trajectory of the rabies epidemic followed forested corridors where abundance estimates were highest. Barriers, such as major highways and rivers, also redirected the spread. Intermittent weaker epidemics occurred behind the primary front as the depleted raccoon population recovered.

With baiting and controlled removal in place, slightly lower numbers of rabid raccoons occurred in the initial wave front. However, a susceptible raccoon population was maintained and rabies took on a sustained cyclic pattern, more characteristic of endemic disease. Raccoons that developed vaccinated immunity still produced susceptible juveniles each year. The infusion of such juveniles each spring contributed to the susceptible pool thereby increasing the probability of contact with a rabid raccoon not allowing the basic reproductive rate, R_0 , to drop below one. Illinois and Cook County face the inevitable arrival of raccoon rabies probably within the next decade. This model lays the foundation for dialogue and proactive planning strategies. As a research tool, it has identified crucial, but missing, information about raccoon rabies epidemiology and has also raised concerns based on the theoretical effects of baiting on R_0 and rabies persistence.