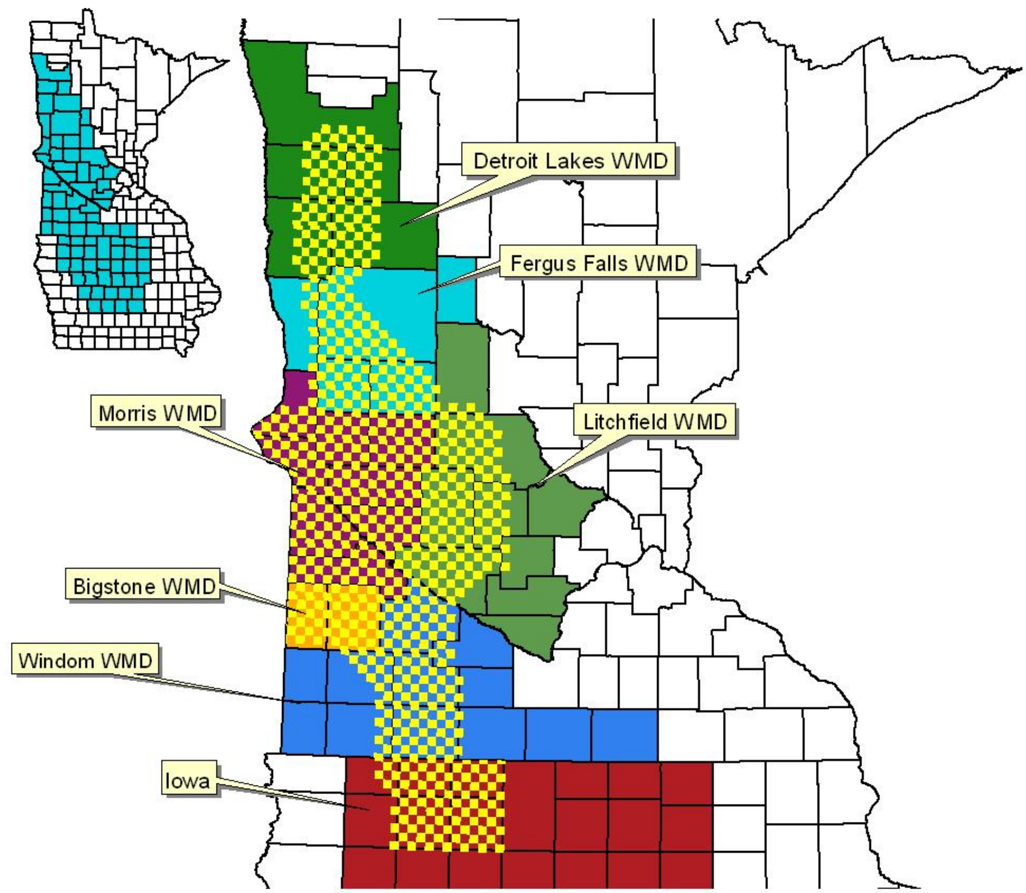
Modeling the distribution and relative abundance of mammalian predators in the Prairie Pothole Region of Minnesota

Mammalian predation is a major factor influencing waterfowl productivity in the Prairie Pothole Region. Rates of predation of waterfowl nests differ by predator species, so understanding spatial patterns in predator density are desired by many natural resource managers. Spatial predictions for the occurrence and relative abundance of predators would allow natural resource managers to make informed decisions when applying management treatments, ostensibly increasing the efficiency and effectiveness of those treatments.



The primary objective is developing statistical models and maps predicting the spatial patterns of primary nest predators in the Prairie Pothole Region of Minnesota and Iowa. The sampled area encompasses 19,642 mi^2 covering portions of 7 USFWS Wetland Management Districts. Systematic track surveys were conducted in 2003, 2004, and 2005. These surveys resulted in georeferenced locations of individual predators. These data of predator observations per survey will be used as the response in hierarchical Bayesian spatial count models fitted with Markov chain Monte Carlo techniques.). All models will be conditioned on the number of available sites per survey block – more suitable sites increase the detectability of predators. Fixed effects of the survey are only available at the resolution of 16 mi^2 (i.e., collected over an entire survey block). Explanatory covariates to aid in predicting patterns in predator abundance include the proportion of a cell in grass, forest, emergent wetland, and road.

Current survey data available for the study area occurs in 16 mi^2 (41.4 km^2) plots. Spatial models resolved at this spatial resolution provide only a coarse perspective on the patterns of mammalian occurrence and relative abundance, constraining the ability of managers to effectively deliver actions for reducing predation on waterfowl nests. Thus, my first objective is to evaluate the potential for resolving historical survey data to resolutions considerably finer than 41.4 km^2 (see Figure for proposed evaluation).

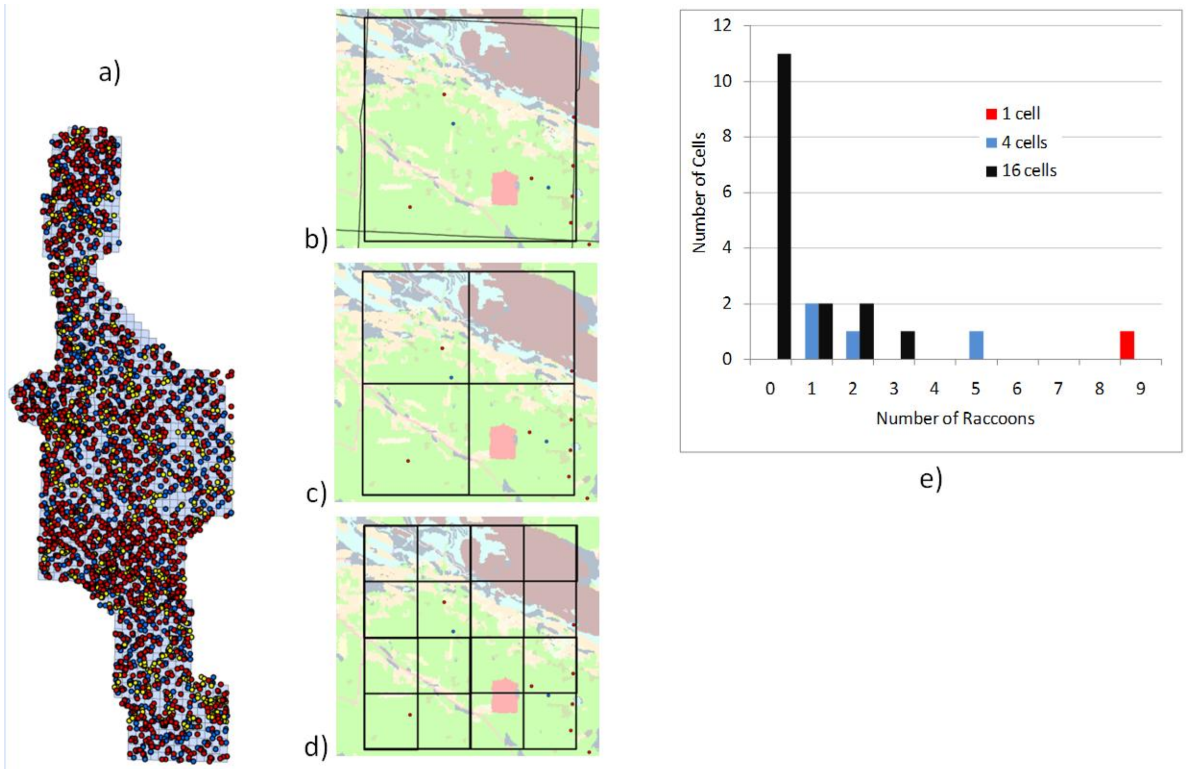


Figure 1. Schematic describing a) spatial distribution of all observations of raccoons in 2004 across full study area; 9 observations of raccoons in b) one 16-mi^2 study block (i.e., a density of 0.56 raccoons per mile, 100% occupancy), c) 4 4-mi^2 study blocks, ranging in density from 0.25 to 1.25 raccoons per mi^2, 100% occupancy, and d) 16 1-mi^2 study blocks, with observed density ranging from 0 to 3 raccoons per mi^2, 31.25% occupancy. The histogram (e) of the number of raccoons/cell indicates an increasing skew toward a greater proportion of unoccupied cells as cell resolution becomes increasingly fine.

Spatial predictions of relative abundance resolved at 1 mi^2 likely have much greater management utility than models generated at a resolution of 16 mi^2. Our second objective evaluates how models change as resolution of the response changes across these three resolutions, 16 m^2, 4 mi^2, and 1 mi^2 (resolutions of ¼ mi^2 are likely too fine to be provided much support, but if time allows, this resolution will be examined). Thus, the full process of model development will occur three time, with model accuracy and bias as the primary means of determining utility of the different resolutions.

For additional information contact:
Dan Hertel
U.S. Fish and Wildlife Service
18965 County Highway 82
Fergus Falls, MN. 56537-7627
(218) 736-0640
dan_hertel@fws.gov