SWAMP RABBITS AS INDICATORS OF OPTIMAL SCALE FOR BOTTOMLAND FOREST MANAGEMENT

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ABSTRACT

Introduction

Specialist wildlife that evolved within forest ecosystems can be sensitive to disturbance regime changes and thereby serve as indicators of optimal scale for forest management. Bottomland hardwood (BLH) forests were once extensive within the Lower Mississippi Alluvial Valley, but land cover conversion has reduced BLH by about 80 percent over the last century. Since 1990, a multiagency effort has been underway to restore BLH forests, with the preservation of wildlife habitat as a primary goal. Habitat loss, coupled with changes in disturbance patterns, has been associated with a decline of the swamp rabbit (*Sylvilagus aquaticus*), a bottomland specialist, throughout the southeastern United States. Afforestation has created a patchwork of early successional stands embedded within a larger agricultural landscape and adjacent to mature riparian stands.

Swamp rabbits rely on habitat components characteristic of both early and mid to late successional BLH stands, but also need upland habitat during periods of prolonged inundation. The small home ranges (HRs) typical of rabbits suggest that all of these habitat components must be within close proximity to one another. Here, we address how the spatial arrangement of BLH plantings influences habitat use by swamp rabbits in southern Illinois. Specifically, we examined the influence of microhabitat and cover type on space use and HR size for 46 swamp rabbits monitored from 2009 through 2012 at seven sites within the Cypress Creek National Wildlife Refuge in southern Illinois.

Methods

Study sites were composed of early and mid to late successional BLH forests with varying amounts of adjacent early successional uplands and agriculture. Early BLH stands were afforested within the last 20 years and were dominated by oaks (*Quercus* spp.), green ash (*Fraxinus pennsylvanica*), boxelder (*Acer negundo*), and sweetgum (*Liquidambar styraciflua*). Tomahawk live traps (Model 205; Tomahawk Live Traps, LLC, Hazelhurst, WI) were placed in areas with rabbit sign, covered with burlap and vegetation, and baited with a quartered apple. We weighed the captured rabbits, determined their sex, and ear-tagged them. We fitted all adult rabbits >1.9 kg with radiocollars weighing 35-42 g. Animals were released immediately after processing at the site of capture. Swamp rabbits were located by triangulation or homing 2-4 times/week during morning (0500-0900 hr), daytime (0901-1759 hr), and evening (1800-2400 hr) sampling periods. We used kernel density estimators to delineate HRs for all animals with >30 radiolocations.

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We conducted microhabitat sampling at all sites May 15-August 15 2012. Sampling was restricted to an area encompassing all radiolocations for rabbits monitored at each site. We sampled randomly placed circular plots (0.02 ha) at a density of 2.5 plots/ha at each site. Within plots, we recorded the proportion of grasses, forbs, and woody ground cover, canopy closure percentage, and basal area. We also recorded the number of trees <10 cm diameter at breast height in three 1-m^2 subplots within plots. Visual obstruction was recorded up to a height of 1.5 m within subplots.

We digitized land cover patches in ArcGIS® 9.3 (Esri, Redlands, CA) by using 2010 color orthoimagery (National Agriculture Imagery Program, administered by the U.S. Department of Agriculture's Farm Service Agency). Patches were classified as early BLH, late BLH, upland forest or grassland, agriculture, river, or permanent wetland. We also verified land cover assignments by using Google Earth™ and prior knowledge based on trapping and vegetation sampling. Proportion of each cover type within core HRs was calculated in Patch Analyst (Esri), and the distance from each rabbit's core HR center to the nearest patch was measured for all cover types within a 2-km circular buffer.

Results And Discussion

We built two sets of generalized linear models to assess importance of microhabitat and land cover variables on HR size. Model significance was assessed at $\alpha = 0.05$, and results are reported ± one standard deviation. Average core and 95-percent HRs were 1.9±1.0 and 8.9±2.4 ha, respectively. The majority of swamp rabbits (63 percent) had core HRs in afforested BLH stands. Most rabbits were within 400 m of a river or mature BLH stand, even at sites with extensive early successional upland forest adjacent. Home range size was associated with few microhabitat or land cover variables; core area was weakly positively associated with distance to a permanent wetland ($\beta = 0.001$ [± 0.0002], $p < 0.000$) and average basal area within core areas ($\beta = 0.006$ [± 0.0002], $p < 0.010$).

Conclusions

Swamp rabbits have relatively small home ranges yet require a range of bottomland forest structures. In young stands, crop tree release may create or maintain dense groundcover conditions needed within the small areas used by this specialist species. Older forests may need more intensive canopy removal to mimic natural blowdown or senescence patterns. Implications for implementing these interventions across multiple agency land holdings are discussed.