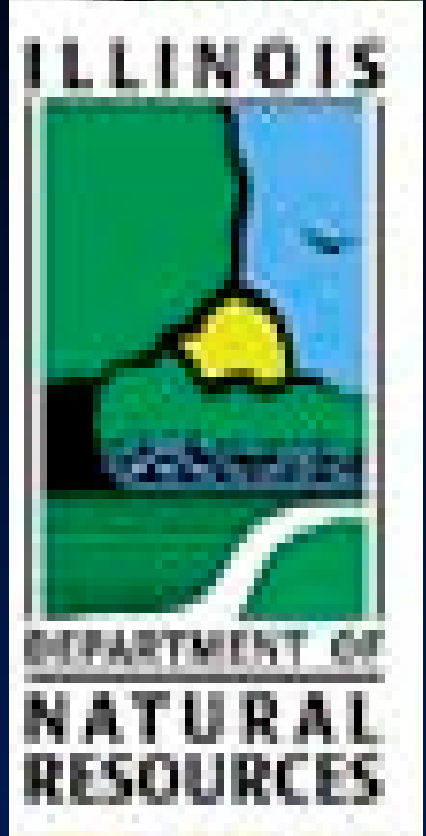




SEASONAL HOME RANGES, HABITAT USE, AND FRACTAL DIMENSION OF MOVEMENT PATHWAYS OF RACCOONS.



Introduction

One of the many reasons that biologists and managers are interested in the raccoon is that raccoons are one of the most common nest predators of ground-nesting birds inhabiting the agricultural landscapes that predominate the midwest. High rates of nest predation result from habitat fragmentation and the increased edge that characterizes agricultural areas. Edges provide abundant and diverse food resources and previous research has suggested that raccoons may preferentially forage along edges, increasing the risk to birds nesting there.

However, some biologists have speculated that most nest predation occurs incidentally as raccoons forage for other foods along edges or when they move between rich resource patches such as wetlands. In essence, grassland patches situated in a row-crop matrix may serve as ecological traps, or population sinks, for nesting birds, if high predator densities contribute to extensive nest predation in these areas. Therefore, management plans designed to conserve edge-sensitive species require reliable information on the relative abundance, habitat use, and foraging behaviors of the potential nest predators in a given landscape.

Research Questions

- Do home ranges differ in size between sexes and among seasons?
- Are there seasonal shifts in the use of core areas?
- How do raccoons move through an agricultural landscape?
- Can fractal analysis be a useful tool for interpreting movement paths in raccoons?

Methods

Study Area.

- ❖ Prairie Ridge State Natural Area, Jasper County, IL

Capture and handling.

- ❖ Raccoons were live trapped and anesthetized using Telazol.
- ❖ Each captured animal was sexed, weighed, aged, and ear tagged.

Telemetry.

- ❖ Selected animals were radio-collared and located at least weekly.
- ❖ Focal animals were tracked during continuous 12-hour periods (6 pm to 6 am).
- ❖ Locations recorded every 30 minutes.

Basemap.

- ❖ Major habitat cover types were digitized in ArcView 3.3.

Home Ranges.

- ❖ 95% kernel home ranges calculated in hectares (ha) using ArcView 3.3 with the Animal Movements extension, using a minimum of 20 locations.

Fractal Analyses.

- ❖ Fractal dimension of movement pathways computed using Fractal Mean estimator, then log-transformed.
- ❖ Fractal dimensions were compared to evaluate differences between sexes and among seasons using Mann-Whitney test ($\alpha = 0.05$).



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Results

- **Do home ranges differ in size between sexes and among seasons?**
 - ❖ Males have significantly larger overall 95% kernel home ranges than females ($p=0.03$).
 - ❖ Additionally, males have significantly larger winter ($p=0.05$) and spring ($p=0.03$) home ranges than female reacoons. (See Table 1.)

Table 1. Overall and seasonal 95% kernel home ranges for male and female raccoons at Prairie Ridge State Natural Area using Mann-Whitney test between sexes ($p=0.05$).

Season	Male	Female
Overall (P=0.03)	95.7 \pm 23.4 ha	33.0 \pm 11.8 ha
Spring (P=0.05)	39.8 \pm 9.4 ha	12.9 \pm 5.7 ha
Summer (P=0.18)	92.5 \pm 23.2 ha	48.4 \pm 7.1 ha
Fall (P=0.72)	51.0 \pm 17.2 ha	85.4 \pm 43.7 ha
Winter (P=0.03)	79.1\pm 39.9 ha	8.0 \pm 5.0 ha

- **Are there seasonal shifts in the use of core areas?**
 - ❖ There appear to be shifts in the use of core areas on a seasonal basis (Figure 1). Further compositional analysis will supply information as to what habitat types raccoons are keying in to on a seasonal basis.

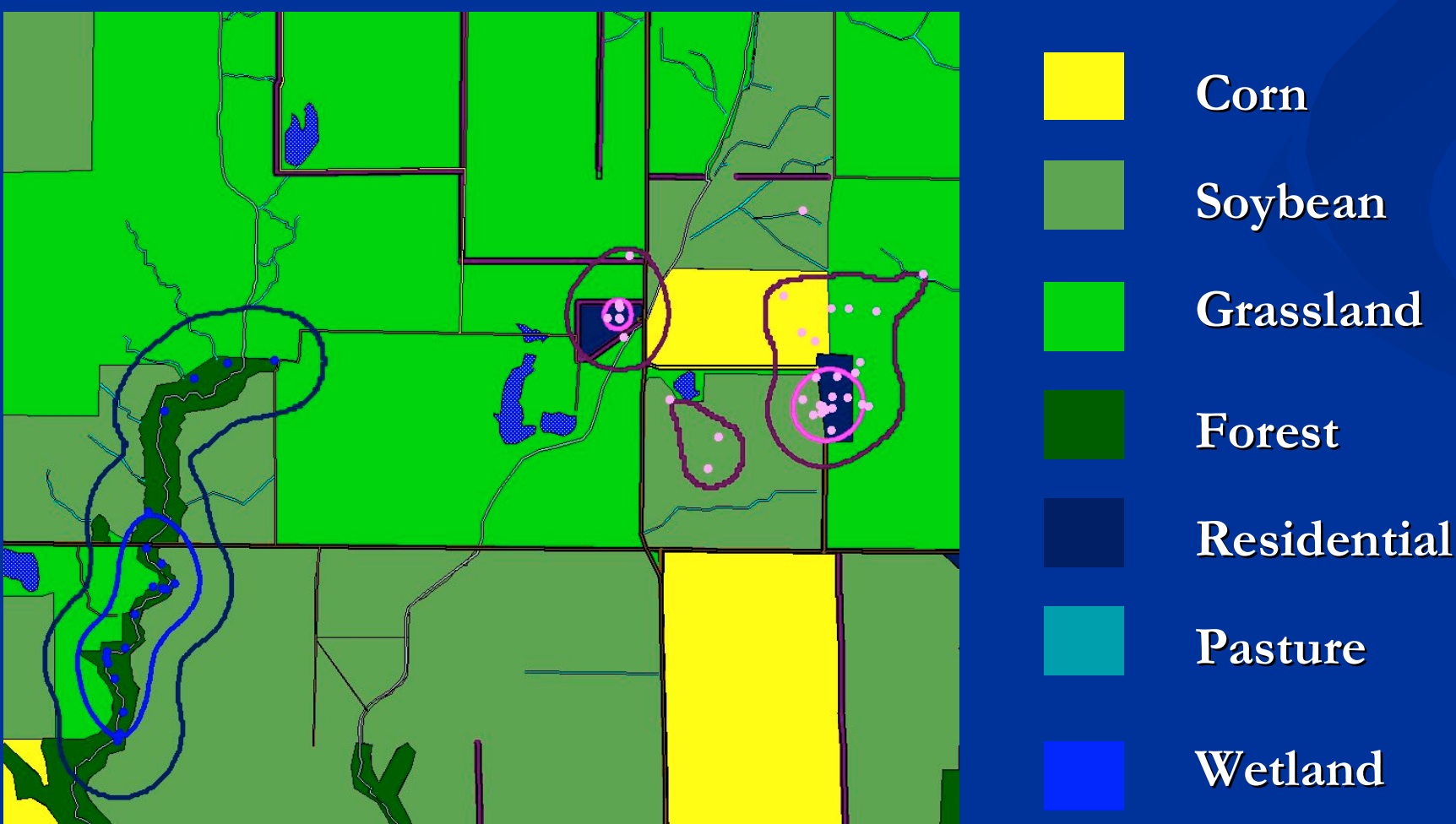


Figure 1. Spring and winter seasonal 95% and 50% kernel home ranges for F345. The spring home range(31.3 ha) is located on the left of the figure in blue along a riparian area. The winter home range of this individual (18.0 ha) is on the right of the figure in pink and occurs primarily in residential habitat types.

Table 2. Seasonal fractal dimension of movement pathways of raccoons showing that seasonal movements are significantly different ($p=0.027$). Spring and summer movements are more linear as raccoons move between rich resource patches and become more convoluted as raccoons search more for scarce resources.

Season	N	Fractal D
Spring/Summer	12	1.22 \pm 0.03
Fall/Winter	14	1.33 \pm 0.04

- **How do raccoons move through an agricultural landscape?**

- ❖ Males ($n=13$) had an average $D=1.25 \pm 0.03$, while females ($n=13$) had an average $D=1.30 \pm 0.04$.
- ❖ There were no significant differences in the fractal dimension of movement pathways between sexes ($p=0.555$).
- ❖ There were significant differences in the shape of movement pathways among seasons ($p=0.027$) (see Table 2 below middle). Spring and summer pathways were more linear, while fall and winter movements were more convoluted.
- **Can fractal analysis be a useful tool for interpreting movement paths in raccoons?**
 - ❖ Yes, fractal analysis allows us to interpret the shape of movement pathways on a seasonal basis. In the spring and summer raccoons tend to follow linear pathways, and move rapidly across grassland habitats, while in winter and fall movement pathways become more convoluted, indicating searching behavior during these seasons, primarily in residential and agricultural habitats (Figure 2).

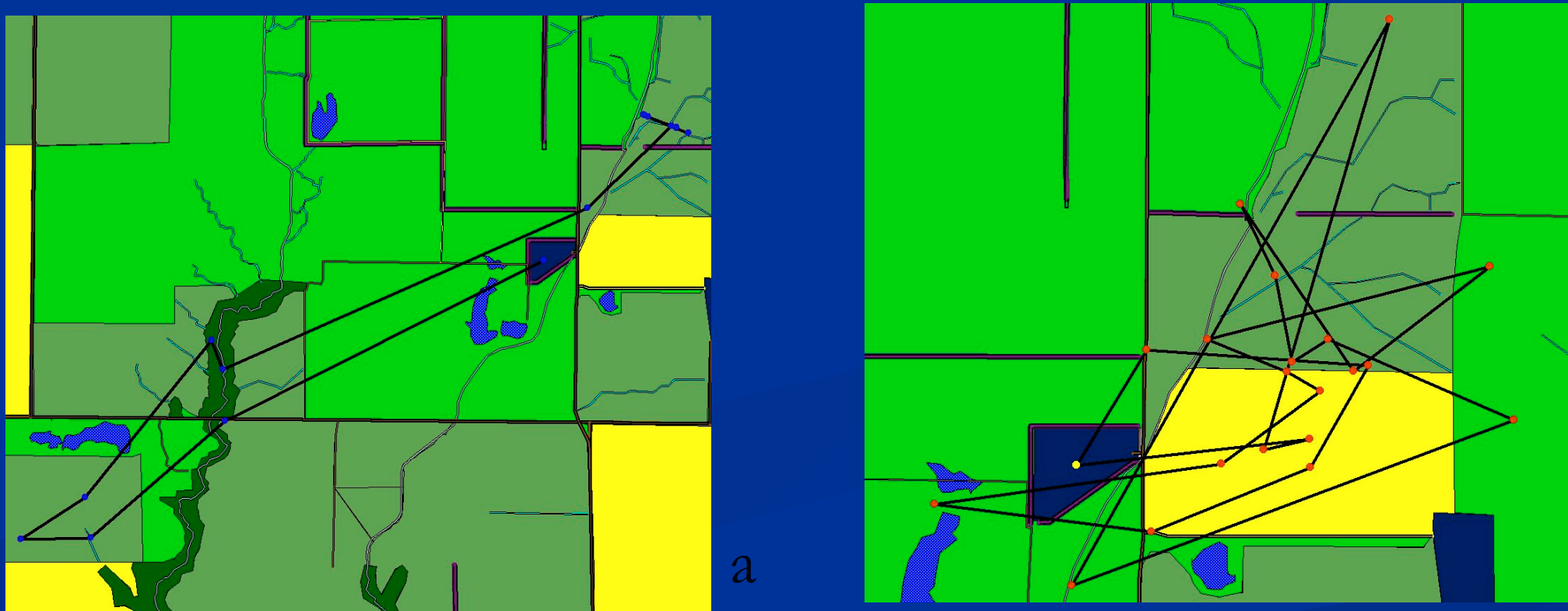


Figure 2. (a) shows a spring pathway with $D=1.12$, with quick, linear movements across grassland habitats, while (b) shows a fall pathway with $D=1.35$, characteristic of the convoluted, searching behaviors typical of fall and winter raccoon foraging pathways.

Conclusions

- ❖ Males have larger home ranges.
- ❖ Seasonal home range size differs by sex, with spring and winter showing greatest divergence.
- ❖ Core areas show pronounced shifts, centered around water in spring and summer, agricultural fields in the fall, and buildings in the winter.
- ❖ Males and females move in similar ways, but foraging paths differ among seasons.
- ❖ Raccoons follow linear paths in the spring and early-summer as they move from dens to rich resource patches.
- ❖ In contrast, foraging paths are more convoluted in fall and winter as raccoons search harder for scarce food.
- ❖ This research supports the hypothesis that raccoons are more likely to predate nests while moving between resource patches, rather than by actively searching fields for nests.

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