

LANDSCAPE ECOLOGY OF SNOWSHOE HARES IN MONTANA

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transsects = 81

66 = proper each type

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This is an inquiry into landscape-level population dynamics in the snowshoe hare, *Lepus americanus*, using empirical field data to test ecological theory. We found evidence supporting a source-sink dynamic, the mechanism proposed to explain why snowshoe hare populations appear not to cycle in fragmented forests of the species southern range. We estimated birth, death, and movement rates for snowshoe hares that lived solely, or in mixtures of, 4 different categories of forest stand structure (FSS) type. We validated the use of ultrasonography as an effective tool to monitor fetal number and pregnancy rate. We sampled individual patterns of FSS type occupancy, which we used as covariates in survival and emigration models. Estimated survival rates decreased as individuals spent proportionally more time in the Open young and Open mature FSS types. The Dense young and Dense mature FSS types were potential "sources." Dense mature had positive expected population growth, which was lower in models that included movement. Open mature and Open young FSS types were "sinks." For a model landscape with a simplified model for succession, and where Dense mature forest was prevalent, snowshoe hare populations stayed higher when loss of high-quality patches was asynchronous.

We used an experiment to test for short-term effects of pre-commercial thinning (PCT) on snowshoe hare densities. Compared to control stands, snowshoe hare densities declined after standard prescription (100% of stand area) PCT; and in stands treated with pre-commercial thinning with reserves (PCT-R), where 20% of the total area was retained in uncut ¼ ha patches. Declines were prominent in the second winter after treatment. Snowshoe hares used retained patches more than thinned areas within PCT-R stands. Also, of 49 dead radio-collared snowshoe hare locations, none were in extremely densely vegetated microhabitats.

Predation risk influenced snowshoe hare movement behavior: snowshoe hares' responses to moonlight corresponded to seasonal variation in moonlight intensity. When the moon was more than half full and the ground snow-covered, predation rates were higher and snowshoe hare movement distances were lower than near new moons. Neither predation rate nor movement rate varied when the ground was snow-free.

Douglas-fir (*Pseudotsuga menziesii*), western larch (*Larix occidentalis*), subalpine fir (*Abies lasiocarpa*), and Engelmann spruce (*Picea engelmannii*). Of these, larch is the most commercially valuable timber species, although Douglas-fir is also highly valued for lumber. Lodgepole pine and Douglas-fir provide relatively high-quality forage for hares; spruce and fir are less valuable nutritionally and larch is deciduous, so larch needles are not available in the winter (Wirsing and Murray 2002). A wide variety of montane and subalpine shrubs and forbs also provide some cover and forage during the summer and fall.

DF =
high
quality
forage
for
hare

The study consists of three areas: Spring Creek, Cold Creek, and Beaver-Finley (Figure 1). Each area had two treatments (standard PCT and PCT-R treatment) and a control within 0.1 – 1.4 km of each other (nine experimental stands total). All study stands were 15-35 year old, even-aged, regenerating stands scheduled for PCT, and were similar in elevation, sapling age, sapling density, and tree species composition. Experimental treatments were assigned randomly to stands, except at Cold Creek, where the control stand was selected by the land owner and only the standard and PCT-R treatments were randomly assigned.

Stand-level pre-commercial thinning experiment

Because PCT is usually a stand-level treatment, stands were the experimental unit and we evaluated changes in hare density at this scale (stands were ≥ 20 ha). Stands of this size are a minimum scale for analyses of hare density because it is roughly twice the size of average snowshoe hare home ranges, which overlap (Hodges 2000a). Studies on the effects of pre-commercial thinning with response variables measured over smaller

NR =
10 ha =
25 ac.