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SNOWSHOE HARE HABITAT EVALUATIONS IN INTERIOR ALASKA

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Abstract: This paper presents a theoretical habitat for snowshoe hares (Lepus americanus) three years after a fire in a mixed coniferous-deciduous forest near Fairbanks, Alaska. A post-burn habitat evaluation is made focusing on food supply and cover availability for hares in winter. This evaluation is compared with pre-fire habitat evaluation data collected from a portion of the forest during April, 1979.

On 7 April 1979, winter snowshoe hare habitat was evaluated on a one acre plot (.405 ha) near Fairbanks, Alaska. The plot is approximately one-quarter mile (300 m) northeast of Smith Lake on the University of Alaska Arboretum. White spruce (*Picea glauca*), aspen (*Populus tremuloides*) and birch (*Betula papyrifera*) trees dominated this site, with a few willow (*Salix* spp.) and aspen shrubs in the understory. The stand was estimated at 60 years old.

Evaluation procedures were based on the Habitat Evaluation Handbook (Konkel et al. 1978). Food, cover, and reproductive values (modified for winter habitat) were determined using the Habitat Suitability Index for Snowshoe Hare in Mixed Coniferous-Deciduous Forest for Ecoregions 1311 and 1320 (portions of interior and southcentral Alaska). These values are listed in the Results section.

The current assignment was to assume that a fire had occurred in the area and to reevaluate snowshoe hare habitat in this same plot three years later. Fire is an important component of the taiga ecosystem. It has created the current pattern of vegetation - deciduous, mixed, and coniferous forests - ~~we see today~~, as well as renewing habitat for successional stage species such as the snowshoe hare (Viereck 1973). The principal food plants of the hare in Alaska are results of post-fire succession: willow, aspen, birch, other woody deciduous plants, and spruce (Fox 1978). So the change from a mature spruce-deciduous stand to a post-fire successional stage was expected to provide better food, cover and reproductive values for snowshoe hares.

METHODS

A literature review on fire, vegetational succession, habitat use, and food preferences of snowshoe hares was undertaken with special reference to Alaskan conditions. Viereck (1972) states "The succession that follows fire is varied and depends upon topography, previous vegetation, severity of burn and available seed source at the time of burn." But due to limited availability of information on post-fire habitats (especially in winter), estimates of successional vegetation parameters on white spruce sites were based mainly on an unpublished report by Foote (1976). Generalized values were given for 1 - 5 years post burn for percent ground cover, percent shrub and sampling crown cover and percent tree canopy closure. Average shrub and sapling height was extrapolated from Wickersham Dome succession data (Viereck 1973). It was assumed that the literature on post-fire vegetational succession reflected natural processes, including ~~and~~ moose or hare browsing effects prior to this evaluation. Stand class (age) and average size of stand were assigned values. The fire was assumed to cover more than twenty acres. Habitat evaluation was set at the same time of year as the prevous evaluation. Mean snow depth, influencing availability of browse, was assumed to be equal for the two evaluations.

Snowshoe hare habitat was evaluated for food, cover and reproductive values by the same methods as used previously.

From the Habitat Evaluation Handbook (Konkel et al. 1978), food value is calculated by:

$$(P_1 \times P_3 \times P_4)^{1/3}$$

where P_1 = Suitability Index (given in handbook) of density of herbaceous forage (%)

P_3 = Suitability Index of shrub and sapling crown cover (%)

P_4 = Suitability Index of shrub and sapling height (ft) - Food

This was modified for winter use by omitting P_1 from the calculations (due to little use in winter - Wolff 1978) and subtracting mean snow depth from mean shrub and sapling height.

So, the equation used was:

$$(P_3 \times P_4)^{1/2}$$

Cover value was determined by:

$$1/4\ [P_2 + (P_3 \times P_4)^{1/2} + (P_5 \times P_6)^{1/2} + P_7]$$

where P_2 = SI of % ground cover

P_3 = as above

P_4 = as above

P_5 = SI of stand class (age)

P_6 = SI of % tree canopy closure

P_7 = SI of size of stand (acres)

Reproductive value is the same as cover value. The overall Habitat Suitability Index for snowshoe hare is the lowest of the three above values.

RESULTS

The post fire food, cover, and reproductive values as well as the Habitat Suitability Index are shown below, as well as summarized in Table I. The highest suitability index possible is 1.0; the lowest 0.0.

Table 1. Habitat evaluation based on Habitat Evaulation Handbook (Konkel et al. (1978)) for snowshoe hares before and after fire on white spruce/aspen/birch plot near Fairbanks, Alaska.

	7 April 1979 (pre-burn)	3 years post burn[4] (hypothesized)
Food value	.346	1.0
Cover value	.727	.750
Reproductive value	.727	.750
Habitat Suitability Index	.346	.750

[4]Data values taken from Foote (1976) and Viereck (1973).

Food value = $(P_3 \times P_4)^{1/2}$

P_3 = SI of shrub and sapling crown cover (%)

= SI of ≥ 50%[1] = 1.0

P_4 = SI of shrub and sampling height

= SI of 1.75 - 4.5 ft (assumed)[2] = 1.0

$(1.0 \times 1.0)^{1/2}$ = 1.0

Cover value = $1/4[p_2 + (P_3 \times P_4)^{1/2} + (P_5 \times P_6)^{1/2} + P_7]$

P_2 = SI of % ground cover = SI of 90% (litter and dead wood) = 1.0

P_3 = 1.0

P_4 = 1.0

P_5 = SI of stand class = SI of immature forest = 1.0

P_6 = SI of % tree canopy closure = SI of 0[3] = 0

P_7 = SI of size of stand = SI of >20 acres = 1.0

$1/4[1.0 + (1.0 \times 1.0)^{1/2} + (1.o \times 0)^{1/2} + 1.0]$ = .750

Reproductive value = .750

Habitat Suitability Index = .750

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[1]This is based on figures of 1333 stems of tall shrub (Salix, Rosa, Alnus, Rubus) per acre and 1261 saplings (Populus tremuloides) per acre from Foote (1976) which were assumed to give ≥ 50% crown cover (may not be true in winter).

[2]This is based on Viereck (1973) Wickersham dome data that showed up to 40 cm shoot growth from P. tremuloides, B. papyrifera, Salix and Alnus the same summer as the fire.

[3]No tree canopy cover given in Foote (1976) - assumed to be 0, since all trees killed in fire.

DISCUSSION

As expected, food, cover, and reproductive values, as well as the overall Habitat Suitability Index for hares improved in the post-fire successional habitat. This is largely due to the assumed root sprouting of aspen, birch and willow and the invasion of low shrub and herbaceous growth such as Labrador tea (Ledum groenlandicum), rose (Rosa acicularis), blueberry (Vaccinium uliginosum), fireweed (Epilobium angustifolium) and bluejoint grass (Calamagrostis spp.) (Grange 1965, Foote, 1976, Viereck 1973). Hare food preferences (especially in winter) have been studied by Wolff (1978), Klein (1977), Trapp (1962) and O'Farrell (1960) and food habits coincide greatly with those species in abundance after a fire.

New growth of woody plant foods has been shown to be more nutritious and usually more highly preferred by hares, but seedlings may also carry antiherbivore toxins or digestibility-reducing substances (Klein 1977). Konkel et al. (1978) fails to consider hare preference, nutritive value or palatability of browse in the habitat evaluation. These factors may be critical in quantifying levels of habitat suitability. Also, only height and percent cover of vegetation, age and size of stand are of consequence for calculating food, cover and reproductive values. Snow depth is also a factor influencing availability of winter browse, which Konkel et al. (1978) does not consider. Bider (1961) notes that hares can browse to 18 in (45.9 cm) above snow line and that big differences in snowfall from year to year can change the quality of browse available. More seasonal studies of food preference and value like Klein (1977) ~~did~~ could also contribute to a more refined hare Habitat Suitability Index.

In addition, the equation for cover may not be particularly well suited for post-fire successional habitats. If the tree canopy closure is 0 (as in my model), this totally negates the positive value given by P_5, the age of stand, since the two values are multiplied together. Keith and Surrendi (1971) and Grange (1965) have documented hare reoccupation of areas 1-4 years after a fire. So perhaps percent tree canopy closure should not reduce the cover value so much, especially if dense shrub provides adquate cover.

Overall, the Habitat Suitability Index for snowshoe hare habitat in an old growth mixed conferous-deciduous habitat improved three years after a fire. This would be expected for a successional habitat species like the hare. Just exactly the magnitude of improvement depends on more refined ways of determining food, cover, and reproductive values (for both pre- and post-burn) as well as the characteristics of the fire and habitat being studied (intensity, size, available seed source, topography and previous vegetation).

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