HABITAT USE AND FOOD HABITS OF SNOWSHOE HARES ASSOCIATED WITH A RECLAIMED STRIP MINE IN INTERIOR ALASKA

by

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Abstract: The value of reclaimed coal stripmine spoils as snowshoe hare (Lepus americanus) habitat in interior Alaska was examined. Hare density in 3 cover types (tall shrub, conifer forest, revegetated lands) was determined using the pellet plot method. Hare food habits were determined via microhistological examination of fecal material. Snowshoe hares used the tall shrub cover type more than any other habitat examined. Hare density in the shrub zone was 10/ha in winter and 18/ha in summer. Shrubs (mainly willow species) comprised the major portion of the summer diet (69%), while spruce made up 51% of the winter diet. Based on dietary data and habitat use, the long-term loss of coniferous forests and tall shrubs due to mining, and the lack of emphasis on the re-establishment of woody vegetation in present reclamation procedures; will greatly reduce and possibly eliminate snowshoe hare populations on large-scale surface coal mines in the northern boreal regions.

Additional Key Words: snowshoe hare, surface mine reclamation

Introduction

Reclaiming surface mined land for fish and wildlife habitat is an attractive and often used option by the coal mining industry. Because of the Surface Mining Control and Reclamation Act's (Public Law 95-87) postmining vegetation cover requirements, the mandatory waiting period to document successful reclamation before bond release, and costs associated with reclamation activities; most mine operators have opted to plant grasses and legumes on reclaimed areas. Grasses and legumes are often chosen over other plant species (especially over most native plant species) because the seeds are more readily available and cheaper than seeds of native plants. But has the development of structurally monotypic, grassland-like habitats on revegetated mine spoils been beneficial to native animals--or have they impeded the re-establishment of local wildlife (Elliott 1989)?

The state of Alaska's identified and hypothetical coal resources range from 1.9 to 5.0 trillion short tons and may be as large as those in the conterminous 48 states (National Research Council 1980). Although surface mining has been a coal extraction technique used in Alaska since the 1960s, little data have been published concerning the adequacy of post-mined lands as wildlife habitat. In 1980, the University of Alaska's Agricultural and Forestry Experiment Station began a study of revegetated stripmine spoils in interior Alaska. One objective of the study was to evaluate post-mining land use of reclaimed areas by native wildlife. In this study I report the use of revegetated coal stripmined spoils by snowshoe hares (Lepus americanus).

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Study Area

The study was conducted on the Usibelli Coal Mine from 1980 to 1981. The Usibelli Coal Mine (UCM) is an active surface coal mine located in south-central Alaska, approximately 13km east of the community of Healy (63° 53'N, 149° 01'W).

The Healy area is physiographically diverse as it is situated within the northern foothills of the Alaska Mountain Range. Elevations in the region range from 396 to 914m. Mean annual precipitation is 43 cm and mean annual air temperature -3° (Mitchell et al. 1985). Vegetation in the region conforms to four general cover types: conifer forest, tall shrub, shrub tundra and surface mined areas (designated disturbed and reclaimed).

The conifer forest cover type is a combination of woodland and open and closed spruce forest. The woodland and open spruce forests are located on upland terraces and

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consist of sparsely distributed low-growing spruce and low-to-prostrate growing shrubs. Principal trees and shrubs include black and white spruce (Picea mariana and P. glauca), quaking aspen (Populus tremuloides), mountain cranberry (Vaccinium vitis-idaea), willow (Salix spp.), birch (Betula spp.), blueberry (Vaccinium spp.), and alpine bearberry (Arctostaphylos alpina). The closed spruce forest is charac- terized by dense stands of mature spruce occurring along drainages, ridges, and terraces.

The tall shrub cover type consists of green alder (Alnus crispa)-feltleaf willow (Salix alaxensis) association. This habitat occurs most frequently at the base of north-facing terraces, along creek drainages, and on floodplains.

The shrub tundra cover type is typified by a glandular birch (Betula glandulosa) and ericaceous shrub-sedge association.

The disturbed and reclaimed cover type represents sites that have been disturbed by mining and reclaimed by planting graminoids and forbs. The disturbed and reclaimed study sites on the UCM were areas revegetated in 1972, 1976, and 1979. Although two of the sites predated the 1977 Surface Mining Control and Reclamation Act, the method of reclamation employed at all sites basically conformed to the procedures set-forth in Public Law 95-87. After the coal was extracted at each disturbed site, the topsoil was redeposited on the area and graded back to original contour. The site was then scarified, furrowed and aerially seeded and fertilized. Ten species of grasses and five species of legumes were originally seeded. At the time of this study, the site supported seven species of plants, of which three graminoids [meadow foxtail (Alopecurus pratensis), boreal red fescue (Festuca rubra cultivar "Boreal"), and bluejoint (Calamagrostis canadensis)] accounted for 65% of the cover and 98% of the biomass on the area (Elliott 1984).

Methods

Snowshoe hare density was determined using the pellet (fecal) census technique (Taylor et al. 1935, Wolff 1982). One 100 m transect was established in each of the plant cover types identified on the study area. A 0.25m^2 plot was placed every 5m along each 100 m transect. The upper left-hand corner of each plot was marked with a painted wooden stake. The plots were cleared of pellets in September 1980, May 1981, and August 1981. Pellets collected between September and May were considered winter pellets, May-August pellets represented summer depositions. All pellets within a single 0.25m^2 plot were counted and the collection regarded as one sample. These samples were used to determine the seasonal diets. Four hundred sixty-six pellets deposited per day was the standard used in calculating snowshoe hare density (Bookout 1965). Habitat use was equated with pellet density per cover type.

Percent composition of plants in the diets of snowshoe hares was determined by microhistological analysis of fecal (pellet) material (Hanson and Flinders 1969). Holechek et al. (1982) reviewed the advantages and disadvantages of using fecal analysis for diet determination. Two of the advantages are that it does not interfere with normal habits of the animal and is a nonconsumptive technique (no animals need be killed). Major drawbacks with fecal analysis are that preference indices cannot be accurately assigned because where the food was consumed cannot be determined; and those forage species that are the most digestible often are under-represented in the feces.

Two alterations were made in the procedure of Hanson and Flinders (1969). Diet slides were prepared using Naphrax high resolution diatom mounting medium (Northern Biological Supply, Martlesham Heath, Ipswich, England) instead of Hertwig's and Hoyer's solution. Five slides per sample, and 20 locations per slide were examined in order to estimate the major species in the diet (Holechek and Vavra 1981).

The percent composition of each plant species identified in the diet was determined following the method outlined by Holechek and Gross (1982). The number of frequency observations of each plant species identified was divided by the total number of frequency observations for all species. This number multiplied by 100 gives the percent by weight composition of the diet.

Vertical foliage density (VFD) is a measure of security cover--the amount of cover occurring at eye-level between a prey species and predator. Foliage density was measured using a checkerboard placard [for dimensions and photograph see Wolff (1980)] placed at ground level 10, 20, 30, 40, and 50m from the observer. The total number of squares obstructed by vegetation at each distance were counted. Each plant cover type on the study area was sampled in December 1981, before leaf development to obtain a measure of VFD during winter conditions; and again in July 1981, to obtain a VFD for the summer.

Results

Snowshoe hares used the tall shrub cover type more than any other habitat examined. Hare density in the shrub zone was 10 hares/ha in winter and 18/ha in summer (Table 1). Shrubs comprised the major porion of the summer diet (69%), while spruce made up 51% of the winter diet (Table 2). Vertical foliage density was greatest in the tall shrub cover type in both winter and summer

(Table 3). VFD values were lowest for all seasons in the shrub tundra and revegetated sites, respectively (Table 3).

Discussion

Many investigators (e.g., Bider 1961; Keith 1966; Wolfe et al. 1982) have noted the importance of suitable vegetative cover as a habitat component for snowshoe hares. Wolff (1980) examined the role of cover and habitat patchiness on a population of interior Alaskan snowshoe hares. He found hares tended to move from winter to summer habitats in response to the availability of food and cover. A patchy environment which provided cover like dense black spruce or willow-alder thickets in winter and open summer range, allowed hares to shift their habitat use seasonally in response to changes in diet and to take advantage of changing environmental conditions.

During summer, Wolff (1980) found hares fed on herbaceous material and low shrubs in open areas; during winter they moved into dense thickets to feed on spruce, willow, and alder. These dense spruce or willow-alder thickets provided the greatest amount of cover, and were designated as "refuge" areas. Refuge areas were defined as regions which provide protection for a nucleus population of hares which are able to survive the heavy predator pressure that follows a hare population high. Wolff (1980) determined that as a population declines, those animals in marginal or suboptimal habitats were the most vulnerable and suffered the greatest mortality. The only hares to survive the population crash were those which were able to stay in the refuge.

Table 1. Density estimates (hares/ha) of snowshoe hares on the Usibelli Coal Mine, Healy, Alaska, 1981.

Cover Type	Density Winter	Summer
Tall Shrub	10	18
Conifer Forest	6	12
Shrub Tundra	0	0
Revegetated	0	0

Table 2. Food habits of snowshoe hares on the usibelli Coal Mine, Healy, Alaska. Values are percent dry weight of diet. Sample size in parentheses.

Plant Species	Winter (42)	Summer (29)
Salix spp.	22	42
Alnus crispa	6	3
Betula spp.	1	T
Picea spp.	51	12
Festuca rubra	-	2
Calamagrostis canadensis	-	T
Vaccinium uliginosum	T	T
Unknown Graminoids	T	4
Unknown Forbs	2	10
Unknown Shrubs	16	24

T: indicates trace amount, <1%

Trapp (1962) found the winter diet of snowshoe hares near Fairbanks, Alaska, consisted primarily of blueberry twigs, labrador tea (Ledum groenlandicum), rose, and willow. Birch bark and twigs were also important food items; but the bark and twigs of alder, balsam poplar (Populus balsamifera), aspen and spruce were not consumed until late winter.

Wolff (1978) determined the seasonal food habits of snowshoe hares in interior Alaska. Hare diets changed from hardwood browse and spruce bark and needles in the winter to leaves and other herbaceous plant material in the summer. The amount of spruce and woody browse in the diet decreased from 82% in winter to 56% in April and to 25% in May as the intake of herbs increased from 1.5 to 8 and 49% over the same time period. Leaves of blueberry and mountain cranberry which remained on branches from the previous summer and were exposed by receding snows were heavily utilized in early spring. The proportion of shrub leaves in the summer diet was 69% (excluding spruce); the amount of woody browse and forbs consumed having declined noticeably. The fall food habits indicated a gradual change in use from herbaceous plant material back to spruce and other woody browse.

Density estimates (Table 1) indicate the tall shrub cover type is the preferred year-round snowshoe hare habitat on the Usibelli Mine. This area would qualify as a "refuge" according to Wolff's (1980) criteria, and hence must be considered important hare habitat. Wolff (1980) characterized a refuge (his designated Area III) as having a vertical foliage density (VFD) of approximately 75%---the tall shrub cover type on the UCM had VFD's over 73% (Table 3).

If the tall shrub cover type qualifies as important snowshoe habitat (i.e., "refuge"), the revegetated areas must be considered as poor hare habitat. There are no tree or shrub communities established on even the oldest reclaimed area---and the VFD values never approach 75% (Table 3).

Table 3. Percent vertical foliage density (VFD) in summer (S) and winter (W) for plant cover types on the Usibelli Coal Mine, Healy, Alaska.

Distance from Target (m)	-- Revegetated-- 1979 S	W	1976 S	W	1972 S	W	Shrub Tundra S	W	Tall Shrub S	W	Conifer Forest S	W
10	13	0	38	0	25	0	11	0	73	50	63	22
20	13	0	38	0	25	0	13	0	84	84	82	84
30	25	0	38	0	33	0	14	0	92	100	84	84
40	25	0	38	0	33	0	14	0	100	100	90	95
50	31	0	63	0	38	0	14	0	100	100	100	100

Winter diets of hares on the UCM were composed of 51% spruce and 45% shrubs [mainly willow (Table 2)]. Summer diets consisted of 69% shrubs, 12% forbs, and 6% graminoids (Table 2). Grass has been reported to be a major food item in the summer diet of hares in Maine (Severaid 1942), Newfoundland (Dodds 1960), and Ontario (de Vos 1964), but in interior Alaska it made up <1% of the diet of any hare (Wolff 1978). The density and frequency of occurrence of a particular plant species in a given habitat has been suggested as an important factor affecting the composition of hare diets (Dodds 1960; Telfer 1972). This may account for the greater consumption of grasses by hares on the UCM; the revegetated areas providing larger acreages of grassland than were available in other Alaskan studies (e.g., Wolff 1978). Many other factors have been found to affect forage selection and consumption by snowshoe hares. Such items as snow depth (Klein 1977), plant secondary chemicals (Bryant and Kuropat 1980), hare density (Wolff 1980), and forage nutrient levels (Sinclair et al. 1982) will all affect the food habits of local Lepus americanus populations. Hence dietary comparisons of hare populations from different geographical areas should be made with caution.

Based on dietary data and habitat characteristics obtained as a result of this study; the long term loss of coniferous forest and tall shrub communities due to mining, and the lack of woody vegetation in present reclamation procedures, will greatly reduce and possibly eliminate the snowshoe hare population on large-scale surface mines in northern boreal regions.

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