THE EFFECT OF LOGGING ON WILDLIFE IN THE BOREAL FOREST

by

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INTRODUCTION

The boreal forest region comprises the greater part of the forested area of Canada, forming a continuous belt from Newfoundland to Alaska (Rowe 1959:9). The region considered in this paper is that classed as "boreal-predominantly forest" by Rowe (1959, map). In Eastern Canada extensive logging has been taking place in the boreal forest region for half a century. In the Prairie Provinces, large-scale pulpwood cutting began only about 15 years ago and has been gaining momentum ever since. The wildlife resources of the boreal forest have been from earliest times of great importance. With modern means of access the use of the boreal forest for hunting and other outdoor recreation has been greatly augmented. It is therefore rather surprising that there has been relatively little research on the relationship between forest practices and wildlife in Canada's boreal forests. The present paper will review briefly but by no means exhaustively the information available on certain aspects of the subject.

Dozens of animal species coming under the general term "wildlife" inhabit the boreal forest. Since it is impossible to deal with them all in a short paper, I will concentrate on the big game species, moose (Alces alces), white-tailed deer (Odocoileus virginianus) and woodland caribou (Rangifer tarandus) with brief reference to others. Because the big game species are subject to considerable consumptive use at present, possible changes in their status due to logging are of critical interest. However, we should recognize all other species as equally valuable and on no account should we allow any boreal forest species to be dangerously reduced in numbers.

SOURCES OF INFORMATION

Because of the paucity of studies of forest-wildlife relationships in the Canadian boreal forest, interpretation must be made from data obtained in similar biotic zones elsewhere. Some studies of habitat selection, food habits and population changes of big game have been published from Newfoundland, Quebec and Ontario. It also is possible to make useful inferences from studies reported from the deciduous-coniferous transition zone of eastern North America.

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2. Canadian Wildlife Service, 515, 10015 - 103 Avenue, Edmonton, Alberta.

Other relevant studies have been reported from the subalpine and montane coniferous forest of western North America and from the boreal forest zone (taiga) of Eurasia.

THE BOREAL FOREST AS A WILDLIFE HABITAT

The usual near-climax forest on good sites in the boreal region consists of evergreens, including spruces (Picea spp.), balsam fir (Abies balsamea) and tamarack (Larix laricina) mixed with a lesser component of birches (Betula spp.) and aspen (Populus spp.). Dry sites are often occupied by jack pine (Pinus banksiana). Because the boreal forest is extremely flammable (Shelford 1963:138) fires have always maintained large areas in an early seral stage at any given time. Since the advent of white settlement fires have probably increased (Scotter 1964:44, 1971:215) and have combined with scattered logging operations to make the boreal forest more suitable for those animals that prefer the early successional stages. Forest stands in the early stages of succession, and older stands with open crown canopies, yield relatively large amounts of potential forage for browsing and grazing herbivores. Such stands may yield more than 30 times more weight per unit area than dense coniferous stands in the region (estimates based on unpublished data collected in deciduous-coniferous transition zone in the Maritime Provinces). On the other hand, later successional stages have higher yields of lichens in much of the boreal forest (Scotter 1964:48). Dense mature coniferous stands also serve as umbrellas against snow and provide a more uniform thermal and mesic environment. Severe winters are characteristic of the boreal environment and snow depths and snow conditions probably exert the most important influences on wildlife. In Canada, snow conditions are more severe in the east (Telfer 1970:5).

EFFECTS OF LOGGING - GENERAL

Most logging in the boreal forest follows the clear-cut system in which everything merchantable is removed at one time. Logging may or may not be followed by such measures to speed the re-establishment of a productive tree stand-measures as scarifying, broadcast burning, planting or seeding. Since most boreal forest stands are of fire origin, and thus relatively even aged, loggers leave few uncut trees except where there are occasional patches of non-merchantable species or size classes. Logging therefore acts like fire as an agent to return extensive areas to early successional stages.

Early successional stages are favoured habitat for moose (Idstrom 1965:76; Bergerud and Manuel 1968:730), for white-tailed deer in summer (Severinghaus and Cheatum 1956:137, 138) and for snowshoe hares (Lepus americanus) (Dodds 1960:59). Vegetation characteristics of such early succession also provides the most favoured habitat for ruffed grouse (Bonasa umbellus) (Berner and Gysel 1969:771, Sharp 1970:49) and beaver (Castor canadensis) (Shelton 1966:50, 124). Other important species such as woodland caribou (Simkin 1965:7) are more closely tied to later stages in the succession.

Peterson (1955:160) believed that clear cutting operations had an effect on moose comparable to large wildfires. He suggested (p. 159, 160) that very large burns and cut areas are not much used by moose until a new stand becomes well established. White-tailed deer are also reported to benefit from logging (Hosley 1956:242). Early successional stages are characterized by high production of woody browse and other forage, including such fruit as blueberry (Vaccinium spp.). A generous food base is necessary to support dense populations of deer, moose, and other herbivores. There has been little study of forage yield in the Canadian boreal forest, especially on a weight per unit area basis. It is sometimes stated that forage from burned areas is more nutritious than forage produced on logged areas, but this has not been conclusively tested.

In addition to ample food, both moose and deer require dense stands of evergreens as a part of their winter habitat (Telfer 1970:3, 4). The needs of deer for proper shelter are especially critical under boreal conditions.

PATTERN OF LOGGING OPERATIONS

When an area is logged or burned the effects are not limited to that area. The proportions of forest stands in the region have been altered, creating a different set of possibilities for the region's wildlife. Leopold (1948: 135) advanced the concept of range balance, stating that for each animal species there is an ideal mixture of food and cover-producing types and other required environmental elements. Unfortunately, little work has been directed toward obtaining quantitative data on range balance, although most wildlife ecologists recognize it subjectively for the species with which they are familiar. Because of the importance of range balance much of the effect on wildlife from logging depends on the pattern produced. Size and shape of cut areas, and uncut residual stands, location of cut and uncut areas on the topography, and species composition of uncut stands all affect range balance.

Since both moose and white-tailed deer require early successional stages to develop dense populations, some burning or cutting in the forest is beneficial for them. How much is good?

Dense evergreen cover amounting to between 5 - 15% of any large land unit is required by white-tailed deer for wintering in eastern North America (Telfer 1970:4). Cover must be left in areas used previously by deer. Such wintering areas should be singled out for a special regime of forest management.

Deer are often described as animals of the edges between food and cover-producing stands (Severinghaus and Cheatum 1956:137). Therefore, outside of wintering areas with special problems, the best pattern for deer would consist of small patches of sapling-size trees and shrubs (usually less than 20 years old) mixed with patches of older timber. In Wisconsin deer were found to make much greater use of clearings less than five acres in area, or five chains (330 ft.) wide, than they made of larger or wider ones

(McCaffery and Creed 1969:54-58). Even within wintering areas small patches of denser, or of more open forest received different use by deer (Robinson 1960:370; Telfer 1967:485-487).

In summary, it appears that logging of a sort that creates a mosaic of small patches and strips of different age classes will greatly benefit deer while large clear cuts will be harmful.

In regions with a deep snow cover, moose concentrate in favourable habitat (Peterson 1955:153-158; Telfer 1967:486), although they can get by with less evergreen shelter than can deer. Wintering areas studied by Prescott (1968:161-189) were composed of a mosaic of patches, averaging between one and two acres in area, of all ages and species mixtures. It appears that moose are more flexible in their wintering requirements than deer, but have definite limits of tolerance to snow depths (des Meules 1964:56).

Vozeh and Cumming (1960:2-4) described with the aid of a map, an 875 acre area that apparently comprised excellent boreal moose range. The area supported 4.3 moose per square mile in winter. Eighy-two per cent of the area was composed of a stand that had reproduced following a burn 19 years previously. It contained trees between 15-30 ft. tall, of a mixture of species, with a dense understory of shrubs and tree saplings. The remainder of the plot consisted of five rather long and narrow patches of mature conifers totalling 18% of the area. These stands contained some patches of dense cover (8% of total area) and were distributed around the edges of the block. No part of the block was more than 1/3 of a mile from a patch of mature coniferous cover. Also, there were probably patches of young conifers in the burn sufficiently large to provide suitable shelter for moose.

Another area that apparently constituted excellent moose range was the Lower Noel Paul drainage in central Newfoundland (Bergerud and Manuel 1968:733). During January of 1960 there was a minimum density of 12 moose per square mile on the area (considered to be an over-population). The drainage had been logged by a series of small logging operations between 1946 and 1956. Data presented by those authors suggest that the average size of cut was about 240 acres. Cutting was to a small diameter limit but left some residual stands of small poles. The logging had provided a patchwork of clear cuts producing browse while nearby uncut or residual stands provided the necessary shelter. Pimlott (1953:577, 578) reported that logging previous to that time had been generally beneficial to moose in Newfoundland and that individual cutting operations were well dispersed and averaged less than 0.5 square miles in area.

The examples cited suggest that moose range may be balanced with much larger clear cut areas and less shelter than deer range. Clear cut areas of 1/2 square mile might be tolerated. Larger clear cut areas are probably not heavily utilized until the new stand has grown sufficiently to provide shelter (15 years or more after logging). Peterson (1955:160) cautioned against too large cuts and suggested that clear cutting of smaller spots or strips creates better moose habitat. Lykke and Cowan (1968:15) believed that the great increase of moose in Scandinavia in this century was largely

due to the shift from selection cutting systems to clear cutting. At present 25% of the Norwegian forest area is in young stands under 30 years old. However, G. Markgren (personal communication) has stated that recent introduction of very large, progressive-type clear cuts in northern Sweden has caused a decline in moose populations which had formerly risen under the influence of smaller clear cuts. Peterson (loc. cit.) also points out that logging by the selection system may not open up the crown canopy sufficiently to allow a large increase in browse yield. My studies (unpublished) suggest that in the coniferous-deciduous transition zone residual basal area must be reduced below 75 square feet per acre before substantial increased browse production results.

Simkin (1965:7) states categorically that lumber and pulpwood cutting cannot result in anything but a reduction in the habitat of woodland caribou. Little is known in detail about the proper range balance necessary for woodland caribou. However, maps comparing caribou winter range and calving grounds in Newfoundland (Bergerud 1971a:40 and Bergerud 1971b:7, 16) suggest that caribou there prefer the non-merchantable lichen woodland and subalpine forest types. Bergerud (1971a:43) shows that these types have a much higher biomass of lichens, a major winter food of woodland caribou, than do dense forest stands. In certain circumstances, the supply of some ground lichens might be increased by logging (Cringan 1948, as quoted by Ahti and Hepburn 1967:59), although food supply may seldom be a limiting factor on woodland caribou populations (Ahti and Hepburn 1967:58).

In virgin timber snowshoe hares are dependent on an interspersion of openings (Dodds 1960:59). Hares also make intensive use of clear cut areas after a dense stand of evergreen saplings develop to provide escape cover. Heaviest use of clear cut areas in the boreal forest occurs 20 to 30 years after logging. Munro (1969:64) found that hare feeding was heavier in clear cut areas under 10 years old than in partially logged stands. Snowshoe hare populations are subject to cyclic fluctuations regardless of habitat conditions (Keith 1966:832). However, Keith (1963:88, 89) also noted that during cyclic low periods in the population such species persist chiefly in islands of favourable habitat.

Small mammal populations immediately after a clear cut logging operation were found to be 4.0 per acre on an area at the edge of the boreal region in Alberta (Radvanyi 1963:54). Logging took place in the spring. In late summer of the same year the population had risen to 8.5 per acre and by the end of the following summer to 12.5. A nearby area logged five years previously had a population of 15.6 small mammals per acre. Ahlgren (1966:617) reports a small mammal population increase of similar magnitude on logged areas in Minnesota. Increases in small mammal populations result in a larger food resource for raptorial birds and carnivorous fur bearers.

Kendeigh (1947:26-28, 34) compared bird populations on cut and uncut blocks in the boreal forest reporting that, on a hundred-acre basis, the logged area had 169 breeding pairs of 27 species compared to 319 pairs of an average 35 species on four blocks in the uncut mature stand. In the mature forest warblers were the dominant group but in the logged area sparrows predominated.

SYNTHESIS

In summary, several points emerge:

1. Vast tracts of dense, mature boreal forest provide good habitat for some birds and probably are important to woodland caribou, but are poor habitat for moose, white-tailed deer, beavers and ruffed grouse.

2. Deer and moose, and probably many other boreal forest animals, require diversity of forest cover within their home ranges at all times of year.

3. Logging can provide useful diversity if planned and conducted with that goal in mind.

4. Very large clear cuts (over several hundred acres) are rather barren, producing sparrow habitat and, depending on local conditions, snowshoe hare and moose habitat for 10-15 years during the pole stage.

5. No attempt has been made here to review the techniques or economics of logging methods that might optimize wildlife values. These factors should be studied as part of a multiple use management research program.

6. There is a scarcity of basic information on the ecology of many forms of wildlife in the boreal forest of Canada. The boreal forest zone is by far the largest region in Canada. It extends from coast to coast and may in the future be developed into the heartland of the nation. We need to know much more about the ecology of that region. The need is urgent.

7. Logging will become the principal ecological influence on the boreal forest. Pimlott et al. (1971:162) report that one million acres, or 1500 square miles, were logged for pulpwood in Canada in 1968. Most of this area was in the boreal forest. Pimlott et al. state: "If the cutting results in favourable conditions for wildlife, it will be of very great importance in the future; if it results in the creation of unfavourable conditions, it will constitute a disaster."

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