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FIRE AND THE DECLINE OF A MOUNTAIN CARIBOU HERD

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The mountain caribou (*Rangifer arcticus*) has decreased alarmingly throughout most of British Columbia. From the Kootenays in the south-east corner of the province to the Cassiar region in the northwest reports are much the same except that there is variation as to when the declines first occurred. Banfield (1949) has noted this condition in his treatment of the status of caribou in America.

Two features have characterized this decline. It has progressed from south to north, beginning in the south shortly after 1900 (Munro, 1947). In central British Columbia it began in the 1930s. The decline in the north appears to be quite recent but information from this wilderness is not detailed. Secondly, the decline has not wiped out most bands for which there is information. Apparently few caribou ranges have had their herds completely eliminated.

Many causes have been suggested for this decline, the most frequently heard being wolves, hunters including Indians, and moose which are said to be incompatible with caribou. None of these suggestions withstands careful scrutiny. Declines have occurred in wolf-free areas. The spectacular increase of moose throughout central British Columbia since 1920 has undoubtedly reduced hunting pressure upon caribou. Finally, every story of moose-caribou incompatibility, when examined, is based upon the caribou decline being concurrent with the moose increase, and not upon observation of the two species together in the field.

One of the decreased caribou herds inhabits Wells Gray Park (Lat. 52°N, Long. 120°W) in the Cariboo Mountains of British Columbia. For four years wildlife investigations in this park have gathered information on this herd, but it is difficult to study both from its wandering habits and the rough country that is its range. The data gathered are fragmentary but are sufficient to form a general history of the herd when combined with information obtained from homesteaders who have lived near the herd for many years.

DESCRIPTION OF AREA

The northern half of Wells Gray Park consists of rugged mountains up to 8000 feet high, with permanent snowfields and large glaciers covering extensive areas. Southward the country becomes less precipitous with more foothill topography and occasional isolated peaks. The whole area is drained by the swift Clearwater River, flowing through a broad valley having sides oversteepened by glaciations. The headwaters of this drainage con-

tain several large lakes which are opaque with glacial silt. These tend to be long, narrow and crowded by mountains.

The pattern of vegetation in the park is complex, due to variations in altitude, a longitudinal gradient in precipitation, and results of extensive fires. Before fires denuded many of the lowest elevations most of the valley floor and adjacent lower slopes were clothed in a mature coniferous forest of red cedar (*Thuja plicata*), western hemlock (*Tsuga heterophylla*), Engelmann spruce (*Picea engelmanni*), and alpine fir (*Abies lasiocarpa*). This is the Columbia Forest of Halliday (1937).

In dry areas with the southern exposure in the southern part of the park, the humid forest floor was replaced by one of Douglas fir (*Pseudotsuga menziesii*) with grassy openings. This fir forest occurred mainly on exposed sites below 2500 feet.

At about 4000 feet, the Columbia Forest gave way to a sub-alpine forest of Engelmann spruce and alpine fir which became increasingly open and stunted with elevation. At about 7000 feet, openings enlarged to meadows. These tended to be of three kinds: thick mats of grasses and sedges, mats of heathers (*Cassiope* spp., *Phyllodoce* spp.), and lush growths of herbs such as false hellebore (*Veratrum viride*), lupines (*Lupinus* spp.), anemone (*Anemone occidentalis*), and Indian paintbrushes (*Castilleja* spp.). Rock lichens *(Cladonia* spp. and others) were not common above timberline although both the sub-alpine and Columbia forests at all elevations were hung abundantly with "tree moss" (*Alectoria sarmentosa* and perhaps other species) resembling *Usnea*.

Thus was the southern part of the park prior to 1926. Most of the lowland was in mature forest except where lightening fires of small size had created seral forests of various ages.

In 1926 a fire started in a dry Douglas fir forest to the south of the park, swept north up the Clearwater Valley with explosive intensity, and completely denuded some 200 square miles of forested land. It missed few lowland areas as it removed humus from the soil and even completely burned boles of mature trees over large areas. While it completely denuded most of the lowest elevations in the park, it did not make much headway in the sub-alpine forests on higher slopes. More recent smaller fires have enlarged the burned area and reburned parts of the old burn.

Now, 27 years after the major fire, the lowlands are grown principally to open stands of willow, aspen, and birch in a poor, sandy soil generally with sparce herbaceous vegetation. Coniferous regeneration is evident mainly near the few unburnt coniferous stands, although isolated pioneers are scattered thinly throughout, mainly as young trees less than ten feet high.

In all, 60 per cent of the vegetation below 4000 feet has been reduced from climax forest to an early seral stage. Fire has drastically changed the vegetation of the valley. Catastrophic change in the ecology of the area is an inevitable result.

FIRE AND THE LARGER MAMMALS

Reliable local knowledge and study of present conditions provide a general history of the larger and better known mammals in and about the valley through the past thirty years. It is a history of change in the mammalian populations concurrent with fire, and no less abrupt than the change of the land itself from dark forests deep in mosses and lichens to bare soils baking in the sun.

Mule deer and caribou were the main ungulates in the timbered valley. A small deer population wintered in warm canyons to the south among Douglas firs and dispersed in summer to open meadows above timberline or to small patch-

es of young forest healing recent lowland burns. Deer avoided heavy forest except traveling through it. A few goats occurred as outpost populations from larger herds in more rugged terrain to the north. Cougars and coyotes inhabited open areas used as winter range by deer, and coyotes, like deer, climbed to the lush meadows in summer were mice were numerous and traveling was easy. Marten were common throughout the dense forests. Beaver and other fine fur species were well distributed. Wolverine ranged alpine meadows in summer and timbered lowlands in winter. Black bears were found sparingly throughout the lowlands, and grizzlies roamed in the high country, descending into the valley in spring. The whole scene was one that had been long established, with that evidence of permanence that has led to the concept of climax.

The fire that followed was catastrophic. In a few hours its destruction changed the scene in the valley from one on intricate complexity to one of relative simplicity. The changes that it wrought would fill volumes if all were known. Chemistry, structure, fauna and flora of the soil, vegetation with its dependent animal life, the very climate of the place were abruptly changed in a sudden fury of destruction. A tangled, wet forest penetrated only by miserable trails became a desert-like area where a horse could roam almost at will.

For a few years, the habitat was desolate, with some deer mice scurrying in the ashes and a few deer wandering among charred forest remains. Fireweed and willow began to heal the land in an environment suddenly suitable for them. Slowly the land that had been like a desert changed to one supporting an abundant growth of willow, birch and aspen. The new vegetation created a new world for mammals. The fire that had destroyed a rich vegetation with a varied mammalian community in which few species were abundant made new and extensive range for a number of species. The fire had totally removed the marten for decades, in destroying the dark forest. It had restricted the lowland wandering of wolverine and grizzly bear. At the same time it created new habitat for others. There was a spectacular increase in mule deer which almost swarmed in abundant browse. Dozens could be seen in a day where they were formerly infrequent wanderers in deep forest. Cougars became so common that one hunter took eighteen in one season where a few years previous it was unusual to see tracks. Coyotes suddenly flourished in this new, prairie-like valley where deer mice had increased and Columbia ground squirrels were abundant where previously unknown. Beaver found new food abundance and increased. Black bears found berries and other foods abundant as they never had been. Goats, among the few species whose ranges were mainly above the fires were affected but little.

Moose were unknown ion this valley before the fires. Wanderers colonized the valley in the early 1930s and increased until the winter of 1945, when homesteaders watched moose browsing close by and children on their way to school dodged them. Moose found extensive winter range in the hundreds of square miles of browse, and summered in the damp sub-alpine forests at and below timberline.

With the establishment and increase of moose, wolves increased markedly from a previously low population density. The new mammalian abundance probably figured strongly in this and other increases in mammalian predators of the valley.

To-day the situation is only slightly changed. Shrubbery is older and higher, and the ground is not quite so bare. Young conifers are slowly repopulating the burn but are still absent from large areas. Deer are not so abundant, nor are cougars and coyotes, but moose in hundreds still wander

down from the mountains to the lowlands in autumn. Mice and ground squirrels are still abundant. The former are a major factor in arresting coniferous reinvasion, for they are efficient gatherers of tree seed.

THE CARIBOU DECLINE

Though this time of change the caribou survived but their numbers were markedly reduced. In 1937, Game Department reports expressed concern over the future of the Clearwater caribou, and in 1940 hunting them became illegal.

The ranges inhabited by these caribou comprise the less precipitous foothill country bordering the mountains. The extensive meadows on the rounded foothill elevations seem better suited to this species than do precipitous slopes and permanent ice of the core of the Cariboo Mountains. The wide, heavily forested Clearwater Valley lay among and below these extensive alplands, and the caribou, following traditional trails through the forest, crossed regularly from one alpland to the other.

In summer and fall caribou were found in high meadows and in adjacent sub-alpine forests that were open and festooned with lichens. In winter and early spring they were usually encountered in valley bottoms in mature forests of cedar, spruce, hemlock and balsam. In these lowlands they seemed to favour the flat, poorly drained areas that were interspersed with open bogs, meadows and ponds, as well as those forests that were near the open ice of lakes. However, their altitudinal distribution was probably not quite as simple as this. At times during the winter they climbed to the high, wind-swept ridges of their summer haunts. This altitudinal movement, as in most such migrations of ungulates in mountainous terrain, was probably controlled by snow. According to several careful observers of this herd, the first deep snows of winter forces caribou down, just as it does elk, moose, deer, and in some areas mountain goats, throughout much of western America. If snows settle and harden the caribou travel the high country in mid-winter. Spring thaws which soften the snow drive them into poorly insolated lowland forests again, from which they move into snow-free alplands in May and June, there to spend much of the summer.

These caribou were forced to live in dense, lowland forests during part of each winter, 4000 feet below their summer range. It appears that just as deer, elk and moose in mountainous terrain must seek low elevations in winter, so must the mountain caribou, in some regions at least. Unlike more common and better known ungulates this caribou descends to mature forest and not to young forest or to open grassy ranges. According to several observers their food in these forests is chiefly tree lichens. Browse is undoubtedly another food item.

The fires that created hundreds of square miles of new range for moose and deer reduced by 60 per cent the area of dense forests used by caribou in winter. It reduced forests with numerous boggy openings by 70 per cent. If these lowland forest ranges are as important to caribou as winter range is to most ungulates in Canada, the cause of the decline of the Clearwater caribou is no mystery. The same fire that allowed the increase of deer, and later of moose, burned from 60 to 70 per cent of the forest probably essential for caribou survival in winter.

Caribou did not become scarce immediately after the 1926 fire. The decline was first noted with alarm about 1935. It may actually have occurred earlier, for decreases are not easily detected in nomadic, gregarious animals inhabiting wilderness. It is probable, however, that the decline took place in the early 1930s, and it was perhaps accel-

erated by fires that followed that of 1926. Five fires burned an additional eighty square miles in the summers of 1930 and 1931, and another 100 square miles were burned before 1940. Now, except for three restricted lowland areas, mature Columbia Forest is gone from valleys bordering the caribou-inhabited highlands. The remaining forests are the only lowland areas where caribou are seen regularly in winter. Lowlands formerly frequented now contain only wanderers. They are rarely seen in burns where old antlers and local; knowledge indicate winter abundance before the fires.

It appears that fire is the major cause of caribou decline in Wells Gray Park. The northward march of the decline through the province is suggestive of the same cause, since the trend of first human influence upon wilderness land in British Columbia had progressed generally from south to north. In Alaska (Murie, 1951, p. 278), western Ontario (de Vos, 1948) and other areas where caribou declines or exterminations were followed by increases in deer or moose there is ample evidence to suspect fire.

CARIBOU MANAGEMENT

Before the fire of 1926, lowland Columbia Forest in the Clearwater drainage covered only 9 per cent of the country used by caribou, while the poorly drained areas which seem to be preferred were only 3 per cent of the total. Fire has reduced these percentages to 3 and one respectively. These small areas appear to be the key to caribou survival.

When small areas of climax or near climax vegetation are necessary to the survival of an animal species, any change in vegetation may doom the animal dependant upon it. In this case fire or clearcut logging completely eliminate caribou range, and the animals disappear as a result.

While caribou management in this area cannot tolerate fire or clearcut logging in winter range, it is possible that a form of selective logging would not endanger the herd. Much more study is necessary before this can be accepted as more than a possibility.

Whereas most game management yields quicker returns than does forestry, caribou management appears to require planning that is just as long term as in forestry, or perhaps longer since the ideal caribou forest could be a senile forest well past ideal cutting age.

Our present incomplete knowledge suggests that three measures are necessary to manage caribou in Wells Gray Park. These are, in order of importance: (1) Protection of remaining mature forests from fire. (2) Protection of remaining animals, or cropping to remove annual increases should data be available to fix harvests levels with accuracy. (3) Vegetation management designed to increase the area of mature forest.

These measures are easily stated; but successfully implementing them in the field calls for research, planning and management, tempered by some of the convictions necessary for wilderness preservation.

SUMMARY

A mountain caribou herd in Wells Gray Park, British Columbia, is one of many in the province that has decreased in size since the turn of the century. Fire appears to be the cause of the decline of the Well Gray herd. Since 1926 about 70 per cent of the forests below 4000 feet have been burned, and caribou, which appear to require mature lowland forests for winter range, are now confined in winter to the unburned forest remnants.

The fires were followed by a dramatic change in composition and population density of the

mammalian community. The caribou decline was accompanied by declines in a few other species, while the overall effect of the fires was to create a mammalian abundance previously unknown.

To maintain and eventually to increase this herd, management will include protection of the animals, protection of the animals, protection of existing lowland forests from fire, and a long-term endeavor to increase the area of lowland climax or near-climax forests.

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