Lightning Behavior in the Yukon

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I COME TO you from the far reaches of the Canadian Northwest, the Yukon Territory, the Land of the Midnight Sun and the scene of the world's greatest historical goldrush—the "Klondike."

The Yukon is that northern portion of Canada with our neighbors, the state of Alaska, to the west; the Northwest Territories to the east; and extending from the 60th parallel latitude to the Arctic Ocean with a total of 207,000 square miles. Majestic mountain ranges divide our drainage system, and in wide terraced valleys, our rivers flow to the Arctic Ocean, the Pacific Ocean and the Bering Sea. The St. Elias Range, in the southwest corner, is the location of Mt. Logan, elevation 19,850 feet, the highest peak in Canada, and many other imposing peaks jut out of one of the largest remaining ice fields in the world. The central portion of the Yukon is geologically known as the "Yukon Group" and is very old, possibly pre-Cambrian. In the northern reaches, from the Arctic Circle to the Arctic Ocean, the Old Crow Flats yield many fine grade muskrat pelts and have recently received extensive exploration for oil and gas.

Climatewise, we have four very distinct seasons: 1) *Spring*, that never ceases to astound by its sudden arrival and the arrival of migratory wildlife; 2) *Summer*, short and sometimes very warm with temperatures of 95° F. in the shade, and, of course, in June with daily sunshine of 23 hours and 59 minutes; 3) *Fall*, sharp frosts, good

hunting with the land an Artist's picture of colors; 4) *Winter*, snow ice, clear dry frosty air, northern lights and damned cold—84° below zero during the winter of 1947, while on the warmer side it was 46° F. above zero on Christmas day at Whitehorse in 1961, and was the warmest spot in Canada on that day.

The Yukon Forest Service, a section of the Resources Division, Northern Administration Branch, Department of Northern Affairs and National Resources is responsible for forest fire protection and forest management in the Territory. This includes fire prevention organization and actual fire suppression, direction of public roadside campgrounds, timber disposal and internal administration under the immediate direction of the Commissioner of the Yukon Territory. The policy of the Department is based on the necessity to protect the timber potential, to gradually inventory our timber reserves, and maintain accurate utilization data and to gain information from which the most economic and practical ways of maintaining a lumber industry can be attained. Some assistance in carrying out this policy is received from the Federal Department of Forestry which acts in the capacity of a forestry consultant and carries out inventory surveys, disease and insect surveys, and research to meet the needs of the forest.

Forestry activity remained almost dormant until the Second World War and the construction of the Alaska Highway which brought about increased wood utilization and greater forest fire losses. During the war years, local timber cut under permit increased to about 1,000-000 board feet of lumber and 20,000 cords annually but, in addition, it is estimated that approximately 14,500,000 board feet, 600,000 lineal feet and 49,300 cords were cut for military construction projects free of permit requirements. The present Forest Service has also plotted the location of man-caused fires for a 10 year period, beginning in the late 1940's, and found that they followed almost exactly the route of the Alaska Highway. Forest reconnaissance surveys were carried out in the Territory by the Department of Mines and Resources in 1943 and 1944, and as a result of information obtained, a Forest Protection Service was organized. I joined the ranks a short time later with Badge Number 4. I now hold the position of Fire Control Officer, and with a summer staff of 30 personnel, carry out forest fire control throughout the entire Yukon. Productive

forested land totals 26,944,000 acres. One of the reasons for this is for the protection of wildlife. Hunting by residents and outsiders is both popular and financially important to the Territory. Big game hunting is one of the Territory's major tourist attractions, and the business is an important secondary industry. Also, trapping is still important to a segment of the population even though it is not as extensive as in the past. Serious forest fires often deplete game population. Recent forest surveys estimate productive forested land to support a total timber reserve of 2¼ billion board feet and 30 million cords which are accessible and 3 billion board feet and 63 million cords which are potentially accessible.

In submitting my opinions regarding the relation of lightning-caused fires to our flora and fauna, I do so, not as a scientist, but as a naturalist and draw my conclusions from a life-time in the field.

When considering the ecological effect of lightning fires on the flora and fauna of the Yukon, it might be advisable to go back in time to the last ice age. This ice covered the Yukon to the extent shown in Figure 1, and started to recede about 10,000 years ago. It shows the central and northern sections were free of ice and could have retained and sustained species of flora and fauna during the last ice age. This opinion is substantiated by fossil remains found in the gold placer diggings in permafrost. Very little knowledge is available regarding the species of flora and fauna during that period of slowly receding ice. We do know migratory waves of people crossed the Bering Strait from Asia and spread south and south-east. The only traces of these people remaining today are flint artifacts and burned bone in their ancient campfires.

I have often sat at one of these ancient camps where diggings revealed five cultures of these people, and pondered their way of life and surroundings during that era. Hunting, for food and clothing, must have been fairly hard because of primitive weapons. Did they have shelter? What species of flora and fauna did they encounter, the woolly mammoth, the mastodon, the saber-tooth tiger, the bison? Fire they did use for warmth and protection and cooking. Did they also use fire to aid the hunt or follow an inherent instinct to burn off the land to maintain a favorable succession of flora and fauna?

In my opinion, as the ice receded, the weather moderated creating conditions conducive to lightning storms and resulting lightning

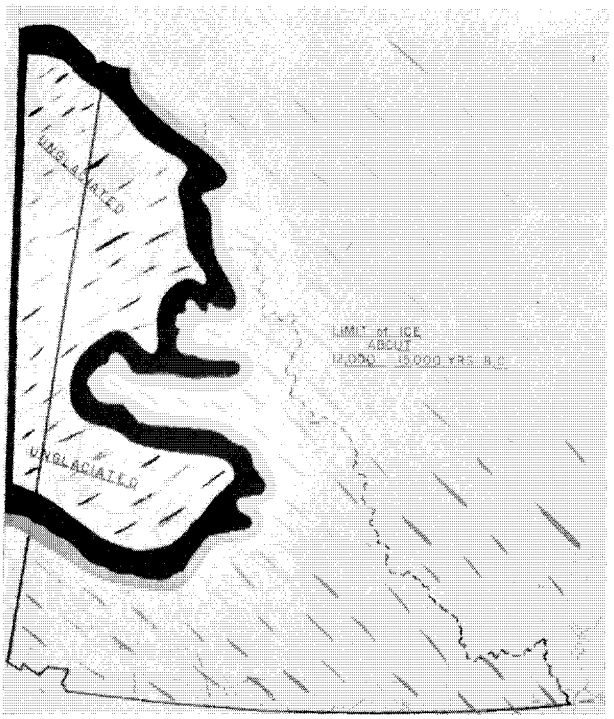

Fig. 1. The Yukon Territory showing limit of ice about 12,000–15,000 years B.C.

caused fires, and, in this locale at least, started an initial cycle. This cycle of fire and succession continued over the millenniums until climate and soil analysis were receptive to the evolution of "fire type" flora and fauna. This is a reasonable assumption, otherwise the land would have remained barren and unproductive and would not appear as it does today.

Now comes the question of which came first: the egg or the hen. Did the fauna seed ahead of the advancing flora? I suggest the fauna found food, shelter and breeding grounds within the slowly advancing flora. Our present moose follow burned-over areas to obtain new and proper browse. Migratory birds nest in "fire-type" flora and raise their broods on seeds and insects peculiar to this type. This cycle has continued to date with our resulting species of herbivorous animals being sustained by our "fire-type" flora and accompanied

with our resulting species of herbivorous animals being sustained by our "fire-type" flora and accompanied with our carnivorous predators.

Our Yukon flora is a botanist's dream and very little research has been carried out in the Yukon. We have the sedges, mosses, grasses and lichens; wild flowers and weeds; dwarf mountain birch and the willows; the deciduous white birch, black and white poplar; the conifers, black and white spruce, lodge-pole pine, balsam fir and tamarack. In my opinion, all of this flora is "fire-type" through natural selection, and the cycle of fire and succession is continuing. With exceptions due to locale, this cycle appears to follow a rather set pattern. Heavy stands of spruce, poplar and pine appear to reach maturity and then start to degenerate with a high percentage of butt and heart rot and with little or no regeneration.

This degeneration could be caused from either the cycle characteristics of the species and soil analysis or both. When these stands are destroyed by fire, regeneration appears to follow a rather set pattern. First, the grasses and fireweed appear followed by white poplar and willows, in that order, or, on occasion, together. This growth continues until sufficient ground cover is established and, no doubt, a chemical change in soil analysis until the soil is receptive to the conifers. In some areas when a high percentage of pine regenerated, it is in turn replaced by spruce which takes over and controls large areas toward the close of the cycle.

A study of lightning-caused fires and the characteristics of lightning has only recently been undertaken by our Department of Forestry in Ottawa. Lightning reports are submitted for all reported lightning-caused fires. Very few records are available for lightning fires in the Yukon prior to 1956 and, therefore, early records are indefinite and incomplete. The maps and charts submitted are compiled from information available and do, to a degree, reveal certain trends (Figs. 2, 3, 4, 5).

It would appear the trend of lightning caused fire incidence is closely related to altitude in the Yukon and appears to favor timbered valley floors and adjacent slopes rather than the higher altitudes. Timber limits extend to the 4,500 and 4,700 foot levels.

In remote areas of the Yukon where fires are mostly caused by lightning, the cycle is very distinct when observed for the air. The

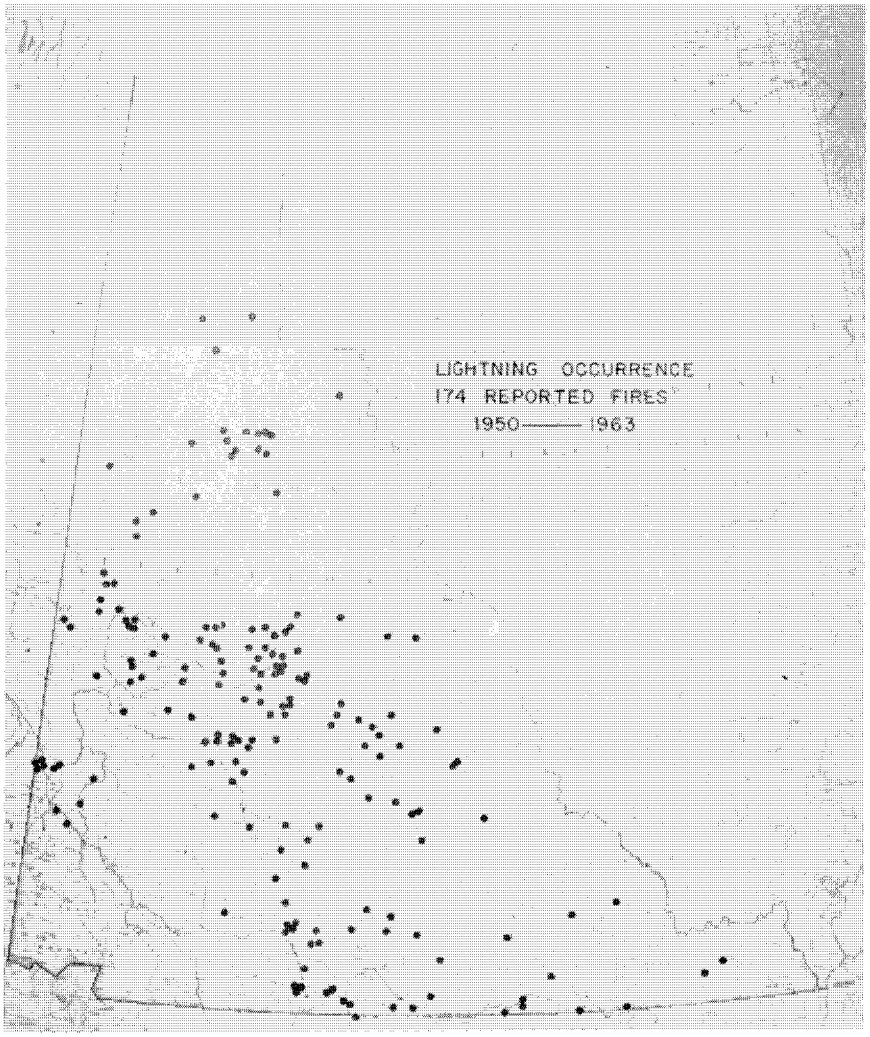

Fig. 2. This map shows reported lightning-caused fires from 1950 to 1963 inclusive. Note the trend or pattern of occurrence along the Rocky Mountain Trench extension and heavy concentrations along the valleys of the Stewart and Yukon Rivers.

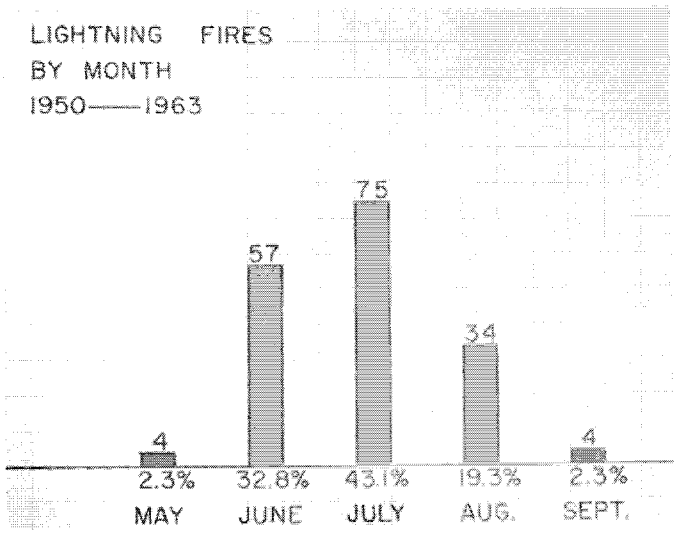

Fig. 3. Note only 4 reported fires or 2.3% in May and an equal number in September with a very sudden rise in June and July with these two months accounting for roughly 76% of all fires. Lightning strikes are very rare below temperatures of 60° F. and peak strikes appear to occur between 70° F. and 78 °F.

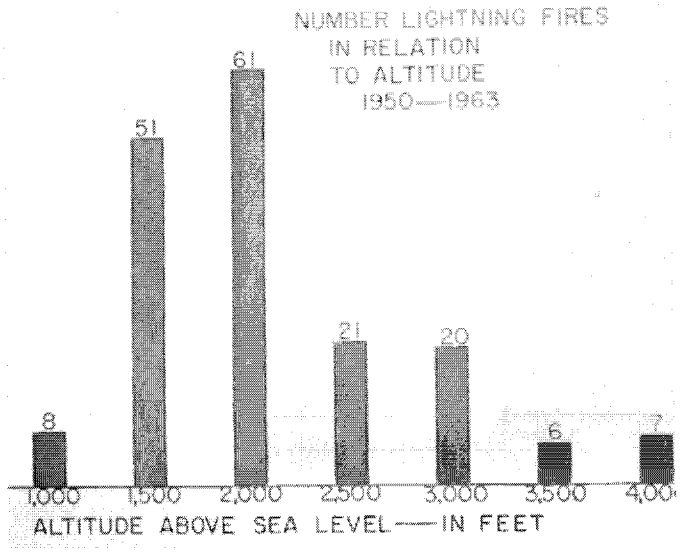

Fig. 4. This chart shows the trend of lightning striking and causing fires at the 1,500 and 2,000 foot elevations accounting for 112 fires out of a total of 174.

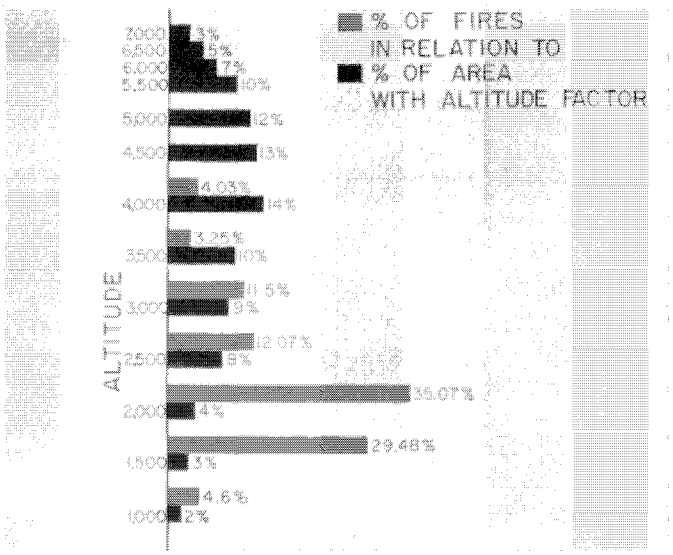

Fig. 5. This chart is a little more complicated and shows the relation of the percentage of fires to percentage of area with altitude factor. The 2,000 foot altitude has an area of 4% of the Yukon but had 35.7% of fires, closely followed by the 1,500 foot level of 2% of the area and 29.48% of fires. The two levels, the 1,500 foot and 2,000 foot, comprise only 7% of the Yukon and have had 64.55% of fires. The usual valley elevation in the Yukon is around 1,500 to 2,000 feet altitude.

terrain is checkerboarded with all phases of the cycle from fresh burn to stands of mature timber. From personal observations, I believe, certain species of fauna, especially migratory birds, favor specific areas of the cycle period. From the air it has been possible to ascertain if certain species are in a given cycle phase and correlate certain species to the various phases of the cycle.

This cycle appears to have had a reasonable balance until the advent of man in the Klondike Gold Rush. Old timers have told me that at the height of the Rush, there were continuous fires burning along the entire length of the Gold Rush route. The paddle-wheel river boats devoured firewood at a tremendous rate and at the crest of the steamboat era, it is estimated 300,000 cords of firewood were burned each summer.

The rock-hard permafrost of the gold placer ground was thawed with wood fires. The thawing was later carried out with wood-fired boilers and the gold recovered with wood-fired dredges. Conse-

quently, nearly all available firewood within 40 miles of the gold fields was utilized. This utilization of the forest resources could have created a small imbalance in the areas affected. However, in the past few years, a very intensive and effective fire control program has been carried out and burned area restricted to a very low average.

In conclusion, I am of the opinion a very careful study should be carried out to determine the rhythm of the fire cycle and the apparent effect of the cycle on the flora and fauna. I have advocated, and hope to see initiated, a research program of controlled burning and continuous study of such burned areas to be carried out in order to obtain data which will ensure the adequate supply of our vital forest and wildlife resources.

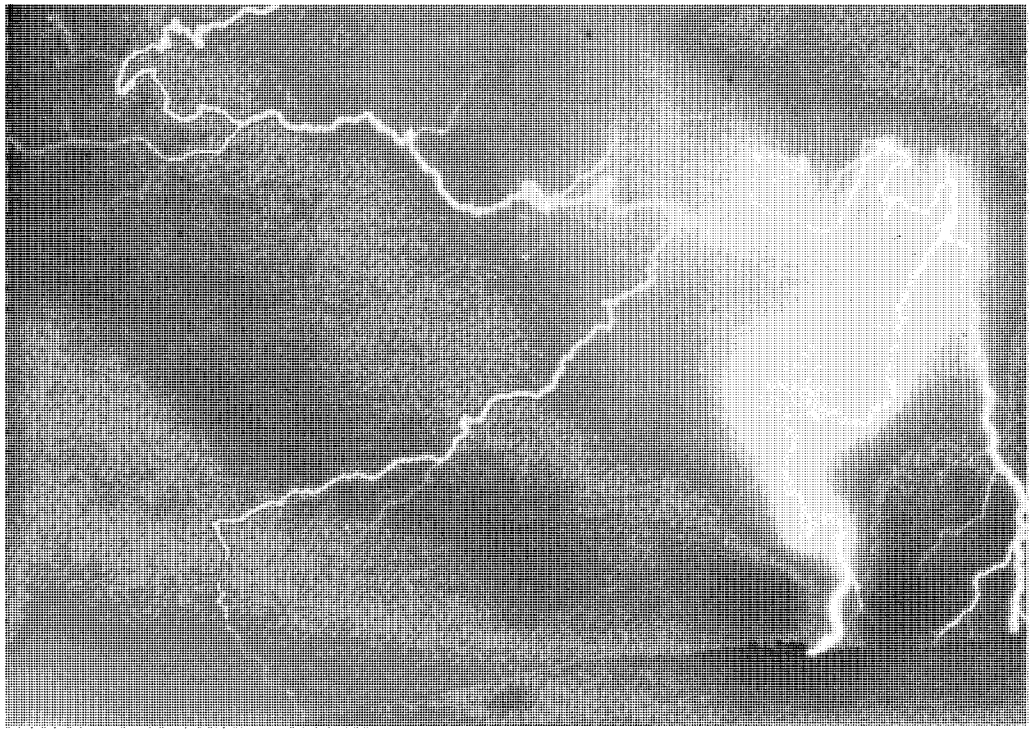

Fig. 1. Cloud-to-ground lightning on the Lolo National Forest, Montana. July, 1962. U. S. Forest Service Photo.

Fig. 2. Lightning started fire. U. S. Forest Service Photo.