Forest Fire and Insects: The Relation of Fire to Insect Outbreak

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THE long-time role of fire in the forests of eastern Canada is masked, I believe, by the history of Canadian forest management in the exploitive years since 1920. There is now more forest land occupied by Industry—mainly the Pulp and Paper Industry—than ever before and the minimum management effort is in the good use of the present crop of trees and protection for the next one.

Protection against fire has become a very specialized task and as time passes the odds in favour of the fire fighters seem to improve because of increasing accessibility in the forest and greater mobility in the protection system, brought about by new tools such as the tractor, tank-truck, radio, power saw, aircraft (detection and suppression), chemicals, water additives, etc. etc., and this in spite of the trend toward increase in incidence of man-caused fires.

Fire records for the period show a surprisingly large chunk of the occupied forest burned one or more times, and show also that the era of the occasional giant fire may be ending.

History of Fire

Although we have a most imperfect knowledge of how the forest survived in its present forms we do know that fire played a part because it is a built-in phenomenon not in any way dependent on man or his inventiveness or separable from the forest. Therefore, we can quickly say that in each year as far back in time as one cares to go there has been fire in the forests of the region. Lightning, the trigger for early wildfire is a weather thing. From weather records of the past 100 years one surmises that we have always had lightning to trigger fires and every year somewhere the kind of weather upon which fire thrives. So we can say with confidence this has been so for a long time.

Forest History

In order to have a fire we must have something to burn and this brings us to the tree cover which is the forest, locally called woods or bush.

Canada's eastern forest is large in extent and has many faces. It is about these faces that I shall talk briefly.

There are two main groups of forest faces. I call them the fire faces and the unfire faces. The fire face forest is composed of stands of trees of the kind that cannot suffer shade of other trees. After fire these appear as small seedlings from seed dropped during the fire or soon after, or from seed on the ground not destroyed by heat, or from seed which has blown in from outside. Pines, black spruce, and tamarack are fire face conifers. Aspens, white birch, pin cherry, and some willows are fire face broad leaf trees.

Ordinarily there are few other tree species present in the first generation after fire except they be of vegetative origin.

The unfire face begins to appear when there is an infiltration of shade tolerating trees such as the white and red spruce, hemlock, cedar, and most important of all—balsam fir, of the conifers; maple, beech, yellow birch, and assorted other minor species of the broad leaf kind.

A real unfire face stand has little or no sign of intolerant tree species—or of past fire.

One species of tree in both fire and unfire face forest can occur as pure stands or in mixture with other species in all combinations.

It is possible to find all conditions from fire face 1 year old jackpine to unfire face 350+ yr. old red spruce and 400+ hemlock stands and hilltops of 300+ yr. sugar maple in the region, but these are very minority conditions. The main one is a mixture of spruce and balsam fir in varying proportions with an admixture of other species of lesser importance.

In aerial photos or seen from aircraft the fire face forest is characterized by uniform tree crowns. Stands have a smooth flat top and an even-aged appearance. Especially smooth is the texture of pure stands.

In contrast the unfire face forest has an irregular stocking, texture is coarse, tree crown highly variable in width and height. Usually two or more age classes are identifiable—these qualities are still in evidence 100 years after fire.

On the ground an experienced observer may often notice these same qualities as much as 150 years after a burn as he crosses the interface in a few paces. Mining around fire face trees should turn up some charcoal. Failure to do so does not mean absence of fire.

FOREST FIRE RISK

Snow covers the ground for as much as 6 months of the year in this region, and in this portion of the year the forest could not be fired with a blow torch. The fire season extends from May, the beginning of the growing season, through August, the end of the growing season, into October.

Even in the fire season a well stocked healthy forest is not of itself a really high risk. It is at risk almost entirely because of the nature and extent of a fuel pile at ground level in close proximity. Most common fuel in the used forest of today is logging slash because it is an annual deposit. Fuel for fire can also be provided from time to time by storms of wind or sleet by insect damage or tree mortality from disease.

Slash up to 10 or more years old will burn and carry fire anytime it is dry enough and it can be dry enough anytime after snow melt through summer and into fall, given the right weather.

INSECT OUTBREAKS

In the bush insects are not all man-eaters. Some kill trees. The conifers for instance host three orders of defoliating insects with a well known ability to completely destroy forest stands—viz. sawflies, loopers and budworms. Of these a specific budworm has come in for a major share of attention because it does affect the major portion of the total forest—the fir-spruce portion. These are native insects, native perhaps as long as their host species.

The spruce budworm between outbreaks is difficult to find and does no harm but when on an expansion hitch the insect multiplies in number almost beyond the powers of one's imagination to comprehend and in a very short span of years strangles great numbers of host trees by defoliation.

Until the current threat to New Brunswick's predominantly spruce-fir conifer forest the insect was unopposed in this country. Backward glances into the history of former budworm explosions tell an imperfect story for these times for which evidence still exists and in truth there is much to be found out about budworm behaviour in spite of excellent probing by entomologists. One suspects that in cases of past outbreaks of great violence the face of the forest was changed completely but there must have been situations as well in which lesser damage occurred and there may have been many uprisings of the insect so short in duration and weak in feeding pressure as to leave no imprint at all.

We do know the sequence of forest changes in the cases of heavy damage. We have seen these. In the onset years some of the succulent foliage of the year of balsam and spruce is eaten. As feeding pressure increases over time, all of this type of needle is consumed. In the case of new needles outnumbered by larvae severe back feeding occurs. Finally loss of foilage over several years to insect feeding coupled with ordinary needle mortality causes death of the tree. First to go is the top, then the whole

tree. Rots begin to attack the sapwood. Winds break off dead tops. Tree stubs dot the scene many still with sound wood in the lower bole. Winds open up the forest even more by knocking over some surviving trees. Most of the wood in branches and stems now is close to the ground. Regeneration in the form of advance growth begins to emerge through the grey ruin. Seedlings of balsam and spruce also appear and in time a new stand begins to take the place of that killed by insects which have now collapsed in number to an endemic stage. The new forest may be in species composition much like its predecessor.

If in the 10 or more years during which it takes for the killed trees to pass out of the fire fuel category the fire hazard is low the forest may just renew its face—that is trade in an old one for a younger version. On the other hand in this time interval should the weather become fire storm weather the forest is likely to lose its tolerant tree face altogether and get a completely different one in which the favourite host of the budworm and looper is absent.

Balsam Fir

Balsam fir is not a very important tree in the United States or in Upper Canada, but in Lower Canada and parts of the Maritimes and Newfoundland not to mention Maine, it is an important tree. Besides it makes good paper from long fibre spruce and not so good lumber which is sold intermixed with spruce.

Balsam (for short) is what we call a tolerant tree plant. It does not really prefer the cool moist climate of the conifer over wood in which to develop. It will make its own all by itself provided conditions are right. It is a prolific seed producer and has a great potential for restocking wherever stands are opened up by wind or sleet damage, by any form of logging which does not disturb the soil cover and in cases in which insects and disease have decimated the main stand.

Only fire seems to discourage balsam. Perhaps an understanding of some of our forest history has been slow in coming because we have been prone to separate balsam, budworms and blazes.

I wish now to introduce two examples in support of my belief

that these three factors combine sometimes to produce a domino effect, and in the past have contributed to a slow rotation of forest faces much as a farmer rotates annual crops.

There is nothing too regular about the workings of the prescription and for those who believe the budworm returns to the scene of his earlier orgies every 50 years or that storm fire weather comes along once in 8 years, or that torn down forests after budworm damage always burn up, I must say it isn't quite that way. What makes it possible for the prescription to have worked is the many great intervals of time in which it has had the chance.

Suppose a large scale insect outbreak has just subsided and that in 2 of the following 10 years there is a dry hot summer with much lightning and little rain and that a continuity in heavy fuel pile exists over say 20 million acres. What are the odds against a fire somewhere in this region in the hot year in the month of June. And what are the odds against said fire covering a large area (say in excess of 500,000 acres) by the same August? Would you bet against such an event? I would not. Why, we have examples of 100,000 acres of mainly old logging slash burning in about 8 days.

Twice during the past 150 years we have seen such a forest condition and such fire weather. It is not at all certain what triggered the fires, probably lightning.

The earlier event took place in 1825, hardly 10 years after a violent and widespread outbreak of spruce budworm had devastated the woods of Maine and New Brunswick. The Miramichi fire would never have been recorded as one of the great fires if it had not burned up some 165 men, women and children, a substantial fraction of the total number in the area at that time. But in fact, it was a fairly large one if all the fires of that summer which coalesced into one are totalled. In the Miramichi watershed area alone it is doubtful if the fire exceeded 600 square miles.

We know from the record that fires burned most of that season—a season that had its storm fire periods. There was smoke in the sky during the summer and into the fall (this was before air pollution ecologists were around). Settlers became so accustomed to smoke that they relaxed their vigilance and one night

in early October on the North side of the Miramichi River they were taken from the rear by a renewed outburst of fire which drove the survivors along with wild animals into the water. Here fire was forced to creep at times and to move rapidly at times with the changing weather, always alive because of a fuel supply and extending over great areas not by burning green woods but by consuming mostly a torn down forest relict, but lately changed out of all recognition by the action of an insect. In the insect big years the Queen's men were looking for white pine with which to war against Napoleon. I wonder how those mast trees happened to be available?

About 100 years later after World War I (considering the very small number of peace years it is safe to date almost any event by referring to its particular war) the record is again of fire which snuffed out human life—the Haileybury Fire of 1922. The following year was a bad fire year throughout the region, the Peribonka and St. Maurice in Quebec, Restigouche in New Brunswick (burned a second time in 1934) are examples of large burns.

Between 1910 and 1920 there was a region wide outbreak of spruce budworm (the tree mortality was heavy in spots, Miramichi drainage lost an estimated 25,000,000 cords of useful wood), again providing the fuel for fires throughout the infested areas. Strangely the wreckage of a forest in Miramichi did not burn up. It is in a lightning belt too. Let's call it a common exception to any all time perfect rule.

One continues to wonder if a rough and not particularly efficient forest face rotation did not in fact occur down through time. In my amateurish fashion I read the signs and say yes it is real.

Nowadays outbreaks of insects continue. So does the lightning flash and balsam fir still abound in the right places. But now we must add in some man-induced effects—his wood operations, his road building, his use of pesticides, his fire fighting, and many more.

For example New Brunswick forest has become highly accessible in the last 25 years. It has supported a full blown budworm

outbreak for 20 of these. It has been sprayed to keep trees alive. Cutting has increased at a rate over 2 times. Most of the fuel for fire is in trees and logging slash instead of in insect damage debris. More fires than ever perhaps have occurred and most of them have been put out while small.

If the short run trends continue and fire is almost banished from the scene and by some good fortune we find out how to make defoliators behave our way, then (a long time off in man-time?) shall we have lost a change of forest face? And will it matter if we have?