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FOREST FIRE CONTROL AND FIRE RESEARCH IN THE ATOMIC AGE

By A. A. Brown
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It was about 50 years ago when the effort began in this country to develop systematic protection against forest fires. Before that most citizens looked at the great forest conflagrations as “acts of God” like hurricanes, floods and droughts. After all, such conflagrations had been known to occur since the white man first became acquainted with North America.

In the great roadless areas of the West attempting to control fires was indeed an heroic undertaking. It takes little imagination to picture the struggle against forest fires at that time as a David and Goliath affair, but with David armed with a pea shooter rather than his sling shot. After all, his sling shot could deliver a “knock-out.” Fortunately, crusaders did not use their imagination in this way. They saw a problem that had to be solved and realists took up where the crusaders left off. They reasoned that every fire started small. If you could just get there soon enough you could whittle the job down to size so that even crude and simple methods of controlling small fires could in the end solve the big problem. That reasoning alone found the most vulnerable spot on the giant. Skill and a good aim could at least keep him away with the simplest of ammunition. Plans and policies built on this reasoning came close to the roots of fire problems.

The wisdom of controlling fires while they are small is attested by the great progress made through organizing fire control forces on this principle. Commonly, wherever forest fire control is well organized, 70, 80 or even 95% of the fires that occur are controlled at small size with an increasing variety of equipment, including airplanes and smokejumpers, but with simple and direct methods. This is a success score far above anything believed possible even 20 years ago. Often, too, it is accomplished by a percentage of total burned area that meets old objectives of maintaining virgin timber in reserve for the future.

Much more can be said about progress up to 1940, including the role of past research. But with this somewhat allegorical substitute for the history of fire control to date, how do we stand now? Any complacency built on the steady progress made, and on the normally successful fire control methods that have evolved through the years, has in turn been rudely shattered in one forest region, then another, in the last few years. To the dismay of fire fighters and administrators alike, forest and brush fires have suddenly defied the most heroic efforts and the best of conventional methods to become great destructive conflagrations. So both fire fighting costs and fire losses have been going up. The giant that seemed on the way to being tamed shows he is still unpredictably dangerous.

“Why?” is asked by the ordinary citizen and by experienced fire fighters alike. The many whys make up the most challenging of the still unsolved problems in management of wild land in 1955.

There are many factors that continue to make fire a critical problem in forestry. Each of the more important have become aggravated since World War II.

Increased populations and increasing accessibility of all our wild lands inevitably expose them to more risk of fires starting. Increased demands for timber products increase the number of scope of woods operations and create cut-over lands at a faster rate. Cut-over areas inevitably are more susceptible to the start and spread of fires, so are much harder to protect than undisturbed green timber stands.

In huge areas organized protection has resulted in the building up of heavy stands of young growth and understory vegetation where once there was little to burn. At the same time the economic importance and dollar value of forest lands have increased at a much faster rate than progress in protection. No longer can a 10,000 acre fire occur anywhere in the U.S.A. without serious local disruption and economic loss to many people. A wild fire through even a 100 acre plantation of “elite” trees can be a major disaster.

Even the wettest section of the U.S.A. are visited periodically by droughts and other extremes of weather that can build up the danger of fires to a point that may have been unknown in that area for 10, 20 or even 50 years.

Finally, and perhaps most important, too little is still known about fire. A distinguished physicist recently stated that less is still known about the nature of combustion than about the nature of nuclear fission. In spite of much valuable research on fire behavior, basic knowledge of the exact relationships that enter into the chain reaction of ignition, combustion and...
progressive build up and spread of an intensive fire, is still woefully inadequate. Lack of such knowledge hinders new approaches to old problems and leave fire agencies without a solid scientific basis for solution of new problems.

We are now at the end of the first ten years of what many believe will be known in history as the atomic age. With the break through to new frontiers in atomic science, progress in nearly all fields of science and technology has been moving at a faster pace than ever before. Fire itself has come back prominently as an instrument of war. So defense against induced fire has become a problem of both civil and military defense. Slowly, but progressively, fire is getting more attention by physical scientists and the prospects are encouraging that modern technology can be increasingly brought to bear on every phase of the problem of reducing fire losses and of increasing the efficiency of the undertaking.

Some of the high spots of progress in forest fires research in the last ten years reflect this more basic research approach. Earlier, the control of a forest, brush, or grass fire was approached as a problem in plane geometry. The fire was increasing its perimeter at a given rate, fire control line could be built at various rates. A combination of men and equipment that would build fire control line fast enough to contain the fires increasing perimeter would theoretically provide the correct solution. Unfortunately, a fire has what might be termed the “third dimension.” It is releasing energy. The amount of heat energy it is putting out may be the most important factor of all. It varies within wide limits depending on fuels and burning conditions. A quarter-acre fire may range all the way from a thin line of slowly moving fire edge with a burned out and cool interior to a young tornado of violent combustion. Obviously, this affects the fire suppression job. Its size and its difficulty cannot be properly evaluated by taking into account only the area of the fire and its rate of spread. Both are significant to the fire fighter, yet his failures will be frequent if account is not taken of the rate of production and level of intensity of heat energy he must deal with. Going projects in fire behavior and in study of the problem of slash fuels are now giving special attention to both the total heat energy potential of natural fuel combinations, and to the rate this energy will be retained under various conditions. Improved means of measuring the thermal energy of test fires are a part of this approach.

It has been customary to regard the variable of fuel and their moisture content, air temperatures and humidity, surface wind speed and slope, plus time, as accounting for all variations in fire behavior. Training of fire fighters and the development of fire danger ratings have been based on these premises. Research during the last few years demonstrates that the condition of the atmosphere itself exerts a controlling influence. Conditions creating local instability or stability of the atmosphere, the pattern of wind velocities aloft, the existence or absence of inversions, and the subsidence of dry upper air all appear to have importance, particularly in the behavior of large or high energy fires. Only a start has been made in establishing the independent relationships between local atmospheric conditions and the behavior of fires. Yet enough has been learned to indicate a strong association between erratic and uncontrollable behavior of large fires and the local atmospheric conditions existing or induced at the time.

Progress in cloud physics and in increased understanding of the processes by which moisture is pre-