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Fire Prevention in Illinois Forests

By

Robert B. Miller, Forester

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FIRE PREVENTION IN ILLINOIS FORESTS

BY ROBERT B. MILLER, FORESTER

ILLINOIS STATE NATURAL HISTORY SURVEY

We were told this spring by an official in Springfield of whom we were seeking information about forest fires, that there were few forests in Illinois and very few forest fires. Perhaps the majority of citizens, who have not actually looked for fires, are of the same opinion.

Let us see. We stood on the top of Bald Knob, three miles from Alto Pass, on the afternoon of March 23 of this year, at an elevation of 1,010 feet, but we could not see the "Father of Waters" because the view was obscured by the smoke and haze of forest fires. Field-glasses were not necessary to see spread out before us on the distant hills six separate and distinct fires, and numerous smoke-patches were still issuing from smoldering fires on adjacent hillsides.

FIG. 1. Forest fires as seen from the top of Bald Knob, Union Co., Ill., on the afternoon of March 23, 1920. (Photo by Paul J. Sedgwick.)

With the field-glasses, from an observation tower on top of the house, we could see red bands of flame shoot up as the fire caught a draft at the top of the ridge or entered a patch of grass or dead tree-tops. At a rough guess, fully two

square miles of blackened forests showed where fires had burned themselves out for lack of material to feed them. Fire protection is unknown in that region, and blazing fires are a common sight at night. It would seem as if the gentleman in Springfield had not gone far enough from the city parks for his information about fires.

On a later trip along the ridges from Womble Mountain to the Cave in Eagle Cliff, Saline county, a distance of more than five miles, burned ridges were the rule and more than one fire was encountered in that short distance. The majority of the trees were fire-scarred and many obstructed the road, having fallen as a result of former burning. Patches of ridge which had not been burned over until the ground was as bare as a floor were of rare occurrence, and the same conditions prevail in Union county. It needs very little argument to prove, then, that there are forest fires in Illinois, although it is almost impossible to get any definite estimates of the area burned over annually.

REASONS GIVEN FOR BURNING OVER THE FORESTS

The Indians fired the forests under pretext of keeping down young growth and underbrush, improving berry-picking, impeding their enemies, and preventing "crown-fires."

Woodland owners of the present day in Illinois give as their reasons for burning over the woods every spring or fall some of the following: (1) that it benefits grazing, making the grass come up better; (2) that the woods are fired by hunters because it makes easier going for the dogs when coon-hunting or 'possum-hunting; (3) that it helps to protect their property from fire; (4) that it improves the general health of the community.

Which is the most important? Clear woods for coon dogs or a forest which is perpetuating itself? We can have one but not both. Let us be careful and not draw the short straw for future generations.

Some of the above reasons will be discussed later in this circular, but in giving some of them do we not seem to be harking back to the arguments of our savage predecessors? One thing that is supposed to distinguish savage and civilized peoples is that the latter exercise forethought—provide for winter during the summer, and conserve natural resources, even at a sacrifice, for future generations.

Are we in Illinois civilized when in the handling of our forests we continue the savage custom of letting our woods burn over annually on various pretexts? We say pretexts, because we believe that a presentation of facts and a little logical thinking will show that they are fallacies.

Let us consider briefly some of these reasons, taking first that of improving grazing by annual burning. This is a reason not limited to Illinois, but is given in Alabama and other parts of the Longleaf Pine Belt for burning over the forests.

We admit that the burning of the grass and shrubby vegetation may leave an ash which will enrich the soil temporarily, but we believe it can be shown that this apparent benefit is more than offset by the damage done to grass roots and to seedlings of pine and hardwoods.

Repeated studies made in the Longleaf Pine Belt of the South by Professor H. H. Chapman, have shown that this annual burning, coming just when seedlings

are starting, is one of the main factors in preventing the reproduction of longleaf pine. Many young seedlings are killed by the severe heat, and the larger ones, which have been killed back as many as eight times by these fires, only survive because the bark gets thicker with age and they are more or less protected by the thick brush of green needles at the top. It is very hard to convince the natives of that region that this burning is a bad practice, and we suppose it is still continued, in spite of assertions of foresters who have spent several seasons there and, by laying out sample plots, have actually studied the high mortality rate among the seedlings.

WILL ANNUAL BURNING PROTECT THE FOREST FROM GREATER CONFLAGRATIONS?

There are two different methods advocated for the protection of forests against fire. The first is *fire prevention*, the processes of which have been worked out by the United States Forest Service, by state foresters, and by the provincial foresters of Canada. Space is wanting to describe these methods in detail, but it may be said briefly that their efficiency depends on a prompt discovery of fires, either by patrolmen or from lookout stations on high points, and on organized methods of handling and fighting the fires after they have been discovered, extending even to the use of power apparatus for putting them out when a water supply is convenient.

The second method may be called "*light burning*," which means protecting the forest from fire by consuming inflammable material on the ground. Since in Illinois this annual burning over of the woods is thought to have several beneficial effects, mentioned before, it will be discussed at some length. In the beginning let it be said that it is the opinion of the best foresters of California, of the U. S. Forest Service, and of the American Forestry Association, that it has no place in a system of forestry intended to perpetuate our forests and keep them continuously productive,—and this, we believe, is what the citizens of Illinois stand for.

In California, it is the opinion of men who have carefully investigated this subject that more than 1,800,000 acres of "brush fields" have been caused by fire. "With an average stand of 20,000 board feet per acre, the present brush fields within the timber belt in California represent a loss of nearly forty billion feet of timber, worth at present at least sixty million dollars—a loss chargeable directly to the repeated 'light fires' of past centuries."*

Statements by impartial observers in the pine forests of California show that instead of decreasing the amount of inflammable material on the ground, these repeated fires may increase it. An examination of a burn made in a certain operation showed four years after the fire "that the litter on burned areas averaged nearly 40 per cent. heavier than on an adjacent area which had been unburned for twenty-five years." We believe this to be the case on the ridges we have examined in the hardwood forests of Illinois. Where these light fires have occurred, the many sprouts killed back by them will be ready to furnish fuel for the next fire, and the large patches of brome grass or hedge grass which have come in the openings, due to the falling of trees as a result of fires, make conditions still more dangerous. Berry-bushes, which come up after fires, serve as lodging places for leaves and other

* "Will Fire Prevent Fire? A Discussion of Light Burning," by S. B. Show and R. F. Hammatt. "Data by Duncan Dunning, S. B. Show and others." From United States Forest Service, San Francisco, California.

dry materials which greatly increase the heat of the next fire. Much of this excess of vegetation is due to too much light entering the forest through a thinning out of the stand by fires.

Great difference in this respect is found on north and south slopes. The cooler north slopes are more apt to be dominated by beech and maple, and with a moist leaf-litter, fire danger is greatly reduced. The south slopes and ridge tops, being drier, burn more vigorously, and it is here that repeated fires cause the worst damage.

DAMAGE DONE BY LIGHT BURNING

Damage to Reproduction and Seedlings.—Advocates of this practice of light burning must admit that it kills reproduction because their immediate purpose is to keep down the brush. Repeated light fires kill seedlings and young trees, and every one must see that these are essential if our forests are to be perpetuated.

On ridges which have been recently burned over, the ground is as bare as a floor, and no seedlings are coming although conditions for germination are of the best. The intense heat has killed the germs of the seeds and many blackened acorns and nuts which can never produce seedlings lie on the ground. If any small seedlings

FIG. 2. This oak-hickory ridge on Bald Knob, Union county, showing the effects of annual burning, is typical of southern Illinois—with a few exceptions. (Photo by Paul J. Sedgwick.)

were produced, which is very unlikely, they would be killed by the heat, and larger seedlings also, because the cambium has no protective layer of outer bark to protect it. Repeated burning may so bake the surface soil that the delicate radicle of the

FIG. 3. Jackson Hollow, in Pope county—a beech woods which has so far escaped burning. (Photo by R. B. Miller.)

oak or hickory seeding can not penetrate it. We have often seen this condition in Connecticut in the case of seedlings of chestnut oak, where the ground had been repeatedly burned over.

How different these conditions are in a beech wood, such as we find in Jackson Hollow, Pope county (Fig. 3,) where it is too moist for fires on account of denser shade! Turning over the light litter of beech leaves we find numerous beech seedlings issuing from the nuts which have been covered over, and even where the soil is bare, being moist, there are hundreds of these seedlings. Such a sight is rare on the blackened oak ridges; we are more likely to see there piles of blackened nuts and acorns which have escaped the squirrels but which will never germinate to form the forest of the future.

Damage to Mature Timber caused by Light Fires.—People are usually little concerned with potential forests; perhaps we can make plainer the damage to that which can be seen—the mature forest. One of the causes of “cull” or deduction in the butt logs of trees in these burned-over forests is due to fire scars which have served as points of entrance for wood-destroying fungi, so that the tree finally becomes rotten. It is safe to say that fully 80 per cent. of the mature trees at Fountain Bluff, in Jackson county, and on the pine hills of Union county, show fire scars due to burning. Some trees have the base slightly blackened, in others the scar extends three or four feet upward and the tree has become distinctly hollow. This piece is left in the woods, and its board-foot contents must be deducted from the gross scale of the log—a distinct financial loss. It is said that in Oregon 18.6 per cent. of the butt logs of pine were so severely fire-scarred that an average of 14 per cent. of the full scale of the defective logs had to be deducted. In Illinois hardwoods, such as oak, this may mean a loss of one railway tie or four feet or more wasted in what should be the best part of the tree. Cutting off four feet from the lower end of a sixteen-foot log means that you must go four feet higher in the tree for the top diameter, with a considerable reduction in the scale, the diameter being diminished through the taper of the tree. In pines (but not in hardwoods) the fire causes a considerable exudation of resin, which may cause a lowering of the grade of the lumber in the burned trees.

Burning down of previously Fire-scarred Trees.—There is another cause of loss to be considered. All over the ridges of southern Illinois we see numerous fallen trees which have been thrown by the wind, and this means a considerable loss to the owner or to the State. After the Ham Station fire in the Eldorado forest, California, in October and November, 1917, a survey of nearly 4000 acres showed a loss from this cause of about 1200 board ft. per acre, worth about \$1.75 as stumpage; and the Howard fire, in Siskiyou county, caused a loss of fire-scarred trees also averaging twelve hundred board feet per acre. Investigations, so far as they have gone, show that the loss by burning down of trees previously fire-scarred will average eleven hundred board feet for every acre of virgin timber burned and for every time such an acre is burned. This statement is from data collected by Duncan Dunning, S. B. Show, and others, in California, in investigating the subject of light burning.

Loss by Heat Killing.—This is a loss which is always present, although perhaps not so noticeable as some other forms of damage by light fires. It will depend on the amount of leaf litter or other debris piled around the bases of the trees, the ve-

FIG. 4. A fire-scarred tree at Fountain Bluff, Jackson county, Fully eighty per cent. of the trees in some stands in southern Illinois show various degrees of fire damage. (Photo by Paul J. Sedgwick.)

FIG. 5. The next stage in annual burning. The trees are weakened by fire and fungi and soon fall over. (Photo by Paul J. Sedgwick.)

locity of the wind, and the thickness of the bark of the species. Where much litter has accumulated, whole clumps of the younger trees may be killed outright; in other cases the damage may only be a retardation of the growth of the tree. In the case of the Ham Station fire mentioned previously, the loss from this cause was placed at six hundred board feet per acre. Some observers add to this a loss due to retardation of growth, and loss of part of the crown through fire; but this would hardly hold for hardwood trees. This loss by heat-killing and the damage to young timber through fires is one of the hardest problems encountered in assessing fire damages, and it is hence usually neglected, damages being awarded only on the basis of injury to merchantable timber. Such an award is entirely inadequate, as it neglects damage through retarded growth and the killing of young, thrifty trees.

Damage to the Soil.—This is a subject which has not been thoroughly investigated by soil physicists or soil chemists. Harry Snyder, in "Soils and Fertilizers," says that the loss of humus from soils is caused by oxidation and fires, and that the great forest fire at Hinckley, Minnesota, caused a loss of twenty-five hundred pounds of nitrogen per acre. This was not a light fire, however, but one of the heaviest and most destructive in history, ranking with the great Miramichi fire of New Brunswick, in 1825, and hence proves nothing in respect to the effect of repeated light burnings. But if there is a loss anything near this figure, it might afford one explanation of the fact that our upland forest soils are very deficient in nitrogen. Representatives of the Soil Survey of the State speak of the reduction of the nitrogen content in soils as a factor in erosion, which may result from the fact that forest fires lay the soil bare and lower its humus content. They say nothing, however, about the loss which destruction of leaf litter and humus means to the soil, or about a change of its physical and chemical nature by repeated burning. This is certainly a point worthy of investigation.

That there is a reduction in fertility is certainly evidenced by the retrogression in vegetative cover and in forest type which takes place on burned lands, a fact familiar to every ecologist. It may take a hundred years to restore the original forest—as it does, indeed, after spruce forests are burned in the Adirondacks—with a long and expensive process of getting rid of inferior species, such as poplar, gray birch, and bird cherry. The growth of these inferior in place of better species on such lands, which stand for years in "brush patches," means that since the soil is not devoted to its highest economic use there is a great loss to the country in valuable products and in time.

RELATION OF FIRE PROTECTION TO THE ESTABLISHMENT OF STATE PARKS AND STATE FORESTS.

There is great interest in many communities in the southern part of the state in maintaining scenic places as public parks. While many of the sites examined are a revelation to those familiar with only the prairie regions of Illinois, there will be no future for such park projects unless the forests of the ridges and in the ravines can be protected from annual fires. The desire of a community to have a favorite place recommended as a state-park site should lead it, in the first place, to develop a sentiment against forest destruction, whether by fires or by cutting. While the beech, maple, and tulip forests in the ravines, such as Jackson Hollow in Pope county, can be perpetuated more easily because of favorable moisture conditions,

forests on the ridges, which are drier and wind swept, like those viewed from Bald Knob, in Union county, can not be maintained if the present rate of destruction by fire continues. Not only will the beauty of the forest be lost—its freshness in spring and its autumnal colorings—but the hills, bared of forest growth, will soon be exposed to great danger of erosion.

Natural advantages being equal, then, in two park sites, that area should be made a state park or state forest about which there is the strongest local sentiment against fires.

It would be poor policy for the state to build hard roads to prominent peaks and beauty spots in the southern Ozarks, and then to permit the tourists' view to be obscured by the smoke and haze of forest fires.

FIG. 6. The final stage on a ridge near Willow Springs, Anna, Illinois. These fallen trees not only represent an actual loss in merchantable contents to the owner, but will afford fuel in the next forest fire. (Photo by Paul J. Sedgwick.)

FIRES SET BY HUNTERS, CAMPERS, SMOKERS, AND OWNERS CLEARING LAND

The setting on fire of the woods by hunters is plainly made a criminal offense by the Illinois Criminal Code. Since this is on the land of another, the offense only needs adequate proof to secure conviction in any court. So far as investigated, however, most of the suits under this law have been civil suits, as the offender is also liable for damages.

Fires set by campers and smokers are mostly due to carelessness, and can best be prevented by a campaign of education setting forth the damage done by fires to the timber of the future. Loss from fires started in clearing land, which has been a source of much importance in Canada, can best be prevented by making a closed season for brush burning, and requiring owners to secure permits from the nearest fire warden during this closed season, with a very careful patrol by wardens during the danger season.

A good system of roads and trails along prominent ridges and peaks is a necessity for better fire protection in state parks and forests. They serve not only as fire lines and good points for starting back-fires, but as means of communication for bringing in supplies and fire-fighters. Reaching fires quickly is as important in fire-fighting in the woods as it is in the city, as incipient fires can easily be put out by one man if taken in time. Good, permanent lookout stations, with telephone communications, are also necessary in the larger forests in hilly country, such as the southern Illinois Ozarks, where a single watchman could overlook a large region, while the fire could be accurately located by plotting its position from two stations. A good force of fire rangers or wardens is the backbone of good fire protection, these men being directly responsible to the state forester or to a chief fire warden. They should be paid for fire-fighting on a cooperative basis, a certain amount from town or township funds and the remainder by the state. Cooperative fire associations, made up of timberland owners of a certain region or watershed, have been very successful in keeping the number of fires down to a minimum and reducing the cost to a very small amount per acre.

【COOPERATIVE FIRE PROTECTION UNDER THE WEEKS LAW

It is possible for states to secure, under the Weeks law, a share of federal funds for cooperative fire protection. The allotment for each state, at last accounts, was about seven thousand dollars, some securing even more than this sum to assist them in fire protection.

It is first necessary for a state seeking such aid to pass legislation providing for organized fire protection, whereupon the state forester may be made a federal officer so that he can administer federal funds. While the law specifies that federal funds must be expended in protecting from fire the headwaters of navigable streams, it is now being so construed that the state forester's salary and expenses may offset federal funds when he is engaged in perfecting fire organization or fire associations; and a part of the time of federal employees may be spent in educational and propaganda work relating to fire protection.

If the state appropriates a given sum to this interest, the United States Forest Service will duplicate it, dollar for dollar, enabling the state to build up an efficient protective service and sentiment. The question is, will Illinois pass the necessary legislation and make an appropriation for fire protection such as to make her eligible to a share of these federal funds, or will we wait until we can organize on an independent basis, thus losing the benefit of federal aid and advice, and leaving our forests, during this time of delay, to go on burning as they have done in the past? It should not take much study to enable us to decide which is the best policy.

Even if we are not yet ready, as a state, to begin reforestation measures, we can make a start right now in preventing forest devastation. This is a safe policy and it will pay. We can at least make provision for the reproduction of our forests and prevent fires. These are two big steps in the right direction. An ounce of prevention now will be worth several pounds of reforestation later.

CONCLUSIONS

1. "Light burning," or repeated burning of the woods, fails to protect the forest from fire as well as would organized fire protection and prevention. We believe it can be shown that it fails to give many of the benefits claimed for it.

2. It destroys viable seeds, prevents the growth of seedlings, and kills reproduction already on the ground. It also does serious damage to young trees by scorching them and making a beginning for future fire scars which permit the entrance of fungi.

3. It causes considerable losses to mature timber through deduction from the scaled contents owing to fire-scarred butts of the trees. It further retards growth and results in serious loss from wind-throw.

4. Repeated burning changes the physical properties of the soil, and by laying it bare and reducing its humus content makes it much more liable to washing and erosion.

5. Just how much the chemical nature of the soil is affected, no one knows definitely. Harry Snyder, in his book "Soils and Fertilizers," says that the great forest fire at Hinckley, Minnesota, not a light but a heavy fire, caused a loss of twenty-five hundred pounds of nitrogen per acre, and that the burning of leaf litter in forests means at best "an unnecessary destruction of humus materials."

6. That the chemical nature of the soil must be greatly modified to its disadvantage by repeated burning, an injury not compensated by the small amount of ash formed from burned vegetation, is evidenced by the retrogression in vegetative and tree growth which always occurs after fires. The length of time taken to produce another forest of value is directly proportional to the severity of the burn and means a great economic loss to the state. Valuable time and the remaining fertility of the soil are wasted to produce an inferior crop before Nature, through the slow process of succession, can produce one equal to that which was destroyed.

7. It has been shown rather conclusively that this constant burning over of the woods every year to improve grazing conditions in the longleaf pine forests of the South is a doubtful policy and one of the main factors in preventing the reproduction of these valuable forests. We believe that the same statement applies with equal truth to the hardwood forests of certain counties of southern Illinois, and elsewhere in the state.

Are these conclusions not enough to show the necessity for organized fire protection in these southern counties and in other counties of Illinois? Let us work for the necessary legislation, and means for enforcement, to protect this valuable resource from being longer destroyed.

Urbana, Ill.,

July 31, 1920.

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