CENTRAL HARDWOOD NOTES

Appraising Fire Effects

Fire effects in the central hardwood forest vary greatly. Depending on a number of factors, some trees will be killed immediately; others will be injured and die in a year or more; still others will incur basal wounds that can provide entry for decay; and some trees will not be affected.

What makes a tree or stand in the central hardwood forest vulnerable to fire? In addition to fire intensity, tree size is a major factor in whether it will live or die. A large tree usually has thicker bark than a small one, and it also has a larger cambium circumference. Even if a portion of the cambium is killed by fire, a large tree can usually continue to function. Other important factors in tree responses to fire are species and the season of the fire. Historically, the most intensive fires that cause the most damage occur in the spring before green-up. However, given fires of equal intensity, mortality and damage are greatest for fires occurring during the growing season.

Fire Killed and Injured Trees

Trees can be killed by heat-either in the crown or in the lower bole. Top-killed, merchantable-size trees can often be salvaged. There may be value loss because they have not reached optimum rotation age or because fire-killed or damaged timber may sell for less. Wildfires can also kill a portion of tree crowns. Crown reduction, in turn, may cause reduced growth and/or mortality. Generally, trees shorter than the height to which crowns have been killed will not survive.

Trees With Basal Wounding

Basal wounds are of greatest concern in pole-size and small sawtimber trees (5- to 16-inches d.b.h.), which will not reach merchantable and/or optimum rotation age and size for a number of years. Basal damage with subsequent decay can eventually weaken trees and cause major losses in both volume and quality at harvest.

Decay following wounding by fire has caused volume and value losses in the butt section of this tree.

While trees smaller than pole-size are usually killed in intense fires, small tree survivors with basal wounds will generally heal with negligible defect. Similarly, wounds on surviving trees at or near rotation age will seldom cause significant volume or grade loss if trees are harvested within a few years.

Estimating Mortality or Survival

When tree mortality is uncertain, a fire-effects appraisal may have to be delayed until at least one growing season passes. Late summer or early fall is often the best time for appraisal because mortality has usually occurred by that time, and you can make survival estimates of damaged trees more accurately. Basal wound size and configuration is easier to see because new callus growth may clearly outline the wounds. Use ax cuts to determine the extent of dead cambium, which is noticeably different from the bright white living cambium.

Burned areas often require inventory and evaluration to determine potential damage and loss.

For various reasons, you may want to assess damage soon after a fire is controlled. If a fire occurs in the dormant season, the appraisal is more difficult. When an immediate appraisal is needed, "scorch" height can be used to determine the likelihood that a tree will die (table 1). For some central hardwood species, scorch (bark discolored by fire) is a visual indicator of the fire's intensity and duration. Scorch includes all degrees of bark discoloration, ranging from slightly browned to blackened or charred. Estimates of volume loss require knowing the height and width of the actual wound. Wound size can be estimated from scorch size when dimensions of the actual wound cannot be measured.

You can get a rough estimate of the likelihood of mortality and volume loss as follows:

1. Select Samples

   Determine the number of sample plots and/or trees in a manner similar to making other timber surveys. Consider desired sampling precision, size of burned area, and timber value involved. Very often, a few representative plots and trees can quickly provide adequate estimates. Use at least two 1/5-acre plots for each timber type-size class combination present in the burned area. The estimating procedure is not reliable for trees less than 3 inches d.b.h. so depend on your own judgment about such trees considering the general appearance of the fire area and apparent fire intensity. Generally, hardwood trees 3 inches d.b.h. and smaller are likely to die if scorch height is greater than 2 feet.

Table 1 .-*Percent of trees that are likely to die from fires that occur in the dormant or growing seasons*

Season	D.b.h.	Scorch height[1]	Black oak[2]	Scarlet oak	White oak	Post oak
	Inches	*Feet*		*--Percent---*		
Dormant	4	2	42	60	30	13
		4	69	88	49	30
		6	96	100	67	48
	5	2	30	48	18	4
		4	57	76	37	21
		6	a5	100	55	39
	6	2	21	38	9	0
		4	48	66	27	14
		6	75	94	46	32
	7	2	12	29	1	0
		4	40	57	19	a
		6	67	a5	37	25
	a	2	5	22	0	0
		4	33	50	12	3
		6	60	78	30	20
	9	2	0	15	0	0
		4	26	43	6	0
		6	54	71	24	15
	10	2	0	9	0	0
		4	21	37	0	0
		6	48	65	19	11
	11+	2	0	4	0	0
		4	16	32	0	0
		6	43	60	14	7
Growing	4	2	59	79	43	24
		4	100	100	70	50
		6	100	100	97	76
	5	2	47	66	31	14
		4	88	100	58	41
		6	100	100	a5	67
	6	2	37	55	21	7
		4	78	97	48	33
		6	100	100	75	59
	7	2	29	47	12	0
		4	69	a9	40	27
		6	100	100	67	53
	a	2	21	39	5	0
		4	62	81	32	21
		6	100	100	60	47
	9	2	15	32	0	0
		4	56	74	26	16
		6	97	100	53	42
	10	2	9	26	0	0
		4	50	68	20	12
		6	91	100	48	38
	11+	2	4	21	0	0
		4	45	63	15	a
		6	86	100	43	34

[1] Scorch height is measured beginning at ground level.

[2] Black oak values can also be used for northern red oak, hickory, and ash.

2. Take Measurements

For each sample plot tree 4 inches d.b.h. or larger:

a. Record species.

b. Measure d.b.h. to the nearest 0.1 inch.

c. Record whether the tree is alive or has been killed by fire.

d. If the extent of the fire wound is apparent, measure the actual wound height to the nearest 0.1 foot from 1 foot above the ground level (stump height) and wound width at the same point to the nearest 0.1 foot measured on the arc of the circumference.

e. If the extent of the wound is not apparent, measure scorch height to the nearest 0.1 foot from ground level and scorch width to the nearest 0.1 foot at 1 foot above ground level (stump height).

f. Exclude trees that have butt rot or large basal wounds from a previous injury.

3. The likelihood of mortality for each tree can be estimated from scorch height (table 1). Actual wound height can be substituted for scorch height by adding 1 foot to the measured wound height.

Estimating Volume and Value Loss

You can get a rough estimate of future volume loss from fire using table 2. If more precise estimates are needed, seek help from a professional fire damage appraiser.

Estimating volume loss requires knowing the actual wound size. If the actual wound dimensions cannot be measured, estimate them from scorch height and width (fig. 1). The values read from figure 1 and table 2 apply only to trees that have basal fire wounds from a single fire and that are expected to survive until harvestable.

You can estimate sawtimber value loss by applying the current stumpage value to the volume losses in table 2. Any tree having a fire wound covering more than two-thirds (one-half for scarlet oak) of the circumference at 1 foot above ground is unlikely to survive until harvest time. (This procedure of estimating volume and value is most applicable for State and regional timber surveys of fire damage. It may also be used for individual fires and stands, but the estimates are less accurate.)

Mortality and the extent of injury to central hardwood species not mentioned in this Note may be quite different. Species with thinner bark will sustain greater damage compared to those with bark having better insulating properties. The southern pines associated with the central hardwood forest are resistant to fire, and basal wounding is seldom a problem. The extent of crown kill generally determines whether or not pine species will survive.

Table 2. Estimated volume losses per tree due to basal fire wounds 10 20. and 30 years after the fire

D.b.h.	Wound	10 years since fire Wound width-feet					20 years since fife Wound width-feet					30 years since fire Wound width-feet				
(Inches)	height'	0.5	1.0	1.5	2.0	2.5	0.5	1.0	1.5	2.0	2.5	0.5	1.0	1.5	2.0	2.5
	feet	-- Board feet-international l/4-inch rule ----------														
10	1	0	0	0	0	0	0	1	4	8	11	4	8	11	15	19
	2	0	0	0	0	3	1	5	8	12	15	8	12	15	19	22
	3	0	0	0	3	7	5	8	12	15	19	12	16	19	23	26
	4	0	0	3	7	10	9	12	16	19	23	16	19	23	26	30
	5	0	4	7	11	14	12	16	20	23	27	20	23	27	30	34
	6	4	7	11	14	16	16	20	23	27	30	23	27	31	34	38
	7	8	11	15	18	22	20	24	27	31	34	27	31	34	38	41
	8	12	15	19	22	26	24	27	31	35	38	31	35	38	42	45
12	1	0	0	0	0	2	0	4	7	11	14	7	11	15	18	22
	2	0	0	0	2	6	4	8	11	15	18	11	15	18	22	25
	3	0	0	3	6	10	8	11	15	18	22	15	19	22	26	29
	4	0	3	6	10	13	12	15	19	22	26	19	22	26	30	33
	5	3	7	10	14	17	16	19	23	26	30	23	26	30	33	37
	6	7	10	14	18	21	19	23	26	30	33	27	30	34	37	41
	7	11	14	18	21	25	23	27	30	34	37	30	34	37	41	45
	8	15	18	22	25	29	27	31	34	38	41	34	38	41	45	48
14	1	0	0	0	2	5	3	7	10	14	17	11	14	18	21	25
	2	0	0	2	5	9	7	11	14	18	21	14	18	21	25	29
	3	0	2	6	9	13	11	14	18	22	25	18	22	25	29	32
	4	2	6	9	13	17	15	18	22	25	29	22	26	29	33	36
	5	6	10	13	17	20	19	22	26	29	33	26	29	33	36	40
	6	10	14	17	21	24	22	26	29	33	37	30	33	37	40	44
	7	14	17	21	24	28	26	30	33	37	40	33	37	41	44	48
	8	18	21	25	28	32	30	34	37	41	44	37	41	44	48	51
16	1	0	0	1	5	8	6	10	13	17	21	14	17	21	24	28
	2	0	1	5	8	12	10	14	17	21	24	17	21	25	28	32
	3	2	5	9	12	16	14	18	21	25	28	21	25	28	32	35
	4	5	9	13	16	20	18	21	25	28	32	25	29	32	36	39
	5	9	13	16	20	23	22	25	29	32	36	29	32	36	40	43
	6	13	17	20	24	27	25	29	33	36	40	33	36	40	43	47
	7	17	20	24	28	31	29	33	36	40	43	37	40	44	47	51
	8	21	24	28	31	35	33	37	40	44	47	40	44	47	51	55
18	1	0		14	8	11	9	13	17	20	24	17	20	24	27	31
	2	14		8	12	15	13	17	20	24	27	21	24	28	31	35
	3	5	8	12	15	17	17	21	24	28	31	24	28	31	35	39
	4	9	12	16	19	23	21	24	28	32	35	28	32	35	39	42
	5	12	16	19	23	27	25	28	32	35	39	32	36	39	43	46
	6	16	20	23	27	30	29	32	36	39	43	36	39	43	46	50
	7	20	24	27	31	34	32	36	39	43	47	40	43	47	50	54
	8	24	27	31	34	38	36	40	43	47	50	43	47	51	54	58

[1]Wound height is measured beginning at 1 foot above ground level (stump height).

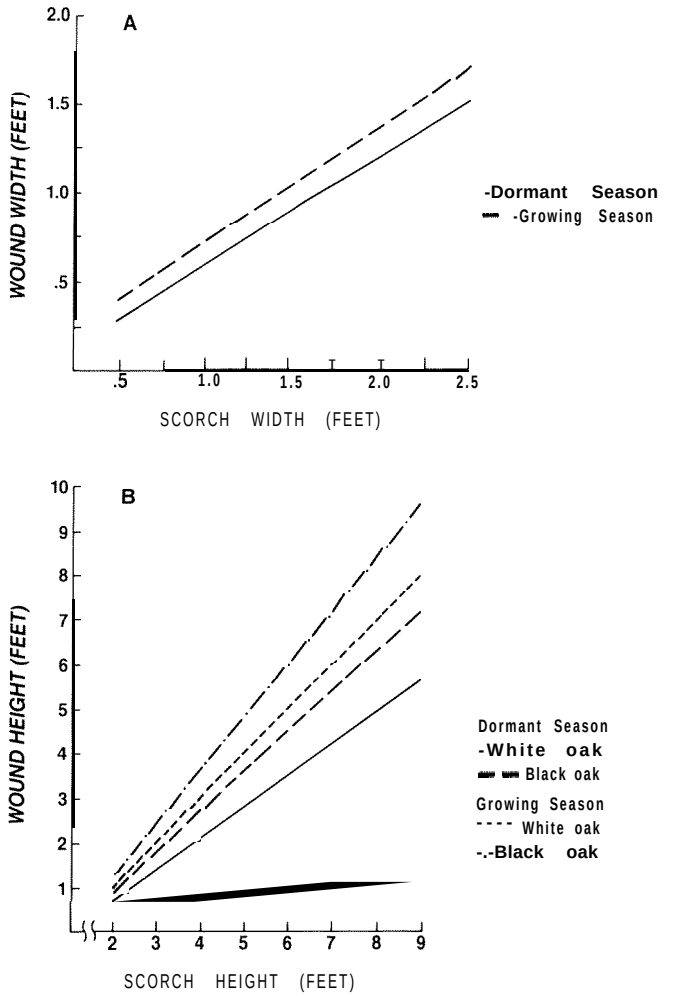

Figure 1.-Relationship between (A) scorch width and wound width for white and black oak and (B) scorch height and wound height for fires occurring during the dormant and growing seasons. Values for white oak also apply to chestnut oak and post oak. Values for black oak also apply to scarlet oak, northern red oak, hickories, and white ash.

Non-Timber Values

Non-timber wildland values may also be affected by fire. These include wildlife, soil, water, recreation, and structures. Most fires occurring in the central hardwoods have little negative impact on wildlife. In fact, the post-fire impacts often benefit wildlife by improving cover and increasing the supply of preferred foods. Impacts on soil and water quality are not usually severe. Recreational value losses are not usually important except when fires burn on or near developed sites. Of course, fires can result in important value losses when they damage buildings and other structures. This problem is most severe at the wildland/urban interface and is likely to increase as more and more people choose wildland sites for their homes.

References

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