

Assessing fire effects on oak timber quality

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Collaborators



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Support:



RESEARCH BRIEF

Fire damage effects on red oak timber product value

time of injury typically experienced little or no value loss. If fire damage is less than 20 inches in height and/or less than 20 percent basal circumference is injured, then little value loss occurred over 14 years. If these thresholds were exceeded, then value loss was likely. Regardless of fire-scar size, value loss was very low if trees were harvested within five years after fire damage.

Study authors note that Brose and Van Lear (1999) found that implementing relatively simple practices (i.e., directional

falling and lopping of excessive fuels near crop trees) in a shelterwood harvest accompanied by prescribed fire can minimize damage to residual trees, indicating that fire-scar heights, and timber quality losses can be effectively minimized.

The findings from the study summarized here are applicable only for red oak trees

which are at least 6 inches DBH at time of fire damage and a log grade typical for dimensional lumber utilization (i.e., 'sawlogs') as opposed to higher value products such as veneer or staves, and with fire-scar residence times not greater than 14 years.

FOR FURTHER READING

P. Brose, D. Van Lear, 1999. Effects of seasonal prescribed fires on residual overstory trees in oak-dominated shelterwood stands. *South. J. App. For.*, 23 (2), pp. 88-93.

		DBH (inches)																							
		10	11	12	13	14	16	16	17	18	19	20	21	22	23										
Fire-scar height x fire-scar depth (inches)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0										
	10	2	2	2	1	1	1	1	1	1	1	1	1	1	1										
	20	5	4	4	3	3	3	2	2	2	2	2	2	2	2										
	30	8	7	6	5	5	4	4	3	3	3	3	3	2	2										
	40	11	10	8	7	6	6	5	4	4	4	3	3	3	3										
	50	15	12	10	9	8	7	6	6	5	5	4	4	4	4										
	60	18	16	13	11	10	8	7	7	6	5	5	5	5	4										
	70	21	17	15	13	11	10	9	8	7	6	6	5	5	5										
	80	24	20	17	15	13	11	10	9	8	7	7	6	6	5										
	90	27	23	19	17	14	13	11	10	9	8	7	7	6	6										
	100	30	26	21	18	16	14	13	11	10	9	8	8	7	6										
	110	33	28	24	20	18	16	14	12	11	10	9	8	8	7										
	120	36	30	26	22	19	17	15	13	12	11	10	9	8	8										
	130	40	33	28	24	21	18	16	15	13	12	11	10	9	8										
	140	43	36	30	26	23	20	18	16	14	13	12	11	10	9										
	150	46	38	32	28	24	21	19	17	15	14	12	11	10	10										
	160	49	41	35	30	26	23	20	18	16	15	13	12	11	10										
	170	52	43	37	32	28	24	21	19	17	16	14	13	12	11										
	180	55	46	39	34	29	26	23	20	18	16	15	14	12	11										
	190	58	49	41	36	31	27	24	21	19	17	16	14	13	12										
	200	61	51	43	37	32	28	25	22	20	18	16	15	14	13										
	210	64	54	46	39	34	30	26	24	21	19	17	16	15	14										
	220	67	57	49	41	36	31	28	25	22	20	18	17	16	15										
	230	70	60	52	43	37	33	29	26	23	21	19	17	16	15										
	240	74	62	52	45	39	34	30	27	24	22	20	18	16	15										
	250	77	64	54	47	41	36	31	28	25	23	21	19	17	16										

Percent value loss on standing timber per butt log, based on fire-scar measurements and tree diameter.



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No. RB-17



www.oakfirescience.com

Marschall et al. 2014. Fire damage effects on red oak timber product value. *For. Ecol. Manage.*





Question
**How does fire
scarring affect
recovered
lumber value?**

Marschall et al. 2014. Fire damage effects on red oak timber product value. For. Ecol. Manage.

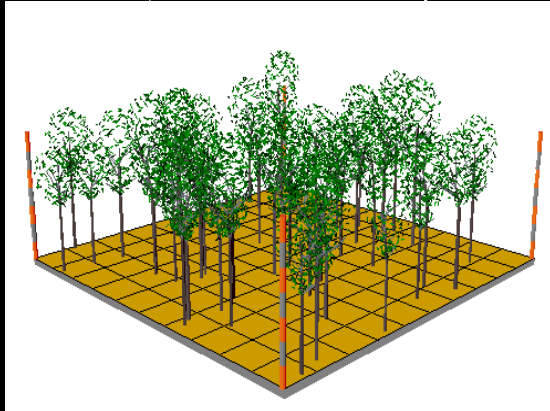
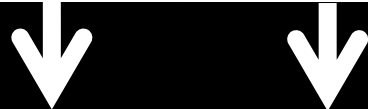
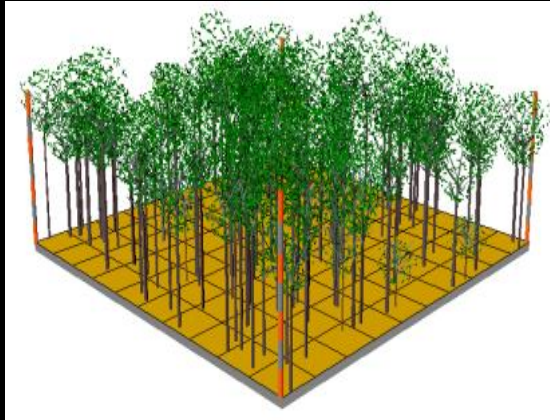


Tree level effects:

- **defect / wood decay**



How does prescribed fire affect timber values at the stand level??



Effects due to fire-induced changes in stand structure and species composition

Knapp et al. 2015

Structure and composition of an oak - hickory forest after over 60 years of repeated prescribed burning in Missouri. Forest Ecology and Management

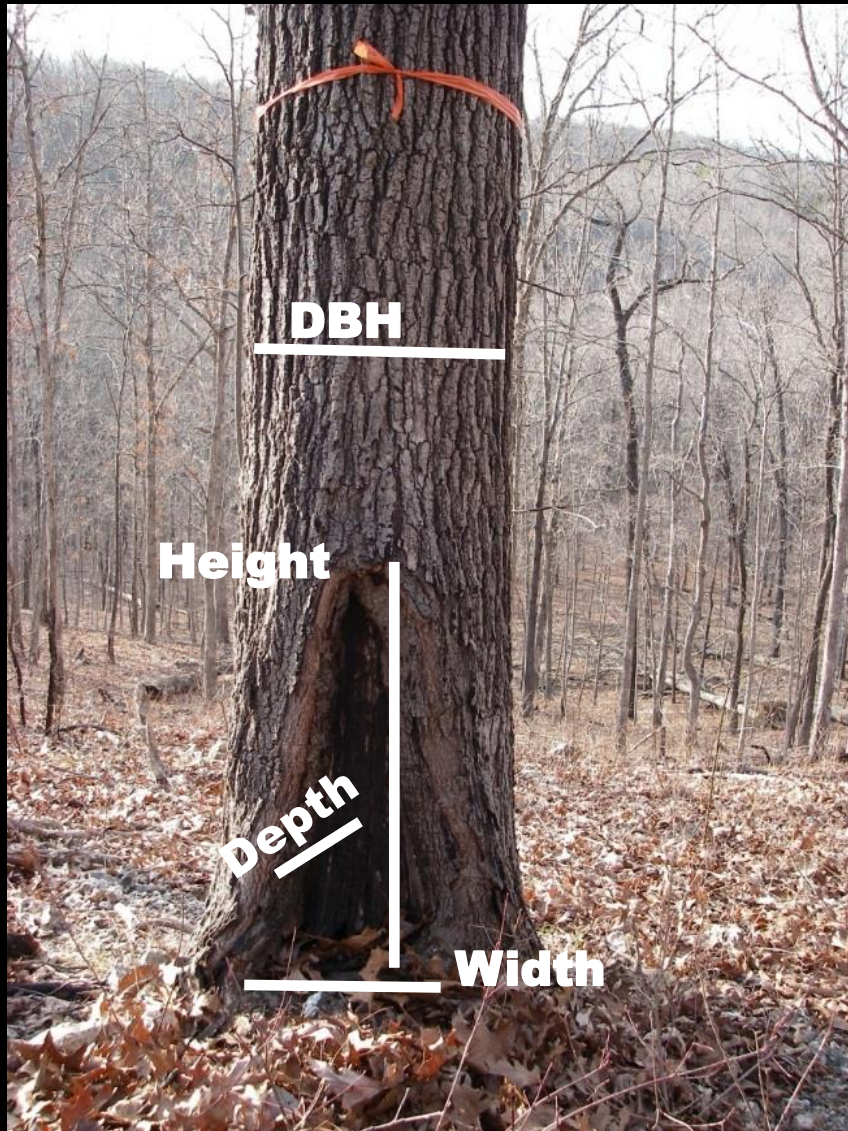
Knapp et al. 2017

Effects of long-term prescribed burning on timber value in hardwood forests of the Missouri Ozarks
GTR-NRS-P-167

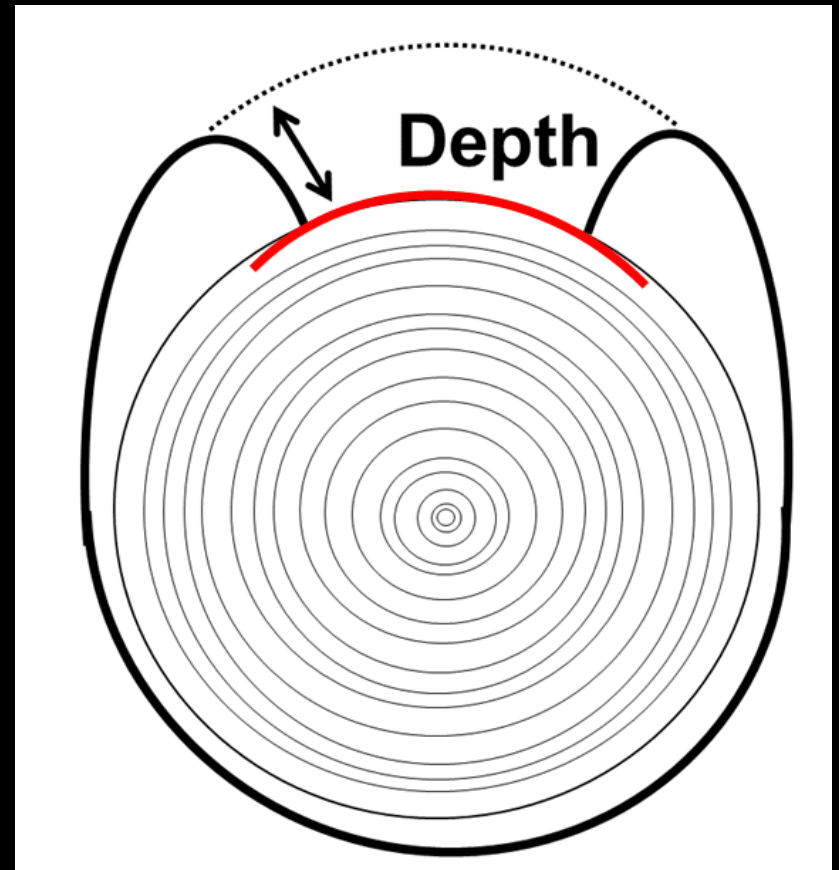
90 fire-scarred red oak sawlog trees
milled into dimensional lumber and
assessed



Methods *In the field:*



- Missouri Ozarks
- Tree, fire scar, and site information
- Cross section collected from each tree stump





Actual: 5BF 3A = \$1.88

Expected: 5BF 2Common = \$2.25

Loss = 16%



Actual: 5BF 2Common = \$2.25

Expected: 5BF 1 Common = \$2.80

Loss = 20%

Unit of Study: Lowest (butt) Log



Loss = 44%



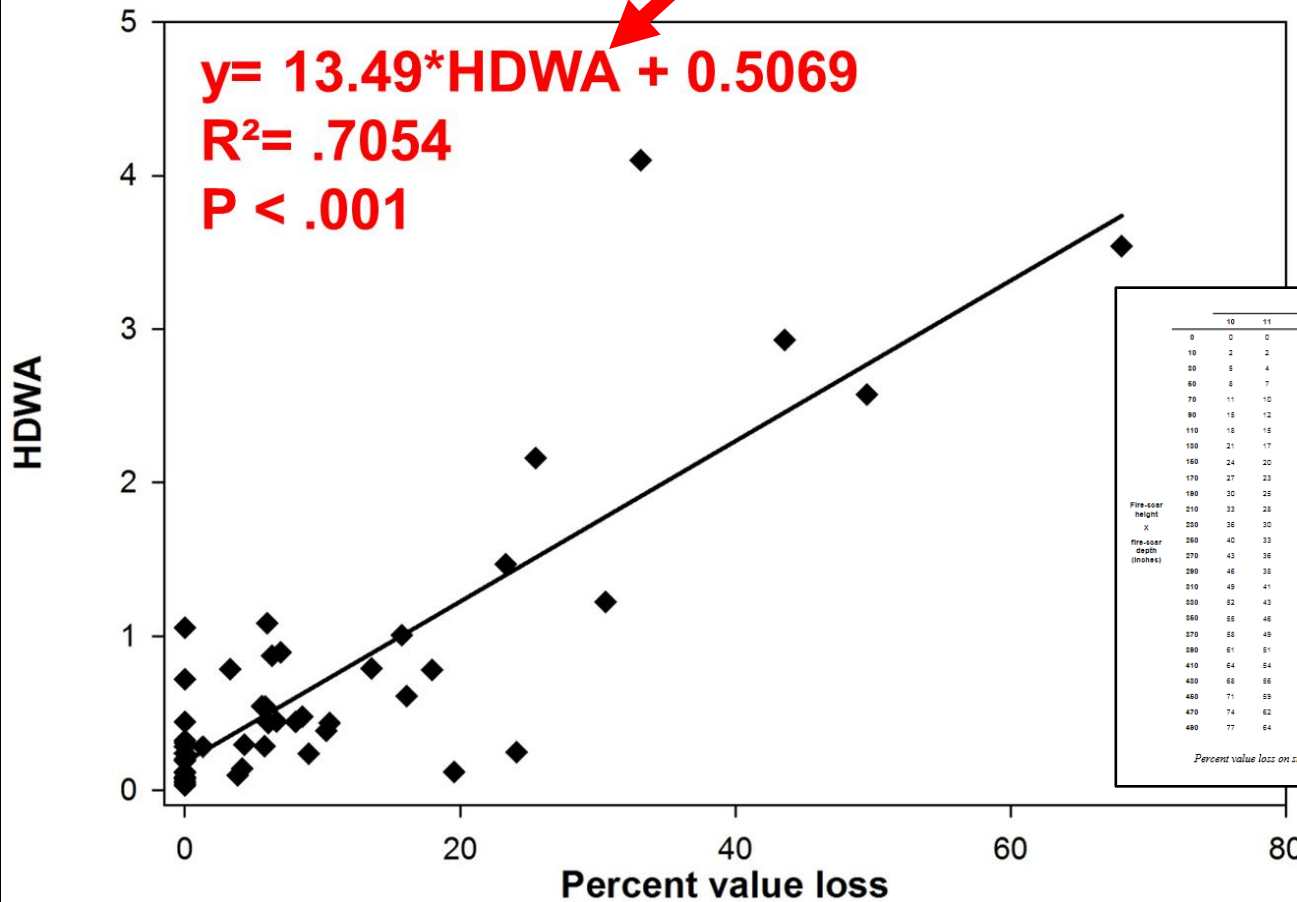
Loss: 1.3%



Loss: 9%

Value loss model (lowest log) based on scar and tree dimensions

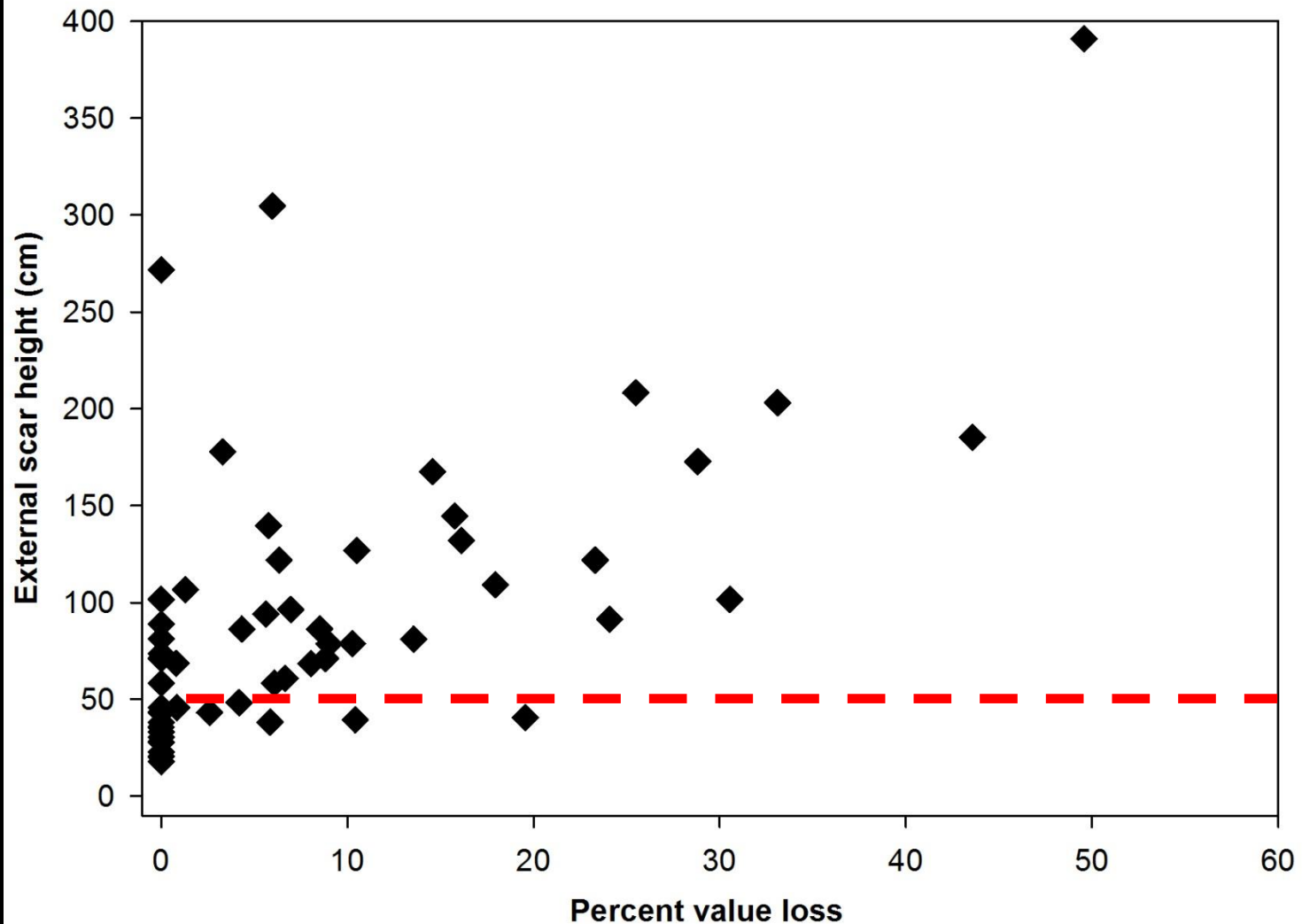
$$\text{HDWA} = \frac{(\text{Scar HT} * \text{Scar Depth})}{\text{DBH}}$$

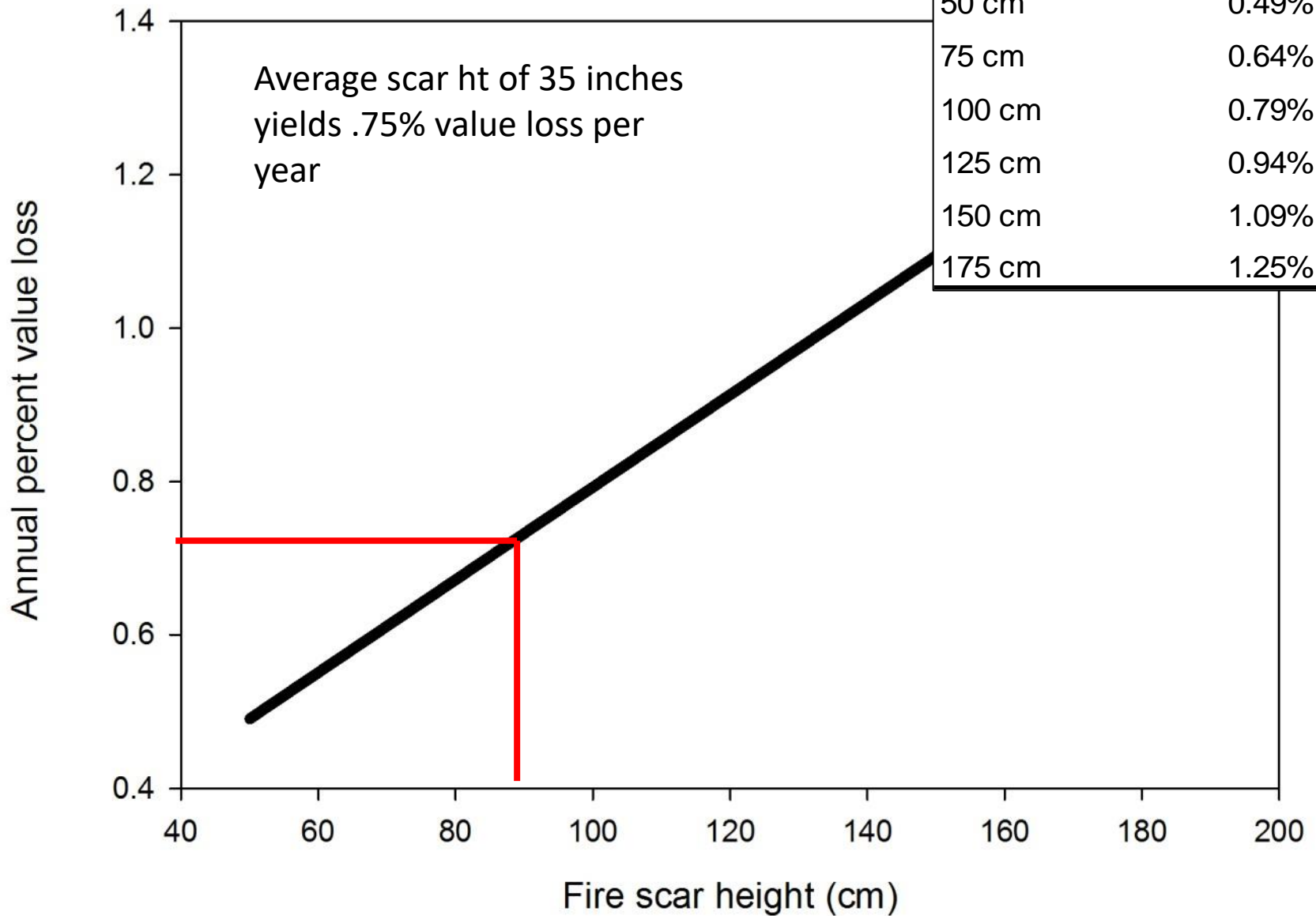


		DBH (inches)															
		10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Fire-scar height (inches)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	10	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1
	20	5	4	4	3	3	3	2	2	2	2	2	2	2	2	2	1
	30	8	7	6	5	5	4	4	3	3	3	3	3	3	2	2	2
	40	11	10	8	7	6	6	5	4	4	4	4	3	3	3	3	3
	50	15	12	10	9	8	7	6	6	5	5	4	4	4	4	4	3
	60	18	15	13	11	10	8	7	7	6	5	5	5	5	4	4	4
	70	21	17	15	13	11	10	9	8	7	6	6	6	6	6	6	5
	80	24	20	17	15	13	11	10	9	8	7	7	7	7	7	6	6
	90	27	23	19	17	14	13	11	10	9	8	7	7	7	7	6	6
	100	30	26	21	18	16	14	13	11	10	9	8	8	8	8	7	6
	110	33	28	24	20	18	16	14	12	11	10	9	8	8	8	8	7
	120	36	30	26	22	19	17	15	13	12	11	10	9	8	8	8	8
	130	40	33	28	24	21	18	16	15	13	12	11	10	9	8	8	8
	140	43	36	30	26	23	20	18	16	14	13	12	11	10	9	8	8
	150	46	38	32	28	24	21	19	17	15	14	12	11	10	10	10	10
Fire-scar depth (inches)	0	49	41	35	30	26	23	20	18	16	15	13	12	11	10	10	10
	10	52	43	37	32	28	24	21	19	17	15	14	13	12	11	10	10
	20	55	46	39	34	29	25	22	20	18	16	15	14	12	11	10	10
	30	58	49	41	35	31	27	24	21	19	17	16	14	13	12	11	10
	40	61	51	43	37	32	28	25	22	20	18	16	15	14	13	12	11
	50	64	54	46	39	34	30	26	24	21	19	17	16	14	13	12	11
	60	68	56	48	41	36	31	28	25	22	20	18	17	16	14	13	12
	70	71	59	50	43	37	33	29	26	23	21	19	17	16	15	14	13
	80	74	62	52	45	39	34	30	27	24	22	20	18	16	15	14	13
	90	77	64	54	47	41	36	31	28	25	23	21	19	17	16	15	14
	100	80	67	56	49	43	38	33	29	26	24	22	20	18	17	16	15
	110	83	70	58	51	45	40	35	31	28	26	24	22	20	18	17	16
	120	86	73	60	53	47	42	37	33	30	28	26	24	22	20	18	17
	130	89	76	63	55	49	44	39	35	32	30	28	26	24	22	20	18
	140	92	79	65	57	51	46	41	37	34	32	30	28	26	24	22	20
	150	95	82	68	59	53	48	43	39	36	34	32	30	28	26	24	22

Percent value loss on standing timber per butt log, based on fire-scar measurements and tree diameter.

83% of the trees with any value loss, had > 20 inch fire scar height (similar threshold found for time until harvest (5 yrs))





Main findings

(red oak sawlogs, < 15 yr)



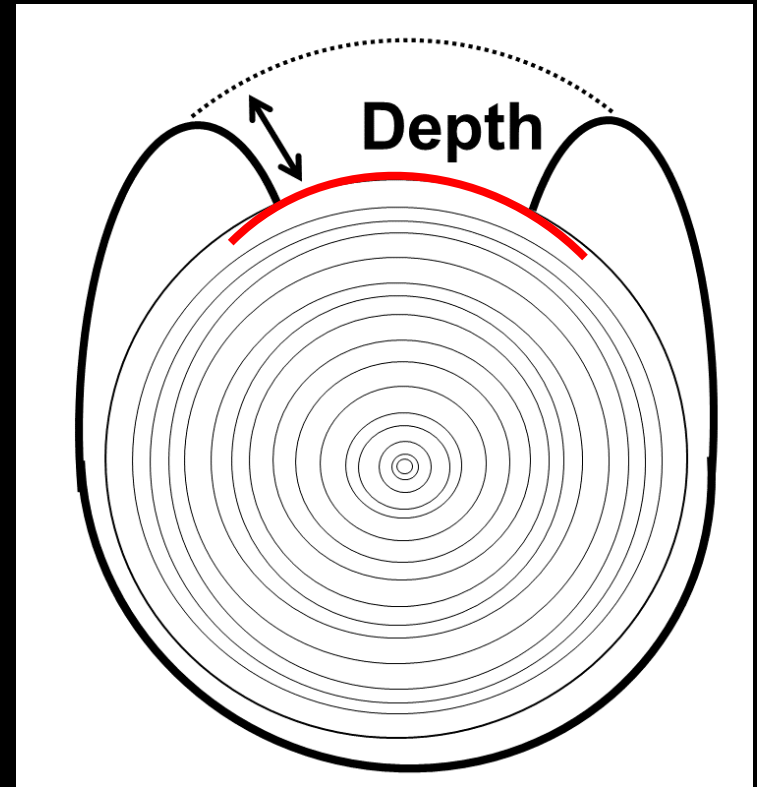
- 2.4% volume loss (all lumber)
- 10.3% average value loss / log
 - * 7% if 'uppers' value cons.
- .75% loss per year / 35" scar ht.
- most defect contained in slabs
- no loss if recovered ≤ 5 years
- no loss if scar height < 20"
 - * (≤ 15 yrs) **Brose and Van Lear, 1999



DBH = 20 in
scar ht = 27 in
scar width = 23 in
scar depth = 5 in

scar ht x scar depth = 135

DBH = 20



$$(\text{scar ht}) \times (\text{scar depth}) = 135$$

$$\text{DBH} = 20$$

Value loss (estimate)= 6%

Value loss (actual)= 8%

-include 'upper logs', value loss is ~5%

		DBH (inches)													
		10	11	12	13	14	15	16	17	18	19	20	21	22	23
Fire-scar height X fire-scar depth (inches)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	10	2	2	2	1	1	1	1	1	1	1	1	1	1	1
	30	5	4	4	3	3	3	2	2	2	2	2	2	2	1
	50	8	7	6	5	5	4	4	3	3	3	3	2	2	2
	70	11	10	8	7	6	6	5	4	4	4	3	3	3	3
	90	15	12	10	9	8	7	6	6	5	5	4	4	4	3
	110	18	15	13	11	10	8	7	7	6	5	5	4	4	4
	130	21	17	15	13	11	10	9	8	7	6	6	5	5	5
	150	24	20	17	15	13	11	10	9	8	7	7	6	6	5
	170	27	23	19	17	14	13	11	10	9	8	7	7	6	6
	190	30	25	21	18	16	14	13	11	10	9	8	8	7	6
	210	33	28	24	20	18	16	14	12	11	10	9	8	8	7
	230	36	30	26	22	19	17	15	13	12	11	10	9	8	8
	250	40	33	28	24	21	18	16	15	13	12	11	10	9	8
	270	43	36	30	26	23	20	18	16	14	13	12	11	10	9
	290	46	38	32	28	24	21	19	17	15	14	12	11	10	10
	310	49	41	35	30	26	23	20	18	16	15	13	12	11	10
	330	52	43	37	32	28	24	21	19	17	15	14	13	12	11
	350	55	46	39	34	29	26	23	20	18	16	15	14	12	11
	370	58	49	41	35	31	27	24	21	19	17	16	14	13	12
	390	61	51	43	37	32	28	25	22	20	18	16	15	14	13
	410	64	54	46	39	34	30	26	24	21	19	17	16	14	13
	430	68	56	48	41	36	31	28	25	22	20	18	17	15	14
	450	71	59	50	43	37	33	29	26	23	21	19	17	16	15
	470	74	62	52	45	39	34	30	27	24	22	20	18	16	15
	490	77	64	54	47	41	36	31	28	25	23	21	19	17	16

Percent value loss on standing timber per butt log, based on fire-scar measurements and tree diameter.



Scar height: 106.68 cm

Scar depth: 3.81 cm

DBH (harvest): 42.9 cm

R-time: 4 years

HxD: 406.45

Tabled PVL:

What is PVL in 10 years?

Predicted value loss (%) by scar/tree size DBH (cm)

Scar height X Scar depth
(cm)

HxD	25	28	31	34	37	40	43	46	49	52	55	58
0	0	0	0	0	0	0	0	0	0	0	0	0
65	2	2	2	1	1	1	1	1	1	1	1	1
194	6	5	4	3	3	3	2	2	2	2	2	1
323	9	8	6	5	5	4	4	3	3	3	2	2
452	13	10	9	7	6	5	5	4	4	3	3	3
581	16	13	11	9	8	7	6	5	5	4	4	3
710	20	16	13	11	9	8	7	6	6	5	5	4
839	24	19	16	13	11	10	8	7	7	6	5	5
968	27	22	18	15	13	11	10	8	7	7	6	5
1097	31	25	20	17	14	12	11	9	8	7	7	6
1226	34	27	22	19	16	14	12	10	9	8	7	7
1355	38	30	25	21	18	15	13	12	10	9	8	7
1484	41	33	27	23	19	16	14	13	11	10	9	8
1613	45	36	29	24	21	18	16	14	12	11	10	9
1742	48	39	32	26	22	19	17	15	13	12	10	9
1871	52	42	34	28	24	21	18	16	14	12	11	10
2000	56	44	36	30	26	22	19	17	15	13	12	11
2129	59	47	39	32	27	23	20	18	16	14	13	11
2258	63	50	41	34	29	25	22	19	17	15	13	12
2387	66	53	43	36	30	26	23	20	18	16	14	13
2516	70	56	46	38	32	28	24	21	19	17	15	13
2645	73	59	48	40	34	29	25	22	19	17	16	14
2774	77	61	50	42	35	30	26	23	20	18	16	15
2903	80	64	52	44	37	32	28	24	21	19	17	15
3032	84	67	55	46	39	33	29	25	22	20	18	16
3161	87	70	57	48	40	34	30	26	23	21	18	17



Scar height: 106.68 cm

Scar depth: 3.81 cm

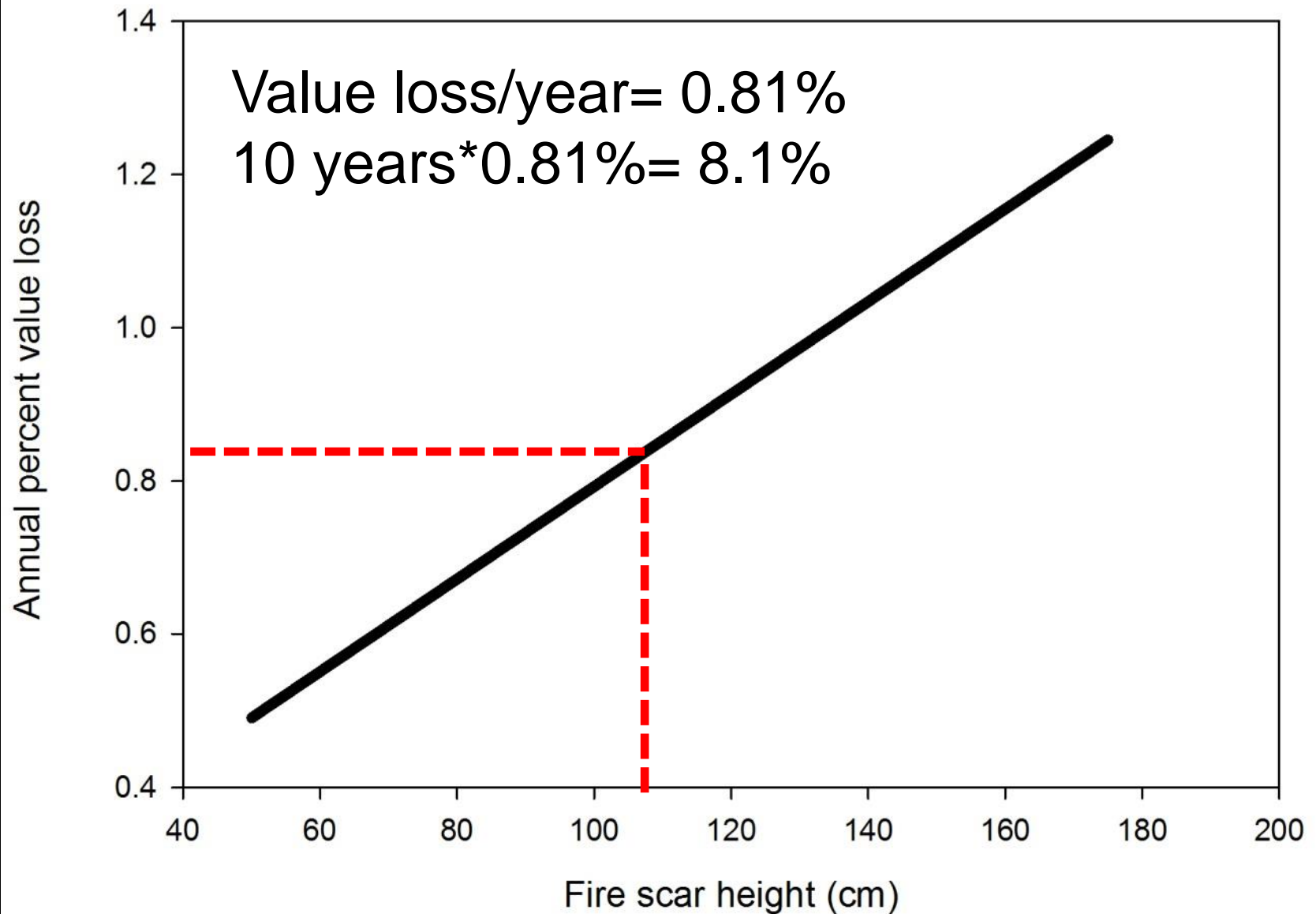
DBH (harvest): 42.9 cm

R-time: 4 years

HxD: 406.45

Tabled PVL: 5%

What is PVL in 10 years?





Tabled PVL: 5%

10 years estimated
additional loss: 8.1%

**Predicted value loss
at R-time 14 years: 13.1%**

Questions?

