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A SYSTEM FOR PREDICTING THE AMOUNT OF *PHELLINUS (FOMES) IGNIARIUS* ROT IN TREMBLING ASPEN STANDS

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ABSTRACT.—The occurrence of *Phellinus* (*Fomes*) *igniarius* white trunk rot in 45- to 50-year-old trembling aspen stands can be predicted by applying a constant to the stand basal area with *P. igniarius* conks to estimate the total basal area with *P. igniarius* rot. Future decay projections can be made by reapplying the basal area of hidden decay for each 6 years projected. This paper describes the methods used to determine the constant and how to use it in the field.

OXFORD: 443.3—172.8 FO:176.1. *POPULUS TREMULOIDES.* KEY WORDS: *Populus tremuloides,* decay, projection.

White trunk rot, caused by *Phellinus igniarius* (L. ex Fr.) Quel., is the most important rot of trembling aspen (*Populus tremuloides* Michx.) in North America. For years, foresters have needed an easy method to estimate the extent of *P. igniarius* rot in trembling aspen stands. Site index, soil, aspect, and a variety of other variables have been examined for predictive use but their correlation with white trunk rot incidence was poor. Many stands that were identified as low *P. igniarius* occurrence areas broke up from white trunk rot in the following 10 years.

In view of the volume of aspen in the Lake States and the magnitude of the problem, this study was begun to find a better way to estimate the amount of white trunk rot in aspen stands.

MATERIALS AND METHODS

Eighteen 45- to 50-year-old trembling aspen stands were examined for incidence of *P. igniarius* decay (Schipper and Anderson 1978). This age class was selected because stand breakup due to *P. igniarius* is usually not a problem in younger stands in the Lake States. Six stands each in Michigan, Minnesota, and Wisconsin were examined. These stands were located in the Ottawa, Chippewa, and Chequamegan National Forests, respectively.

The examination procedure was to arbitrarily select a starting point 1 chain (20.1 m) in from the edge of the stand to be examined, and to proceed from that point in a cardinal direction along a transect 20 feet (6.1 m) wide. The first 85 trembling aspen trees encountered on the transect were measured for d.b.h., examined for visible *P. igniarius* conks, and tested for hidden decay by taking a core sample at d.b.h.

RESULTS

Analysis of the data from the 18 stands after d.b.h. had been converted to basal area revealed a relation between the basal area of aspen trees on a plot with visible conks and the total basal area of aspen trees with decay (table 1). The average basal area of trees with visible conks ranged from 2.31 feet squared (0.21 m^2) in Michigan to 3.31 feet squared (0.31 m^2) in Minnesota. Hidden decay ranged from 1.16 feet squared (0.11 m^2) in Michigan to 2.76 feet squared (0.26 m^2) in Wisconsin. However, when the conversion factor needed to compute the total amount of decay on a plot was determined, we found that the basal area of total decay averaged 1.9 times the basal area of trees with conks, with a standard error of 0.17.

Table 1.—The average basal area and factor determination for the six stands examined on each of the three National Forests

National Forest	Average basal area of aspen on plots	Average basal area of aspen with conks/plot	Average basal area of hidden decay/plot[1]
	Ft^2		
Ottawa	29.354	2.312	1.166
Chippewa	26.853	3.313	2.696
Chequamegon	29.93	3.176	2.756

[1] Hidden decay factor ranged from 2.89 to 1.01; averaged 1.9 with a standard error of 0.17

DISCUSSION

In the Lake States, aspen stands older than about 40 years are subject to breakup due to *P. igniarius* decay. Elsewhere, such early breakup is rare. Breakup refers to the physical loss of trees in the stand through loss of wood fiber due to decay and stem breakage during wind storms due to weakening of the stems by decay.

When a stand in the Lake States is about 40 years old, the land manager must be able to predict whether it must be harvested quickly to salvage the wood before breakup or whether harvest can safely be delayed to allow additional volume increment. Although stands can be examined for *P. igniarius* conks, an average of 6 years is required between the time infection occurs and the first conks become visible. Therefore conks only reveal trees that have been infected for a least 6 years. If stands are examined every 10 years or even more infrequently, breakup may occur in a stand thought to be relatively free of decay. By examining trees for visible conks and then estimating total basal area of trees with decay, the general health of the stand at the time of the survey can be determined. By then using the factor for total basal area with decay at present as the basal area of trees with conks 6 years in the future, the land manager can determine whether the stand is approaching breakup or whether it can safely be retained for future harvest. Using the current amount of hidden decay as an estimate of future decay assumes that infection occurs at a constant rate. This may not be a valid assumption and in fact may err toward a higher infection rate than would actually occur.

ESTIMATION PROCEDURE

1. Determine the basal area of trembling aspen trees with one or more *P. igniarius* conks. At least 10 sample plots should be used per stand, more in less uniform stands (fig. 1).

2. Multiply the basal area of aspen with conks by the factor 0.9 to estimate the amount of hidden decay, then add this basal area to the basal area of trees with visible conks to estimate total decay.

3. Correct present volume for 6 years growth (table 2) and reapply the hidden decay factor to the total basal area with decay determined above. Add this hidden decay basal area to the total basal area with decay to estimate total decay in 6 years.

4. Repeat step 3 for 12 years' growth and estimate the total decay that will be present in the stand in 12 years.

5. Decide whether to harvest now or whether it can be defered, based on the estimates for decay at present and in 6 and 12 years.

Age 45 Basal area factor 1.9

I. TREE COUNT

	(1) Plot	(2) All trees	(3) Trees with conks
	1	⊠ ••	:
	2	⊔	•
	:		
	10	⊠	:•
Σ	10	80	20
$\bar{x}$		8	2
Basal area/acre (multiply $\bar{x}$ by basal area factor)		80	20

II. CALCULATIONS

	Basal area per acre
A. Current stand - Age 45	
1. Stocking, all trees : from tally	80
2. Observed decay : last line, col. 3, tally	20
3. Hidden decay : line 2 x 0.9	18
4. Total decay : sum lines 2 and 3	38
B. Stand in 6 years - Age 51	
5. Stocking, all trees : line 1 plus growth (table 2)	91
6. Total decay : sum lines 3 and 4	56
C. Stand in 12 years - Age 57	
7. Stocking, all trees : line 5 plus growth (table 2)	100
8. Total decay : sum lines 3 and 6	74

Figure 1.—Example of initial survey and the subsequent calculations. Assumes a 10-factor point sample cruise on 10 plots.

Table 2.—Net periodic basal area growth by age and stand density (Schlaegel 1972)

(In ft^2/acre)

Total stand age (years)	Basal area 20	40	60	80	100	120	140
20	2.39	3.40	3.89	4.03	3.92	3.62	3.14
25	1.92	2.72	3.11	3.23	3.04	2.69	2.51
30	1.60	2.27	2.59	2.69	2.62	2.41	2.09
35	1.37	1.94	2.22	2.30	2.24	2.07	1.79
40	1.20	1.70	1.94	2.02	1.96	1.81	1.57
45	1.06	1.51	1.73	1.79	1.74	1.61	1.40
50	.96	1.36	1.56	1.61	1.57	1.45	1.26
55	.87	1.24	1.41	1.47	1.43	1.32	1.14

Examples of the results of two surveys are shown below.

	45					
		Stand 1 Age		*Stand 2* Age		
	45	51	57	45	51	57
Basal area per/acre	80	91(table 2)	100	80	91	100
Basal area/acre of trees with conks (*P. igniarius*)	20 (x1.9)			5 (x1.9)		
Basal area/acre of trees with rot—estimate (*P. igniarius*)	38(+18)	56(+18)	74	9.5(+4.5)	14.0(+4.5)	23.5
Basal area/acre of trees with sound wood—estimate	42	35	26	70.5	77	76.5

Stand 1 has a high amount of decay and is predicted to begin breakup within the next 10 years. Stand 2 has a much smaller amount of decay and is predicted to continue to produce sound wood during the next 10 years. Using these criteria alone, stand 1 would be harvested in the near future and harvest of stand 2 would be defered until after another survey and decay estimate had been made 10 years in the future. However, in practice the decision to harvest or retain a stand will depend upon stand objectives, markets, and a variety of other management objectives.

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