

THE INTENSIFICATION  
OF RED PINE INFECTION  
BY FOMES ANNOSUS WITHIN THE  
ST. WILLIAMS FOREST STATION

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INFORMATION REPORT O-X-184

CANADIAN FORESTRY SERVICE  
DEPARTMENT OF THE ENVIRONMENT

APRIL 1973

*Copies of this report may be obtained  
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## ACKNOWLEDGMENTS

The author wishes to express his appreciation to the Ontario Ministry of Natural Resources for cooperation in the course of this study. The assistance of the staff of the St. Williams Forest Station is gratefully acknowledged.



Frontispiece. Sporophores of *Fomes annosus* at the base of an infected red pine stump.

## ABSTRACT

An examination of the 473 acres of red pine type on the St. Williams Forest Station in 1971 resulted in the identification of 25 previously undetected infection centers caused by *Fomes annosus*. Prior to 1971, 21 centers had been found, bringing the present total to 46. Most of the centers were found in stands thinned in the 1960's. The intensification of the disease since its initial discovery in 1955 demonstrates the need for stump treatment in areas where the fungus is established. Early detection of the fungus, once it becomes established in new areas where stump treatment is not carried out, is extremely important.

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Cover photograph shows an infection center created by *Fomes annosus* in a red pine plantation. Note the dead trees, which indicate the center of the diseased area, and the thin foliage in the crowns of the trees on the margin.

## INTRODUCTION

*Fomes annosus* (Fr.) Karst. was found in Ontario for the first time in 1955, attacking red pine (*Pinus resinosa* Ait.) in a plantation on the St. Williams Forest Station. The damage caused by *F. annosus* in Europe and in the southeastern United States gave rise to concern over the impact this fungus could have on forestry in Ontario. A research program was initiated by the Canadian Forestry Service in cooperation with the Ontario Ministry of Natural Resources to evaluate this problem and, if it should be warranted, to seek means of control. The intensification of *F. annosus* within an area known to have active infection centers was studied as a part of this program.

*Fomes annosus* usually becomes established within conifer plantations by colonizing fresh stumps left from thinning operations. The airborne basidiospores of the fungus land on the stump top, germinate, and the resulting hyphae grow down into the stump and out into the stump's root system. The fungus spreads into the roots of nearby trees and stumps via root contacts, creating an infection center or pocket. Sporophores of *F. annosus* are produced on infected hosts within these centers. New centers would seem more likely to occur near an existing infection center because of a greater spore load in the atmosphere; however, the spores can be carried considerable distances. For example, the northernmost infection centers in Ontario are located near Barrie, while spores have been detected as far north as White River and Thunder Bay (Punter 1971). Rishbeth (1959) collected spores of *F. annosus* from the air in the Shetland Islands, 180 miles from the nearest spore source.

## DESCRIPTION OF THE AREA STUDIED

The St. Williams Forest Station, located in Norfolk County in southern Ontario, consists of two tracts, separated from one another by approximately 4 miles. The survey for *F. annosus* infection centers was conducted on the 473 acres of red pine type on the two areas. These stands are primarily located on old field sites of a sand or loamy sand soil type, with a pH averaging 5.4 (range 4.7 - 6.2). The oldest plantations had been established in 1913 and the youngest in 1934; all had been thinned at least once. Most of the thinnings were made during the period from 1952 to 1964, with the heaviest thinnings from 1962 to 1964. Annual sanitation thinnings now remove approximately five trees per acre in the red pine type. Much of the sanitation cutting is required because of infection by *F. annosus*.

## INTENSIFICATION OF FOMES ANNOSUS AT ST. WILLIAMS, 1955-1970

After its initial discovery in 1955, *F. annosus* was detected on the forest station periodically and by 1969, a total of 10 infection centers had been found in the red pine type. During this period, six infection centers had also been located in jack pine (*Pinus banksiana* Lamb. [= *P. divaricata* (Ait.) Dumont]) plantations and one infection center was located in a white pine (*Pinus strobus* L.) plantation. Infection centers had also been found in jack pine plantations in the adjacent Turkey Point Provincial Park. In 1970, forest station personnel detected an additional 11 *F. annosus* infection pockets in the red pine type, bringing the total number to 21 known locations. No effort had been made, however, to survey the entire acreage of the red pine type for this disease.

### SURVEY PROCEDURE

The plantations were examined on foot in 1971, using a pattern that provided reasonably thorough coverage of each area. A close examination was made at points where one or more dead trees were found or where the crown of a tree was abnormally thin or off-color. The standing trees and the stumps in the immediate area of the suspected point of infection were checked for sporophores of *F. annosus*. Wind-thrown trees, trees attacked by bark beetles, and patches of brush or herbaceous growth on an otherwise clear forest floor provided additional points requiring examination. A detailed account of the procedure used has been published (Myren and Sippell 1972). Forest station personnel assisted the survey effort by providing the locations of areas they suspected of being *F. annosus* infection centers and areas where dying red pine had been observed. Only those trees or stumps bearing sporophores were considered infected, and infection centers were considered confirmed only when infected material was present. When a center was located, its position was marked on a map of the entire station, the infected trees and stumps were marked and enumerated, and the diameter of each infected tree was recorded. This information allowed the development of a center to be followed accurately.

### RESULTS

In all, 25 infection centers were located as a result of this survey, 12 in one tract and 13 in the other (referred to in the tables as Tract I and Tract II, respectively). A description of each compartment in which *F. annosus* was found and of each infection center is given in Tables 1-8 and a summary of the data is presented in Table 9.

## DISCUSSION

The objectives of this study were to determine to what extent *F. annosus* had intensified within the red pine type on the St. Williams Forest Station since its discovery in 1955, and to record all existing infection centers so that their development could be followed. The descriptions of the centers reveal that, in most cases, infections were limited to a relatively small number of trees and stumps. Previous experimental work had indicated that symptoms are not seen in living trees until 4 - 5 years after nearby stumps have become infected. This suggests that the centers found resulted from thinnings in the early 1960's, since some dead trees were already present. Although most centers were young, it is felt that the time elapsed since thinning had been sufficiently long to allow the appearance of the disease pockets that would develop from direct stump infections. Most of the infection centers found had probably been evident for a year or two but had escaped detection.

The number of trees found to be infected in this survey was small, as would be expected with young infection centers. There were undoubtedly many trees with some degree of root decay but in which the decay had not yet progressed to the extent needed to allow sporophore production. Sporophores probably do not develop until the fungus reaches the root collar of the host and even then they are not produced every year. Frequently dead trees and trees with symptoms of infection by *F. annosus*, on which sporophores could not be detected, were found in the infection centers.

Since the number of basidiospores now produced in the St. Williams area is presumed to be quite high, the probability that any given stump will become infected should increase greatly. All cutting operations conducted on the forest station since 1964, however, have utilized the recommended stump treatment and are timed, when possible, to coincide with periods of low spore production (Punter 1968). These measures can reduce the establishment of new infection centers.

Results of this survey demonstrate the necessity of using some measure of protection for fresh stumps against infection by *F. annosus* in areas where the fungus is now established. Also, it should alert forest managers to the need for early detection of the disease in previously uninfected areas.

Additional research on procedures designed to reduce or halt the expansion of established centers of *F. annosus* infection is warranted. In a situation in which many infection centers of *F. annosus* are found in a relatively small area, attempts to halt their spread would likely be rather costly and possibly ineffective.



However, in a thinned stand in which stumps had been treated to inhibit *F. annosus* infection, the development of new infection centers should be infrequent. Under these circumstances, efforts to halt the fungus could be justified. The development of measures to halt the expansion of infection centers and of methods to establish regeneration on infected sites are included in the research program presently being conducted on *F. annosus* by the Canadian Forestry Service.

## REFERENCES

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## APPENDIX

Table 1 Description of compartment and infection centers initiated by *Fomes annosus* on the St. Williams Forest Station (Tract 1, Compartment 33)

Area (acres)	Species <sup>a</sup> (%)		Planted (yr)	No. infec- tion centers prior to 1971	New infec- tion centers	Location of <i>F. annosus</i> sporophores						Avg DBH of infected trees (in. <sup>b</sup> )			
						Stumps		Living trees		Dead trees		Living		Dead	
						rP	wP	rP	wP	rP	wP	rP	wP	rP	wP
75.0	rP	90	1923	11	1	0	0	1	0	0	1	8.0	0	0	6.1
	wP	10			2	4	0	1	0	0	2	10.5	0	0	8.7
					3	0	0	1	0	0	1	9.5	0	0	5.9
					4	5	0	0	0	1	3	0	0	7.1	3.4
					5	6	0	2	0	2	1	7.4	0	6.1	3.1

<sup>a</sup> rP = red pine  
wP = white pine

<sup>b</sup> 1 in. = 2.54 cm

Note: Compartment numbers and acreage were obtained from maps made of the Forest Station in 1959 by the Ontario Department of Lands and Forests (now the Ontario Ministry of Natural Resources).

Table 2 Description of compartment and infection centers initiated by *Fomes annosus* on the St. Williams Forest Station (Tract 1, Compartment 53)

Area (acres)	Species <sup>a</sup> (%)	Planted (yr)	No. infec- tion centers prior to 1971	New infec- tion centers	Location of <i>F. annosus</i> sporophores			Avg DBH of infected trees (in. <sup>b</sup> )	
					Stumps rP	Living trees rP	Dead trees rP	Living rP	Dead rP
9.0	rP 100	1913	3	1	10	1	0	9.4	0

<sup>a</sup> rP = red pine

<sup>b</sup> 1 in. = 2.54 cm

Note: Compartment numbers and acreage were obtained from maps made of the Forest Station in 1959 by the Ontario Department of Lands and Forests (now the Ontario Ministry of Natural Resources).

Table 3 Description of compartment and infection centers initiated by *Fomes annosus* on the St. Williams Forest Station (Tract 1, Compartment 75)

Area (acres)	Species <sup>a</sup> (%)	Planted (yr)	No. infec- tion centers prior to 1971	New infec- tion centers	Location of <i>F. annosus</i> sporophores			Avg DBH of infected <sup>b</sup> trees (in.)	
					<u>Stumps</u> rP	Living	Dead	<u>Living</u> rP	<u>Dead</u> rP
						trees	trees		
8.5	rP 100	1920	1	1	71	4	0	8.7	0
				2	26	0	1	0	9.0
				3	13	1	2	8.5	9.0
				4	1	0	1	0	4.1

<sup>a</sup> rP = red pine

<sup>b</sup> 1 in. = 2.54 cm

Note: Compartment numbers and acreage were obtained from maps made of the Forest Station in 1959 by the Ontario Department of Lands and Forests (now the Ontario Ministry of Natural Resources).

Table 4 Description of compartment and infection centers initiated by *Fomes annosus* on the St. Williams Forest Station (Tract 1, Compartment 128)

Area (acres)	Species <sup>a</sup> (%)		Planted (yr)	No. infec- tion centers prior to 1971	New infec- tion centers	Location of <i>F. annosus</i> sporophores						Avg DBH of infected <sup>b</sup> trees (in.)			
						Stumps		Living trees		Dead trees		Living		Dead	
						rP	wP	rP	wP	rP	wP	rP	wP	rP	wP
2.0	rP	99	1913	0	1	2	0	0	1	0	0	0	6.0	0	0
	wP	1													

<sup>a</sup> rP = red pine  
wP = white pine

<sup>b</sup> 1 in. = 2.54 cm

Note: Compartment numbers and acreage were obtained from maps made of the Forest Station in 1959 by the Ontario Department of Lands and Forests (now the Ontario Ministry of Natural Resources).

Table 5 Description of compartment and infection centers initiated by *Fomes annosus* on the St. Williams Forest Station (Tract 1, Compartment 145)

Area (acres)	Species <sup>a</sup> (%)	Planted (yr)	No. infec- tion centers prior to 1971	New infec- tion centers	Location of <i>F. annosus</i> sporophores			Avg DBH of infected trees (in. <sup>b</sup> )	
					Stumps	Living	Dead	Living	Dead
					rP	rP	rP	rP	rP
2.5	rP 100	1925	0	1	5	0	2	0	8.0

<sup>a</sup> rP = red pine

<sup>b</sup> 1 in. = 2.54 cm

Note: Compartment numbers and acreage were obtained from maps made of the Forest Station in 1959 by the Ontario Department of Lands and Forests (now the Ontario Ministry of Natural Resources).



Table 6 Description of compartment and infection centers initiated by *Fomes annosus* on the St. Williams Forest Station (Tract 2, Compartment 34)

Area (acres)	Species <sup>a</sup> (%)		Planted (yr)	No. infec- tion centers prior to 1971	New infec- tion centers	Location of <i>F. annosus</i> sporophores			Avg DBH of infected trees (in. <sup>b</sup> )	
						Stumps rP	Living trees rP	Dead trees rP	Living rP	Dead rP
11.0	rP	100	1934-1935	0	1	7	2	1	6.6	6.0
					2	5	0	1	0	6.4
					3	4	1	2	6.9	6.1
					4	5	0	2	0	5.4
					5	2	0	0	0	0
					6	1	1	0	6.2	0
					7	2	1	0	6.5	0

<sup>a</sup> rP = red pine

<sup>b</sup> 1 in. = 2.54 cm

Note: Compartment numbers and acreage were obtained from maps made of the Forest Station in 1959 by the Ontario Department of Lands and Forests (now the Ontario Ministry of Natural Resources).

Table 7 Description of compartment and infection centers initiated by *Fomes annosus* on the St. Williams Forest Station (Tract 2, Compartment 53)

Area (acres)	Species <sup>a</sup> (%)		Planted (yr)	No. infec- tion centers prior to 1971	New infec- tion centers	Location of <i>F. annosus</i> sporophores						Avg DBH of infected <sub>b</sub> trees (in.)				
						Stumps		Living trees		Dead trees		Living		Dead		
						rP	jP	rP	jP	rP	jP	rP	jP	rP	jP	
30.0	rP	90	1931-1935	0	1	0	1	0	0	4	3	0	0	6.1	5.9	
						3	0	0	0	3	0	0	0	5.4	0	
						3	14	0	2	0	4	0	9.3	0	7.0	0
						4	3	0	1	0	1	0	6.2	0	4.4	0
						5	7	0	0	0	0	0	0	0	0	0

<sup>a</sup> rP = red pine  
jP = jack pine

<sup>b</sup> 1 in. = 2.54 cm

Note: Compartment numbers and acreage were obtained from maps made of the Forest Station in 1959 by the Ontario Department of Lands and Forests (now the Ontario Ministry of Natural Resources).

Table 8 Description of compartment and infection centers initiated by *Fomes annosus* on the St. Williams Forest Station (Tract 2, Compartment 78)

Area (acres)	Species <sup>a</sup> (%)		Planted (yr)	No. infec- tion centers prior to 1971	New infec- tion centers	Location of <i>F. annosus</i> sporophores						Avg DBH of infected trees (in. <sup>b</sup> )			
						Stumps		Living trees		Dead trees		Living		Dead	
						rP	wP	rP	wP	rP	wP	rP	wP	rP	wP
42.5	rP	60	1930	0	1	3	0	1	0	4	0	6.5	0	6.9	0
	wP	40													

<sup>a</sup> rP = red pine  
wP = white pine

<sup>b</sup> 1 in. = 2.54 cm

Note: Compartment numbers and acreage were obtained from maps made of the Forest Station in 1959 by the Ontario Department of Lands and Forests (now the Ontario Ministry of Natural Resources).

Table 9 Infection centers of *Fomes annosus* found in the red pine type on the St. Williams Forest Station in 1971

Tract	Area of red pine type (acres)	Infection centers located		Number of infected <sup>a</sup>		
		In 1971	Prior to 1971	Stumps	Dead trees	Living trees
I	291	12	18	143	17	12
II	182	13	3	54	25	9

<sup>a</sup> Pertains to infection centers found in 1971 only; infection is based on the presence of a sporophore.

Note: Compartment numbers and acreage were obtained from maps made of the Forest Station in 1959 by the Ontario Department of Lands and Forests (now the Ontario Ministry of Natural Resources).