A Revised Estimate of the Impacts of the 1980 - 1984 Douglas-fir Tussock Moth Outbreak

by

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Table of Contents

Abstract

This report provides revised estimates of losses from the 1980-1984 Douglas-fir tussock moth outbreak, based on a recently completed Canadian Forestry Service - British Columbia Forest Service damage appraisal project. This project provided more precise loss estimates for the entire outbreak period, than the loss report by Ross and Taylor (1983). Original timber volume losses estimated at 68 000 m^3 and combined timber-property value losses of $.7 million increased to 308 100 m^3 and $3.1 million, respectively. The more recent estimates are higher as a result of new information on tree mortality, and a more precise determination of infested areas from the last outbreak which occurred from 1980 to 1984.

Introduction

The intent of this report is to make up-to-date information on impacted resource values available to forest managers as an early reference document prior to the next Douglas-fir tussock moth (DFTM) Orgyia pseudotsugata (McDunnough), outbreak.

The last outbreak of this pest (1980-1984) caused timber volume losses of 68 000 m^3, and combined timber-property value losses of $0.7 million according to Ross and Taylor (1983). However, these loss estimates were based partly on data on tree mortality from Washington and Oregon, and predictions for only 6 514 hectares of defoliation in 1983 for the Kamloops Forest Region. In 1983 the Canadian Forestry Service (CFS) and the British Columbia Forest Service (BCFS) undertook a study of tree mortality over a three year period, which, along with new data on 1983 defoliated areas, was designed to provide better estimates.

Methods

The appraisal program was initiated during the peak of the last DFTM outbreak, to determine the amount of tree mortality caused by defoliation. The primary objective was to develop more precise tree mortality estimates stratified by gross age class of infested stands, and the number of years of successive defoliation. Other factors examined included top-kill, secondary influence of bark beetles, and the effects of a variety of environmental and biological factors (slope, elevation, aspect, species composition, and diameter class) on mortality.

In 1983, 61 permanent, fixed-radius plots were established according to stand age and duration of defoliation as shown in Table 1. A stand was considered mature if tree age exceeded 121 years.

Table I Number of Permanent Sample Plots Estimated during the 1980-1984 DFTM Outbreak

	Stand Age (Number of Plots Established)		
Sample Plot Type	Mature	Immature	Total
Areas without attack	7	9	16
Areas with attack	23	22	45
Total	30	31	61

Plots were placed only on poor sites[a], in stands containing at least 40% Douglas-fir. An examination of the area infested in 1982 indicated that 75% of the defoliation occurred on poor sites, where Douglas-fir was the dominant species.

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a. Poor sites may be defined as interior Douglas-fir stands which are capable of reaching a height between 12 and 21 meters in 100 years.

Plot size varied from 0.008 to 0.1 hectares to contain approximately 20 Douglas-fir trees each. All trees were marked with paint, and two trees per plot were photographed annually to record crown condition. In addition, tree heights and ages were taken of three trees per plot, along with the following information: diameter at breast height, site index, aspect, slope, elevation, and crown class. Annual assessments, until 1985 when the infestation collapsed, included tree mortality, severity of defoliation, live crown-ratio, top-kill, and the presence of secondary pests[b].

New mortality estimates from the field study, in conjunction with a more precise determination of infested areas from the last outbreak, are used instead of old estimates, to recalculate resource value impacts. Previous estimates of timber volume and combined timber-property values affected were based on predicted defoliation of 6 514 hectares for 1983. However, the CFS Forest Insect and Disease Survey (Erickson and Ferris 1983) determined 23 410 hectares of new defoliation in 1983. This larger area constituted another basis for recalculation.

The basic method used by Ross and Taylor (1983) to calculate timber and property values were changed as follows:

1) The area of tree mortality was subtracted only from the area susceptible to loss. This method of calculation avoided inclusion of already dead trees in the count.

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b. More details on field study methods will be available in a subsequent report.

2) Formerly, it was assumed that tree mortality occurred in all areas of light, moderate, and severe infestation. By contrast, the field study indicates that significant mortality occurred only in severe infestation areas.

Results

Observations from this field study showed that only severely defoliated stands experienced significant mortality directly attributable to the DFTM. In these stands, mortality rates by volume averaged 32% in stands defoliated one year and 57% in stands defoliated two or three years.

Tables II to IV (below) show losses by timber volume, property value and timber value. Losses for the Ross and Taylor (1983) report are provided for comparison.

Table II Volume losses attributed to the DFTM for the 1980-1984 outbreak

Loss Component	Volume Loss Estimates m^3	
	Previous [a]	New [b]
Growth	6 600	6 600
Mortality	61 800	301 500
	68 400	308 100

a. Based on infested areas from 1981 to 1983 of 1072, 12 770, and 6 514 hectares, respectively.

b. Based on infested areas from 1981 to 1983 of 1072, (Wood and Woensdregt, 1981), 12 770 (Wood and Ferris, 1982), and 25 750 (Erickson and Ferris, 1983) hectares, respectively.

As a result of recalculation of impacts based on estimates of new tree mortality, the volume of timber lost in the DFTM infestation area totalled 308,100 m^3 for the period 1980 - 1984 (Table II). The growth component of this loss was 6,600 m^3 and the mortality component 301,500 m^3.

Table III Property value losses for the 1980-1984 outbreak by private land classes

Land Class	Lost Value of Forest Cover ($) Previous	New
Residential	90,000	433,000
Rural	40,000	174,000
Wildland	1,000	6,000
Indian Reserve Lands	80,000	381,000
	211,000	994,000

Table IV Timber value losses by land status group

Land Status Group	Timber Value Estimates ($) Previous	New
Crown (Provincial)	300,000	1,402,300
Private	130,000	608,300
Indian Reserve	20,000	92,900
	450,000	2,103,500

Property value losses as a result of declining timber volumes totalled approximately $1.0 million (Table III). Residential and Indian Reserve land properties constituted more than 80% of this loss.

Timber value losses totalled $2.1 million (Table IV), of which Crown and private lands comprised 95%. Therefore, the total damage resulting from the last DFTM outbreak was estimated to be $3.1 million, half of which occurred on private lands.

Discussions

New field study results provided tree mortality estimates for three successive years of defoliation that were five, four and two times larger respectively than estimates used in the Ross and Taylor report (1983). Because previous estimates were based on a conservative extrapolation of Washington and Oregon data, increased estimates were expected.

The estimates of impacts on timber from the DFTM outbreak (1980 - 1984) increased over four times by volume from the previous report. The growth component of this loss remained unchanged, while the estimates of mortality increased by four and one-half times, due to both the field study results and the revised estimates of the 1983 infested area. Previous predictions of infestation area were based on egg-mass surveys conducted in the fall of 1982. These surveys were conducted only in areas where defoliation previously had been observed, and did not identify areas with no defoliation, where DFTM populations were developing.

Due to a significant increase in estimates of timber loss by volume, estimates of both property and timber value losses increased by four and one-half times over those shown in the 1983 report.

Conclusions

The numbers presented in this report are important because they highlight the following facts:

a) DFTM damage was significant for the last outbreak; and
b) the private property component of the total damaged area was considerable.

These facts mean that efforts expended during the next outbreak on justification and analysis of the control options should be worthwhile. Also, because the damage to private property was extensive, control projects should hinge on the consideration of property values, as well as timber values.

The results and technical processes used in this report and the Ross and Taylor (1986) report, may assist forest managers to analyze future outbreaks in the following ways:

a) The tree mortality results, and other information from the three year field study, will be directly applicable to the next DFTM outbreak.

b) The damage appraisal processes developed in these reports will provide a framework upon which to analyze future outbreaks. Specific damage appraisal techniques are continually changing and some of the ones used in these reports may be out-of-date prior to the next outbreak. For example, forest managers may enhance the present detection system used by the widespread use of pheromone traps to direct the placement of egg-mass surveys.

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