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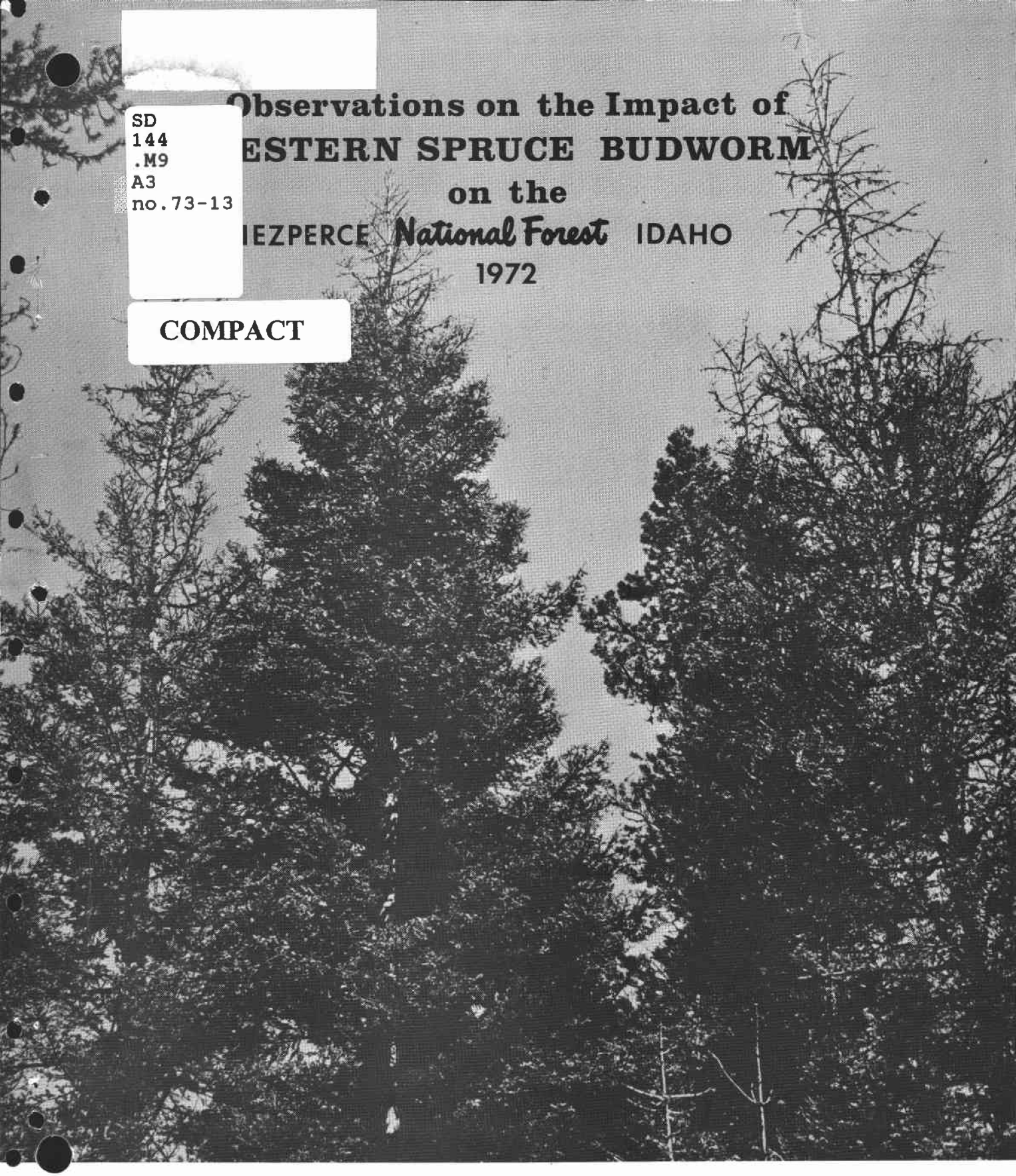

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Cover photo: Grand fir top killed by repeated western spruce budworm defoliation, Newsome Creek, Nezperce National Forest.

OBSERVATIONS ON THE IMPACT OF WESTERN SPRUCE BUDWORM ON THE NEZPERCE NATIONAL FOREST, IDAHO 1972

by

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ABSTRACT

Aerial surveys of the Nezperce National Forest in Idaho revealed 138,692 acres of aerially visible top kill and tree mortality due to repeated defoliation by western spruce budworm, *Choristoneura occidentalis* Freeman. A small ground sample indicates that up to 47 percent of the grand fir volume was affected by top kill in some areas. True firs were most severely affected by repeated defoliation, and Engelmann spruce was intermediately affected. No top kill or tree mortality was observed on Douglas-fir.

INTRODUCTION

Defoliating insects are known to have far-reaching effects on the forest resource. Direct effects on trees include mortality, growth loss, defect, and increased susceptibility to secondary insects and disease (Kuhlman 1971). From the standpoint of the resource manager, these might have a wide range of both beneficial and detrimental effects on all resources including timber, forage, wildlife, recreation, and watershed values. Precise data on impacts of defoliation is sketchy or often unavailable. Consequently, resource managers are unable to obtain precise information to establish realistic cost-benefit ratios to decide for or against pest management efforts designed to reduce existing losses.

The western spruce budworm, *Choristoneura occidentalis* Freeman, is the most widespread defoliator in the forests of the Northern Rocky Mountains. This insect has been at epidemic levels in portions of Montana and Idaho since the late 1940's. In recent years, this insect has defoliated in excess of 4 million acres of Douglas-fir, true fir, and spruce forests in the Northern Region annually (Ciesla et al. 1971, 1972; Dooling and Dewey 1973).

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Western spruce budworm reached epidemic levels on the Nezperce National Forest in north central Idaho in 1965 and soon caused extensive defoliation over large areas. In 1971, a total of 1,337,000 acres suffered aerially visible defoliation (Ciesla et al. 1972). Trees suffering a top kill (cover photo) and tree mortality occurred over extensive areas as a result of repeated defoliation. In 1972 a survey was initiated to measure and document this loss. This report is a progress report on information acquired to date.

METHODS

An aerial survey was conducted over the entire Nezperce National Forest exclusive of wilderness areas, compartment by compartment, and areas of top kill and mortality were mapped. This survey was flown during mid-July immediately prior to peak spruce budworm defoliation. Top kill and mortality were easily separated from areas merely defoliated by the presence of an overall grey cast to the forest as opposed to defoliation which usually appears as a reddish-brown color.

Preliminary ground data on characteristics of the damaged stands were obtained from a small number of variable (BA = 20) plots established in infested stands on Asbestos Peak, Clearwater District[3/], and in the Newsome Creek drainage, Elk City District. Sample trees were classified into three categories:

1 - Green, undamaged
2 - Top killed
3 - Entire tree killed

RESULTS

A total of 138,692 acres of forested land within the boundaries of the Nezperce National Forest were classified as having noticeable top kill and tree mortality. An additional 3,800 acres occurred on Bureau of Land Management and private lands surrounding Elk City (table 1). Damaged stands were concentrated north and west of Elk City (fig. 1), particularly in the Newsome Creek drainage.

The ground sample provided somewhat of a cross section of conditions within infested stands on the Nezperce National Forest. The Asbestos Peak stand is an *Abies lasiocarpa - Xerophyllum tenax* habitat type (Daubenmire and Daubenmire 1968) and has suffered relatively little permanent injury. A total of 6.4 percent of the volume is on stems which have suffered top kill, and 3.5 percent of the volume had been killed. All permanent injury occurred on subalpine fir (table 2).

3/ Henry C. Lerandeau, forester, Clearwater District, assisted with this survey.

Table 1.--Acres of aerially visible top kill and tree mortality by compartment, Nezperce National Forest, Idaho, 1972

Compartment number	Acres of top kill and mortality	Compartment number	Acres of top kill and mortality	Compartment number	Acres of top kill and mortality
103	280	412	200	804	10,520
117	130	413	1,560	805	4,112
122	200	414	5,840	806	2,080
123	600	415	1,040	807	740
201	240	416	600	808	3,080
202	20	419	500	809	2,120
204	560	421	1,700	810	5,760
205	480	422	1,840	811	7,840
209	2,880	423	400	812	5,240
210	500	506	500	813	2,120
212	690	507	7,100	814	100
213	840	508	400	815	450
301	400	510	200	816	580
302	600	528	960	817	880
303	800	709	100	818	1,230
306	4,400	710	800	819	1,520
307	2,280	718	400	820	1,240
312	2,600	719	2,040	822	3,440
313	1,760	720	120	823	660
314	200	721	3,000	824	360
316	480	722	1,880	825	1,760
317	3,040	727	160	826	100
318	1,080	801	7,720	828	1,280
319	480	802	8,120	Σ =	138,692
330	1,920	803	4,480		

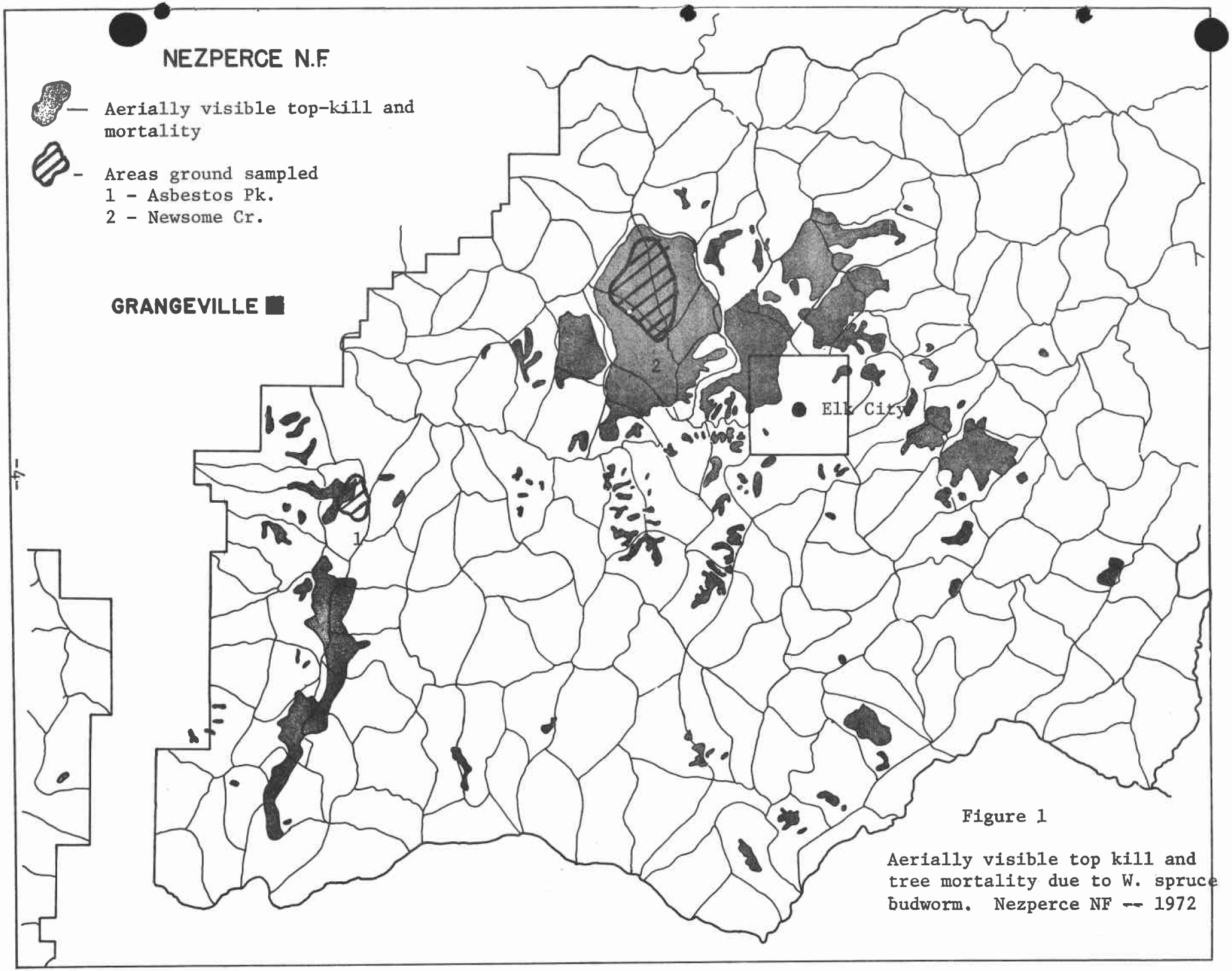

Figure 1

Aerially visible top kill and tree mortality due to W. spruce budworm. Nezperce NF -- 1972

Table 2.--Top kill and tree mortality due to western spruce budworm in two sample sites, Nezperce National Forest, Idaho, 1972

Tree class	Species	Trees/acre	Net volume/acre (board feet)	Average d.b.h.
	ASBESTOS PEAK (10 PLOTS)			
Undamaged	Grand fir	4.5	11	9
	Subalpine fir	15.8	1,898	13
	Western larch	23.0	1,923	10
	Engelmann spruce	84.2	1,725	6
	Lodgepole pine	56.0	1,284	6
	Ponderosa pine	2.2	155	13
	Douglas-fir	8.6	390	11
	Subtotal	194.3	7,386	--
Top killed	Subalpine fir	92.3	528	4
Dead	Subalpine fir	3.7	292	10
	Subtotal	96.0	820	--
	Total	290.3	8,206	--
	NEWSOME CREEK (7 PLOTS)			
Undamaged	Grand fir	115.7	706	6
	Western larch	1.7	1,510	25
	Engelmann spruce	35.8	4,455	13
	Lodgepole pine	30.9	1,713	7
	Douglas-fir	2.9	846	19
	Subtotal	187.0	9,230	--
Top killed	Grand fir	108.9	7,505	11
	Engelmann spruce	17.2	1,363	11
	Subtotal	125.9	8,868	--
Dead	Grand fir	35.4	349	5
	Subalpine fir	5.2	338	10
	Subtotal	40.6	687	--
	Total	353.5	18,785	--

The Newsome Creek stand was classified as an *Abies grandis - Pachystima myrsinites* habitat type and was located in the heart of the area of permanent injury on the Forest (fig. 1). In Newsome Creek 35.6 percent of the stems in the stand suffered top kill, accounting for 47 percent of the volume. An additional 3.6 percent of the volume had been killed by repeated defoliation. Most of the permanent injury occurred on grand fir with a minor amount of top kill and tree mortality on Engelmann spruce and subalpine fir (table 2). Douglas-fir, an important host of the western spruce budworm, occurred in small numbers in both areas but apparently did not suffer top kill or tree mortality.

DISCUSSION

This evaluation indicates that the current spruce budworm outbreak on the Nezperce National Forest has caused extensive top kill and tree mortality of grand fir and other hosts. The ground survey data presented thus far is based on a small sample; however, a multistage aerial photo-ground survey is planned for 1973 to obtain more detailed data on degree of top kill, tree mortality, and growth loss.

Based on the data collected here, true firs--grand and subalpine--are most conspicuously affected by repeated western spruce budworm defoliation on the Nezperce National Forest. This is in agreement with data presented by Williams (1966) for eastern Oregon which indicates that grand fir was most severely affected by western spruce budworm with Engelmann spruce somewhat less affected, and Douglas-fir and ponderosa pine least affected.

Top kill is the most commonly occurring and most conspicuous effect of defoliation on the Nezperce National Forest. This may result in deformity and loss of height growth, and dead stems may provide an infection court for decay fungi. Stillwell (1956) reports that balsam fir, *Abies balsamea*, which contained top-killed leaders 0.5 inch or larger in diameter in New Brunswick as a result of a spruce budworm outbreak during 1912-20, contained some measure of decay. Wickman and Scharpf (1972), on the other hand, report that decay defect in white fir, *Abies concolor*, top killed by Douglas-fir tussock moth, *Hemerocampa pseudotsugata* McD., in California was not economically serious. Decay is of major consequence in grand fir in Idaho. On the Nezperce National Forest a cull factor of 50 to 60 percent is considered "normal." Studies are needed to establish the importance of western spruce budworm defoliation caused top kill as an infection court for entry of decay fungi in the Northern Region.

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