RECOVERY OF SNOW-BENT YOUNG WESTERN LARCH

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RESEARCH SUMMARY

Heavy winter snowfalls are common in the subalpine forests of the Northern Rockies. These forests are generally well adapted to winter snows. But occasionally unseasonal, heavy, wet snows damage these forests. In June 1966, a heavy,wet snow flattened many young stands in the Flathead area of northwestern Montana. Included was a 13-year-old western larch stand on one of our stand development study areas on Coram Experimental Forest. Photographic evaluations of this stand over an 11-year period following the snowfall showed that: (1) all trees in the sample, regardless of severity of the snow damage, eventually recuperated; (2) slightly snow-bent trees returned to vertical within 2 years, moderate and heavily snow-bent trees within 4 years, and severely snow-bent trees within 6 years; (3) the most apparent aftereffects were crooks in the tree boles, with the extent of crook deformities directly related to the severity of the snow bend: (4) dominant and nondominate trees recovered at about the same rate. These results illustrate phenomenal recuperative abilities of vigorous young larch and demonstrate to the manager that snow bend doesn't always reduce his management options.

INTRODUCTION

Heavy snowfalls are common in the subalpine forests of the Northern Rockies. Favorably, snow provides much of the moisture for these forests. Unfavorably, heavy wet snow that accumulates on the crowns can damage trees extensively over large areas. In addition, movement of deep snowpacks down the steep mountainside can seriously deform trees (Leaphart and others 1972).

Snow damage is certainly not an uncommon phenomenon in conifer forests of the Northern Rockies, but its occurrence is erratic and unpredictable. Effects may range from a significant forest management problem to a mere ripple in the flow of forest succession. In some cases snow damage may help the manager--hastening the thinning of natural overstocked stands by reducing the number of trees per acre (Haig and others 1941; Blum 1966). However, this same amount of damage and mortality is not welcome in stands that have been thinned or planted--they are already near their desired stocking level.

What is this paper about?

The results of snow damage in a young western larch (*Larix occidentalis* Nutt.) forest are reported in this paper. Larch is a deciduous conifer, losing most of its needles in October. Thus, larch is essentially bare during the winter snow period with no crown to "catch" the snow. As a result, snow is not commonly thought to be a threat to larch (Schmidt and others 1976).

Because larch is deciduous, natural selection for snow damage resistance has probably been less rigorous for larch than for some of its associate conifers. Thus, when larch has a full complement of needles, it may be less resistant to snow than other conifers.

Why did we study snow-bend?

On June 4, 1966, forested areas in the Flathead River drainage of northwest Montana were blanketed with 6 to 8 inches (15-20 cm) of heavy, wet snow. By this date, larch needles are fully developed. One of our stand development study areas on Coram Experimental Forest was in the main path of the snowfall. Most of the sapling stands--primarily western larch--on the Forest were flattened by the weight of the snow blanket. It appeared as if the young stands were "mowed down." However, closer examination revealed that

damage was not uniform within stands; some trees were horizontal, others stood at 45 degree angles, and others were only slightly bent. Snow bend predominated but some trees had broken tops or split stems.

Would the snow-bent trees eventually straighten up? Would the larger dominant trees recover as well as or as rapidly as the smaller codominant and intermediate trees? Would there be any tree mortality? If they recovered, how long would it take?

How did we study snow-bend?

To answer these questions, we devised a pictorial scheme to evaluate recovery of the trees. We selected individual trees by damage categories and crown class and photographed them from the same point over a period of 11 years--annually the first 5 seasons, and again in the 9th and 11th seasons. We chose the following categories:

Damage classes

Slight (averaged 15° from vertical)
Moderate (averaged 31° from vertical)
Heavy (averaged 56° from vertical)
Severe (averaged 67° from vertical)

Crown Classes

Dominant
Nondominant (mainly intermediates with some codominants)

Replicates

Three
This made a total of 24 trees photographed.

We took the first series of photographs June 29, 1966, about 3 weeks after the snowfall. Some of the trees had already started recovery from the snow bend so, if anything, the initial angles of snow bend are conservative. Most photos were repeated in June or July, but some were taken in the fall or spring when the trees were defoliated to better illustrate crooks and bends of the main bole.

The trees we sampled were part of a 13-year-old larch stand that had been thinned 5 years earlier. Sufficient time had elapsed since thinning for the trees to fully adjust to their current stand density and the stand was in a good healthy condition at the time of

What did we learn about snow bend?

the snowfall. Stand densities around the sample trees ranged from 300 to 1,700 trees per acre (120 to 680 trees per hectare) but no attempt was made to sample by stand density. This area is a good quality site for larch, falling in the *Abies lasiocarpa/Clintonia uniflora* habitat type (Pfister and others 1977). At the time of the snow, the stand averaged about 15 feet (4.5 m) in height.

Very simply, the slightly snow-bent trees rapidly returned to vertical with few after-effects--the severely snow-bent trees returned slowly to vertical and suffered more after-effects such as crooks in the bole. The basis for this is shown in both pictorial examples (fig. 1) and in schematic drawings that highlight the bole configurations (fig. 2).

To quantify the recovery rates, we measured the angle from vertical of every sample tree (fig. 3). As shown in table 1, the slightly snow-bent trees returned to vertical the second growing season, the moderate and heavy the fourth growing season, and the severely snow bent the sixth growing season (we considered any angle under 5 degrees vertical).

Table 1.--*Angle from vertical of snow-bent trees by original snow-bend category and year*

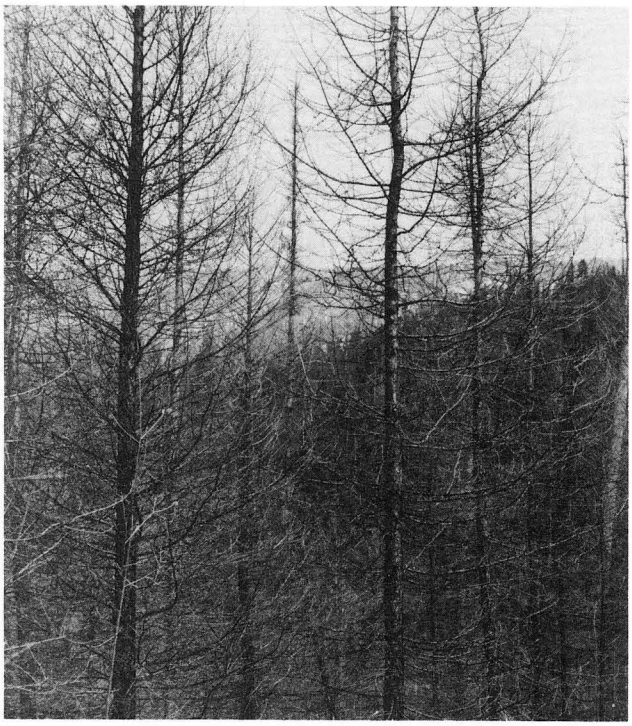
Snow-bend category	Snow-bend angle from vertical					
	1966	1967	1968	1969	1970	1971
	Degrees					
Slight	15	0	1	0	0	0
Moderate	31	7	5	3	3	1
Heavy	56	13	6	3	0	0
Severe	67	30	20	10	5	4

1966

1967

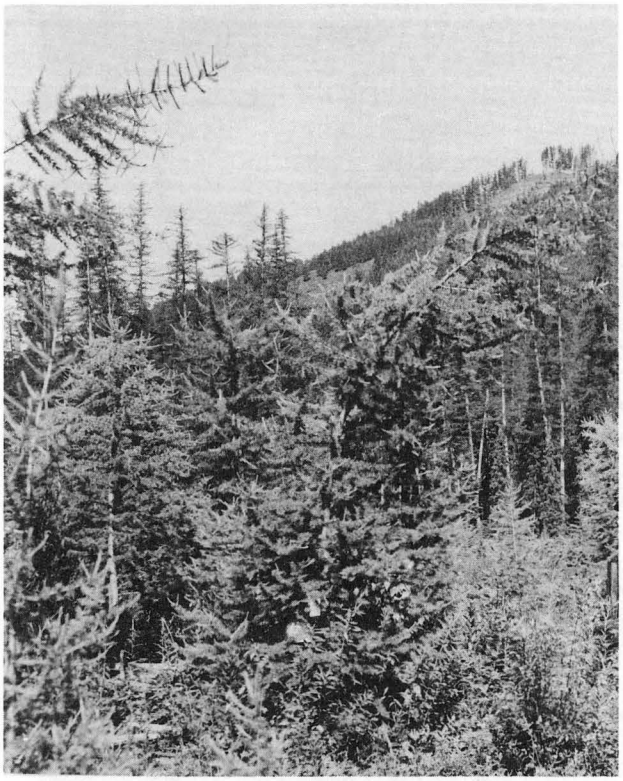
Photo series A = slight snow bend.

1970

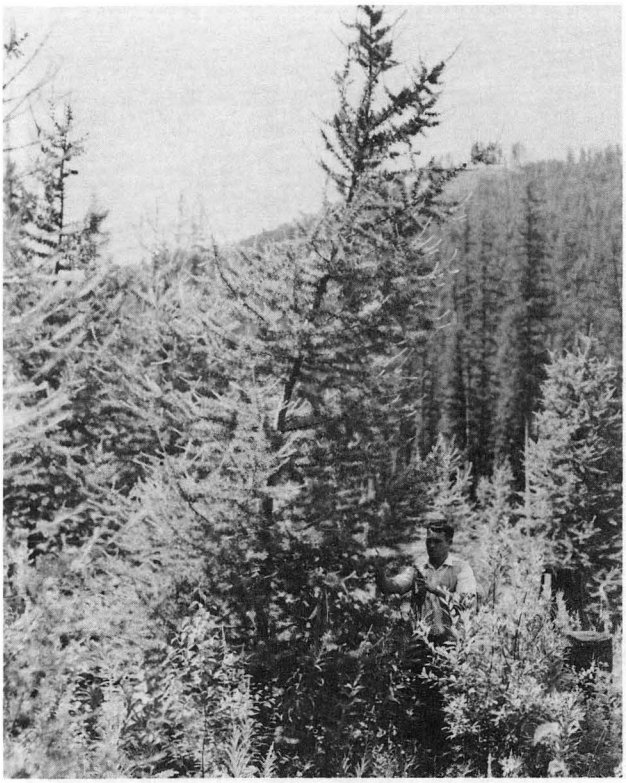


1976

Figure 1.--Initial snow-bend categories and trees' rate and extent of recovery during an 11-year period. Trees were 13 years old when initially snow bent.



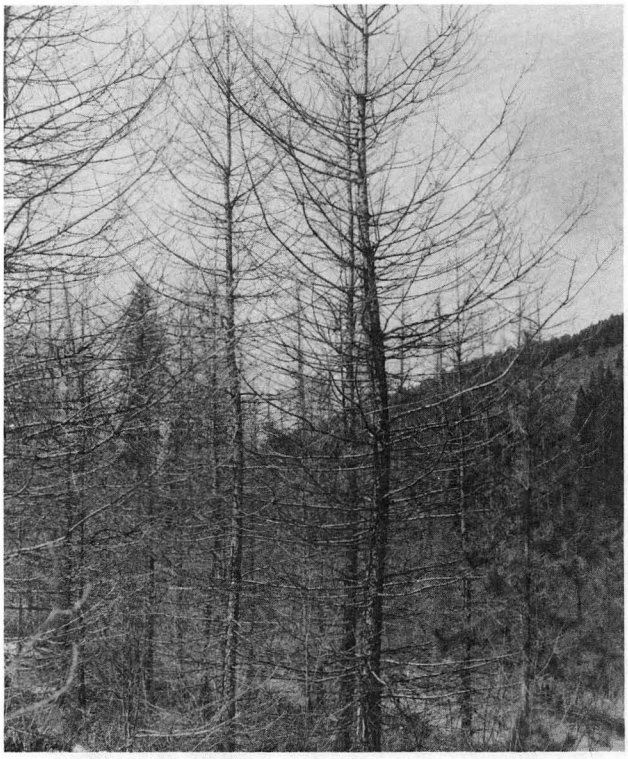
1966



1967

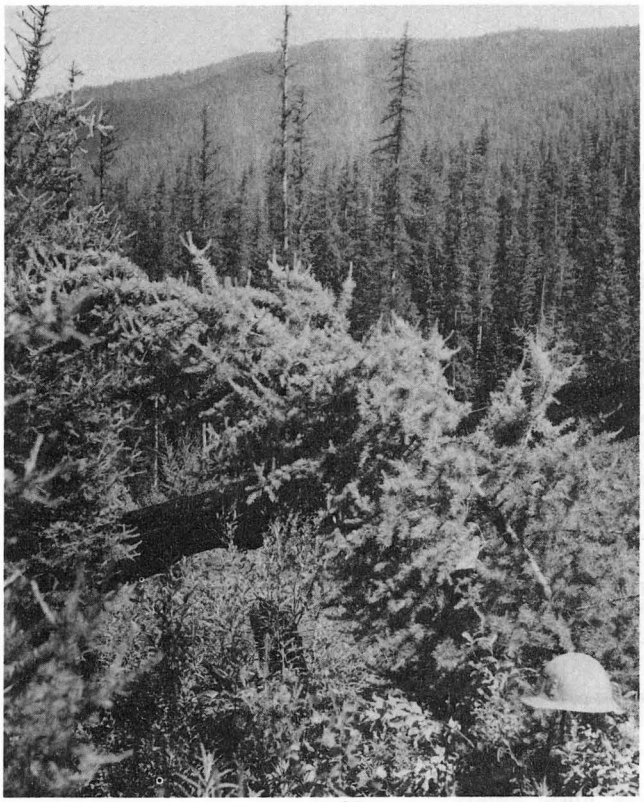
Photo series B = moderate snow bend.

1970



1976

Fig. 1 con.

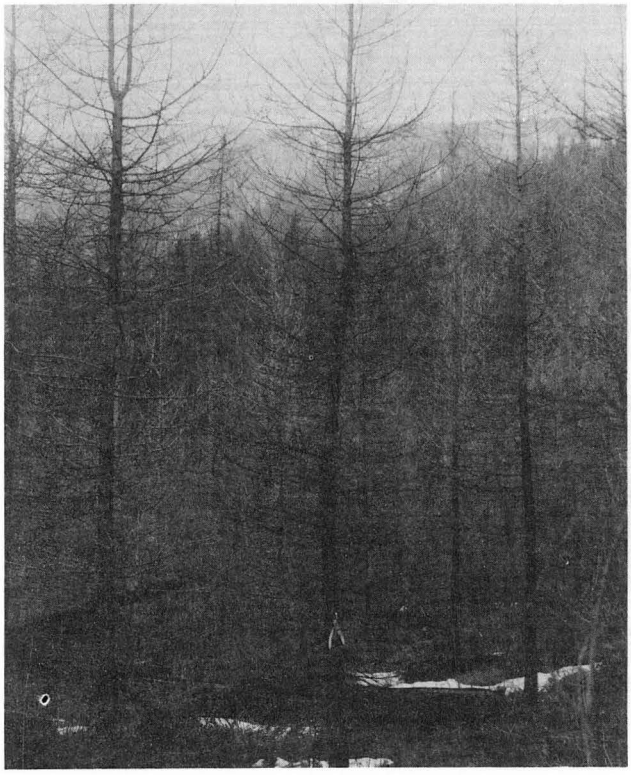


1966

Photo series C = heavy snow bend.

1967

1970



1976

Fig. 1 con.

1966

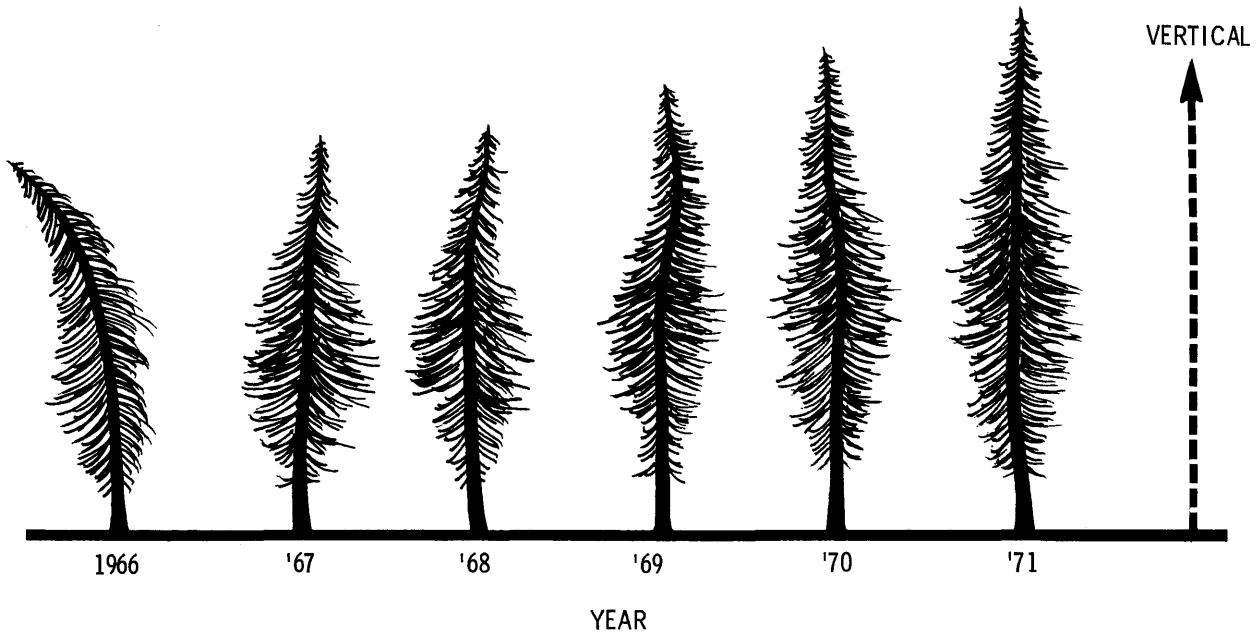
1967

Photo series D = severe snow bend.

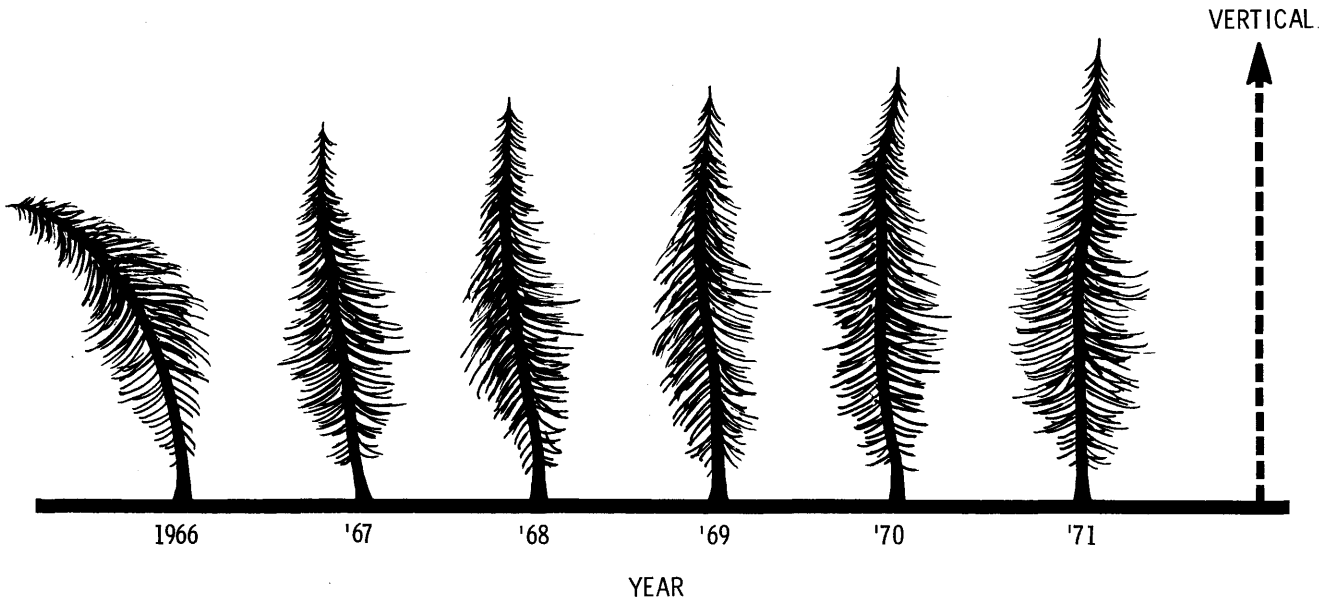
1970

1976

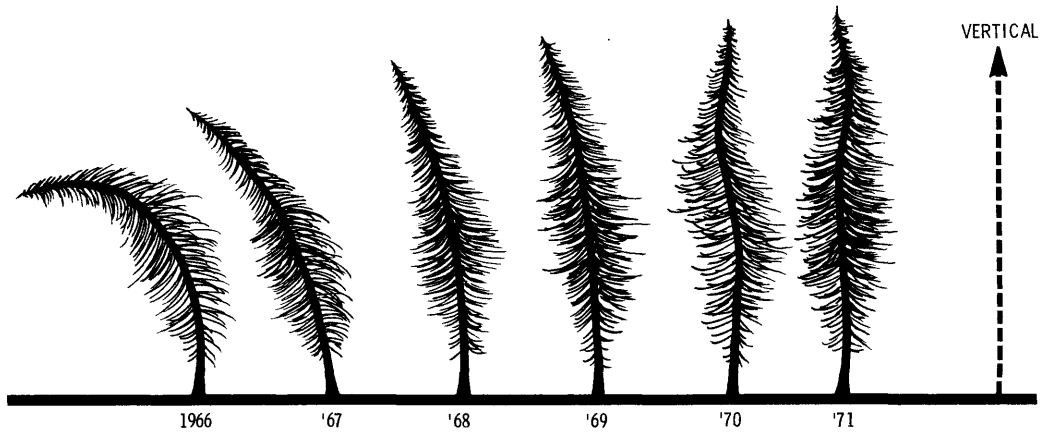
Figure 2.--Schematics from actual examples of tree recovery by snow-bend category and year, with emphasis on bole configuration.



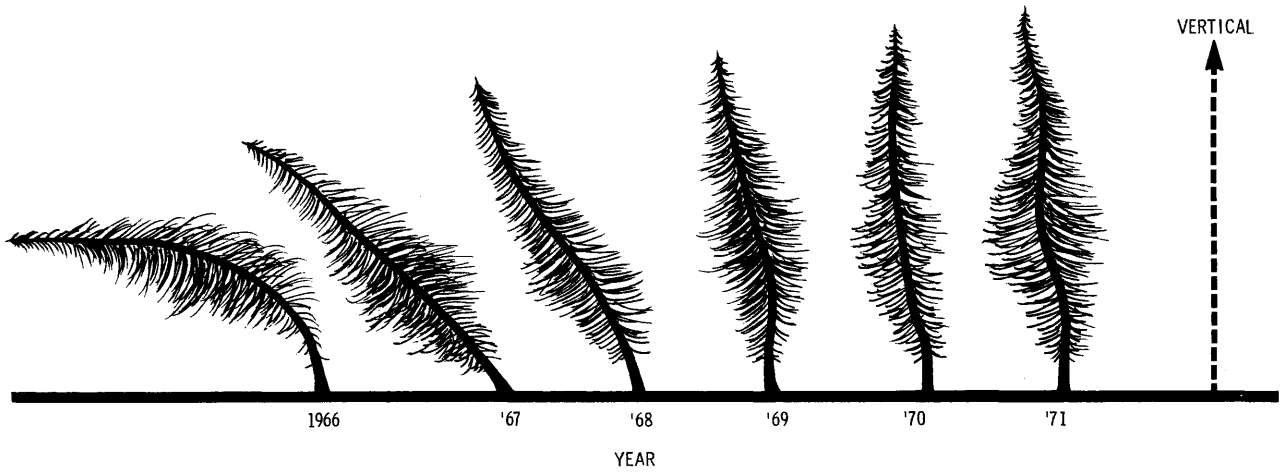
Schematic A = slight snow bend.



Schematic B = moderate snow bend.



Schematic C = heavy snow bend.



Schematic D = severe snow bend.

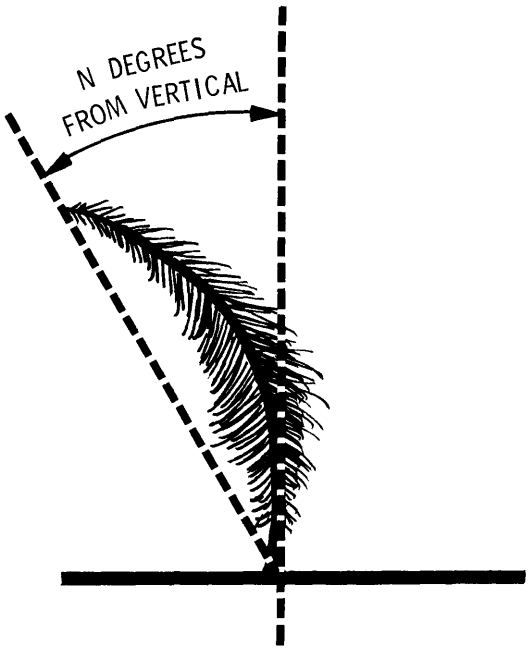


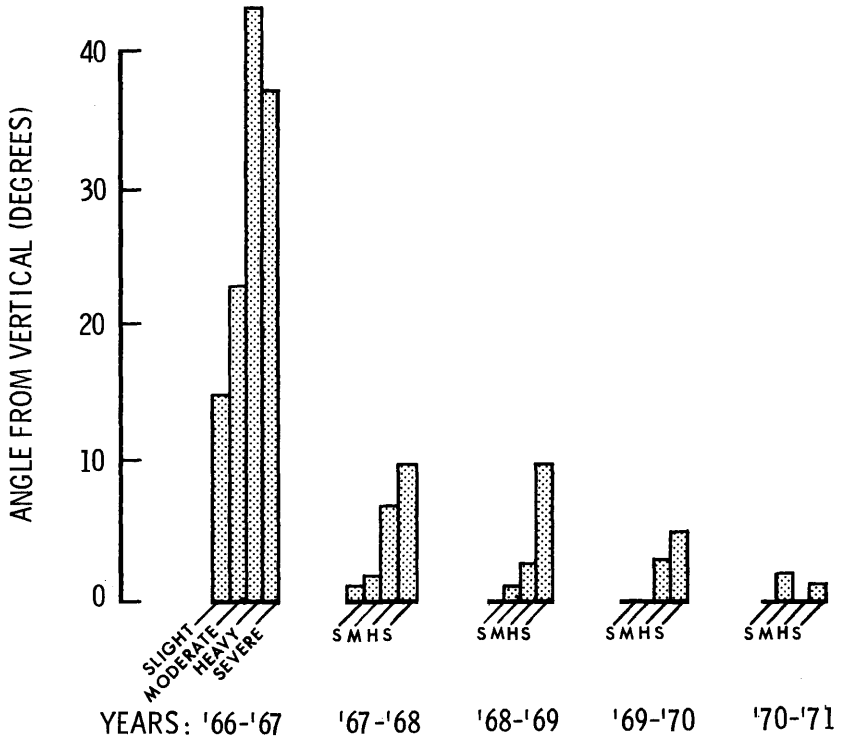
Figure 3.--How we measured snow-bend angle from vertical.

All the trees rapidly approached vertical with the most dramatic changes (percentage) occurring in the most heavily snow-bent trees in the first year (fig. 4). The annual change in angle differed significantly between initial snow-bend categories. However, we detected no significant differences between tree crown classes--dominant and nondominant trees recovered at the same rates.

As shown schematically in figure 5, trees tended to overcorrect in response to snow bend. The terminal leader grew vertically, regardless of the angle of the bole. In the meantime, the bole itself reapproached a vertical position. This in turn threw the terminal into a reverse angle from the initial snow-bend angle. The next season, the process reversed itself and crooked boles resulted. Usually, the crooks that developed from this process ameliorated. It is doubtful if there will be any significant long-term effect of this overcorrection process.

Snow bend stimulated abnormal needle tufting in larch. Tufts (or clumps) of needles were observed on snow-bent trees, with few or none on the slightly snow-bent and many on the most heavily snow-bent trees. Minor amounts of this abnormality were observed as soon as one year (1967) after the snow, then gradually building up and becoming most pronounced in the 4th and 5th seasons after the snow. This abnormality then gradually subsided until the 11th season when no more tufting was observed. Snow damage apparently triggered physiological processes that resulted in adventitious growth--most likely a survival mechanism for larch.

Figure 4.--Annual angle change during the period of recuperation from snow bend by snow-bend category.



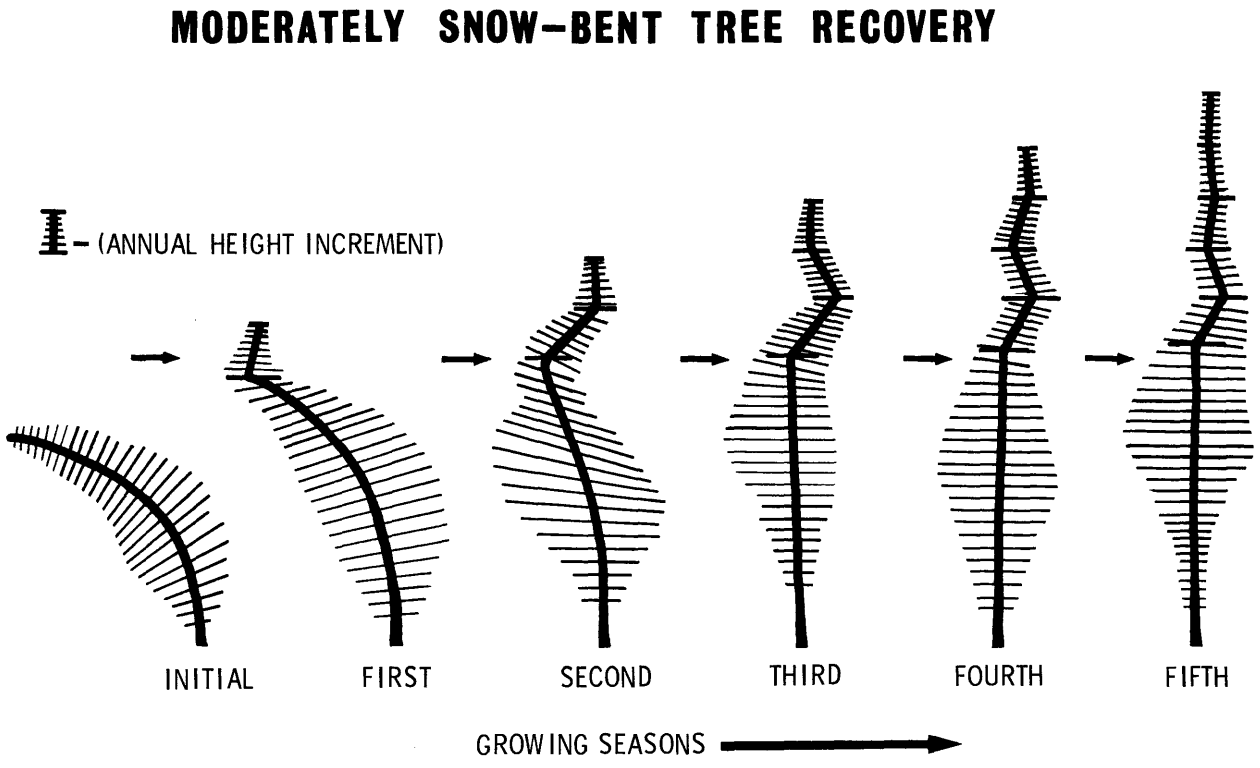


Figure 5.--Schematic illustration of snow-bend recovery showing the tendency of larch trees to overcorrect and in the process produce crooks in the boles.

What do we conclude about snow-bend?

Don't despair if you see your young larch flattened by a late spring snow. All is not lost. In all likelihood they will recover. There will be some crooked boles for a while but even they will not be a significant problem a decade or so later. This corresponds to similar observations of conifers in the Cascade Mountains (Williams 1966).

We speculate that successive years of late spring snows would produce a much less favorable recovery. The more severely snow-bent trees would likely gather a heavier load of snow while in that position, thus perpetuating the condition. As a result we would expect many malformed trees. However, that didn't happen in the course of this study and likely has a low probability of happening.

A word of caution--the results reported here are from a forest that was not heavily overstocked and that had the advantages of youth. Hence, the trees were in excellent condition. Had these trees been very recently thinned from a heavily overstocked condition, or had they been an older age, recovery might have been much less favorable.

Young larch are very supple and capable of rapid recovery. The strong apical dominance characteristics of larch contribute heavily toward its ability to recover from snow, as well as a host of other physical and biological factors.

What have other author's found?

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1979. Recovery of snow-bent young western larch. USDA For. Serv. Gen. Tech. Rep. INT-54, 13 p. Intermt. For. and Range Exp. Stn., Ogden, Utah 84401.

This paper illustrates how much, how long it takes, and the method in which young western larch responds to snow bend. A 13-year-old vigorous larch stand was flattened by a heavy, wet snow in June 1966 in northwestern Montana. We recorded photographically how two different crown classes (dominant and nondominant) of young larch subjected to four levels of snow bend (slight to severe) recuperated during the 11-year period following damage. The vigorous condition of the supple young larch contributed greatly to their remarkable recover.

KEYWORDS: Larix occidentalis, western larch, snow bend, snow damage, crooked boles.

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