

RELATIONSHIPS BETWEEN OCCURRENCE OF BEAR DAMAGE AND CLEARCUTTING IN CENTRAL HONSHU, JAPAN

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Abstract: Damage to coniferous trees by black bears (*Selenarctos thibetanus japonicus* Schlegel) was studied in 1 man-made stand recently clearcut and in another stand 20 years old, in west-central Honshu. Diameters of stumps of bear-damaged trees in the man-made stand ranged from 9.8 cm to 29.8 cm, and, in the 20-year-old stand, trees with a dbh greater than 10.4 cm became susceptible to damage. Information on geographical distribution and history of bear damage and on species and ages of bear-damaged trees was obtained by questionnaire. Relating changes in the pattern of bear damage to the practice of clearcutting and to great declines in natural forests more than 51 years old shows that when clearcutting and man-made forests are extensive, bear damage to man-made forests increases.

Tree damage by the Japanese black bear usually occurs on coniferous species such as Japanese cypress (*Chamaecyparis obtusa*), Japanese larch (*Larix leptolepis*), cryptomeria (*Cryptomeria japonica*), fir (*Abies firma*), and Japanese white pine (*Pinus parviflora*). The damage occurs when the bears peel the bark from the basal portions of the trees and eat the exposed sapwood, leaving a pattern of vertical grooves made with their teeth.

The objective of this study was to find out why bears feed on sapwood or the inner portion of the bark of coniferous trees. As a first step in our study, the following subjects were investigated: (1) characteristics of bear damage, (2) geographical distribution and past history of bear damage, and (3) changes in clearcut areas of natural forests, and in man-made forests apparently susceptible to bear damage.

The term *natural forest* refers to forest stands older than 51 years, because in these stands, the natural Japanese cypress, Japanese white pine, and fir are scattered and might be the objects of bear damage. Also, a more abundant supply of food might be available in the older stands than in man-made forests and young natural forests.

STUDY AREAS AND METHODS

To determine the characteristics of bear damage, diameter measurements were made in August 1975 and July 1976 at 2 damaged Japanese cypress stands in the vicinity of the yamanokuchi River, Mashita district, Gifu prefecture (Fig. 1). One stand was cut in 1974 and the other was a 20-year-old stand. Most trees in man-made forests in this district are Japanese cypress. In the area that had been cut, diameters at heights ranging from 20 cm to 50 cm from the ground were measured

both for bear-damaged trees and nondamaged trees. In the 20-year-old forest stand, which was damaged in 1976, diameters at breast height (dbh) were also measured. In addition, in the cutover area, the year and diameter of damage occurrence were determined from an examination of scars that remained on stumps. The area covered by this investigation was about 4 ha, at an elevation of about 1,000 m.

A questionnaire was found to be the only practical way of obtaining information on the geographical distribution and history of bear damage. The questionnaire was sent to personnel directly involved in the management of forests in the villages of Maze and Kiyomi and the town of Hagiwara. Of 890 questionnaires sent, 369 were returned.

The questionnaire asked for the following basic information (1) geographical distribution of bear damage, (2) past history of bear damage, and (3) species and ages of bear-damaged trees.

To study changes in forest areas susceptible to bear damage, the vegetation was divided into 4 forest types — man-made Japanese larch forest; man-made cryptomeria forest; man-made Japanese cypress forest; and natural forest, including virgin and second-growth forest. Age-class areas in each forest type were calculated from their forest description tables.

RESULTS

The investigation showed that bear damage in the cutover area in the man-made Japanese cypress forest was first seen in 1947 and had been seen, since then, over a period of 24 years. It was also determined that concentrated bear damage was observed during 1961-63, affecting about 81 percent of all bear-damaged trees counted. The ratios of the diameters (at

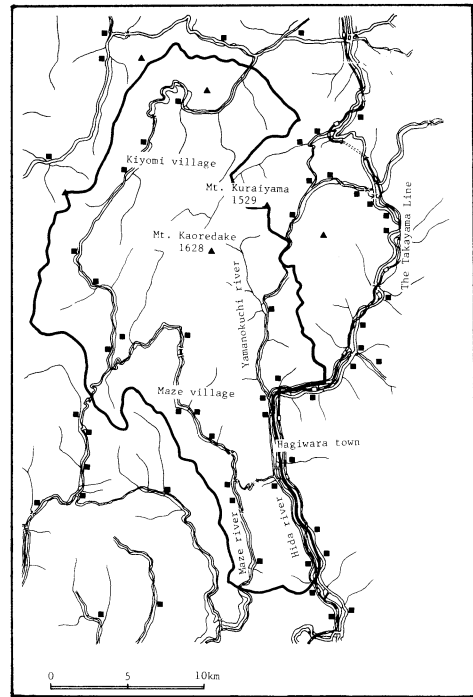


Fig. 1. Study area, Gifu prefecture, Honshu. Study area is enclosed in bold line. ■ rural settlement

stump) of nondamaged trees in this forest stand to those of bear-damaged trees at that time are shown in Fig. 2.

The bear damage occurred to the larger trees. Diameters of stumps of bear-damaged trees ranged from 9.8 cm to 29.8 cm. The average stump diameter of all trees was 15.8 cm.

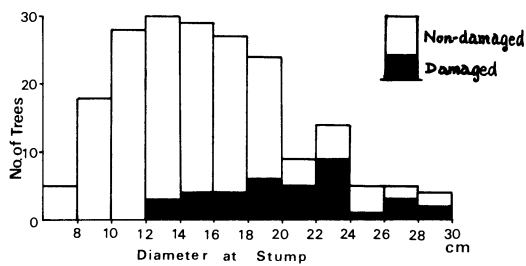


Fig. 2. Number of damaged trees by diameter class as determined from examination of 199 trees in cutover areas of Japanese cypress stands.

Fig. 3 shows dbh of trees and percentage occurrence of bear damage in the man-made Japanese cypress forest that is 20 years old. When the average dbh exceeded 10.4 cm, bear damage was seen. The relation between dbh and bear damage, according to the data

currently available, is shown in Table 1. It is known that bear damage appears when the average dbh in man-made Japanese larch forests and man-made cryptomeria forests exceeds 10-12 cm. As a result, a forest stand where average dbh is greater than 10 cm is hereinafter called an *apparently susceptible man-made forest*.

According to the standard growth curve obtained for man-made forest stands in this region, Japanese cypress, cryptomeria, and Japanese larch attain an average dbh of 10 cm in 20-30 years, 20 years, and 16-20 years,

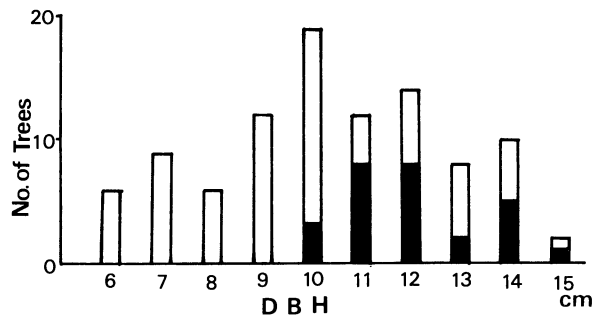


Fig. 3. Number of damaged trees by diameter class as determined from examination of 105 trees in stand of 20-year-old Japanese cypress.

Table 1. Average size of timber in damaged forest stands in 4 prefectures, Honshu.

Tree species	Age (years)	Average dbh (cm)	Sampled area (ha)	Study area	Source
Japanese cypress	30	18.0	1.03	Shizuoka	Teramoto and Omori 1952
Japanese cypress	29	14.9	1.27	Shizuoka	Kobayashi and Morisawa 1952
Cryptomeria	37	25.6	0.20	Yamagata	Imano et al. 1969
Cryptomeria	About 30	22.6	0.07	Kyoto	Watanabe et al. 1970
Cryptomeria	About 30	22.0	0.15	Kyoto	Watanabe et al. 1970
Cryptomeria	17-20	14.7-16.1	0.25	Kyoto	Watanabe and Komiyama 1976
Cryptomeria	16-18	12.3-14.1	0.25	Kyoto	Watanabe and Komiyama 1976
Japanese larch	22	19.2	0.25	Nagano	Furubayashi et al. 1975
Japanese larch	20	10.6	0.08	Nagano	Furubayashi et al. 1975
Japanese larch	20	20.2	0.10	Nagano	Furubayashi et al. 1975
Japanese larch	18	12.2	0.10	Nagano	Furubayashi et al. 1975
Japanese larch	13	15.1	0.09	Nagano	Furubayashi et al. 1975
Japanese larch	12	11.8	0.06	Nagano	Furubayashi et al. 1975
Japanese larch	11	10.9	0.10	Nagano	Furubayashi et al. 1975

respectively. Apparently susceptible man-made forest stands in the study areas would be those that are older than the ages mentioned above.

The distribution and historical changes in locations of bear damage in the natural forests and in the apparently susceptible man-made forests were studied to determine the effects of clearcutting natural forests areas. The results are shown in Figs. 4 and 5.

DISCUSSION

Natural forest older than 51 years has dramatically decreased over time. Only remnants of natural forest remain; the apparently susceptible man-made forest has increased rapidly since 1970. Paralleling this trend, areas of bear damage are expanding (Fig. 6). These trends are particularly marked in the central part of the

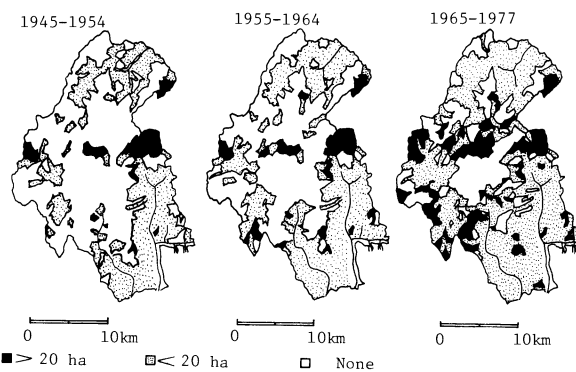
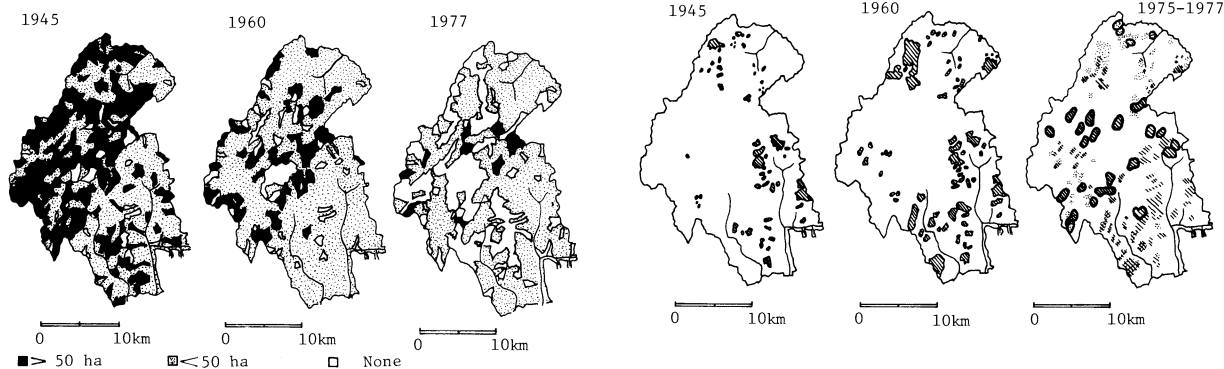

Fig. 5. Distribution of man-made forests apparently susceptible to bear damage as determined from forest description table.

Fig. 4. Distribution of natural forest land in 1945, 1960, and 1977 as determined from forest description table.

Fig. 6. Distribution of bear damage as determined from questionnaire data. Dotted areas indicate bear damage in natural forests. Shaded areas indicate bear damage in man-made forests. Areas in bold outline indicate locations of bear damage since 1972.

study area. In this central area, about 3,000 ha were clearcut after 1955. The clearcutting must have caused a very sharp decrease in the number of coniferous trees likely to receive bear damage. Possibly because of this decrease, bear damage is occurring more frequently and more widely in the man-made forests surrounding the clearcut natural forests. Even in the area where bear damage was seen before 1955, and where man-made forest stands are now susceptible to bear damage, damage spreads from 1 forest stand to another.

In the man-made forests of Japanese cypress, cyp-

tomeria, and Japanese larch, all of which were planted in the cutover areas, bear damage first occurred about 1975, the time when the trees became big enough to be subject to bear damage. In other words, where clearcuts and man-made forest plantations are extensive, bear damage is generally seen more frequently in man-made forests. The increase in man-made forest stands serves to impair the quality of bear habitat by reducing the supply of the bear's natural foods. Even without hunting pressure, it will become harder for the bear to survive in these large man-made forest areas.

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