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The Effects of Harvesting Operations on Broadleaf Forest Stand

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Abstract: This study was carried out in the northern forests of Iran (i.e. Hyrcanian Forests) near the Caspian Sea at compartment 14 in the Neka Chob Company. These forests are completely mixed natural broadleaf forests. All of remain trees in that compartment were measured (100%) as damaged and undamaged trees based on depth, size and location of wounds on trunks. This research has shown that approximately 7 trees per hectares were damaged during the harvesting operations. More than 90% of wounds were located at h<1 m from the ground level. About 8% of wounds are cambium damage and in totally about 75% of them are big in size.

Key words: Forest harvesting, hyrcanian forest, cambium damage, bark damage

INTRODUCTION

The Northern forests of Iran (i.e. Hyrcanian Forests) are located in north of Iran near the Caspian Sea. All of these forests are completely natural mixed broadleaf forests. Scientific forestry plans started about 40 years ago with introducing the shelterwood and selection systems.

A study in Iran has shown that 54% of wounds were located at h<1 m from the ground level on trunk of remain trees which damaged during the harvesting operations[1], while another research showed amounts of 69% and also indicated that 5% of all damages were cambium damage[2]. Hamidi[3] indicated that amounts of wounds on remain trees by shelterwood system are significantly more than the selection system.

A research in Iran has shown that 17.5% of regeneration was damaged by skidding operations in a shelterwood system in the Hyrcanian Forests[4], while another study put the damage level at 14.5%[5]. Whitman *et al.* [6] reported damage levels of 50% to trees and 15% to seedlings in a selection harvesting operation in northern Belize, while Bertault and Sint[7] reported damage levels as high as 41% of all remaining trees after logging operations in natural forests in East Kalimantan.

Pavel[8] evaluated the amounts of trees damaged during the harvesting operations in the Skina River areas were 12 trees per hectares and most of wounds had 400 cm^2 in surface areas.

This study will discuss the effects of forest harvesting on remain trees in a compartment of the Hyrcanian Forests of Iran.

MATERIALS AND METHODS

The study site: The study site was located near the town of Sari in the center of the Hyrcanian Forests of Iran at compartment of the Neka Chob Company (Fig. 1). The canopy cover was 75% and the standing timber volumes were 345 m^3 ha^{-1}. The soil type was a forest brown earth with a moderate pH (i.e nearly 7). The under-lying geology was lime stone. The vegetation association is *Fageto carpinetum* with alder (*Alnus* sp.), maple (*Alnus* sp.), oak (*Quescus castanifolia*) and Persia (*Parrotia persica*). This site is managed using the selection system. Total surface area was 30 ha.

Harvesting system: Trees felling was carried out motor-manually. The skidder was used a wheeled Timber jack 450 C model with a weight of 9.8 t and 174 hp engine. The width of the machine was 3.8 m and length 6.4 m. The landing was located at the down of the hill at roadside and the timber was extracted uphill to landing. Three extraction tracks were used in this compartment.

Damage measurement: After the harvesting operations, all trees with diameter more than 30 cm were measured in this compartment. For each tree, five characters were measured: 1) name of species, 2) diameter in depth, 3) location of wound on trunk, 4) depth of wound and 5) surfaces of wounds. Locations of wounds are divided to three classes: a) h <1 m b) h = 1-2 m and c) h >2 m from ground level. The depth of wound divided to two classes: a) bark damage and b) cambium damage. The surfaces of wounds are divided to three classes: a) small size; s<100 cm^2 b) medium size; s = 100-1000 cm^2 and c) big size; s>1000 cm^2.

RESULTS AND DISCUSSION

Table 1 shows summary information for the harvesting damages. In generally, about 5420 trees were measured in that compartment which 271 of them were damaged during the logging operations (5%).

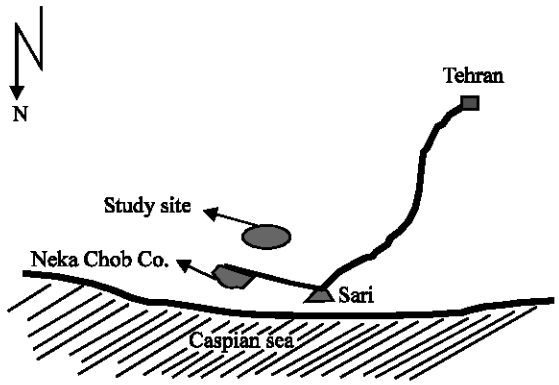

Fig. 1: Site location

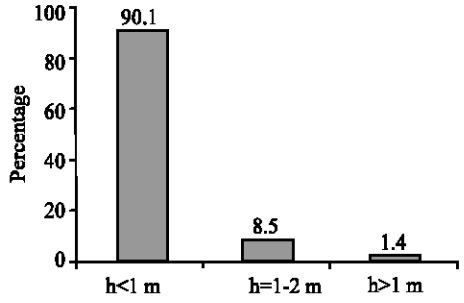

Fig. 2: Wounds location on trunk from the ground level

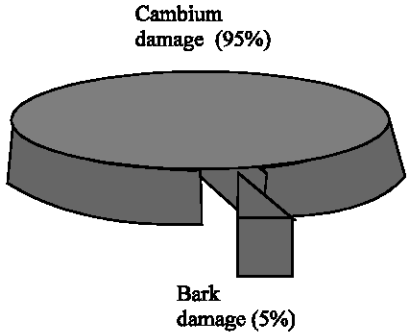

Fig. 3: Percentage of cambium and bark damages

About 365 wounds were observed on trunks, which about 90% of them were located on h<1 m (Fig. 2).

The cambium damages are 5%, while others are bark damages (Fig. 3).

Table 2 shows that 74% of wounds include small size (S<100 cm^2), 15.6% are medium size (S = 100-1000 cm^2) and others are big size (S>1000 cm^2).

More than 50% of trees which damaged are located near the skidding tracks and more than 90% of wounds were take placed at h<1 m (because of the skidding system). Furthermore, the majority of cambium damages were observed near the skidding tracks. Approximately, all big size of wounds (S >1000 cm^2) was observed on trees which are located near the skidding tracks.

Table 1: Numbers and percentage of trees which were damaged.

Species	Number	Percentage
Beech	92	34
Birch	100	37
Persia	10	3.6
Maple	24	8.9
Alnus	19	7
Others	26	9.5
Total	271	100

Table 2: Numbers and percentage of wound based on their size

Status	Number	Percentage
S<100 cm^2	269	73.9
S=100-1000 cm^2	57	15.6
S>1000 cm^2	39	10.5
Total	365	100

This study showed the amounts of harvesting damages (in quality and quantity) on remain trees near the skidding tracks were significantly more than others which are far from the skidding tracks.

Because of steep slopes, high elevations and sensitive sites, harvesting and extraction operations in the Hyrcanian Forests in Iran needed to be carefully planned and extracted. In order to reduce in impact of harvesting operations, training of timber extraction crews in environmentally sensitive harvesting methods is essential.

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