

7. Sarzyński W. (1994): Ocena urządzeń firmy Damas do czyszczenia nasion drzew iglastych. Głos Lasu nr 12.
8. Suszka B., Muller C., Bonnet-Masimbert M. 1994. Nasiona leśnych drzew liściastych. Wyd. Nauk. PWN, Warszawa-Poznań.
9. Suszka B. 1999. Zagadnienia nasiennictwa w szkółkarstwie górskim. Sylwan nr 1, 37-42.
10. Toka K. 1998. Instrukcja technologiczna nr 1. Leśny Bank Genów Kostrzyca.
11. Tylek P., Walczyk J. 2002. Separator pneumatyczny do nasion drzew leśnych. Przegl. Tech. Roln. i Leśnej 10, 16 – 25.
12. Tylek P. 2003. Kolumna do separacji nasion drzew leśnych na podstawie różnic sprężystości. Przegląd Techniki Rolniczej i Leśnej nr 12, 20-22.
13. Tylek P., Walczyk J. 2003 a. Critical air velocity as a separation feature in nuts of European beech (*Fagus silvatica* L.). Electronic Journal of Polish Agricultural Universities, Series Forestry Volume 6, Issue 2.
14. Tylek P., Walczyk J. 2003 b. Film jako instrument w badaniu sprężystości nasion. Inżynieria Rolnicza nr 11 (53), 223-228.

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HELICOPTER LOGGING SYSTEM IN THE NATURAL BROADLEAF FORESTS OF IRAN

The Natural Broadleaf Forests (i.e. the Hyrcanian Forests) of Iran are located in the north of Iran near the Caspian Sea, which is the commercial forest in Iran. For many reasons the main harvesting system in these forests is the skidding system and the helicopter logging system is used in the small parts and special cases. This paper will discuss the helicopter logging system which was used in central of the Hyrcanian forests of Iran and compare with the old system.

Keywords: Helicopter logging, Hyrcanian Forests, Forest Harvesting, logs

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Вертолітна система лісозаготівлі в природних широколистяних лісах Ірану

Природні широколистяні ліси (Гірканські ліси), які є комерційними, розташовані на півночі Ірану біля Каспійського моря. Головно, в цих лісах застосовується наземне трелювання, але на невеликих площах, в окремих випадках, може використовуватися для транспортування деревини вертоліт. Наведено порівняльну оцінку вертолітної та традиційної наземної систем лісозаготівель в центральній частині Гірканських лісів Ірану.

Ключові слова: вертолітна система лісозаготівлі, Гірканські ліси, колоди.

Introduction

Natural broadleaf forests of Iran (i.e. the Hyrcanian Forests) are the only commercial forests in Iran, which cover about 1.8 million hectares in land area of Iran. Most of these forests are located in the steep terrain with high slopes on the Alborz Mountains overlooking the Caspian Sea. The length of these forests strip is about 1000 km with width of about 30 km.

Chainsaws are used for cutting the trees. Because the logs diameters of trees, chainsaw operations use long bars. In general, one chainsaw is run by two people. After

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felling, delimbing and crosscutting are carried out using the chainsaw. The branches less than 7 cm in diameter are left in the forest, while straight branches over 30 cm in diameter are considered logs. Logs are 2.8 m in length or a multiple of this. For many reasons, the main extraction system in the Hyrcanian Forests of Iran is skidding system. Harvesters and forwarders machines are not used in these forests.

The helicopter logging system is used in small especial parts. The Forest and Range Management Organization (The Iranian Forestry Board) organized this system with supporting of a forestry private company about 5 years ago. This paper will discuss about this system and compare with the old system according the harvesting costs.

Site Location

The site location was in the Sad Abroad Forestry Planning near the Nowshahr town in the north of Iran (Figure 1). The compartments of 204 and 205 of this forestry planning were selected for this study. The total surface cover was 103 hectares which about 7 % of it is protected area. Average altitude is nearly 1500 m from the sea level and with slope of more than 30 % (Table 1).

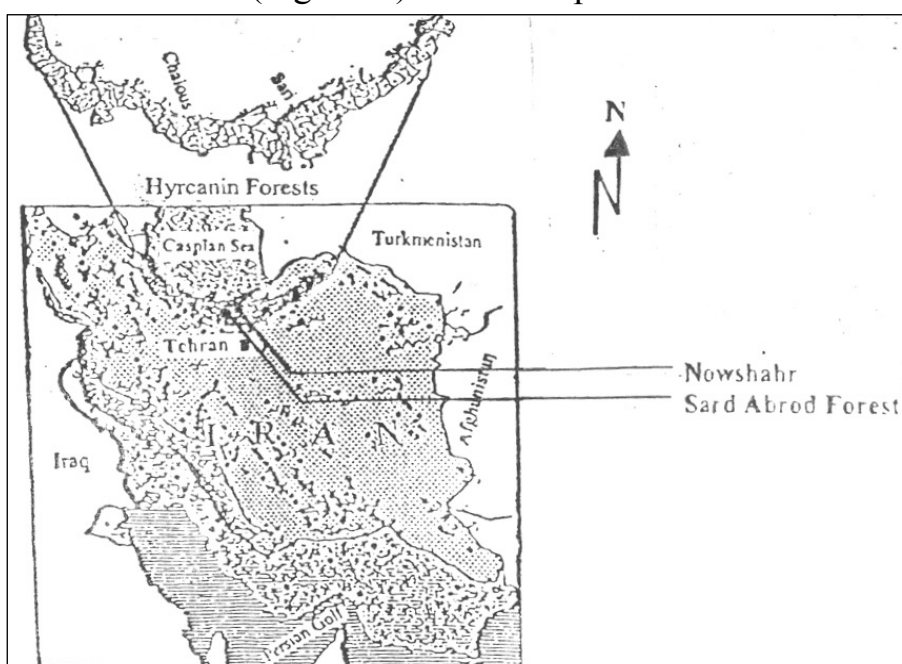


Figure 1. Site location in North Forests of Iran

The standing timber volumes were more than 350 m³ per hectare and canopy cover was 6075 %. The vegetation association is *Fagetum (Fagus orientalis)* with managed using the schetlerwood system.

Table 1. Average slope and land the field study

Slope (%)	0-30	31-60	61-80	81-100
Land area (ha)	21	33	43	6

Road Construction

There are two forest main roads in top and bottom of field study (Figure 2). Average forest road density is 25 m per hectare. Minimum distance between two forest roads is 700 m and maximum is 950 m.

Helicopter system

The helicopter used was a Kamov 32 model with two propellers with 4500 horsepower engine. Average speed of this machine was 100-120 km/h (maximum 230 km/h). The chockers were connected to cable with 60 m in length (Figure 2).

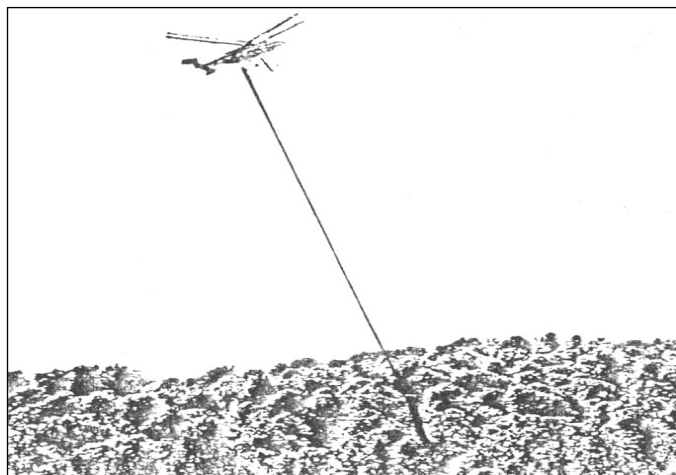


Figure 2. Helicopter logging system

Methods

The timber volumes were measured in landing and weights of timber per loading were measured by the helicopter system. Logs were carried uphill to downhill. Average transport was 1-4 km from the forest stand to landing. The climate was sunny during the extraction operations and temperature was 12-30 °C

(Table 2). So, without environmental and silvicultural viewpoints, helicopter extraction costs compared with the old system (animal system). Furthermore, according the Iranian market, the values of forest products were evaluated in each harvesting system.

Results

About 1800 m³ timber volumes were extracted by 365 flights in different temperature during 15 days (Table 2).

Table 2. Number of flights in different temperature

Temperature (°C)	23	24	25	26	27	28	29	30	Total
Number of flights	47	55	75	34	23	16	83	32	365

As a result, harvesting costs of timber volume per m³ in the helicopter system was 4 % more than the old system. While the product value in the helicopter system were 25 % more than the old system. So, this paper showed that productivity costs in the helicopter system was 21.9 % more than the old system (Figure 3).

If old system have been used instead of the helicopter system, straight branches and stem over 30 cm in diameter were be cut as quadrilateral timber in the forest using chainsaws. All other parts are called residual and are used for fuel, charcoal, fiber, pulp and paper industries. A study indicated that about 36 % of logs volume ends up as residual material (Sarikhani. 1994).

Conclusion

Based on topographic conditions, using skidding system was not possible and the quality of logs was so good. For these reasons, most of logs were not cut as quadrilateral products in the forest by chainsaws. In addition, by using the skidding tracks we may observe soil compaction and other skidding damages on forest remain stands and regeneration.

References

1. **Anonymous.** (1997). Evaluation of helicopter logging system in the Hyrcanian Forests of Iran. Forest and Range Management Organization. Volume. 2.
2. **Sarikhani, N.** (1994). Forest Utilization. Tehran University Publication.