

## Investigation of Some Extraction Methods in Terms of Damages on Forest Stand

**Kenan Melemez\*, Metin Tunay, Tuna Emir**  
Department of Forest Engineering, University of Bartin  
74200 Bartin, Turkey  
[kmelemez@hotmail.com](mailto:kmelemez@hotmail.com)

### Abstract:

*Raw wood extraction works have become more important due to forest lands which are drawn back to mountains in Turkey and in the world and the increase in the difficulty of working in these fields. It is important to present the product to the market with a minimum damage and without reducing its quantity and quality in the wood extraction process. In the present study, 5 different wood extraction methods (animal power, aerial line, hauling with tractor, skidding with tractor, hauling with forest tractor) damages brought to residual trees and saplings in the stands on routes during skidding works are assessed separately and compared to each other. Accordingly, average the number of damaged residual trees for wood extraction methods with animal force, skidding with tractor, hauling with tractor, hauling with forest tractor and aerial line in a skidding distance of 100 meters was found 2.1, 3.8, 3.1, 2.1 and 0.5 respectively. On the other hand, number of damaged sapling for wood extraction methods with animal force, skidding with tractor, hauling with tractor, hauling with forest tractor and aerial line in a skidding distance of 100 meters was determined 21, 25, 24, 20 and 9 respectively. Consequently, the study has been determined that the varied extraction methods have caused harms in different shapes and degrees to saplings and planted trees; the most damage has been given to the planted trees by hauling with tractor and the most damage has been given to the sapling by skidding with tractor.*

**Keywords:** extraction method, reduced impact logging, tree damage, wood extraction

### 1 Introduction

Wood extraction from compartment usually requires the wood raw material spread on a large area to be brought together under difficult transportation conditions, thus constituting the most expensive process in the harvesting practices (Bayoglu 1985). The use of environmentally friendly, non-time consuming and more sensitive methods for the production of wood raw materials is a necessity of rationally benefiting from the forests (Acar and Eroglu 2003). The work of wood extraction from compartment is an important part of the harvesting process, which was conducted by man and animal power, and is now replaced by mechanical power.

Environmental damages that occur during the skidding on the ground by man and animal power and with tractors are as follows: tree stem injuries as a result of hitting the planted trees, uprooting the seedlings or disrupting the humus layer on the forest ground, tearing of the upper layer of the ground, and causing erosion etc. (Eroglu 2007). Timber products, standing trees and seedlings get damaged as a result of hitting, breaking, tearing and injuring during the skidding of the trees towards the roadside of the forest. The weight of the felled tree and the width of its branches also damage the environment as a result of the hitting and frictions (Ozturk 2009).

In a study of Unver (2008) conducted to determine the product losses and environmental damages which occur during skidding the wood raw material by man power, standing trees were observed to be injured or broken, and seedlings were observed to be toppled down, uprooted or broken. Dykstra (2009) conducted a study about the damages of forestry harvesting works on the timber products and the standing trees, and found that small stems were more vulnerable to damage compared to big stems, and the harvesting equipments or the wood raw material during the skidding practice damaged the residual planted trees. Spinelli et al. (2010) examined the damage to the remaining stands and the soil after the harvesting

practices; they determined that the remaining stands were damaged at the rate of 12-14% with the use of the traditional method, and suggested the use of cable systems to haul the trees.

The present study aimed to determine the damage to the trees and seedlings on the remaining stands during five different hauling methods (animal power, skidding with tractor, hauling with tractor, hauling with forest tractor, aerial line) implemented in only one compartment within the Devrek Forest District Directorate in Zonguldak region of Turkey.

## 2 Material and method



**Figure 1: Extraction equipments used in the context of research**

The present study was conducted within the borders of the Devrek Forest District Directorate which is one of the rich areas in terms of forest resources in Turkey. Measurements in the area were conducted during the wood raw material harvesting practices in 2011. 10a numbered compartment of Purenkaya

Forest Sub-district in Devrek was chosen for the present research, which would be used for harvesting in accordance with the forest management plan in April, May and June, 2011. This compartment was chosen in that harvesting was planned to be conducted in 2011, the area had the average land characteristics, and that it was appropriate for the implementation of different extraction methods. Average slope of the compartment was about 40%, aspect of which was northwest. Stand type of compartment was beech-oak mixed stand.

Measurements were conducted using 5 different extraction methods within the research. These are skidding by animal power, skidding with tractor, hauling with tractor, hauling with forest tractor and aerial line. Two oxen were used for the method of skidding by animal power, while one Erkont 4x4 agricultural tractor was used for the method of skidding with tractor. A logging winch assembled on the agricultural tractor, a logging winch assembled on the MB Trac 900 forest tractor and a Koller K300 aerial line were used in the methods of extraction by hauling with tractor, hauling with forest tractor and aerial line, respectively (Figure 1).

The negative effects of these 5 different extraction methods on the standing trees and seedlings were compared within this study.

### 3 Results

Standing trees in the above mentioned area which were damaged during the harvesting works were counted one by one using each extraction method, and the average and total numbers of the damaged trees for each time were determined. Similarly, young seedlings damaged during the works were counted one by one using each extraction method. Then the average number of the damaged seedlings and the total number of the damaged trees were determined (Table 1).



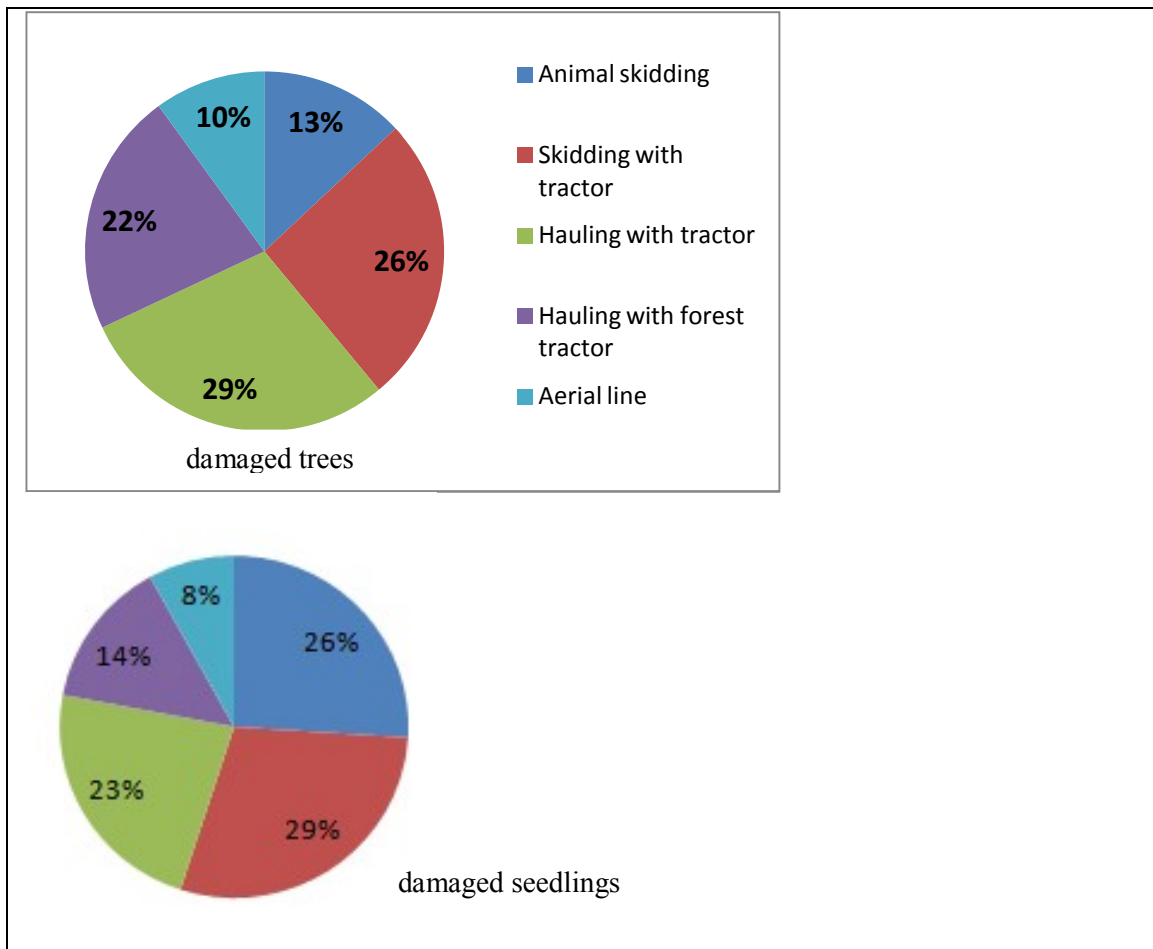
**Figure 2: Damage to the standing trees during the extraction practices**

The damages to the standing trees were determined by counting the trees that were damaged during the skidding and hauling practices on a 100 meter-line for each extraction method (Figure 2). The method of hauling with agricultural tractor was determined to damage the trees most, and the methods of skidding with tractor, hauling with forest tractor, skidding by animal and finally extraction by aerial line followed it. The methods of skidding with tractor, hauling with tractor and hauling with forest tractor were determined to damage the standing trees during tree-length logging, while the methods of extraction by

animal power and aerial line were determined to damage the standing trees during cut-to-length logging. The damages to the standing trees include bark injury or cracked stem.

**Table 1: Total number of the damaged trees during the extraction practices**

Skidding method	Damage on standing trees		Damage on seedlings	
	Average	Total	Average	Total
Animal power	2.1	4	21	52
Skidding with tractor	3.8	8	25	57
Hauling with tractor	3.1	9	24	45
Hauling with forest tractor	2.1	7	20	28
Aerial line	0.5	3	9	17



**Figure 3: Distribution of the total number of the damaged trees and seedlings during extraction practices**

The damages to the seedlings were determined by counting the saplings that were damaged during the skidding and hauling practices on a 100 meter-line for each of the above mentioned method. The method of extraction by skidding with tractor was determined to damage the seedlings most, and the methods of

animal skidding, hauling with agricultural tractor, hauling with forest tractor and finally extraction by aerial line followed it. The damages to the seedlings include uprooted, broken or injured seedlings.

#### 4 Conclusion

Among the 5 different extraction methods, the method of hauling with agricultural tractor was determined to damage the standing trees most, and the methods of skidding with tractor, hauling with forest tractor, animal skidding and finally extraction by aerial line followed it; while the seedlings were determined to be damaged mostly by the use of the method of skidding with tractor, and the methods of animal skidding, hauling with agricultural tractor, hauling with forest tractor and extraction by aerial line followed it.

Pinardi et al. (2000) examined the planning that decreases the harvest damages and the traditional harvesting method, and found that the damages to the planted trees and to the soil reduced from 50% to 28%, and from 13% to 9% respectively, as a result of the harvesting plan, controlled felling and limited skidding. Pollini et al. (1989) conducted a study examining the aerial lines in Italy, and Koller K300 aerial line was found to damage less in comparison with the other methods. Considering the extraction methods in terms of their damages to the trees and seedlings, aerial lines were determined to be the least damaging method, the use of which should be encouraged in all cases, especially in the regeneration areas where the protection of the seedlings is quite important.

Spinelli et al. (2010) examined the damages to the standing trees and to the soil as a result of the harvesting practices, and determined that the traditional and mechanized methods damage to the remaining stand in the proportion of 12-14% and 20% respectively; and damage to ground surface about 42%, and suggested the use of cable logging. Eroğlu et al. (2009) determined that skidding by aerial line on the snow damaged the trees less in the proportion of 56%.

Although the method of extraction by aerial line has many advantages, it is suggested to be used together with the method of hauling with agricultural tractor in one-storied and even-aged forests. Felling on the snow in the regeneration areas and continuous forests in the winter may decrease the seedlings damage to a great extent, thus it should be preferred. In case that the slope is sufficient in continuous forests where the seedlings are damaged to a great extent, the methods of extraction by aerial line and skidding with agricultural tractor may be suggested to be combined in order to minimize the damages to the seedlings and the trees.

#### 5 References

- Acar, H., Eroglu, H., (2003): *Daglık Arazide Uretilen Ince Caplı Odunların Fiberglass Oluk Yontemi ile Bölmeden Cikarılması Imkanları Uzerine Bir Arastirma*. KTU Arastirma Fonu Projesi. KTU Proje No: 22.113.001-2, Trabzon, s. 35.
- Bayoglu, S., (1985): *Ormancilikta mekanizasyon ve gelismesi, Ormancilikta Mekanizasyon ve Verimlilik*, I. Ulusal Sempozyumu. Milli Produktivite Merkezi Yayinlari, 339, Bolu, s.38–67.
- Dykstra, D. P., (2009): *Forest growth and timber quality: Crown models and simulation methods for sustainable forest management*, Proceedings of an International Conference. Gen.Tech.Rep.PNW-GTR-791, Portland,U.S. Department of Agriculture, Forest Service, p. 103-108.
- Eroglu, H., (2007): *A theoretical approach for determining environmental hazards caused by technical forestry operations*. International Symposium The 150th Anniversary of Forestry Education In Turkey, Bottlenecks, Solution and Priorities In The Context of Functions of Forest Resources, İstanbul, p. 374-383.
- Eroglu, H., Eker, M., Ozturk, A., Ozturk, U., (2009): *Farkli bolmeden cikarma teknikleri ile tasinan urunlerde olusan zararların tespiti ve zararların ekonomik boyutlarına yönelik genel bir degerlendirme*. II. Ormancilikta Sosyo-Ekonomik Sorunlar Kongresi, Isparta, s. 284-293.

Ozturk, U., (2009): Daglik Arazideki Ladin Mescerelerinde Farkli Bolmeden Cıkarma Yontemlerinin Cevresel Acidan Irdelenmesi Uzerine Bir Arastırma. Yuksek Lisans Tezi, Artvin Coruh Universitesi, Fen Bilimleri Enstitusu, Orman Muhendisligi Anabilim Dalı, Artvin, 103 s.

Pinard, M. A., Barker, M. G., Tay, J., (2000): Soil disturbance and post-logging forest recovery on bulldozer paths in Sabah. *Forest Ecology and Management* 130, p. 213–225.

Pollini, C., Leonelli, G., Olivari, M., (1989): Introuzione di razionali tecnologie nelle utilizzazioni forestali: Prove di esbosco con una gru a cavo a stazione motrice mobile. Consiglio Nazionale Della Ricerche, Istituto Per La Tecnologia Del Legno, San Michelle All' adige, Trento, No: 18, 70 pp.

Spinelli, R., Magagnotti, N., Nati, C., (2010): Benchmarking the impact of traditional small-scale logging systems used in Mediterranean forestry. *Forest Ecology and Management* 260.