FORMEC 2010
Forest Engineering: Meeting the Needs of the Society and the Environment
July 11 – 14, 2010, Padova – Italy

THE USE OF EXCAVATORS IN CLEARING OF RHODODENDRON SPP.

Selcuk Gumus[1], Yilmaz Turk[2]

[1]Faculty of Forestry, Karadeniz Technical University, 61080
Trabzon, Turkey
e-mail: sgumus@ktu.edu.tr

[2]Faculty of Forestry, Karadeniz Technical University, 61080
Trabzon, Turkey
e-mail: yilmaz_turk@hotmail.com

Keywords: excavator, clearing of Rhododendron spp., productivity of excavator, environmental damage

Abstract: *The excavators have been commonly used in Forestry. They can be used in road construction activities, as loader, harvester, processor, and cable yarder in timber harvesting operations. In recently, there has been an increasing interest in using the excavators in clearing of Rhododendron spp. activities. Rhododendrons dominate the understories of the mesic forests of the Black Sea Region of Turkey. They dramatically reduce forest growth and regeneration and local plant diversity. Therefore they should be cleared land. In this study, clearing of Rhododendron spp. by using hydraulic excavator were investigated technical, economic, and environmental in forested lands in Western Black Sea Region of Turkey. Study area was sampled at 17different point. Productivity of excavator and environmental damages were investigated in every point. In addition, feature of area was took note. Consequently, productivity of excavator was found as m^2/hour average 41% ground slope. The excavator damages lesser than bulldozer environment that was found. Besides, excavator was used greater grand slope than bulldozers. The excavators should be commonly used in controlling rhododendrons for environmentally sensitive areas to reduce impact on forest vegetation.*

1. Introduction

In recent decades, the excavators have been commonly used in Forestry. They can be used in road construction activities, as loader, harvester, processor, and cable yarder in timber harvesting operations. The excavator has the advantages of performing excavation activity with better control and placing the material efficiently on fill slope. In a study conducted by Erdas (1986), it was indicated that excavator should be used in construction activities on steep terrains to reduce environmental impacts. Bayoglu (1986) suggested that bulldozers should be used in the forested areas with less than 40% ground slope, while excavators should be preferred when the slope is greater than 40%.

Excavators have been used as a complement to the bulldozers and in most cases they successfully replaced the bulldozers. Excavators can be used to construct roads, upgrade old roads, load gravel and woods, extract hard cut material, break rocks, shape high-sided cut slopes, build the sub-grade and side ditches, and place culverts (FAO, 1998). They have advantages of working on smaller sections in the slopes from 20-50%. There are many excavator operating techniques related mainly to terrain types and environmental sensitivity (Stjernback, 1982).
The excavators carry the logs by moving backward and pile them at one side of the road, leaving other side free to obtain fill material and access to the forest (Stjernback, 1982). It is rather difficult and inefficient to carry out the logs all the way to landing area due to lower travel speed of the excavators (FAO, 1999). Then, the waste material such as unmerchantable trees, stumps, branches, and topsoil is removed from the road base. In wet areas, excavator can easily remove the topsoil without disturbing the

roots or mixing it with fill material (Ozturk, 2009). Figure 1 shows Daewoo Doosan 225 LCV trademark hydraulic excavator which used this study.

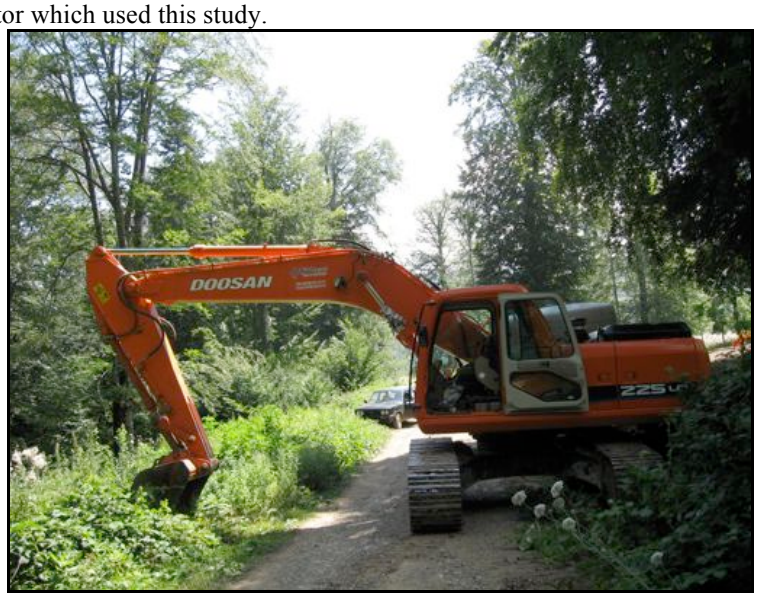

Figure 1. Using hydraulic excavator in the study

In recently, there has been an increasing interest in using the excavators in clearing of Rhododendron spp. activities instead of bulldozers in Turkey. Rhododendrons dominate the understories of the mesic forests of the Black Sea Region of Turkey (Figure 2). They dramatically reduce forest growth and regeneration and local plant diversity (Esen et al., 2006). Therefore they should be cleared in forest area.

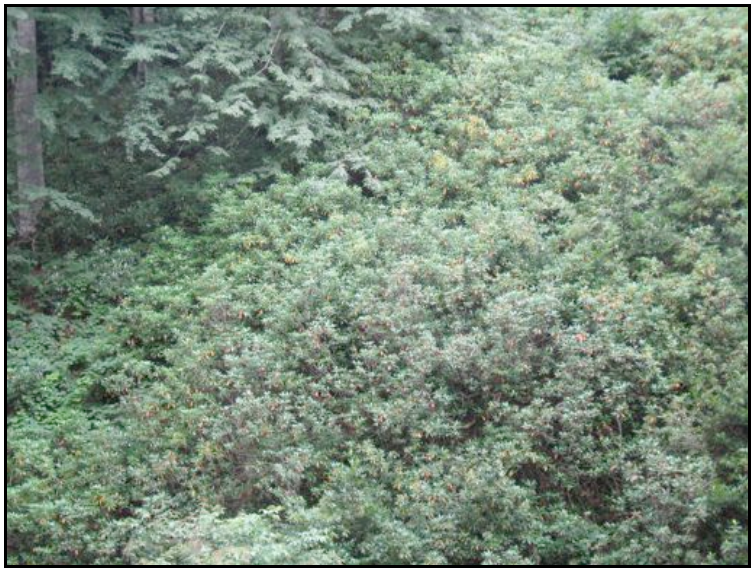

Figure 2. Density Rhododendrons the understories of the mesic forests (Duzce, Turkey)

Many woody vegetation control methods have been applied to rhododendron on eastern beech natural regeneration sites in Turkey (Suner, 1978; Es¸en et al., 2006). Manual uprooting has been used widely to control rhododendron in Turkish forests (Varol, 1970; Esen et al., 2006). However, the labor costs involved are high (Esen and Zedaker, 2004; Yildiz et al., 2005). Bulldozing has some advantages with regard to cost-effectiveness and natural regeneration success. Bulldozers equipped with a brush rake can uproot entire root systems of the brush which can be, however, the use of mechanical site preparation is limited to slopes of less than 40% and to stable soils (Bayoğlu (1986). In addition, bulldozers with a brush

rake windrow the forest floor and some of the topsoil, which may deplete nutrients that are within reach of a seedling's root system (Ballard, 2000). Forest floor displacement and vegetation removal can expose mineral soil to the impact of erosive rainfall and repeated passes of heavy equipment over the site can cause excessive soil compaction, which can affect the physical environment enough to decrease forest productivity. Since the forest floor and topsoil are the dominant reservoirs of plant nutrients in forest ecosystems, mechanical site preparation with bulldozers can lead to scalping and surface soil removal with substantial negative effects on site nutrient supplies (Yildiz et al., 2007). In contrast to bulldozers, the excavators help to prevent soil erosion at this study because they do terraces with cutting material (Figure 3). In addition, excavators are not stack topsail that is dominant reservoirs of plant nutrients in forest ecosystems. They put it same place. In this study, clearing of Rhododendron spp. by using hydraulic excavator were investigated technical, economic, and environmental in forested lands in Western Black Sea Region of Turkey.

Figure 3. Cutting material to do terraces with excavators (Duzce, Turkey)

2. Materials and Methods

2.1. Materials

The study was made in a beech (*Fagus orientalis* Lipsky) and a pure fir (*Abies bornmulleriana* Mattf.) forest. The study area is in the boundary of zone 64 of Asar Region of Duzce Forest Enterprise, Turkey. Asar Region covering a surface area of 8211 ha is located in the West Black Sea geographical region between latitudes 40º 38' 52" - 40º 45' 08" N and longitudes 31º 17' 48" - 31º 27' 04" E. According to the data given by Duzce meteorology station, average annual precipitation is 840 mm, average annual moisture ratio is 76%, average annual temperature is 13ºC, high temperature is 42.0ºC and low temperature is -21ºC. The climate of Asar Forest is cool in summer and cold in winter. Altitude of the study area is between 400-1590 m above sea-level. Average area slope of Asar Forest is 40%.

The forest was an untended stand, middle old, with an average height of 30 m, and growing stock of 257 m^3/ha. Selecting felling was practiced. Area of Rhododendrons covering a surface area of 1782 ha was located in the Asar Region of Duzce Forest Enterprise. Total 72.6 ha Rhododendrons were cleared using of excavators at Asar Region of Duzce Forest Enterprise in 2009.

2.2. Methods

In recently, there has been an increasing interest in using the excavators in clearing of Rhododendron spp. activities instead of bulldozers in Turkey. Study area was sampled at 17different point. Productivity of excavator and environmental damages were investigated in every point. In addition, feature of area was took note. Area slope and coordinate of every the points were determined. Diameter and of density Rhododendrons and slope of area are important effective factors of Rhododendrons clearing with excavator and time of excavator study.
In this study, after determination of clearing effective factors, a continuous time of excavator study was investigated (Figure 4). Clearing area of excavator was determined an hour with digital chronometer total 17 times in study area. Methods of time calculate was continues time calculate in this study (Aykut, 1972). Consequently of every an hour, clearing area was measured by rope (Figure 5).

Figure 4. The use the excavators in clearing of Rhododendron spp. activities (Duzce, Turkey)

Figure 5. Surface sample points measuring by rope (Duzce, Turkey)

3. Results

In this study, Table 1 shows results which are data about sample points Rhododendrons clearing with excavator which worked an hour every sample points. According to Table 1, productivity of excavator was found 960 m^2/h averages 41% ground slope. Minimum area clearing materialized number 17 sample. Maximum area clearing materialized number 6 sample. The excavator damages environmental lesser than bulldozer it was found. Besides, excavator was used greater grand slope than bulldozers. The excavators should be commonly used in controlling rhododendrons for environmentally sensitive areas to reduce impact on forest vegetation instead of bulldozers in Turkey.

Table 1. Results about sample points Rhododendrons clearing with excavator

Sample Points	Area (m^2)	Average Slope of Area (%)	Property of Rhododendrons	Time (h)
1	1090	35	density, thin diameter	1
2	1170	35	density, thin diameter	1
3	859	18	density, thin diameter	1
4	842	18	density, thin diameter	1
5	806	54	density, thin diameter	1
6	1632	48	density, thin diameter	1
7	1008	50	density, thick diameter	1
8	1028	50	density, thick diameter	1
9	1016	50	density, thick diameter	1
10	998	50	density, thick diameter	1
11	1003	50	density, thick diameter	1
12	688	53	density, thick diameter	1
13	679	53	density, thick diameter	1
14	1130	40	density, thin diameter	1
15	1121	40	density, thin diameter	1
16	623	23	density, thin diameter	1
17	619	23	density, thin diameter	1

Before except the sample points in same region Rhododendrons clearing with excavator area was investigated. Natural seedlings covered complete of the area that was determined result of study1-2 years ago. Figure 6 shows natural seedlings after Rhododendrons clearing with excavator.

Figure 6. Natural seedlings after Rhododendrons clearing with excavator (Duzce, Turkey)

4. Conclusion

This study presented a discussion on applying Rhododendrons clearing with excavator activities. Rhododendrons clearing with excavator and time of excavator study can be limited by some factors including diameter and of density Rhododendrons and slope of area. A result of the study, productivity of excavator was found 960 m^2/h averages 41% ground slope. The excavators are advantage in controlling rhododendrons for environmentally sensitive areas to reduce impact on forest vegetation instead of bulldozers. After Rhododendrons clearing with excavator, natural generation is success in forest next years. Rhododendrons clearing with excavator should be used for natural generation study same areas.

References

Aykut, T. (1972). Acording to Researching in Bolu Region Loading Logs on Truck, Standard Times of Various Phase of work, Review of the Faculty of Forestry, Istanbul University, İstanbul, 1, 22.

Ballard, T.M. (2000). Impacts of forest management on northern forest soils. Forest Ecology and Management, 133, 37–42.

Bayoglu, S. (1986). Mechanization in Forest and Progress. Mechanization and Productivity at Foretsry, 1. National Symposium,MPM Proceeding, Ankara, 339, 38-67.

Erdas O (1986). The Rationale Use of Cut and Transport MachinesConnected with Project and Construction Technic on Forest Roads. Mechanization and Productivity at Foretsry, 1. National Symposium,MPM Proceeding, Ankara, 339,110-128.

Esen, D., Yildiz, O., Kulac, S,., Sarginci, M. (2006). Controlling rhododendron spp. in the Turkish Black Sea Region. Forestry 79, 177–184.

Esen, D., Zedaker, S.M. (2004). Control of rhododendron (Rhododendron ponticum and R. flavum) in eastern beech (Fagus orientalis Lipsky) forests of Turkey. New Forests, 27, 69–79.

FAO (1999). Environmentally sound road construction in mountainous terrain. Food and Agriculture Organization of the United Nations. Forest Harvesting Case Study- 10. Rome.

FAO (1998). A manual for the planning, design and construction of forest roads in steep terrain. Food and Agriculture Organization of the United Nations. Research Paper, Rome, Italy.

Ozturk, T. (2009). The Use of Excavator in Forest Road Construction in Karst Region of Turkey. Review of the Faculty of Forestry, Istanbul University, İstanbul, 59.

Stjernberg, E.L. (1982). The use of hydraulic backhoes in forest road construction: Centre and Eastern Canada. Feric Publications, Canada, 59.

Suner, A.(1978). Research on the Regeneration Problems of Pure Eastern Beech Stands in Duzce, Cide, and Akkus Localities. Turkish Forest Research Institute Publications Technical Bulletin, 107, 7–55.

Varol, M. (1970). Control of Rhododendrons. Turkish Forest Research Institute Publications Technical Bulletin, 46, 1–57.

Yildiz , O., Sarginci, M., Esen, D., and Cromack Jr, K. (2007). Effects of vegetation control on nutrient removal and Fagus orientalis, Lipsky regeneration in the western Black Sea Region of Turkey. Forest Ecology and Management. 240, 186–194

Yildiz, O., Esen, D., Sarginci,M., Guler, M., 2005. Effects of vegetationmanagement practices on long-term site productivity in eastern beech (Fagus orientalis, Lipsky). In: Erdem,U., Nurlu, N.M.(Eds.),X.EuropeanEcological Congress, European Ecological Federation and Turkish Ecological Society. Ege University Centre for Environmental Studies, Kusadasi, Turkey, 259.