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(Ballard, 1984

Hatchell and (Froehlich *et al.*, 1980)

Ralston (1970)

Armlovich (1995) .

(Adams and Froehlich, 1984)

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Pritchett and)

(Fisher, 1987; Adams and Froehlich; 1984

Froehlich and McNabb, 1984; Ares *et al.* 2005;)

(Eliasson and Wasterlund, 2007

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Adams) (et al. 2006

(and Froehlich, 1984

(Wronski, 1980; McMahon and Evanson, 1994)

McDonal and Seixas,)

(Ampoorter *et al.* 2007)

Williamson and Neilson (2000) . (1997

Steinbrenner (Adams, 1990)

and Gessel (1955)

(Page-Dumroese *et al.* 2006)

Lanford and Stokes (1995) .

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Jourgholami and Majnounian (2011) .

Gomez and Power .
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Gayoso and .
Iroume (1991)

Krag *et al.* (1986)

(Etemad, 2002)

Smith and Wass .
Sidle and . (1976)

Drlica (1981)

Fagus orientalis)

Carpinus) (Lipskey.

Jamshidi *et al.* (2008) .

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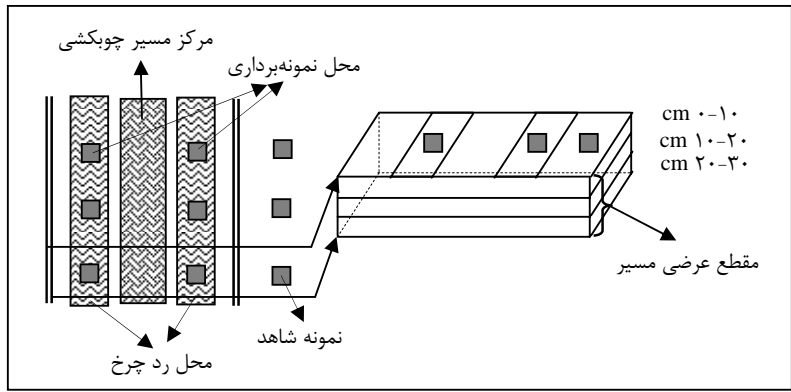
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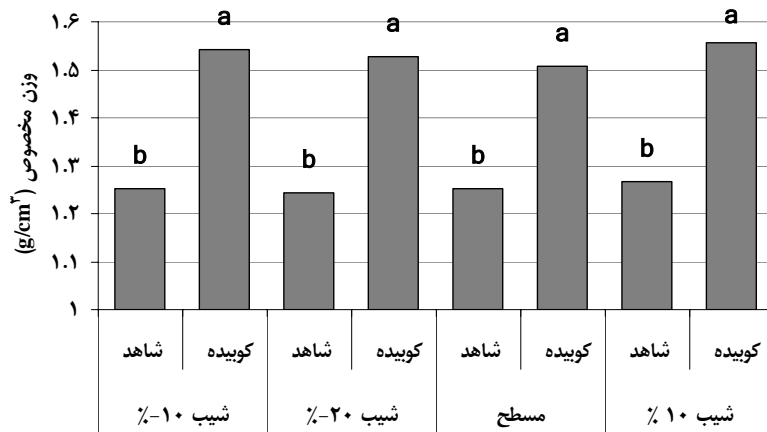
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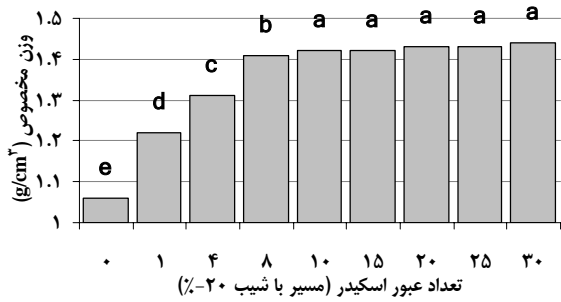
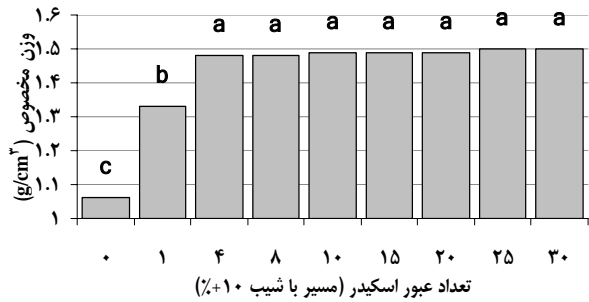
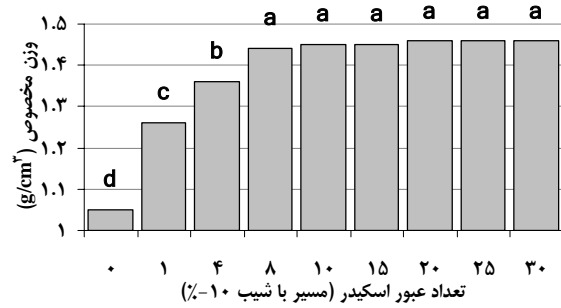
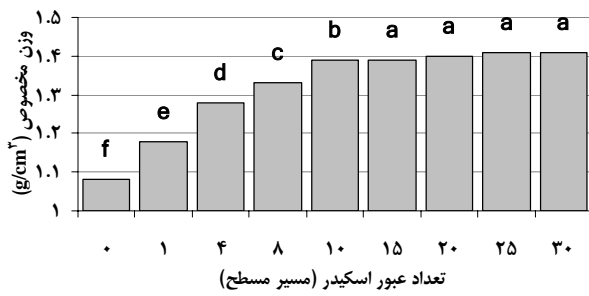
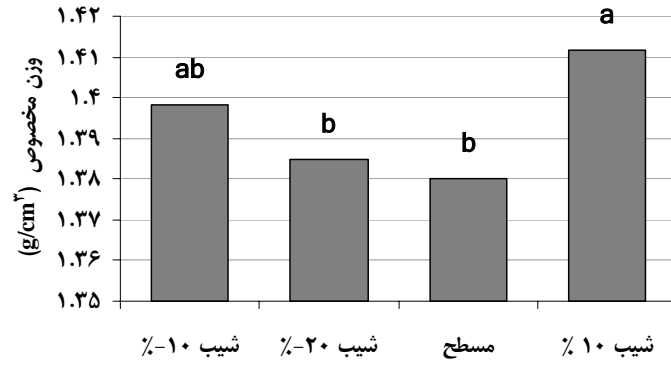


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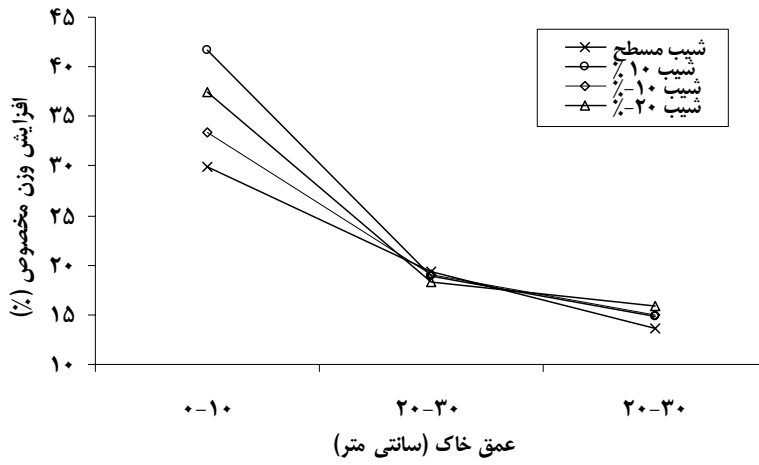
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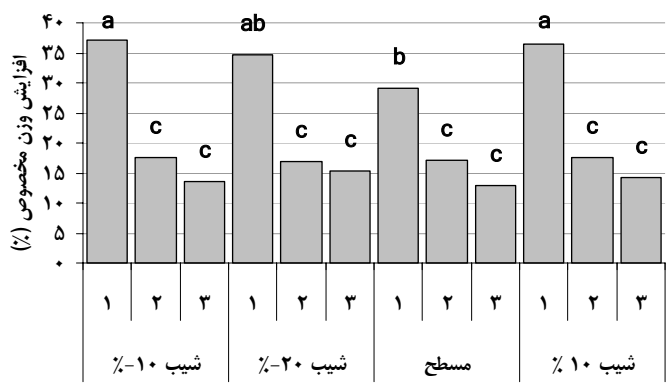


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(1997; Page-Dumroese *et al.* 2006

Hatchell and Ralston, 1970;)
Froehlich *et al.* 1980; Lenhard, 1986; Armlovich,
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(Sidle and Drlica, 1981)

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(Eliasson and Wasterlund, 2007

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Dickerson, 1976;)

(Froehlich, 1979

(Greacen and Sands, 1980)

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Environmental Impacts of Tree-Length Logging Method on Forest Soils in Kheyroud Forest

M. Jourgholami^{*1}

¹Assistant professor, Faculty of Natural Resources, University of Tehran, I.R. Iran

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Abstract

In forest harvesting, there is an ongoing trend to increase constantly the size, power and load of logging machines. This may cause soil degradation in forest ecosystems as the passes of these machines modify important soil structural characteristics. The present study was conducted to examine impact of skidding traffic, trail slope, traffic frequency, and soil depth on bulk density and soil compaction due to tree-length logging method using rubber-tired skidder in Namkhaneh district in Kheyroud Forest. The level of soil compaction at eight levels of traffic (1, 4, 8, 10, 15, 20, 25, and 30 passes), four levels of slopes (0, 10, 1-10, and -20) and three soil depth (5, 15, 25 cm) were applied in three replicates consequently. Bulk densities were measured on the undisturbed surface (UD) and within the tracks (WT). Result showed that in four different slopes most bulk density increasing was occurred during the first few passes of skidder, although density continued to increase in amount and depth with the number of passes. About 5.2% of total area of harvesting unit were disturbed and compacted. Uphill skidding increases compaction more than downhill skidding. The increases in bulk density were still important at the maximum sampling depth of 20-30 cm. The results indicated that slope steepness had a strong effect on the soil physical properties and soil disturbance. Designated skid trails should be used to minimize the influence on the forest stand.

Keywords: Environmental impacts, soil compaction, bulk density, tree-length method, rubber-tired skidders.