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Full Length Article

Study of road length condition in different year (1999-2003) in forest plan (case study: Neka forest plan, North of Iran)

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ABSTRACT
Forest road construction is the most costly operation in forestry. Road designing and construction in unsuitable areas may increase construction and maintenance. The aims of this research are study of road length condition in different year (1999-2003) in Neka forest plan, North of Iran. For this study used the information of Forest plan (parcel 212 to 248) in 1998-2007 and extract information of forest road include: Road length (m) in 1999-2003. Result showed that constructed 9835 meter road in the five year in 956.9 hectare (10.27 m/hectare). In the 2002-2003 the quantity of road are higher the mean of road density (road constructed). The researcher proposed to increase the road density up to 20 m/ha for Hyrcanian forest, but available forest road density (m/hec) is 10.28 m/hectare and this quantity is very less the norm of road density in Hyrcaian forest. In base of this results author suggested the increase road density to 20 m/ha.
Key words: road length, 1999-2003 year, forest plan, Neka forest plan, North of Iran

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INTRODUCTION

The past, forest road network designing was mainly done for its main goals- management and exploitation. Forest road construction is the most costly operation in forest management. In order to choose the optimal variant with regard to costs and performance, it is necessary to evaluate road variants before construction. The aim of this research is study of forest roads density in Neka forest, Mazandaran province in Hyrcanian forest (north of Iran). For this study used the information of Forest plan (1998-2007) and extract information of forest road include: Road length (m), Predicted road (m), Available road (m), Predicted road density (m/hec), Available road density (m/hec) and total of road density (m/hec). Results showed that if planed and insert Predicted road (m), the total density (m/hec) are 16.64 (m/hec). Researcher in forest engineering science proposed to increase the road density up to 20 m/ha for Hyrcanian forest, This research showed that available forest road density are 7.58 (m/hec) and this quantity is very less the norm of road density in Hyrcaian forest. Overall results showed that the condition of road density in study area is poor and very weak. In base of this results author suggested the increase road density to 20 m/ha.With regard to the theoretical model, the forest road network is consisting of straight line even spaced roads. So the log moves on the shortest path to the nearest road. But these conditions seldom occur in the field [10]. Forest road network is one of the most important forest management projects that play a great role in timber transportation as well as other forest services such as tourism, hunting, etc. Essentially water accumulation on forest roads can be the main reason for road destruction through erosion and decrease of road strength [9]. Hyrcanian (Caspian) forest in northern Iran has a richness of biological diversity, with endemic and endangered species, and a diverse range of economic and social conditions. About 45% of the Hyrcanian forests are located in mountainous areas, where forest lands are not readily accessible with ground-based logging equipment's, but cable yarding technologies are still undeveloped in this forest area (Jourgholami, 2012). These forests are known as one of the most basic resources for wood production contributing an important role in supplying wood to the related industries. Commercial logging in the Hyrcanian forests of Iran are accomplished within the legal framework of forestry management plan and annual remove in managed areas (1.2 million hectares) producing one million m^3 per year. The current forest harvesting method in

these forests is mainly selective cutting. Chainsaw and cable skidder are two main logging machines for tree felling and timber extraction in these forests. Forest roads are one of the most essential infrastructures for managing forested areas. Sustainable forest road network and preserving construction costs need permanent road maintenance. Road monitoring is key element in road maintenance principles [12]. Forest road networks are essential structures to achieve the forestry aims, but these structures include most implemental and environmental costs [5]. the several study accrued in forest roads in Iran, include: The researcher studied the Cross Drainage Design of Forest Road in Shafarood Basin, Guilan Province and results in this research indicate that, drainage pipe diameter in talwegs could be estimated by considering discharge in talwegs, rain intensity, runoff coefficient, area and hydrological conditions. Road location on the foothill, slope length, and water discharge play the main role in determining the distance between pipes, the more the height of road, the more will be the distance between pipes [9].

The researcher studied the planning and technical evaluating of forest road networks from accessibility point of view using GIS and firstly a digital elevation model (DEM) was prepared based on digital topographic maps at the scale of 1:25000 and was used for collecting required data. In the next step, 12 road variants were designed using PEGGER (an extension of ArcView software) and digital contour map, and by taking advantage of GIS possibilities the passing percent of all variants of all gradients and directions were derived. Finally all variants were evaluated from a technical point of view in GIS using TON×KM and a new method called CORRECTED TON×KM and the optimal variant was chosen [11].

The researcher studied the determination of Correction Factor for Skidding Distances in Mountainous Forests of Northern Iran and objective of this study was to estimate correction factor of skidding distances in Patom district. To assess the trails from practical standpoint, each trail was checked with compass and clinometers in field and any potential modification was corrected in maps. One hundred and eighty nine sample points were selected and theoretical and practical skidding distances were measured. After that using these samples, regression models were determined to convert theoretical distance to practical one. Then significance and reliability of models were tested. The estimated correction factor for study area was 2.03 [10].

The researcher studied the efficiency of Backmund method for evaluation of forest road networks with regard to capabilities of wheeled skidders in ground skidding method and results showed that in order to evaluate the forest road networks from technical point of view with regard to capabilities of wheeled skidders in wood extraction, Backmund method is not precise enough to be the best variant and the limitations of ground skidding should be considered to use this method [14].The researcher studied the effect of Forest Road Construction on Forest Villages Development and Result showed that Calculated correlation rate was equal to r=0.866 that alluding to direct andmeaningful relation was between access to forest roads and village development. Finally this study indicated that the villages by accessing to forest roads for more years and means of communication in long time could be enjoyed possibilities, services and had best situation in respect of rural development [7].

The researcher studied the monitoring the Conditions of Forest Road Network Compared to the Standards and in this study the forest road network of Namkhaneh district was monitored, cross section values of roads were measured and were compared to standard ones. The results showed the average distance of culverts and turnout in the district were 267±25 and 184±25 meters, respectively. Meanwhile, about 99.2% of samples had standard gradient but only 9% of the samples showed standard crown and cross section [12].

The researcher studied the planning road network in mountain forests using GIS and Analytic Hierarchical Process (AHP) and the results of this study illustrated that using AHP and GIS simultaneously can introduce an appropriate and suitable method in the forest road network planning [13].

The researcher studied the possibility of Designing and Evaluation of Forest Road Network Variants Using GIS and Field Investigations and present road coordinate was determined using GPS and was used to plan road network variants. All variants were evaluated from a technical stand of view in GIS using Backmund and Segebaden methods. Regarding Backmund proposed variant and management necessities, the variant which was selected as optimal variant was checked in the field. Finally, the changes were applied on it. The results suggest the utility of GIS to improve planning methods [1].

The researcher studied the forest road planning considering road and skidding costs and the study used continuous time studies based on empirical data for this logging method. The resulted regression model is a function of skidding distance. The best solution found by NETWORK 2000 indicated that all proposed roads should be built to minimize the total skidding and road building costs [6].

The researcher studied the forest road network planning based on environmental, technical and economic considerations using GIS and AHP and with review the result of environmental and technical evaluations of 7 variants, the variant with lowest total value in MCE with regard to technical principals

was determined. This variant was evaluated economically, and then was checked by field reconnaissance. The obtained results showed that using GIS and AHP will improve planning methods [15] .
The researcher studied the applying Landslide Hazard Zonation in Forest Road Network Design and according to the results, 14.7%, 26.9%, 38.9%, 15% and 4.5% of the district were classified as very low, low, moderate, high and very high hazard, respectively. Finally due to lack of landslide occurrence in slope class of 0-15%, as well as it is suitable slope for road design, this class was suggested as positive control points. The other slope classes that were in low and very low hazard were defined as second priority for road design. Road building in high and very high hazard is possible, if increasing the number of culverts, also biological and mechanical reinforcements of cut and fill slopes [5].
Forest roads play an important role in forest management, protection and rehabilitation in mountainous areas. Efficiency of forest harvesting depends on an appropriate forest road network [3].
The aim of this research is study of road length condition in different year (1999-2003) in forest plan in Hyrcanian forest (north of Iran)

MATERIALS AND METHODS

This study was carried out in a temperate mountain forest district (District 2, Neka- Sari plan in 956.9 hectare area) in Mazandaran province (northern Iran). The area is located between 53°20'27" and 53°27'10" (E) longitude, and 36°32'52" and 36°37'13" (N) latitude. Ground skidding is the dominant method of harvesting and accounts for approximately 60% of the log volume in this forest (Naghdi et al 2008).

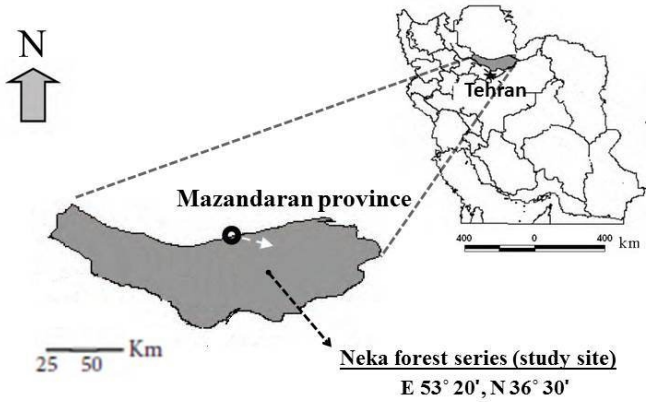

Figure 1: location of study area in Mazandaran province in Hyrcanian forest (northern of Iran)

Methods

For this study used the information of Forest plan (parcel 212 to 248) in 1998-2007 and extract information of forest road include: Road length (m) in 1999-2003.

RESULT AND DISCUSSION

Forest road construction is the most costly operation in forestry. Road designing and construction in unsuitable areas may increase construction and maintenance costs and also cause many environmental impacts. Therefore, it is required to pay more attention to forest road design [13].

Table 1: information of road information in Neka forest in 1998-2007.

		Kind of road			
Road code		R_F	R_F	R_G	
Degree of road		3	3	3	
		Year of create road in forest plan			
Yearutilization of tree in the path		2000	2002	1999	
Year(road constructed)		2001	2003	2000	
Road length (m)					
Parcel information	Area (Hectare)	4955	3250	1530	total
212	43.7		530		530
213	14.8		75		75
214	30.5		250		250
216	27.3		435		435
217	33		320		320
218	60.1		540		540
219	29.7		80		80
220	27.5		650		650
221	26.5		370		370
222	52.5	620			620
223	29.7	200			200

224	42.2	545			545
225	21.9	185			185
226	27.3	310			310
228	5	275			275
230	47.8	620			620
231	37.5	250			250
232	34.4	315			315
233	23.4	180			180
234	42.9	440			440
237	41	165			165
238	41.8	415			415
239	36.7	260			260
240	26.6	175			175
244	15.6			180	180
245	34.5			330	330
226	25.4			340	440
247	28.1			200	200
248	49.5			480	480
	956.9	4955	3250	1530	9835

Table 1 showed that that constructed 9835 meter road in the five year in 956.9 hectare (10.27 m/hectare).

Table 2: The mean of road density in different year in study area

Year	Road length (m)	Area (Hectare)	Mean of road density (m/hec)
2000-2001	4955	510.7	9.7
2002-2003	3250	293.1	11.1
1999-2000	1530	153.1	10
total	9835	956.9	10.27

Result table 2 showed that constructed 9835 meter road in the five year in 956.9 hectare (10.27 m/hectare). In the 2002-2003 the quantity of road are higher the mean of road density, but the mean of road density in the 1999-2000 and 2000-2001are lower the mean of road density.

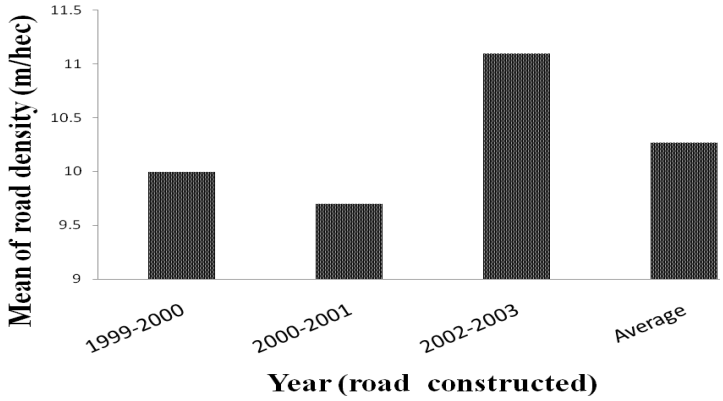

Figure 2: The mean of road density in different year in Neka forest plan

Results showed that the mean of road density in all year are 10.28 m/hectare, in the 2002-2003 the quantity of road are higher the mean of road density (by 11.1 m/hectare), in other hands the mean of road density in the 1999-2000 (by 10 m/hectare) and 2000-2001(by 9.7 m/hectare) are lower the mean of road density (by 10.28 m/hectare).

CONCLUSION

Hyrcanian forests are the only forests designated for commercial timber production in Iran. Ground-based skidding is the most common timber harvesting system used in these forests, but due to low road density (1-2m/ha), large parts of the forests are still inaccessible. To facilitate timber harvesting in the forest, it has been proposed to increase the road density up to 20 m/ha [6]. Forest managers have to be concerned about road designing and construction more than past because of environmental impacts of forest roads and their cost [8], [2]. Road construction in forests absorbs huge resources and imposes highest costs on the forest management. Therefore, various choices should be evaluated and the least costly one with highest technical efficiency should be selected [11]. Result showed that constructed 9835 meter road in the five year in 956.9 hectare (10.27 m/hectare). In the 2002-2003 the quantity of road are higher the mean of road density, but the mean of road density in the 1999-2000 and 2000-2001are lower the mean of road density (table 2 and table 2). Results showed that the mean of road density in all year

are 10.28 m/hectare, in the 2002-2003 the quantity of road are higher the mean of road density (by 11.1 m/hectare), in other hands the mean of road density in the 1999-2000 (by 10 m/hectare) and 2000-2001(by 9.7 m/hectare) are lower the mean of road density (by 10.28 m/hectare) (table 2, and figure 2). Jourgholami et al [6] proposed to increase the road density up to 20 m/ha for Hyrcanian forest, but available forest road density (m/hec) is10.28 m/hectare and this quantity is very less the norm of road density in Hyrcaian forest. Overall results showed that the condition of road density in study area is poor and very weak. In base of this results author suggested the increase road density to 20 m/ha.

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