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Research Article

COMPARSION OF TREES BIODIVERSITY IN EXCAVATION AND EMBANKMENT TRENCH OF FOREST ROADS

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ABSTRACT
The purpose of this study is to investigate the effect of forest roads on biodiversity of trees established at a distance of 25 meters from the edge of the road. In this study in the forest, that the same volume per hectare and species composition was selected in total road length, 4 transect sampling in excavation trench and 4 transect sampling in embankment trench was designed. Comparison of diversity indices also showed that species diversity indices (Shannon - Wiener and Simpson) and Shannon index in the excavation and embankment trench are significant in the distance of 15 meters and up to 25 meters away from the edge of the road, respectively ($p < 0.05$).

Keywords: *Forest Roads - Biodiversity - Transect Sampling - the Road Edge Trees*

INTRODUCTION
Construction of roads effects on ecosystem structure, their dynamics and function and has direct effects on ecosystem components such as species composition. It is clear that construction of roads will cause direct destruction of available ecosystem and re-configuration of land's local forms. However, the roads have wide direct primary and indirect secondary ecological effects on landscapes. Roads effects on living and non-living parts of aquatic and terrestrial ecosystems can be examined (forman *et al.*, 2003) (Torabi, 2007). Depending on the severity and extent of the effects, density and diversity of plant communities will change (Najafi *et al.*, 2009). Many plants that are included in the category of public plants are present widely alongside of the roads (Worley and Tyser, 1992). In addition, there are plenty of non-native plants at the edge of the road and their seeds are dispersed by vehicles and thus can be considered as a threat to the environment (Scbmidt, 1989). There is plenty of light and little competition for moisture on the road edges from bushes and established trees and quick flow of nutrients exist periodically in them. Easy access to limiting factors such as light, water and nutrients which are combined with invasive mechanisms of species in scattering, the frequent involvement of human and development and expand of the roads sides continuously up to the hundreds of kilometers have been make these areas achievable easily and properly for species (Parandes and Jones, 2000, 2003; Torabi, 2007).

MATERIALS AND METHODS
***Details of the Study Area*:** For this purpose, a total of 8 transect sampling perpendicular to the road path were established so that of these 8 transect sampling, the number of 4 transect sampling were designed in excavation slope and 4 were designed in embankment slopes, and these transect sampling were started from the edge of the forest road and continued to distance of 25 meters inward the forest, and the distance of next was selected 3 m plot and the first transect sampling were determined randomly and the next ones were set at a height equivalent to the tallest trees which was considered as 26 meters and for investigate, the first transect sampling at a distance of 2.5 m, the second at 7.5 m, the third at 15 m and the fourth were stationed at a distance of 25 m from the edge of the road. A total of 30 transect sampling and 120 circular sample plots were measured and the analysis of data was performed using the ecological software. For this purpose in order to mean comparison, the paired t test was used. The species diversity is calculated by the use of Simpson and Shannon - Weiner indices, and in the end the values of diversity indices were determined using the ecological software.

RESULTS AND DISCUSSION

Results

Diversity Indices

The results of species diversity indices comparison in the excavation slope at different distances from the edge of the road showed that the highest species diversity located in sample plots was observed at distance of 2.5 and 15 meters. But in embankment slope, the highest Shannon and Simpson biodiversity indices were observed at a distance of 15 meters. Also the lowest value of Shannon index in excavation and embankment slope was respectively observed at 2.5 and 25 meters, and the lowest Simpson index in embankment slope was observed at a distance of 25 m (Table 1).

Table 1: Comparison of trees biodiversity indices at different distances from the edge of the road in two excavation and embankment slopes

Simpson index		Shannon index		Distance from the road edge (m)
Embankment slope	Excavation slope	Embankment slope	Excavation slope	
0.92	0.92	2.58	2.61	2.5
0.92	0.93	2.58	2.65	7.5
0.93	0.93	2.63	2.68	15
0.91	0.92	2.57	2.63	25

Comparison of Different Diversity Indices in both Excavation and Embankment Slope

Comparison of these two slope in the terms of biodiversity indices using paired t test showed that up to distance of 25 m from the road edge, the Shannon diversity at the excavation slope is significantly ($0.05 > p$) greater than that of the embankment slope while the Simpson diversity has no significant differences (Table 2).

Table 2: Comparison of different diversity indices in both excavation and embankment slopes

Significance level	t-statistics value	Embankment slope	Excavation slope	Diversity indices
0.008	6.148*	2.59	2.60	Shannon diversity
0.18	1.73ns	0.92	0.93	Simpson diversity

** the significant difference up to 95% probability level.*
^{ns} represents the lack of significant difference up to 95% probability level.

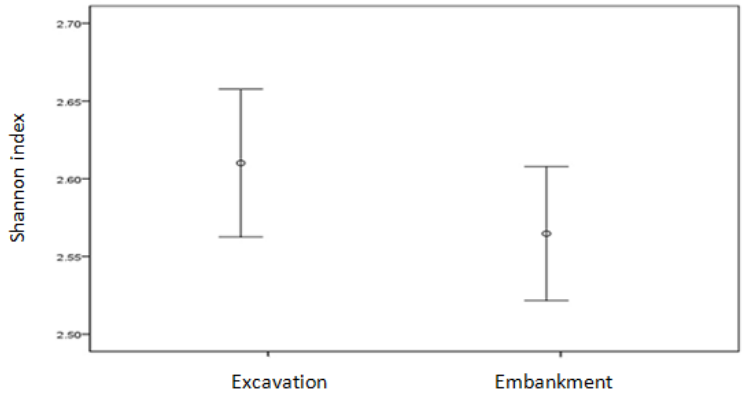

Figure 1: Mean and confidence limits of Shannon diversity index in both excavation and embankment areas

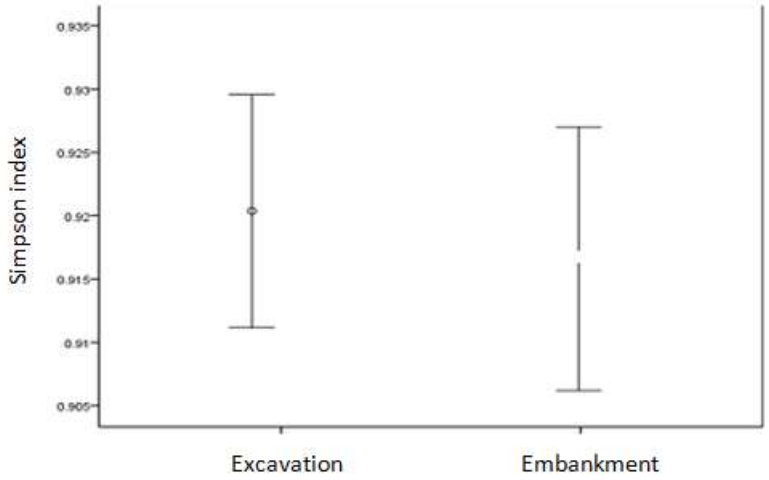

Figure 2: Mean and confidence limits of Simpson diversity index in both excavation and embankment areas

Discussion

The highest biodiversity indices (Shannon and Simpson) have the greatest value in a distance of 15 meters from in embankment slope and in a distance of 25 meters the excavation slope has the highest number of seedlings and the highest amount of Shannon diversity and since the main limiting factors of trees regeneration in destroyed forest lands include food shortages, soil compaction, lack or abundance of soil moisture, direct sunlight radiation, intraspecific and interspecific competition (Nepstad *et al.*, 1991), lack of sufficient seed and the distance of seed origin, seed feeding by seed eaters (Mcclanahana and Wolfe, 1998) and being trampled and loss by livestock (Harrey and Haber, 1999), and because in this area, all remained households livestocks intervene and grazing in entire areas of series 4, this process causes damage to natural regeneration and forest vegetation and inventory reduction in this area.

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