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An investigation into the effects of rural roads on plant diversity of roadsides in arid rangelands of Iran

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Introduction

Roads are essential elements of human societies. Rural roads are clear indicators of rural development. Most rural roads in Iran are dirt roads and roadside vegetation is an important part of the ecosystem. Making roads can change the microclimate, including the light regime, pH and organic matter of soil, hydrological and sedimentation regimes (Karim and Mallik 2008; Hayasakaa *et al.* 2012). This can affect the composition of vegetation, with increased density and frequency of some fast-growing species close to the road for example (Parendes and Jones 2000). Road-building can also contaminate the air, soil, and water, with destruction of some species (Coffin 2007, Liu 2011). Roads also interrupt the uniformity of vegetation. Vegetation close to the road can be more diverse compared to that further away. In this study, the effect of proximity of dirt roads on vegetation is discussed.

Materials and Methods

We measured the species richness and diversity of plant communities along 10 km of dirt roadsides in the Pishkuh Aliabad rangelands. ‘Nearby’ rangelands were beside the road (up to 3 m) and ‘far-road’ rangelands were over 3 m from the road. Thirty randomly selected plots (1 x 1m) were sampled on both sides of road. In each plot, individual plants of different species were counted. To measure plant diversity, the Shannon, Simpson, and Brillouin indices were used. To determine richness, and evenness, the Jackknife

and Smith-Wilson indices were used. ‘Importance Value’ of each life form was determined by using the following equation: $IV = (\text{relative density} + \text{relative dominance} + \text{relative frequency})/300$.

Results

Species richness and evenness indices were significantly different in the two plant communities of nearby and far distance roadside rangelands ($P < 0.05$). Richness and evenness of plant communities of far distance road was higher than the nearby road (Fig. 1).

The diversity measures (a combination of species richness and evenness) were significantly different between the study areas - it was higher in plant communities of far-road sides (Fig. 1). The Importance Value of shrubs and grasses were significantly different ($P < 0.05$). In nearby-road rangelands, the IV of shrubs has decreased, but the IV of grasses has increased (Table 1).

Table 1. Importance value of three life forms in two locations of roadside.

Study Area	Importance Value		
	Grasses	Forbs	Shrubs
Nearby road	0.16 a (±0.56)	0.08 a (±0.39)	0.02 a (±0.42)
Far distance road	0.12 b (±0.75)	0.09 a (±0.44)	0.01 b (±0.18)

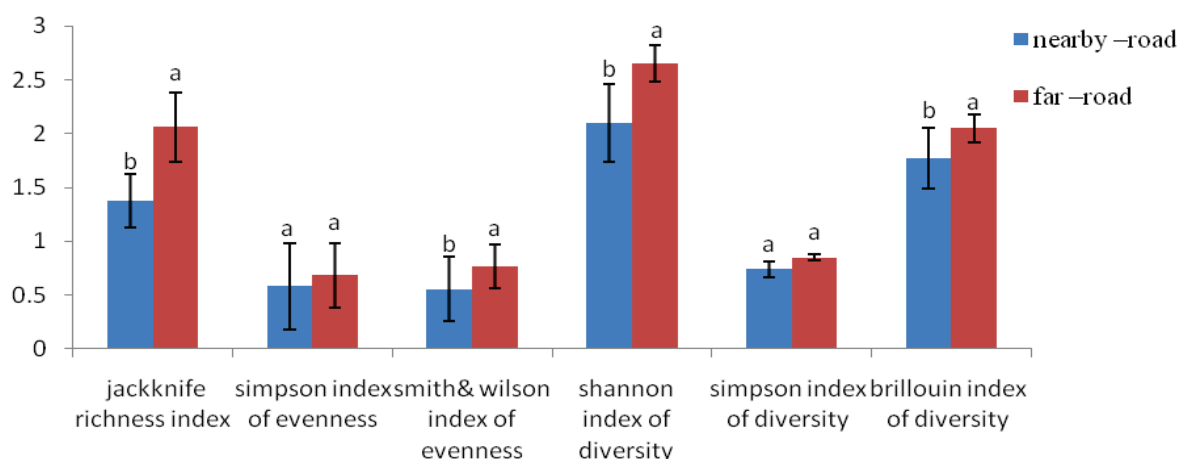


Figure 1. Richness, Evenness, and Diversity indices of nearby and far distance road.

Conclusion

Roadsides have changed the plant community of rangelands, so that richness, evenness, and diversity of plant communities were reduced. In nearby road, IV has decreased for shrubs and has increased for grasses in nearby-road rangelands (Liu *et al.* 2011). It seems that in developing around roads, grasses were more opportunistic species than shrubs, because by making the roads and the creation of suitable spaces for growth, grasses had extended themselves very fast (Coffin 2007). Meanwhile, low growing shrubs, could not establish themselves in suitable empty spaces (Hayasakaa *et al.* 2012).

Due to the negative impact of road on vegetation, it can be recommended that more attention should be made in construction of rural roads.

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