ROAD EFFECTS ON VEGETATION COMPOSITION AND SOIL PROPERTIES IN GOL-E-GOHAR REGION (KERMAN PROVINCE, IRAN)

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Abstract: *Construction of the road in the saline area can alter plant communities and diversity. To determine the road effect on plant community composition and diversity in the saline environment around Gol-E-Gohar region (Kerman province, Iran), we conducted a study along roads of Sirjan- Gol-E-Gohar Iron ore and in nearby non-road (i.e. natural) areas in the rangelands of Kaviz Kouh, Sirjan. In addition to plant richness, diversity and composition of plant communities along this roads, we evaluated physiochemical changes in soil of roadside and non-road areas. Floristic data and soil samples were collected along the roadside of Sirajn – Gol-E-Gohar and nearby Kaviz Kouh . To evaluate plant communities at each site, 30 1 m × 1 m quadrats were placed at 10-m intervals along roads and 30 quadrats were arranged randomly in non-road areas. To determine the difference in plant community composition between roadside and non-road areas, we measured species richness and diversity in each site by Shanon index. Plant community (species richness, diversity) and soil physicochemical properties (pH, salinity, ESP, SAR, Lime, Gypsum and Texture) were compared between roadside and non-road areas by using t-tests. Results showed species richness and diversity in roadside areas was significantly higher than in non-road areas and higher Shannon index indicated that roadside can support more species composition. The plant communities in roadside areas had lower percentages of Chenopodiaceae family and had the higher percentage of Asteraceae, Poaceae and Brassicaceae family in plant composition. Compared to non-road areas, activities associated with roads significantly decreased, bulk density and salinity and increased soil pH and sand. According to results road Construction in the saline area of Gol-E-Gohar can improve portion non Halophyte species in plant composition and alter soil properties just along the roadside.*

Keywords:PLANT DIVERSITY, SALINE REGION, ROAD BANK, GOL-E-GOHAR, IRAN

1. Introduction

Roads make a crucial contribution to economic development and growth and bring important social benefits. They are of vital importance in order to make a nation grow and develop. In addition, providing access to employment, social, health and education services makes a road network crucial in fighting against poverty.

Transport is a significant sector in the economy especially in arid and semi-arid vast area because, by transport systems, culture and wealth are distributed in remote areas(. The transport sector can be divided into transport 'overland', which includes road haulage and rail carriage; transport 'over water' which includes sea freight and inland shipping; air transport; and services with regard to the transport sector. Each category includes the transport of both freight and people. Road transport is the main and rapidly growing category of Iran transport sector. The road transport sector covers several subsectors, which are characterized by varying activities(Hesse & Rodrigue, 2004)

One of the most important parts of mining activities is transportation and these activities depend on the road. The construction of different soil roads or asphalt can help to transport mineral products but road construction can affect nature and these effects can be positive or negative.

The vegetation cover in arid zones is scarce, but it has a vital role in maintaining an ecological balance and improving the livelihood of people in the arid regions(Lambin et al, 2001).

The construction of roads is accompanied by a change in nature and plants are the first part that changes in this process. Therefore, it is very important that the vegetation cover is studied for the planning and management of natural resources, in order to achieve sustainable development in the mining industry. in this study, the effects of road development on vegetation cover were investigated in the Gol-e-Gohar zone. This zone is an important area in the Iranian steel industry and located on the main Sirjan path to Shiraz.

The aim of this study is to examine the effect of the road on the natural vegetation cover of the region.

2. Materials and Methods

2.1 Study area

This research has been carried out during summer 2017 along the Main road of Sirjan to Gol-e-Gohar mining zone (Fig. 1). The study area is located in latitude between 3240504.8m to 3229551.4m N and in longitude between 358304.6m to 346463.9m E nearby Sirjan salt lake. It is a playa with a temporal saline lake located in the west of Gol-e-Gohar mining zone (Fig. 1). The average elevation of the study area is roughly 1700 meters above sea level. Much of the study area is covered with saline soil, which is occupied by native halophytes, e.g., *Halocnemum strobilaceum* M.B. and *Seidlitzia rosmarinus* (Ehrh.) Bge. During a 15-year-period, mean annual precipitation is 124 mm in the plain and about 70% to 80% of the annual precipitation is concentrated in the months from September to March, while less than 5% occurs in the summer months (Naseri, 2016). The average annual temperature is 18°C, but significant variations nonetheless occur. According to Do marten drought index (Mashari Eshghabad, 2014), the study area is located in the dry regions by 4.6 of drought index. Temperatures are extremely high in summer, the hottest month being July. The landscape is defined by a series of mostly short mountain and plain. From a geological point of view, Most of the roads are located on plains that are mostly deposits of the fourth geological period (quaternary). The main soil categories in the region include Aridisol and Inceptisols (Jafari *et al*, 2009).

2.2 Methods

Floristic and soil samples were collected along the roadside of different parts of Sirjan to Gol-e-Gohar road and nearby non-road areas. To evaluate plant communities at each site, 30 1m * 1m quadrats were placed at 10-m intervals along roads and 30 quadrats were arranged randomly in non-road areas. Thus, at each roadside site quadrats were placed in a line alongside the road (0–3 m from the road), and in non-road sites, the 30 quadrats were placed random- systematics. Within each quadrat, we identified and counted all vascular plants.

Fig. 1 *Geological position of Gol-e- Gohar (study area) in Iran*

In addition to floristic composition, to determine the difference in plant community composition between roadside and non-road areas, species richness and diversity were evaluated in each site by the total number of species and Shannon–Wiener Index.

Soil samples were taken from topsoil up to 50 cm deep for each site (totally 10 samples for two different site) by profile digging. All samples saved in plastic bags and transferred to soil lab of International Desert Research Center at University of Tehran and Soil physicochemical properties include pH, salinity, ESP, SAR, Lime, Gypsum, and Texture were determined according to standard methods.

Soil reaction (pH) and electrical conductivity (EC) were measured in The saturated soil extract. Particle size according to the hydrometer method (Bouyoucos, 1962) was also calculated. Exchangeable bases were extracted with 1.0 M ammonium acetate solution at pH 7.0. Sodium and potassium contents in the extract were determined by flame photometry while calcium and magnesium contents were obtained by atomic absorption spectrophotometry. Thomas (1982) method was used for the determination of exchangeable acidity. Cation exchange capacity (CEC) was determined using the ammonium distillation method. Total exchangeable bases and percent base saturation were then calculated using values obtained from the exchangeable bases and exchangeable acidity.

Exchange-able sodium percentage (ESP) was calculated by using the equation below: ESP = (Exchangeable Na/CEC) × 100. For calculating the sodium adsorption ratio (SAR) the below formula were used: SAR = Na^+ / [(Ca^{2+} + Mg^{2+})/2]0.5.

According to Richard (1954), gypsum was calculated. Amount of lime also was determined by using calcimeter methods. Finally, after normalization of data, statistical analysis was performed in the T - Student method and the comparison of means was done by SPSS ver 15 software.

3. Result and discussion

the results of this study include identification of 93 species related to 30 family and Asteraceae(14.1%), Chenopodiaceae(9.7), Poaceae(9.7%), Papilionaceae(7.6%) and Brassicaceae(6.5%) are the most important available families of this region and comprise 47.6 % of overall species. Overall, 89.2% of the species were found in roadside areas, while 25.8% were found in non-road areas, this means that up to 74.2% of the plant species only occurred in areas along road meanwhile just 15.5% of plants species occurs in both area as common species.

Species richness and diversity in roadside areas was significantly higher than in corresponding non-road areas (Fig. 3 and 4) but homogeneity of plants in non- road area is higher than roadside(fig. 4), this factor could reflect the impact of human activities in arid and semi-arid area as fingerprint (Barbier et al, 2006). Low homogeneity means that distribution of plant species is not equal, that 's predictable in roadside because the passage of vehicles, especially agricultural machines, could propagate the plants. However it increases the plant diversity, but in other hands, it reduces the homogeneity.

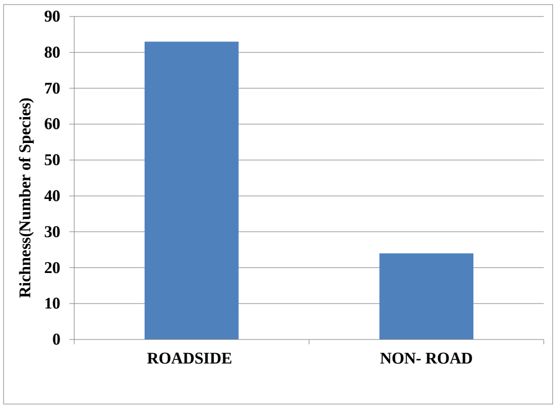

Fig. 2 *the total number of species in both site as pant richness index*

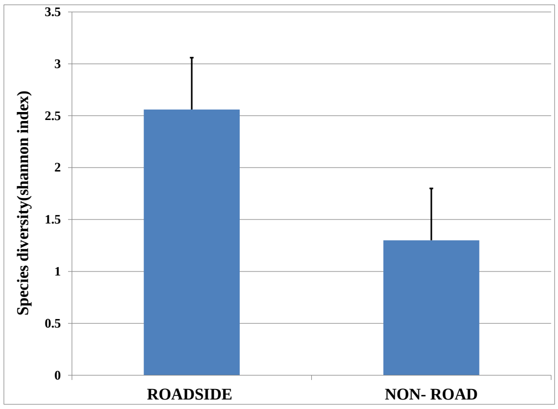

Fig. 3 *Diversity according to Shannon index in in both site*

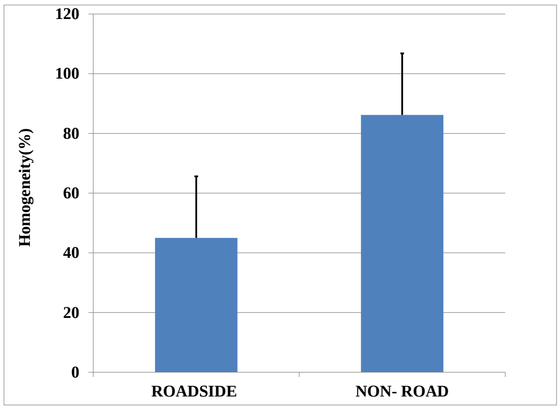

Fig. 4 *Percentage of homogeneity in vegetation of both site*

The soils in the roadside areas were more acidic than in non-road areas (Table 1), but no significant difference in soil pH was found between them. For other parameters, there is the significant difference between two area(Table 1) and this means road construction has a profound effect on the soil properties, For example, adding sand to topsoil for First preparation of road – building alters heavy soil texture to sandy. Water table salinity is controlled by sandy soil and consequently more species plants appear on this type of soil because low salinity provides the better condition for germination and plant growth(Ben-Hur et al, 1985).

Table 1: *physicochemical properties (mean ± stand error) of soil samples taken from study area*

Soil properties		Roadside	Non- road
pH		8.1±0.1	7.9±1.2
EC(dS/m)		2.52±0.02 [a]	29.8±8.6[b]
SAR		5.64±1.1 [a]	15.9±2.25 [b]
ESP		6.59±0.12 [a]	18.16±3.5 [b]
Gypsum(%)		0±0.0 [a]	18.2±2.4 [b]
Lime(%)		33.2±6.2 [a]	10.2±4.1 [b]
Particles	Sand(%)	82±11.2 [a]	22±5.2 [b]
	Silt(%)	9±2.5 [a]	26±6.8 [b]
	Clay(%)	9±0.9 [a]	52±11.3 [b]
Texture		Sandy loamy	Clay

It is very clear that a large amount of soil is transferred from the soil during the road construction by moving the soil from other parts, the soil texture changes, and this change could alter the physicochemical properties of soil.

While the Chenopodiaceae family is dominant family naturally in a non-road area and upper than 65% of plants belong to this family in roadside the Asteraceae family shows more species. Salt tolerance species like Halocnemum strobilaceum and Seidlitzia rosmarinus belong to Chenopodiaceae plant family and their presence indicates the concentration of salt in soil and clay texture. Establishment of Nitrarai shoberi proves soil condition is favorite for pssamophyte plants because this specie is an indicator of sandy soil (Naseri, 2014). Indeed, some studies have suggested that the role of roads as suitable habitats are superior to their function as potential conduits because the availability of suitable habitats for colonization and establishment of plant species are necessary before populations begin to spread (Sykora *et al*. 2002).

Zheng et al(2011) state that roads help to decrease soil salinity alongside roads, similar to the agricultural method. The roadbed is elevated in construction, and the terrain of the road and shoulder are slightly higher than the natural areas. Additionally, road effects may mitigate salinization by directly or indirectly changing water availability along roads. The abundant runoff from road surfaces forms gullies that go from the roadside to natural habitats (Forman et al, 2002). In spite of the positive effect of the road, the high concentrations of roads may cause damage to natural vegetation and biodiversity during long periods.

5. Conclusion

Results show that roads have a significant impact on vegetation and soil properties. Road construction increase plant diversity and change species composition by providing favorable habitats for plant species and most importantly decreased salinity stress. As a result, more non-halophytic plants survive in the roadside area, while halophytic plants dominate in non-road areas.

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