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Study on The Effect of Mining Activities on Floral Diversity In Western Rajasthan

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Abstract

The mining is a dangerous activity produced by humans for giving indispensable quality and security to their expectation for everyday comforts. The mining in the concerned zones gives crude materials as gravels, crusher and stones etc. for development of roads, railroad lines and other infrastructures. From the most recent couple of years the mining rate has expanded a few times. It brings about the loss of biodiversity of both vegetation and fauna and land form changes of the concerned zone. After the mining activity in any territory is finished, the indication of same lean back for quite a long time and might be until the end of time. It brings about formation of such huge numbers of environmental issues and health risks. During the investigation, effects of mining over plant biodiversity at Chaukri kalan have been assessed. At the investigation site, a sum of 81 diverse plant types of herbs, shrubs and trees were identified. The whole site is viewed as biodiversity rich, which have danger of loss because of mining and its related exercises.

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Keywords

Floral diversity;
Mining;
SPM;
Western Rajasthan.

Introduction

Mining is extraction of valuable minerals or other geological materials in or on the earth planet. The mining procedures, the materials are expelled from the earth by stabbing and detonating. The two methods of mining for desolation of nature ore are, opencast (surface mining) and underground mining. Opencast mining process is making for extracting minerals near the surface of the earth or for soft-rocks. The classification of these types of mining is based desired parameters for their application. Open cast mining cause unnecessary air pollution as they produce huge quantities of wastes than underground mining.[1] It has therefore become necessary for governments, regulatory agencies, local communities and the industry itself to adopt strategies attributing landscape, flora and fauna properties to ensuring the functionality of reclaimed ecosystem.[2] The top soil especially gets seriously damaged during extraction.[3] Mining is a worldwide Marvel and has been the reason for concern wherever on the planet, including the propelled nations. In one

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hand this action has prompted the improvement in different division viz.- social, monetary, transport, educational and industrial etc, and in other hand such huge number of severe concerns related with natural environment. So deterioration in physical, chemical, and biological quality of the environment affects both flora and fauna resources.[4]

Specifically, usually important to detonate rocks with boring, blasting with explosives and drilling, so as to extricate material however this strategy for extraction offers ascend to heavy noise, it denoted to noise pollution. The other vital ecological issues related to mining of sandstone along with noise pollution are - environmental problems such as - pollution of water and air, depletion of vegetation cover, emergence and growth of xerophytes species, instability of the Mountain, loss of natural resources, fauna and biodiversity and change in land topography, degradation of agriculture land, and also the soil and rock masses. According to Lamb (2001) reclamation is mostly used to refer to re-vegetation of highly degraded site such as mined lands.[5]

Socio-economic benefits have been generated from mining while there have been unfavorable effects of mining to the ecosystem due to enormous excavation and elimination of soil and rock layers.[6] Mining causes huge damage to biological communities and landscapes to the earth.[7] During sandstone mining activities involved extraction like-drilling, blasting, loading and transportation by this generate dust into the mining besides areas causes air pollution by SPM (suspended particulate matter). The pollutants released in atmosphere by motorized machines involved during the mining process like-bulldozer, drilling machine, dumper, tractor and other transportation vehicles.

Mining is a major source of economy in Rajasthan but is also a major cause of ecological disturbance due to the land degradation and related changes in the structural and functional characteristics of the native vegetation.[8] India has its peerless character on the planet because of the extraordinary decent variety of natural biological communities[9] and rich plant variety in its diverse parts.[10] It holds approximate 49,000 plant species, 2.4% overall topographical region and 08% biodiversity of the world.[11] The plant refines air through the method of photosynthesis and furthermore expels numerous toxicants from air, water and soil.[12] The plants assimilate heat and discharge water vapor to retain temperature[13] and furthermore increment moistness in environment.[14] The plants inhibit soil disintegration[15] and enhance soil fecundity.[16] In mining boundaries the ecosystems are affected the aquatic and terrestrial bodies and the effects could extend beyond the boundaries of the mining area for a long time period. The mining and quarrying activities are mainly responsible for decreasing of faunal diversity and population distribution of wild life but beneficial to some adaptable species.[17]

Vegetation is the principle part of earthbound ecosystems.[18] Timberland ecosystems give items and administrations that are of incentive to human social orders.[19] Vital ecological issues related to mining of sandstone are- environmental problems, on the surrounding area leaving the region appeared scarred with irregular patches.

The resultant to mining, loss of surface and subterranean biodiversity makes an enormously ruthless condition which is unsuitable for restoration of the local biological community[20] with high financial esteem, and makes the region unfit for utilization of the local societies. Opencast mining in Chaukari kalan has regularly caused irreversible changes in vegetation, fauna, hydrology, and soil science and the formation of enormous overload dumps. Thusly, disposed of mines are perceived as man-made deserted destinations which have impacts on both an environmental and monetary weight on society.[21] Vegetation investigation of this mining region would help in understanding the influence of mining on the floral variety. The mining zone which is under investigation have been undermining from quite a while, therefore, the present examination deals with the plant species diversity and impact of mining exercises in and around Chaukri kalan mining zone.

Materials and Methods

The present study has been carried out at Chaukri kalan open cast mining zones of Jodhpur district, situated at 26°51'09.62"N latitude and 73°66'69.18"E longitude amid July, 2018 to June, 2019 (Fig. 1).

The examination region was inspected in a regular routine amid the field surveys. Field overview was

led in each season consistently. Arbitrary points were selected in the study area, the latitude-longitude coordinates were recorded with the assistance of a GPS. In those chosen points the vegetation cover of a 10mX10m region was made with the assistance of ropes and poles. This 100m^2 region was then overviewed by getting an exhaustive tally of the quantity of plants in it. The species were identified to the assistance of accessible literature. The native names were solicited from the neighborhood individuals from the concerned zones. Any obscure plant species was either photographed or gathered so as to get it recognized later on. Rest were distinguished, counted and archived.

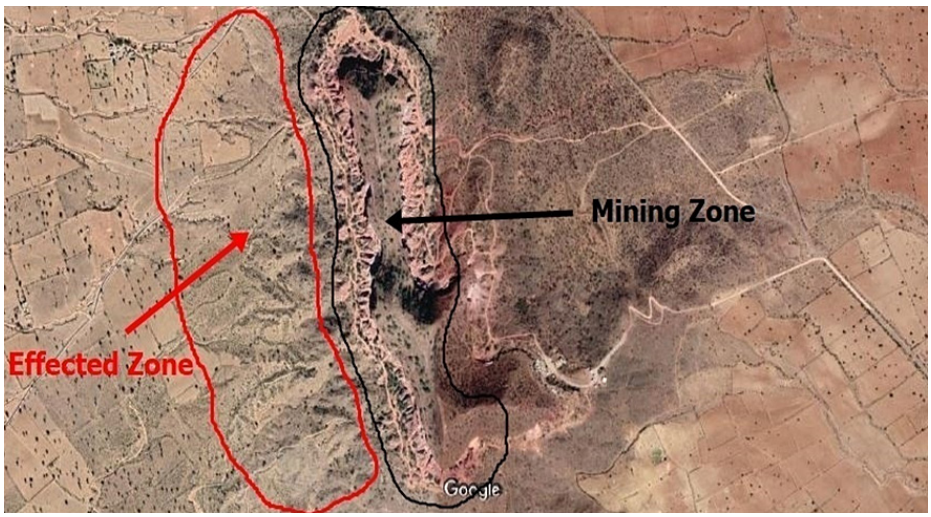

Fig. 1: Map showing mining and its affected zone at Chaukri kalan. (Source- Google Maps)

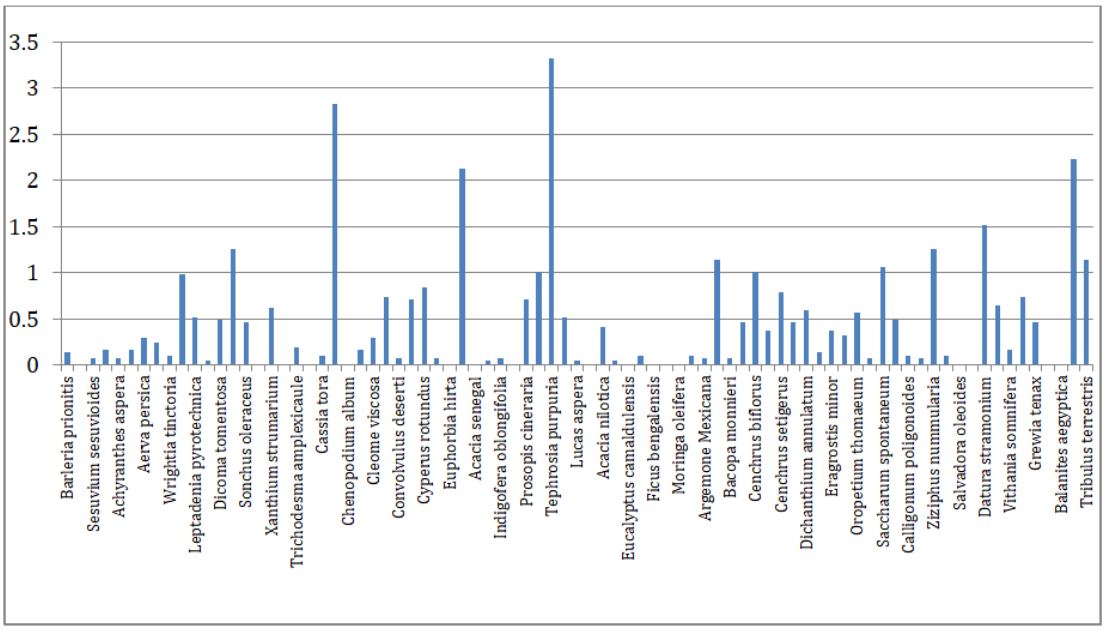

Fig. 1: Map showing mining and its affected zone at Chaukri kalan. (Source- Google Maps)

Data analysis for vegetation cover- Floristic analysis at mined and non-mined zones were estimated using diversity indices like as, richness, diversity and evenness-

Formulas-

Pi= n/N
Where,
n= number of species
N= total number of species observed in all families

Pi LN Pi = Hs
Where,
LN = natural logarithms
Hs= Shannon waiver diversity index

Richness= n/√N
Evenness= Hs/ n

Results and Discussion

From the study area an aggregate of 81 diverse plant species have been observed at Chaukri kalan non-mined study site. In which 50 species were of herbs, 14 of shrubs and 17 of trees were observed whereas only 64 plant species were observed in mined area.

In non mined area, the observed diversity indices Simpsons (D) and Shannon Wiener (Hs) were 42.77584 and 4.01195 respectively while in mined area, the diversity indices were observed 27.80326595 and 3.65606 respectively.

Table 1: Showing richness and evenness of plant species in mined and non-mined zones

Family	Plant Species	Habit	Richness	Evenness	Richness	Evenness
Acanthaceae	*Barleria prionitis*	H	0.14	5.23	0.48	2.50
	Justicia simplex	H	0	0	0.30	2.87
Aizoaceae	*Sesuvium sesuvioides*	H	0.08	7.66	0.32	2.80
	Trianthema portulacastrum	H	0.16	4.70	0.74	2.24
Amaranthaceae	*Achyranthes aspera*	H	0.08	7.66	0.97	2.10
	Aerva lanata	H	0.16	4.70	0.30	2.87
	Aerva persica	H	0.30	3.51	0.57	2.39
	Digera muricata	H	0.24	3.83	1.03	2.07
Apocynaceae	*Wrightia tinctoria*	T	0.11	6.07	0.51	2.46
Asclepidaceae	*Calotropis procera*	S	0.98	2.35	2.55	1.72
	Leptadenia pyrotechnica	S	0.52	2.86	1.22	1.99
	Sarcostemma acidum	S	0.05	12.15	0.38	2.67
Asteraceae	*Dicoma tomentosa*	H	0.49	2.91	1.73	1.85
	Oligochaeta ramose	H	1.25	2.20	1.81	1.84
	Sonchus oleraceus	H	0.46	2.97	1.20	2.00
	Verbesina encelioides	H	0	0	0.33	2.77
	Xanthium strumarium	S	0.63	2.68	1.33	1.96
Bignoniaceae	*Tecomella undulate*	T	0	0	0.50	2.47
Boraginaceae	*Trichodesma amplexicaule*	H	0.19	4.33	0.44	2.56
Brassicaceae	*Lepidium sativum*	H	0	0	0.21	3.20
Caesalpinaceae	*Cassia tora*	H	0.11	6.07	1.03	2.07
Capparaceae	*Capparis deciduas*	S	2.83	1.81	4.32	1.57
Chenopodiaceae	*Chenopodium album*	H	0	0	0.32	2.80
	Salsola baryosma	S	0.163	4.70	0.87	2.15
Cleomaceae	*Cleome viscosa*	H	0.30	3.51	1.24	1.99
Combretaceae	*Anogeissus pendula*	T	0.73	2.55	2.20	1.77
Convolvulaceae	*Convolvulus deserti*	H	0.08	7.66	0.55	2.41
Cyperaceae	*Cyperus bulbosus*	H	0.71	2.58	1.40	1.94
	Cyperus rotundus	H	0.84	2.45	1.71	1.86

Euphorbiaceae	*Euphorbia caducifolia*	S	0.08	7.66	0.65	2.31
	Euphorbia hirta	H	0	0	0.21	3.20
Fabaceae	*Acacia nilotica subsp. Cupressiformis*	T	2.12	1.93	3.17	1.65
	Acacia senegal	T	0	0	0.38	2.67
	Crotalaria medicaginea	H	0.05	12.15	0.55	2.41
	Indigofera oblongifolia	H	0.08	7.66	0.31	2.84
	Parkinsonia microphylla	T	0	0	0.05	6.66
	Prosopis cineraria	T	0.71	2.58	0.94	2.11
	Prosopis juliflora	S	1.01	2.33	1.46	1.92
	Tephrosia purpuria	H	3.32	1.75	4.51	1.56
Lamiaceae	*Anisomeles indica*	H	0.52	2.85	0.77	2.21
	Lucas aspera	H	0.05	12.15	0.21	3.20
	Ocimum americanum	S	0	0	0.07	5.16
Mimosaceae	*Acacia nilotica*	T	0.41	3.11	1.16	2.01
Meliaceae	*Azadirachta indica*	T	0.05	12.15	0.53	2.43
Myrataceae	*Eucalyptus camaldulensis*	T	0	0	0.05	6.66
Molluginaceae	Mollugo cerviana	H	0.11	6.07	0.51	2.46
Moraceace	Ficus bengalensis	T	0	0	0.01	0
	Ficus religiosa	T	0	0	0.05	6.66
Moringaceae	Moringa oleifera	T	0	0	0.05	6.66
Nyctaginaceae	Boerhavia diffusa	H	0.11	6.07	0.40	2.62
Papaveraceae	Argemone Mexicana	H	0.08	7.66	0.46	2.52
Pedaliaceae	Pedalium murex	H	1.14	2.25	2.55	1.72
Plantaginaceae	Bacopa monnieri	H	0.08	7.668	0.32	2.80
Poaceae	Aristida adscensionis	H	0.46	2.97	1.02	2.07
	Cenchrus biflorus	H	1.01	2.33	2.54	1.72
	Cenchrus ciliaria	H	0.38	3.19	1.45	1.92
	Cenchrus setigerus	H	0.79	2.50	1.98	1.80
	Dactyloctenium sindicum	H	0.46	2.97	0.80	2.20
	Dichanthium annulatum	H	0.60	2.72	1.22	1.99
	Digitaria bicornis	H	0.14	5.23	0.48	2.50
	Eragrostis minor	H	0.38	3.19	0.97	2.10
	Ochthochloa compressa	H	0.33	3.39	0.87	2.15
	Oropetium thomaeum	H	0.57	2.77	1.18	2.01
	Protis indica	H	0.08	7.66	0.44	2.56
	Saccharum spontaneum	H	1.06	2.30	1.39	1.94
	Sporobolus diander	H	0.49	2.91	1.49	1.91
Polygonaceae	Calligonum poligonoides	S	0.11	6.07	0.87	2.15
Rhamnaceae	Ziziphus mauritiana	S	0.08	7.66	0.50	2.47
	Ziziphus nummularia	S	1.25	2.20	2.00	1.80
Rubiaceae	Borreria articularis	H	0.11	6.07	0.52	2.44
Salvadoraceae	Salvadora oleoides	T	0	0	0.05	6.66
	Salvadora persica	T	0	0	0.06	5.74
Solanaceae	Datura stramonium	S	1.52	2.09	2.70	1.70
	Solanum surattense	H	0.65	2.65	1.00	2.08
	Vithania somnifera	H	0.16	4.70	0.86	2.16
Tiliaceae	Corchorus depressus	H	0.73	2.55	1.41	1.93
	Grewia tenax	S	0.46	2.97	2.00	1.80
Ulmaceae	Holoptelea integrifolia	T	0	0	0.04	8.41

Zygophyllaceae	*Balanites aegyptica*	T	0	0	0.34	2.74
	Fagonia cretica	H	2.23	1.91	4.69	1.55
	Tribulus terrestris	H	1.14	2.25	1.35	1.95
			(D) M = 27.80	Hs M = 3.66	(D) NM = 42.78	Hs MN =4.01

The study result shows that in non-mined area *Fagonia cretica* had highest richness (4.692416) while *Ficus bengalensis* had lowest (0.01188) and the highest and lowest evenness was observed for *Haloptelea integrifolia* (8.408658) and *Fagonia cretica* (1.54508) respectively. The observation of mined area shows that *Tephrosia purpuria* had highest richness (3.31919) while *Sarcostemma acidum, Crotalaria medicaginea, Lucas aspera* and *Azadirachta indica* had similar and lowest richness (0.054413). The highest and lowest evenness in mined area was observed for *Sarcostemma acidum* (12.14517) and *Tephrosia purpuria* (1.752363) respectively (Table. 1)

Fig.2. A-B showing mining activities and C-D showing mining dust on crop and crop field.

The mining action reasonably ruins the vegetation cover. The diversity indices of the mining site showed the big difference to non-mined site. The non-mined zone had higher Simpsons (D) and Shannon Wiener (Hs) indices as compared to mined zone. The investigation site has rich sources from floral biodiversity purpose of perspectives.

Habitat annihilation is the leading cause of species extinction and biodiversity loss in natural ecosystems.[22, 23] In mining activities the blasting technique produces harmful gases and dust particles (as SPM). These dust particles mixed with gaseous composition and deposited on the upper and lower surface of leaves, so the upper and lower surface

stomata were closed with thin layer of dust (Fig. 2). It causes less gases exchange and pigment loss of leaves. In other hand the thin layer of dust blocks the absorption of sun energy by leaf, which causes decreased photosynthesis and respiration; it results in the plant senescence or plant death. Deposition of mined exhausted toxic and harmful particles on upper layer of soil caused changes in soil physio-chemical parameters and surface texture composition (acidic/ alkaline/ saline/ toxicity), consequently this type of soil would not be useful for vegetation growth. The stones/rocks of the size beyond what 25cm could seriously influence the root entrance of plants and result in stunted development, that too when the level of stones surpasses 50-60(%) of soil.[24] According to Haule *et al.,* limestone mining in the study area exposed to devastate natural vegetation and it was revealed by the existence of the large mining pit found in the study area covering about 38.25 ha of the forest cleared for limestone mining. It had also substantiated by 61.7% of the respondents who noticed an increase in deforestation in Usongwe Division.[25] Biswas *et al.,* also concluded that the floral diversity was disturbed by opencast mining in Sonepur Bazari of Raniganj coalfield area, West Bengal.[26] International Council on Mining & Minerals (July 2005) recommend that, there ought to be precise arranging and biodiversity balances while building up mining industries, so harm because of mining could be redressed.[27]

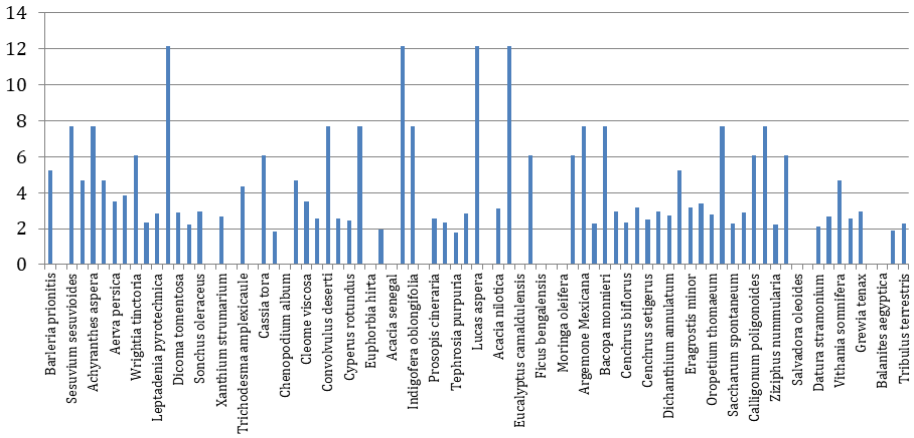

Fig. 2: Evenness of Species: Mined area from Chaukri Kalan Study Site

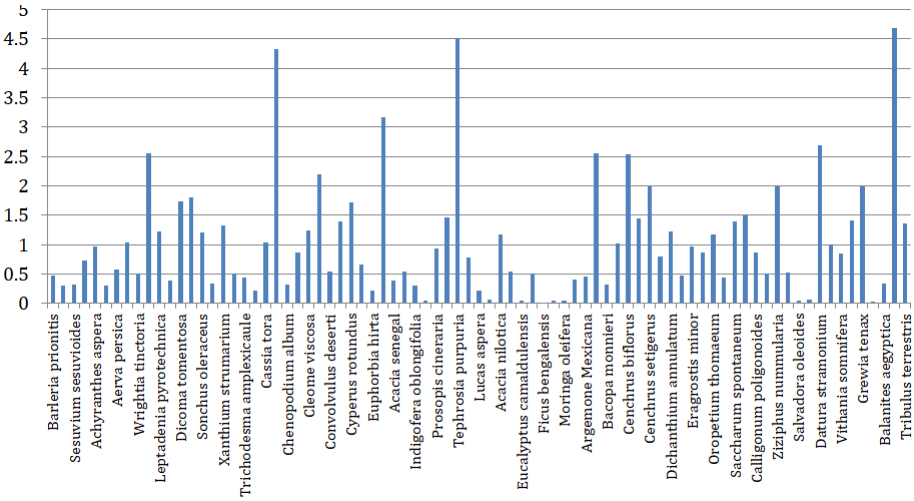

Fig. 3: Richness of Species: Non mined area from Chaukri Kalan Study Site

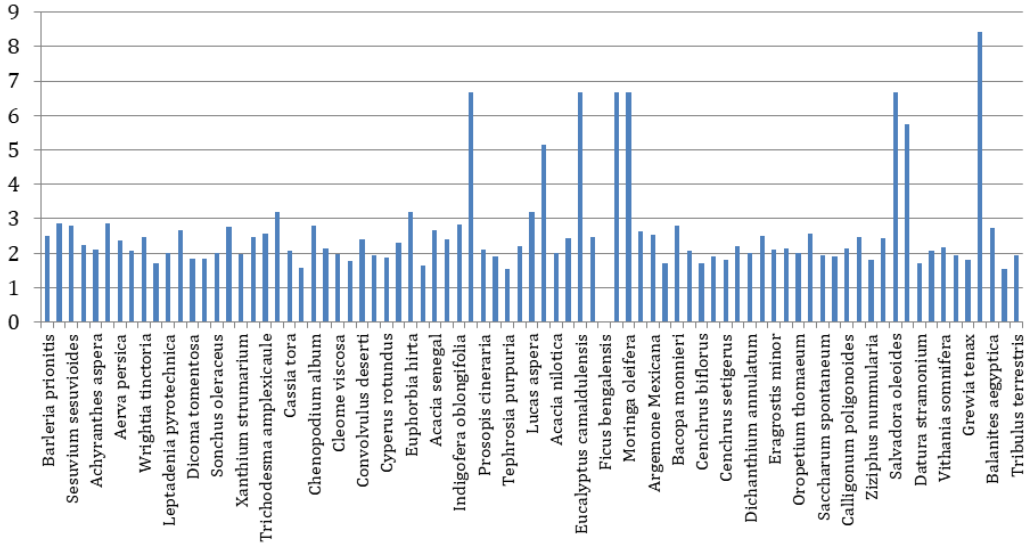

Fig. 3: Richness of Species: Non mined area from Chaukri Kalan Study Site

Conclusion

The stone mining at Chaukri kalan site has incredibly influenced the natural environment and vegetation diversity. Plants have been stripped off their normal territory because of stone mining exercises. The nonappearance of natural vegetation has extraordinarily expanded the danger of gorge disintegration in mining territories. The outcome investigation shows that mining tasks are directly or in a indirect way influences the vegetation, changes the soil surface and climatic condition. So it can be presumed that the mining tasks influences the nearby plants diversity and climatic conditions of encompassing regions. The present study is limited to sand stone mining area and its surrounding vegetation which showed the depletion impact on floral diversity. It is necessary to conduct further research on other types of mines to get satisfactory information about mining impacts on surrounding floral diversity.

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Conflict of Interest

The authors do not have any conflict of interest.

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