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IMPACT OF MARBLE MINING ON MOUNTAIN BIODIVERSITY: A SPECIAL REFERENCE TO DISTRICT BUNER PAKISTAN

Kausar Saeed[*1], Muhammad Jawad[2], Intikhab Alam[3], Imad Ali Khan[4], Daoud Khan[5], Abdul Aziz[6], Zaigham Hassan[7], Azam Jan Afridi[8], Zakir Ullah[9]

*[*1]Department of Zoology, University of Buner Khyber Pakhtunkhwa, Pakistan.*
[2]Department of Plant Sciences, Quaid e Azam University Islamabad, Pakistan.
[3]Department of Zoology, Govt College University Lahore, Pakistan.
[4]Department of Zoology, Batagram Campus Hazara University Khyber Pakhtunkhwa, Pakistan.
[5]Department of Forestry and Wildlife Management, University of Haripur, Khyber Pakhtunkhwa, Pakistan.
[6]Department of Zoology University of Swabi, Khyber Pakhtunkhwa, Pakistan.
[7]Institute of Zoological Sciences, University of Peshawar, Peshawar 25120 Khyber Pakhtunkhwa Pakistan
[8]Department of Zoology, Govt Post Graduate College Landi Kotal, 24800, district Khyber Pakistan
[9]Department of Botany Bacha Khan University charsadda

[*1]kausarsaeed@yahoo.com, [9]zakirullah271@gmail.com

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Abstract

Background: Mining is important for human sustenance and an essential division in the national economy. On the other hand, its effects on the environment and mountain biodiversity cannot be taking too lightly. Which are effective to attract government's attention. Environment and wildlife are focus to the harmful impacts of mining and its associated activities.
Objectives: The current study was conducted on the impact of marble mining on mountain biodiversity: a special reference to district Buner Khyber Pakhtunkhwa Pakistan from September 2022 to August 2023. To study the impacts of marble mining on mountain biodiversity: a special reference to district Buner KP Pakistan.
Methods: Data and literature were collected from various sources. Information relating to the health status of the residents and economic impacts were collected using structured questionnaires. Respondents involved selected miners and the educated persons of families living in the mining zones.
Results: During our study large number of species of

mammals and birds are found extinct due to marble mining, blasting and transportation of stones from mining sites to the factories. District Buner consists of about total number of 566 mining sites which increase the economic importance of district Buner. On the other hand, it has also negative impact on wildlife and habitat of wild animals of the study area.

Conclusion: In the study area we identified 11 species of mammals and 11 species of birds with different order and families. The mammalian species are Wild cat, Porcupine, Pangolin, Monkey, Jackal, Hyena, Hare, Grey goral, Fox, Bat, and Common leopard. While the bird's species are Crow, Crane, Quail, Chukar, Owl, Sparrow, Pigeon, Bulbul, Myna, Kingfisher, See-see partridge. Understanding the impact of marble mining on mountain biodiversity of district Buner is very important for sustainable management of these natural resources. The government organizations, NGOs and the research agencies must fill the knowledge gap.

INTRODUCTION

Mining activity has existed since the beginning of human society and minerals have contributed to the development of human civilization since the Stone Age. The mining industry impacts directly on the macro-economy by improving infrastructure, increasing employment, developing rural communities and enabling new spin-offs and downstream businesses (1). Rock quarrying and stone crushing is a global phenomenon, and has been the cause of concern everywhere in the world, including the advanced countries. In particular, it is often necessary to blast rocks with explosives in order to extract material for processing but this method of extraction gives rise to noise pollution, air pollution, damage to biodiversity and habitat destruction(2). Mining activities are widely regarded as having severe consequences on the environment, both in terms of their magnitude and their impact on biodiversity. Industrial activities such as mining operations release heavy metals into the environment. Some of these metals (e.g., lead and cadmium) are toxic to living organisms even at low concentrations. Others (e.g., copper and iron) are harmful at high concentrations (3). For example, mining associated infrastructure development can attract human populations causing new threats or exacerbate pre-existing threats, such as over-exploitation (e.g. hunting, fishing), invasive species and habitat loss for other land uses(4). The negative impacts of mining on the environment and biodiversity may be direct or indirect. Direct negative impacts include habitat loss and fragmentation, killing of wildlife during land clearance, disruption of hydrological systems and air and water pollution within and beyond the immediate confines of the mining operations(5). Mining produces a wide range of impacts that can affect the richness, abundance, and diversity of biotic communities, among the most important impacts of green removal which alters the availability of food, water, and wildlife habitat(6). Mining and its related activities are one of the major causes for the destruction of natural habitats for wildlife (7).

MATERIALS & METHODS

Study Area

District Buner is situated between 340-11' and 340-43' North Latitude and 720-13' and 720- 45' East Longitude in Khyber Pakhtunkhwa province of Pakistan. The district is surrounded by Swat district on North, Malakand Agency on the West Mardan district on the South and Hazara Division on the east having altitudinal range 366-291 m, with a total area of 1865 km2 and population of 506,048 individuals (8).

The climate of the area is subtropical to montane type having warm to hot summers and cool winters. The mean monthly rainfall is 235 mm in summer and 116 mm in winter and mean annual rainfall of 1068 mm. The summers are mild, and the winters are cool, with snowfall at high elevations. In June, the mean high temperatures are 32°C; while in January mean lowest temperatures are below freezing point. Average annual temperature is 19°C. Relative humidity is 60-65%. Barandu being the lonely river, flows in the central region of Buner and is a main source of irrigation, although severely degraded by the outflow from hundreds of marble factories. The people mostly live-in rural settlements and 45.38% people live below the poverty line. They mainly depend on agriculture, livestock, fuel wood, timber, government services and overseas employment for livelihood (9).

The district Buner consisting of the following 06 tehsil.

1. Tehsil Daggar
2. Tehsil Gagra
3. Tehsil Gadezai
4. Tehsil Mandanr
5. Tehsil Chagharzi
6. Tehsil Khudokhail

Map of study area

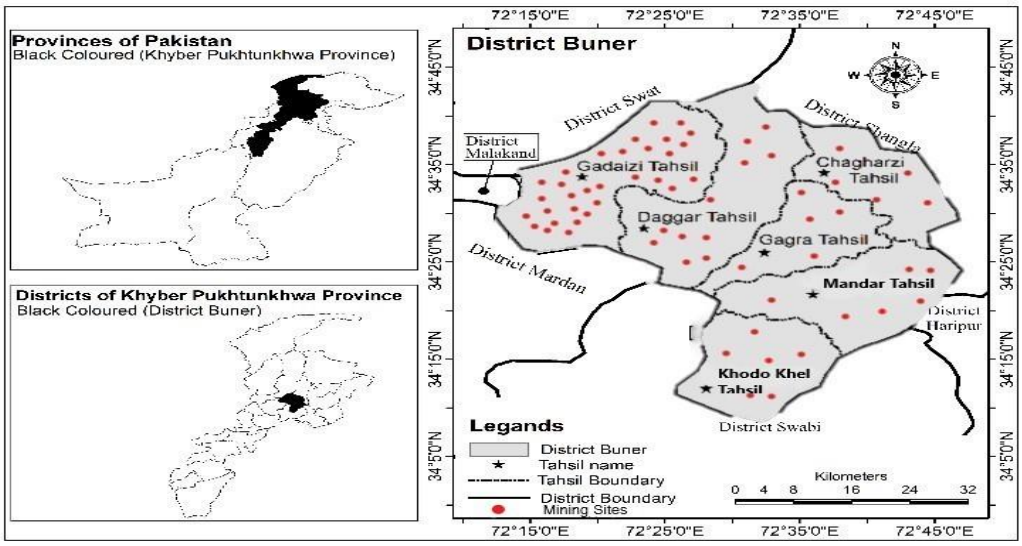


Figure 1.1: Map of district Buner(10).

Table 1.1: Number of mining tehsil wise distribution in district Buner

S.No	Mining Locality	Tehsil	Number Of Mining
1	Barjokanra	Gadezi	02
2	Ghazi Khani	Gadezi	03
3	Jowar	Gadezi	60
4	Bampokha	Gadezi	130
5	Pirabai	Gadezi	08
6	Bazargai	Gadezi	05
7	Katkala	Gadezi	08
8	Sultanwas	Gadezi	01

9	Kingargalli	Gadezi	55
10	Balo Khan	Gadezi	20
11	Nansair	Gadezi	13
12	Bagra	Daggar	15
13	Gokand	Daggar	15
14	Zaga	Daggar	02
15	Elai	Daggar	14
16	Torwarsak	Daggar	155
17	Amnawar	Gagra	07
18	Kulyari	Gagra	03
19	Dewana Baba	Gagra	06
20	Rega	Gagra	02
21	Shalbandi	Gagra	03
22	Matwani	Gagra	03
23	Sangara	Gagra	05
24	Dherai	Gagra	01
25	Chinglai	Khudokhail	09
26	Budal	Chagharzai	01
27	Batara	Chagharzai	02
28	Ghazibanda	Chagharzai	01
29	Gulbandai	Chagharzai	01
30	Pandhair	Chagharzai	10
31	Tangora	Chagharzai	03
32	Shangra	Chagharzai	02
33	Gumbat	Chagharzai	01

Study Design

Sampling

Research field studies was conducted from September 2022 to August 2023 of different mining zones of district Buner. Data and literature were collected from various sources. Information relating to the health status of the residents and economic impacts were collected using structured questionnaires. Respondents involved selected miners and the educated persons of families living in the mining zones. The aims of our study are to identify the effects of mining on the wildlife of the area. We also concentrate on other long-lasting mining impacts in the study area such as blasting, pollution, hunting, deforestation, and habitat destruction etc. Data were collected using direct and indirect methods to study the current status of wildlife in the area. Direct data were collected by visiting to the study area. In the collection ofindirect data, we interview from Hunters, residents, and other educated people about the status of birds, reptiles and mammals. A survey was designed to obtain information on the environmental impact of marble mining at the community and household levels through questionnaire method. The well-structured questionnaires contained large number questions.

RESULTS

Mining is the process of extraction of rocks materials through blasting. Mining activity is an essential that provides much of the materials used in traditional hard flooring, such as granite, limestone, marble, sandstone, slate and even just clay to make ceramic tiles. The mining industries give employment to the people. The current study was conducted on the impact of marble mining on wildlife species of district Buner Khyber Pakhtunkhwa Pakistan from September 2022 to august 2023. During our study large number of species of mammals and birds are found extinct due to marble mining, blasting and transportation of stones from mining sites to the factories. District Buner consists of about total numbers of 566mining sites which increase the economic importance of district Buner. On the other hand it has also negative impact on wildlife and habitat of wild animals of the study area. Total 11 species of mammals are identified the mammalian species are Wild cat, Porcupine, Pangolin, Monkey, Jackal, Hyena, Hare, Grey goral, Fox, Bat, and Common leopard. And 11 species of birds are identified the bird's species are Crow, Crane, Quail, Chukar, Owl, Sparrow, Pigeon, Bulbul, Myna, Kingfisher, See-see partridge with different order and families.

Fauna of district Buner affected by marble mining

Mammalian Fauna

Total 11 species of mammals are recorded in district Buner. The mammalian species are Wild cat, Porcupine, Pangolin, Monkey, Jackal, Hyena, Hare, Grey goral, Fox, Bat, and Common leopard. Types are shown in (Table 1.2). The mammalian species are found under threat. Foremost reasons for the decline of the mammalian species are mining, blasting, illegal hunting, transportation, over population and climatic changes.

In district Buner, tehsil Gadezai mostly has a problem with large number of mining, blasting zones, deforestation and over population leading to threat and extinction of such species like Grey goral, Pangolin, Common leopard etc.

Table 1.2 Mammalian species affected from marble mining in district Buner.

S.No	Order	Family	Common Name	Scientific Name	*IUCN Status
1	Carnivora	Felidae	Wild cat	*Caracal caracal*	LC
2	Rodenta	Hystricidae	Porcupine	*Hystrix indica*	LC
3	Pholidota	Manidae	Pangolin	*Manis crassicudata*	EN
4	Primates	Cercopithecidae	Monkey	*Macacca mulatta*	LC
5	Carnivora	Canidae	Jackal	*Canis aureus*	LC
6	Carnivora	Hyaenidae	Hyena	*Hyaena hyaena*	NT
7	Largomorpha	Lepodridae	Hare	*Lepus negricollis*	LC
8	Artiodactyla	Bovidae	Grey goral	*Naemorhedus goral*	NT
9	Carnivora	Canidae	Fox	*Vulpesbengalensis*	LC
10	Chiroptera	Vespertilionidae	Bat	*Myotis myotis*	EN
11	Carnivora	Felidae	Common leopard	*Pantherapardus*	VU

***IUCN Status** LC (Least Concern),EN (Endangered), NT (Near Threatened), VU (Vulnerable).

Avian Fauna

Total 11 species of birds are recorded in district Buner.The bird's species are Crow, Crane, Quail, Chukar, Owl, Sparrow, Pigeon, Bulbul, Myna, Kingfisher, and See-See Partridge. In district Buner there is also migratory birds are found. But these migratory birds are also in decline rate due to lose of forests, over population, over hunting and marble mining. Table 1.3 shows the representation of avian fauna in district Buner.

Table 1.3 Bird's species affected from marble mining in district Buner.

S.No	Order	Family	Common Name	Scientific Name	*IUCN Status
1	Passeriformes	Corvidae	Crow	*Corvus splendens*	LC
2	Gruiformes	Gruidae	Crane	*Grus grus*	LC
3	Galliforms	Phasianidae	Quail	*Coturnix coturnix*	LC
4	Galliforms	Phasianidae	Chukar	*Alectoris chukar*	LC
5	Strigiformes	Strigidae	Owl	*Strixaluco*	LC
6	Passeriformes	Passeridae	Sparrow	*Passer domesticus*	LC
7	Columbiformes	Columbidae	Pigeon	*Columba livia*	LC
8	Passeriformes	Pycnonotidae	Bulbul	*Pycnonotus cafer*	LC
9	Passeriformes	Sturnidae	Myna	*Acridotherestristis*	LC
10	Coraciiformes	Alcedinidae	Kingfisher	*Alcedoatthis*	LC
11	Galliformes	Phasianidae	See-See Partridge	*Ammoperdix griseogularis*	LC

***IUCN Status** LC (Least Concern),EN (Endangered), NT (Near Threatened), VU (Vulnerable).

Table 1.4Tehsil wise distribution of mining in district Buner

S.No	Tehsil	No of Mining
1	Daggar	201
2	Gadezai	305
3	Gagra	25
4	Chagharzi	21
5	Khudokhail	9
6	Mandanr	5

The above table1.4 shows the recorded number of mining zones in each tehsil of district Buner. In district Buner tehsil Gadezai have top most number of mining zones which is about 305. While tehsil Daggar is 2nd most number of mining zones and it is about 201 and tehsil Gagra, tehsil Chagharzi, tehsil Khudokhail, tehsil Mandanr have 25,21,9 and 5 number of mining zones respectively.

Table 1.5 Number of mammals affected in marble mining and control area in district Buner.

S.No	Common Name	Scientific Name	No in control area	No in mining area
1	Wild cat	*Caracal caracal*	39	19

2	Porcupine	*Hystrix indica*	47	31
3	Pangolin	*Manis crassicudata*	5	1
4	Rhesus Monkey	*Macacca mulatta*	43	23
5	Jackal	*Canis aureus*	69	37
6	Hyena	*Hyaena hyaena*	0	0
7	Hare	*Lepus negricollis*	39	17
8	Grey goral	*Naemorhedus goral*	15	7
9	Fox	*Vulpes bengalensis*	36	16
10	Bat	*Myotis myotis*	44	15
11	Common leopard	*Panthera pardus*	0	0

The above table 1.5 shows the number of mammals in mining area and control area of district Buner. The number of mammals decreased in mining area as compared to non-mining area or control area due to mining, blasting, overcrowding, over hunting, over population and also due to transportation of rocks as well as noise of the blasting and transportation. Due to these factors they may migrate from these residences to non-mining area and during migration they may be hunted by people or environmental factor affected them. In these mammals some are very rare found in Buner. Pangolin (*Manis crassicudata*) species are very few in number in mining area as well as in non-mining area too. Hyena (*Hyaena hyaena*) and Common leopard (*Panthera pardus*) are not present in district Buner they extant from Buner.Greygoral (*Naemorhedus goral*) species are near threatened to IUCN status and they are few in number fund in Nansair of tehsil Salarzi, Mir Dara of tehsil Gagra & Elum of tehsil Gadezi.

The table 1.6 showing the number of bird's species recorded in district Buner during our study. The bird's species are mainly affected by mining and the noise of heavy machineries of mining and also by hunting and over trading decrease the number of bird's species in the district Buner so they migrated from mining zones to non-mining zones for survival. In the following table some species are found in large number in control area as well as in mining area like Crow (*Corvus splendens*), Sparrow (*Passer domesticus*), Myna(*Acridotherestristis*) and some are very few in number e.g. Crane (*Grus grus*),Bulbul (*Pycnonotus cafer*), Owl (*Strixaluco*), Kingfisher (*Alcedoatthis*),Pigeon (*Columba livia*) and some peasants are also found very rare in district Buner they are Quail (*Coturnix coturnix*), Chukar (*Alectoris chukar*),See-See Partridge (*Ammoperdix griseogularis*).

Table 1.6 Number of birds affected in marble mining and control area of district Buner.

S.No	Common Name	Scientific Name	No in control area	No in mining area
1	Crow	*Corvus splendens*	83	54
2	Crane	*Grus grus*	19	09
3	Quail	*Coturnix coturnix*	27	12
4	Chukar	*Alectoris schukar*	18	06
5	Owl	*Strixaluco*	20	11
6	Sparrow	*Passer domesticus*	78	43

7	Pigeon	*Columba livia*	43	26
8	Bulbul	*Pycnonotus cafer*	33	13
9	Myna	*Acridotherestristis*	68	29
10	Kingfisher	*Alcedoatthis*	27	11
11	See-See Partridge	*Ammoperdix griseogularis*	19	07

DISCUSSION

Mining is important for human sustenance and an essential division in the national economy. On the other hand, its effects on the environment and biodiversity cannot be taking too lightly. Which are effective to attract administration's attention. Environment and wildlife are focus to the harmful impacts of mining and its associated activities. The current study was conducted on the impact of marble mining on wildlife of district Buner Khyber Pakhtunkhwa Pakistan. During our study large number of species of mammals and birds are found extinct due to marble mining, blasting and transportation of stones from mining sites to the factories. District Buner consists of about total numbers of 566 mining sites which increase the economic importance of district Buner. On the other hand it has also negative impact on wildlife and habitat of wild animals of the study area. Total 11 species of mammals are identified the mammalian species are Wild cat, Porcupine, Pangolin, Monkey, Jackal, Hyena, Hare, Grey goral, Fox, Bat, and Common leopard. And 11 species of birds are identified the bird's species are Crow, Crane, Quail, Chukar, Owl, Sparrow, Pigeon, Bulbul, Myna, Kingfisher, See-see partridge with different order and families.

The direct and indirect observations and interviews with local people before the mining operations in 1996 indicated that 40 species of medium to large mammalian species belonging to 15 families occurred in the study areas. These included nine species of global conservation concern. In comparison to the above study we also identified large number of species of mammals are found extinct due to marble mining, blasting and transportation of stones from mining sites to the factories. Total 11 species of mammals are identified the mammalian species are Wild cat, Porcupine, Pangolin, Monkey, Jackal, Hyena, Hare, Grey goral, Fox, Bat, and Common leopard with different order and families(5).

The endangered species of wild fauna were found very good numbers in the area during early 80's, as reported by the State Forest Department of Rajasthan include Wolf, Caracal, Blackbuck, Chinkara, Desert fox, Desert cat, Porcupine, several unique birds and reptiles. Before mining district Buner consist of high number of wild fauna. But now the numbers of wild fauna is very low due to mining in district Buner. The wild fauna of district Buner are Wild cat, Porcupine, Pangolin, Monkey, Jackal, Hyena, Hare, Grey goral, Fox, Bat, and Common leopard, Crow, Crane, Quail, Chukar, Owl, Sparrow, Pigeon, Bulbul, Myna, Kingfisher, See-see partridge with different order and families(11).

About09 species of mammals, 21 species of birds were recorded, in District Mardan with different order and families. In the Mohmand region 02 species of mammals, 04 species of reptiles and 09 species of birds were recorded. The fauna of the study areas was not rich due to mining activity, hunting and other environmental problems.We also identified total 11 species of mammals and 11 species of birds with different order and families. The study was conducted in district Buner. There are also large numbers of mining zones(9).

The concentration of HMs has been determined in soil samples collected from the control and mining sites. Pb, V, Cu, As, Zn, Cd, and Hg concentrations were significantly higher ($p < 0.05$) at the mining site, when compared with the control site. The results revealed non-significant difference in Fe concentration between both sites. *L. shawii*samples at the mining site showed higher concentrations of Pb, V, Cu, As, Fe, Cd, and Hg, whereas Zn concentration was not significantly different when compared with the control site.With the contrast to the above research study differences are present in our study work. They only work

on the chemical and heavy metals in the water of the area. We study the impact of marble mining on wildlife species of district Buner Pakistan. In our study great number of species of mammals and birds are found extinct due to marble mining, blasting and transportation of stones from mining sites to the factories.District Buner is made up of large number of mining sites which increase the economic importance of district Buner. On the other hand it has also negative impact on wildlife and habitat of wild animals of the study area(12).

Theyrecorded 52 species belonging to 17 families, and 12 species were amphibians and 40 species were reptiles. With the contrast to the above study variation are present in our study. They recorded theamphibians andreptilian species. While in our research study we recorded total 11 species of mammals the mammalian species are Wild cat, Porcupine, Pangolin, Monkey, Jackal, Hyena, Hare, Grey goral, Fox, Bat, and Common leopard. And 11 species of birds are identified the bird's species are Crow, Crane, Quail, Chukar, Owl, Sparrow, Pigeon, Bulbul, Myna, Kingfisher, See-see partridge with different order and families(13).

CONCLUSION

The current study was conducted on the impact of marble mining on mountain biodiversity: a special reference to district Buner Khyber Pakhtunkhwa Pakistan from September 2022 to August 2023. During our study large number of species of mammals and birds are found extinct due to marble mining, blasting and transportation of stones from mining sites to the factories. District Buner consists of 566 numbers of mining sites which increase the economic importance of district Buner. On the other hand it has also negative impact on wildlife and habitat of wild animals of the study area. In the study area we identified 11 species of mammals and 11 species of birds with different order and families.The mammalian species are Wild cat, Porcupine, Pangolin, Monkey, Jackal, Hyena, Hare, Grey goral, Fox, Bat, and Common leopard.While the bird's species are Crow, Crane, Quail, Chukar, Owl, Sparrow, Pigeon, Bulbul, Myna, Kingfisher, See-see partridge.

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