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Impact of stone quarrying on sloth bears in Swarnachud-Mitrapur reserve forest of Balasore, Odisha, India

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Abstract

In India, sloth bears are widely distributed but their population still in a risk of isolation and fragmentation. In Odisha, highest sloth bear population found in Swarnachud-Mitrapur reserve forest in the Nilagiri wildlife range (NWLR), which is a part of the Balasore wildlife division in Odisha and people of this region always face a major challenge of human-sloth bear conflict. Since 2021, stone quarrying activities have been operating in Kathagochhi village of Mitrapur and this area and its surroundings are the main habitat of sloth bears. Our present investigation observed that sloth bears of Mitrapur-Swarnachud reserve forest adversely affected by stone quarrying activities. Methodology includes field observation, photo documentation and interview of local people through a predesigned structured questionnaire to know the perceptions of local people about the impacts of stone quarrying on sloth bears and the local environment. Our study revealed that, stone quarrying activities cause sloth bear's habitat destruction, increase human-sloth bear conflict, increase nutritional deprivation, increase sloth bears accident, declining their population in this region due to their migration to other areas, excessive noise from quarrying activities disturbed their behaviour like increase aggressiveness, fear, anxiety and alternation of timing of their daily activities. As their habitat exposed by quarrying activities, they were more prone to poaching, hunting, killing and capturing that ultimately affected their survival. There is an urgent need to conserve these species in this region by creating awareness programme among local people and maintaining strict regulation on stone quarrying activities in wild animal's habitat.

Keywords: Sloth bears; Quarrying; Mitrapur; Habitat destruction; Human-sloth bear conflict

1. Introduction

Many wild animals and their habitat nearer to quarrying site negatively affected by quarrying activities [1]. Quarrying activities consist of extraction of minerals, rocks, drilling, crushing, transportation etc. All these activities are responsible for various adverse impacts on animals by causing their habitat destruction. Excessive noise from quarrying activities can interfere with animal vocal communication, changes their sleeping pattern, causes water, air and soil pollution lead to various ill impacts on animal health like it causes difficulty in breathing, eye infection, behavioural changes like promote anxiety, fear, aggressiveness and interfere with their day to day activities [2].

Today, the main threat to wild animals is habitat destruction caused by anthropological activities. In India, sloth bears are widely distributed but their population still in a risk of isolation and fragmentation [3]. Due to continuous habitat loss and fragmentation over the past century, sloth bear population has steadily declined. Today, they exist only on some isolated or fragmented habitat across the country. The sloth bear is listed in Appendix I of the CITES convention on International Trade in Endangered species and has been assessed as " Vulnerable A3c'' by IUCN red list, and it is also listed under Schedule I of India's wildlife protection act, 1972. In Odisha, highest sloth bear population occupies in Swarnachud-Mitrapur reserve forest in the Nilagiri wildlife range (NWLR), which is a part of the Balasore wildlife division in Odisha, India and people of this region always face a major challenge of human-sloth bear conflict [4]. This

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region consists of mixed deciduous forest which gives excellent habitat for sloth bears. Increased demand for natural resources, poaching, human-sloth bear conflict, pollution, habitat destruction, etc. are the main cause of declining sloth bear population in India [5].

Excessive demand of stones due to rapid infrastructure development led to uncontrolled stone quarrying in Mitrapur panchayat of Balasore district causing serious environmental degradation and wildlife habitat destruction [1]. A large numbers of tribal people of this area are dependent on stone quarrying activities for carrying their livelihood [6]. However, quarrying activities have been associated with a significant impact on the environment and animal habitat. Negative environmental impacts like dust pollution, noise pollution, water contamination, soil infertility, change of landscape and loss of plants/ vegetation are always associated with quarry activities [1]. Rock drills and explosion of dynamite are common methods used for opencast quarrying. It has many negative environmental impacts like destruction of animal's habitat, vegetation loss, soil erosion, river siltation, noise pollution due to blasting off mountain, transport of rocks by truck, dumper etc., and dust pollution. Quarrying activities induced serious pressure on soil and water resources. It also disturbed normal hydro-geological cycle and pre-existing ecosystem. It alters substratum, transform landscape pattern, disrupt the natural habitat and change genetic resources of the local biodiversity. Further quarrying activities aggravate dust emission, noise pollution and water contamination. Dumping of waste rocks blocks natural drainage system results in diversion of stream and river to other area result in flooding of crop fields. Mahapatra T (2023) first time studied environmental, social and health impact of stone quarrying in Mitrapur area of Balasore district, Odisha and found that serious environmental impacts and socio-economic conflict occur in this area due to quarrying activities [1].

The aim of this present study to determine impacts of stone quarrying on sloth bears in Mitrapur-Swarnachud reserve forest and on local environment. This study focuses to evaluate local community's perceptions about effects of quarrying activities on the immediate environment and on sloth bear's population, their habitat, their day to day activities and their behaviour which is the most dominating wild animal of this area and stone quarrying activities have been operating in this area since 2021.

2. Materials and methods

2.1. Study areas

Figure 1 Location of study site in India map

The study was undertaken in the Swarnachud-Mitrapur reserve forest of Nilagiri wildlife range (NWLR), which is a part of the Balasore wildlife Division in Odisha, India. It lies between 21^0 25' and 21^0 40' North latitude and 86^0 35' and 86^0

55’ East longitude. The study area is one of the tribal areas of Balasore district (77.7% tribal population). The tribal community mainly constitutes Bhumija, Kolha, and Santala community. Stone quarrying is the largest engagement occupation and major source of livelihood of this area. The economical sound people own quarrying site and crusher mill whereas tribal people working in this field for various allied quarrying activities like stone cutting, stone polishing, loading stone on truck and dumpers etc. as daily labour. There are around 15 km long stone belt spread from Mitrapur in the west to Sajanagada in East. But quarrying activity permitted only in Kathagochhi village of Mitrapur Panchayat. But many stone crusher mills developed in nearer villages and people of this region actively engaged in quarrying activities and negatively impacted by it. Swarnachud, Mitrapur, Ajodhya, Tinkosia and Arabandh are the five reserve forests that make up the most forest cover of NWLR. Among these Mitrapur and Swarnachud reserve forest and mountain contain height sloth bear population because this region consists of mixed deciduous forests which are providing the excellent habitat for sloth bears.

2.2. Data collection

The study was based on qualitative research design. Community members were interviewed to gather information about their perception of quarrying activities of this region on local environment and of the most dominant species of this region that is sloth bears. A semi-structured questionnaire was prepared for survey. Prior to data collection, the primary investigators tested the interview guide to determine the feasibility of the question being asked participants by conducting pretest interview with honour students. Further 20 households of nearer villages were surveyed to know their experience in last two years about the impacts of stone quarrying on sloth bears. Impacts of stone quarrying activities on local environment, sloth bear’s habitat, their behaviour and on their daily activities also accessed through interview.

2.3. Statistical analysis

Data were collected and entered in a Microsoft excel worksheet for the purpose of analysis and calculation of percentages.

Informed consent was obtained from all individual participants included in this study.

3. Results

Stone quarrying always associated with several adverse impacts on the environment and biodiversity. In Mitrapur Panchayat of Balasore district which is a part of Nilagiri wildlife range, stone quarrying is one of the major livelihood occupations of many local people. Mitrapur Panchayat primarily a tribal area (77.7% people belong to various tribal communities) of Balasore district [6]. Majority unskilled tribal people engaged in various activities of stone quarrying. Stone quarrying site that is khadan area (local word) locate in Kathagochhi village of Mitrapur panchayat. It causes severe environmental degradation like dust pollution, noise pollution, forest depletion, ecological degradation, water contamination etc. in local areas. Many local people have been suffering from several health issues like respiratory problem, mood swing of engaged worker in this field, irritation due to noise pollution, allergy, increase heart beat, eye infection etc. due to dust pollution caused by quarrying activities. Apart from it, this region is the main habitat of sloth bears in Odisha and they are the most dominant wild animal of this region. But due to continuous stone quarrying activities, their habitat got destructed and this wild animal faces a lot of challenges in their daily activity and behaviour.

3.1. Field observation

Quarrying areas in Kathagochhi village and surrounding forest were observed many times from May, 2022 to June, 2024. There is only one side protective wall present in one side periphery of quarry sites and no protective wall present on other side. There are no warning sign boards around the quarry that lead to a serious threat to the life of human and animals. It was clearly seen that sloth bear’s habitat got destructed by these activities because this site is the main habitat of sloth bears. Many people observed that sloth bears were migrated to other areas because of their habitat destruction. The quarry site is surrounded by agricultural land, forest and houses of local people. Many times it was reported that sloth bears accidentally fell on the quarry site. In this area, quarrying activities cause sandblasting and release of various chemicals to the environment causes soil, water and air contamination. More than 20 stone crusher mills were located in nearer villages. The stone crushers were a major source of dust and noise pollution. Many local people perceived that noise from quarrying activities interfered sloth bears vocal communication, disturbed their sleeping pattern, affected their behaviour, increased their fear and anxiety. In Kathagochhi village, due to constant quarrying activities, water contamination observed because of surface runoff water from quarry site drained to nearer ponds. One of the major concerns about the quarrying activities is the safety of people and animals around the quarry, because various allied activities of quarrying taking place in close proximate to the houses and dwelling, the locals and

animals are more prone to accidents. In the past many animals were injured due to stone hit during blasting in the quarrying. There is no information was available about the current status of stone quarrying that is total estimated material was to be removed. How much exactly remove till date, up to what depth the excavation is permitted and done, what regulations were to be followed and in case of violation what actions were taken against the concern parties. How many illegal quarries activities is taken place there, their current status etc., what are the current standard about the permissible height, hill cutting angle, maximum depth of the quarry allowed, etc. This indicates the serious and permanent negative impacts of quarrying on local environment and wild animals.

Figure 2 Sloth bear habitat in Swarnachud-Mitrapur reserve forest

Figure 3 Stone quarrying site in Swarnachud-Mitrapur reserve forest

Figure 4 Sloth bear habitat disturbed by stone quarrying in Swranachud-Mitrapur forest area

Figure 5 Stone quarrying site in Kathagochhi village of Mitrapur

3.2. Impacts of stone quarrying on local environment

Impacts of stone quarrying on local environment determined through interview. It was reported that majority of the respondents experienced many negative effects of the dust pollution by stone quarrying activities like stones crushing, cutting, polishing and transportation on local ecosystem and environment. Quarry sites produced dusts during blasting operation and transportation of stones that causes air pollution. Dusts in air leading to difficulty in breathing, many respiratory problems, allergies, eye infection, reduced visibility, create cloudy environment, etc. Among other pollutions, noise pollution is most devastating to local biodiversity. It mainly interfered sleeping pattern, behaviour, metabolism, communication, and grazing behaviour of animals. Quarrying world wide have been related to heavy metals contamination such as lead, arsenic, mercury, cadmium, etc. which is diffused to water and loaded on vegetations. Consumption of these contaminated food and water causes toxicity which was also observed by many people of our study area. Percentages (%) of people's perception about the impacts of stone quarrying on local environment of our study area clearly mentioned in figure 06.

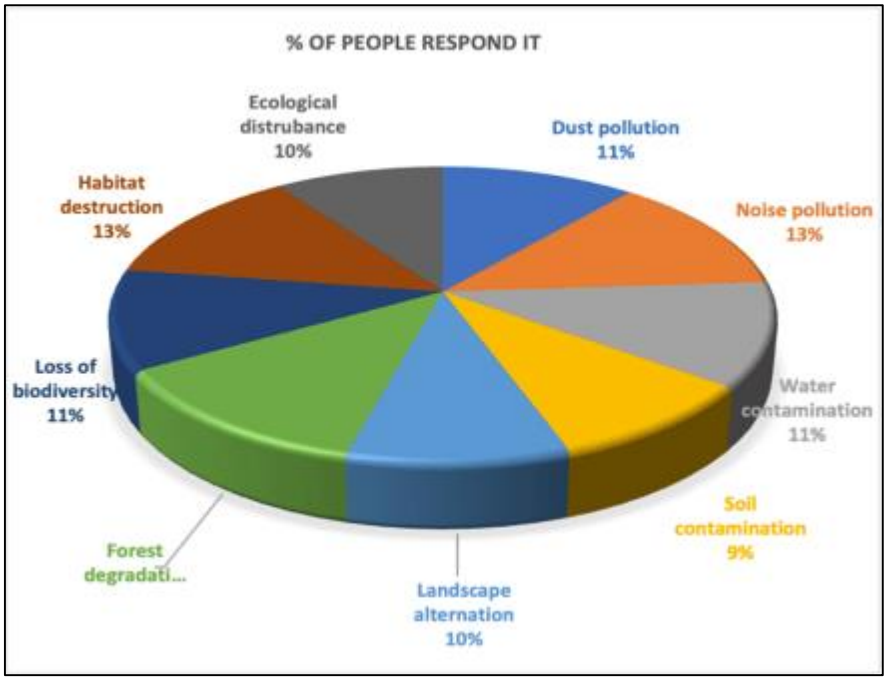

Figure 6 People's perception about the impact of stone quarrying on the local environment of Swarnachud-Mitrapur reserve forest

3.3. Impacts of stone quarrying on sloth bears

Impacts of stone quarrying on sloth bears were examined through interviews. Majority of the respondents experienced that sloth bear's habitat got destructed by quarrying operation in Mitrapur area (92%). Habitat destruction created obstacles in their free movement, altered their usual route, changed the location of their food and water sources, increased sloth bears-human conflict, and changed their behaviour that ultimately affected their survival and reproductivity. Many local people perceived that there were approximately 30 times human-sloth bear conflict increased after initiation of stone quarrying in this area. Many times sloth bears were coming to quarrying sites. Many respondents stated that death of sloth bears occurred due to quarrying activities like during blasting operation, by accidentally fell in quarry site and accident by trucks that carried stones. More than 100 trucks transport the stones from the quarrying site in Kathagochhi village of Mitrapur daily. Many times sloth bear-human conflict reported particularly in quarrying site at kathagochhi village. It has been observed in last two years, due to continuous stone quarrying activities in the habitat of sloth bears that is in Kathagochhi village of Mitrapur, there were increases in accident of sloth bears, human-sloth bear conflict, their behavioural alternation, alternation of their daily activities etc. Generally sloth bears appear during night, but it has observed many times sloth bears were coming to human habitat during day time because they were getting confused due to changes of local ecosystem because of quarrying activities. Continuous noise from quarrying operations like the sound from blasting, stone cutting, transportation of stones etc. affect sleeping patterns, behaviour, communication and feeding behaviour of sloth bears. It also leads to increased fear and anxiety among sloth bears. Sometimes make them more aggressive due to local habitat disturbance and also make them vulnerable to accident, hunting and poaching by smugglers. Many times, news came about the illegal poaching, killing, capturing and hunting of sloth bears which is increasing in last few years due to quarry activities because their habitat got exposed to people. Loss of vegetations, water contamination in quarry sites, soil erosion etc. lead to storm water runoff affected their feeding habit. They could not access grazing lands when the lands were flooded because of quarry activities. Many local people of Mitrapur area have observed that due to stone quarrying activity, sloth bear population of this area declined and many sloth bears migrated to other areas. Some people also stated that sloth bears were getting confused to find their daily route, and many times they disturbed by blasting operation and noise from quarrying activities. Percentages (%) of people's perceptions about the impacts of stone quarrying on sloth bears have mentioned in table 1. And the overall impacts of stone quarrying on sloth bears shown in figure 08.

Table 1 % of people's perceptions about the impact of stone quarrying on sloth bears of Swarnachud-Mitrapur reserve forest

Impact of stone quarrying on sloth bears	% of people respond it
Habitat destruction	92%
Human-sloth bear conflict	77%
Alternation in daily activity	74%
Behavioural changes	65%
Accident of sloth bears by quarrying activity	78%
Fear	71%
Agrressiveness increase	89%
Deprivation to access food	44%
Bad health due to pollution	82%
Loss of biodivesity	78%
Hunting and poaching	66%

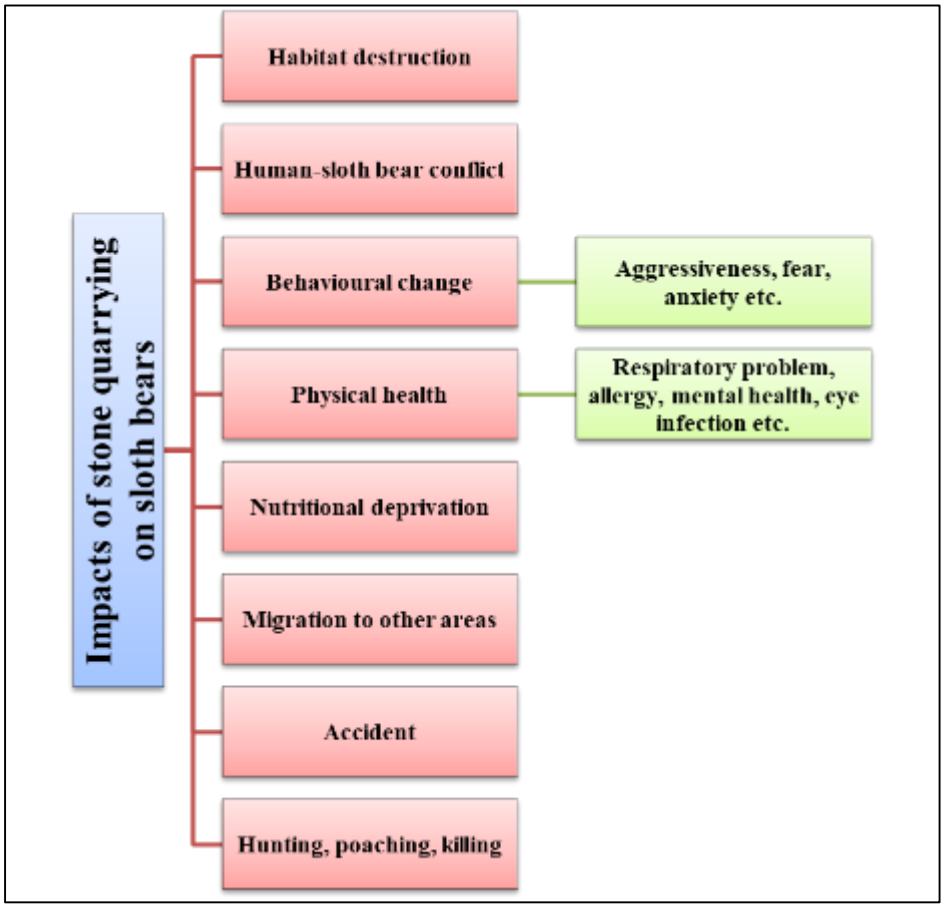

Figure 7 Impact of stone quarrying on sloth bears in Swarnachud-Mitrapur reserve forest

4. Discussion

Infrastructure development associated with quarrying activities in India. However, quarrying activities always associated with a significant impact on the environment and animal habitat [1]. Negative environmental impacts like

dust pollution, water contamination, forest depletion, soil infertility, change of landscape etc. always associated with stone quarrying [7]. Previous studies reported that habitat destruction of wildlife by quarrying activity directly impacted their reproduction and survival similar to our study (8). In India habitat destruction is the main cause of sloth bear population declining and our study has shown that the first and immediate impact of stone quarrying in Mitrapur was the sloth bear's habitat destruction which was also indicated in previous studies in other areas [9]. Apart from habitat destruction, several environmental pollutions, landscape alternation, local vegetation loss, water contamination, local ecosystem alternation due to stone quarrying also negatively affected sloth bears which were observed during the investigation. Quarrying activities in Mitrapur adversely affected sloth bear's daily activities and their behaviour. Another important problem was human-sloth bear conflict which was frequently reported after the start of stone quarrying operation in their habitat. Sloth bear's accident and death also increased in our study area and local people thought that it was increased due to quarrying activities. Sloth bear population has been declining in Madhya Pradesh due to habitat destruction by anthropological activities which is similar to our observation [10]. As quarrying activities operate in sloth bear's natural habitat, ultimately, their habitat got exposed to people that led to their illegal capturing, hunting and poaching.

Our present investigation observed that sloth bears of Mitrapur-Swarnachud reserve forest of NWLR, Balasore adversely affected by stone quarrying activities in this area. Hill cutting, blasting, stone crushers, and stone transportation cause sloth bear's habitat destruction, local landscape alternation, dust pollution, water contamination, loss of vegetations, excessive noise pollution, accident of sloth bears by truck carrying stones and by blasting operation, poaching, hunting, capturing of sloth bears, frequent human-sloth bear conflict, caused their behavioural changes like increased their aggressive behaviour, fear, anxiety behaviour and exposed of their natural habitat to people, alternation of timing of their daily activities and that ultimately affecting their survival. There is an urgent need to conserve these natural animals in their natural habitat by creating awareness programme among local people.

5. Conclusion

Keeping the balance between the ever growing stone quarrying activities and wildlife is critical, which require better understanding of the ecological needs and dwellers. Stone quarrying operation should not operate in wild animal's habitat because these activities always produced adverse impacts on ecosystems and wildlife. There is a need to study more on sloth bear population, their habitat and try to find out the solution to reduced human-sloth bear conflict. Modern techniques like camera trap, unmanned aerial vehicle, drone etc. should be used to monitor sloth bear's activity without disturbing their habitat to reduced human-sloth bear conflict. There is an urgent need to formulate methods and policies for conservation of sloth bears in their natural habitat.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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