International Journal of Global Science Research **ISSN: 2348-8344 (Online)**
Vol. 11, Issue. 1, April 2024, pp. 2239-2250 **DOI: 10.26540/ijgsr.v11.i1.2024.260**
***Available Online* at www.ijgsr.com**

Research paper

An investigation of Plant diversity in and around Opencast Mining areas of Bundelkhand region of Uttar Pradesh, India

Priyanka Singh[1]*, Rajeev K. Niranjan[2] and Amit Pal[1]
[1]Institute of Environment & Development Studies, Bundelkhand University, Jhansi, India
[2]Nehru P. G. College, Lalitpur, Bundelkhand University, Jhansi, India
*Corresponding author Email: apu13@rediffmail.com

Received: 20/03/2024
Revised: 27/03/2024
Accepted: 02/04/2024

Abstract: Open cast mining and allied activities contributing significant infrastructure development and raising the living standards of mankind. However, Mining and Stone crushing industries has caused potentially adverse impacts on natural environment, society and cultural heritage, health of workers and communities in close proximity to operations. The forest of Bundelkhand region is Tropical Dry Deciduous in nature are under tremendous pressure of biotic interferences, climate change and vast experiences of open cast granite mining activities. Present studies have been carried out to evaluate the existing flora in Four opencast mining areas and their adjacent villages of Jhansi and Lalitpur district of Bundelkhand region of Uttar Pradesh. On the basis of our extensive survey out of four selected sites highest numbers of species (53) have been found at Bundela Bandhu site in Lalitpur district and lowest number of species (31) has been observed at Karari site at Jhansi district. In present study and our periodical investigation there are 81 plant species have been found belonging to 36 Family. On the basis of their abundance in existing severe environmental conditions following species may be recommended as 1st choice for greenbelt design in an around opencast mining areas of Bundelkhand region. The species are as follows: *Acacia nilotica, Bambusa vulgaris, Butea monosperma, Calotropis procera, Cynodon dactylon, Eucalyptus globulus, Jatropha curcas, Lantana camera, Ocimum gratissimum, Ziziphus mauritiana, Dalbergia sisoo, Vachellia nilotica, Adhatoda vasica, Allianthus excelsa, Datura metel, Nerium oleander, Tecoma stans.*

Keyword: Bundelkhand region, Opencast Mining, Stone crushing, Vegetation.

Introduction:

Mining has some unique features such as natural background contamination associated with mineral deposits, industrial activities and contamination in the three

International Journal of Global Science Research
Vol. 11, Issue. 1, April 2024, pp. 2239-2250
Available Online at www.ijgsr.com

ISSN: 2348-8344 (Online)
DOI: 10.26540/ijgsr.v11.i1.2024.260

dimensional subsurface space problem of long-term remediation after mine closure, problem of secondary contaminated areas around mine sites, land use conflicts and abandoned mines. These problems require special tools to address the complexity of the environmental problems of mining-related contamination. Mine is a major economic activity in many developing countries. Operations whether small or large scale are inherently disruptive to the environment, producing enormous quantities of dust wastes that can have deleterious impacts for decades. Mine and stone crushing industry in India has been growing rapidly due to increasing demand from the construction industry and the present emphasis on developing the country's infrastructure (e.g. road, bridges buildings, etc.) though reliable statistics are lacking for this industrial sector due to its informal nature. It is estimated that there are more than 12000 stone crushers in India which provides direct employment to thousands of rural migrant and unskilled workers.

Stone crusting in India is basically a labour intensive small scale industry, where most of the operations are performed manually (Aslam *et al*, 1992). Very little information is currently available regarding dust emissions from these units, associated with occupational exposures and the baseline respiratory health status of workers. Mining in peripheral parts of the world economy is a consequence of larger global economic interests. Historically, long-distance trade and export production of minerals and other natural resources primarily for the benefit of core countries are responsible for transforming the natural environment and landscapes of peripheral sectors of the world economy.

It is clear that the impacts (both beneficial and adverse) of mining begin before a mine is even established and does not disappear with the closure of a mine. Due to lack of proper adequate precaution measures, granite mining has caused serious negative impacts on the environment and on human health (Singh *et al*., 2008). In Jhansi granite mining is done mainly through the open cast mining. Opencast mining is damaging more the environment than underground mining. Some potential impacts from blasting are ground vibrations, noise, dust, and fly rock (Langer, 2001). It starts within a natural ecosystem and it not only disturbs the existing ecosystems, but also generates an artificial one, which has its own factors including pollutants and contaminants. The important environmental problems that arise out of the opencast mining operation are, water, soil, noise, land pollution etc. Mining operations not only affect the physical and biological structure of an area; it leads to an overall change of the surrounding i.e. the socio-economic status. Although open cast mining has various negative impacts on the environment but it has got positive impact even. It has also eliminated many traditional sources of income.

Mining is one of the core industries in India and plays a positive role in the economic development of our country (Chaulya and Chakraborty, 2001). Most of the major mining activities contribute in the emission of suspended particulate matter (SPM), leading to the problem of air pollution directly or indirectly, and right from exploration to exploitation including mineral processing (Sinha and Banerjee, 1994; CMRI, 1998). The magnitude and significance of environmental pollution caused by mining depends on the type of mineral being mined, the method of mining and various other factors (Ghose, 2007). Currently, there are no limitations to the capacity of mine production but it is, however, necessary to maintain a suitable condition for miners as well as the general public (Chakraborty et al., 2002; Tadesse,

International Journal of Global Science Research
Vol. 11, Issue. 1, April 2024, pp. 2239-2250
Available Online at www.ijgsr.com

ISSN: 2348-8344 (Online)
DOI: 10.26540/ijgsr.v11.i1.2024.260

2000). According to given our new understanding of the significance of deposited dust in air quality, it is one of the main causes of complaints about air pollution (Vallack and Shillito, 1998). Mining is the main source of livelihood for many people and play a crucial role in the economic development of many countries. However, quarrying tends to make a notable impact on the environment. Vegetation can be affected at site clearing stage and during off road movement of the trucks. The operation of land clearing led to loss of vegetation cover and land degradation. On the other hand, studies showed that quarry sites can improve biodiversity with careful planning and management. Therefore, it is important to evaluate the effect of stone mining on vegetation for effective and sustainable management of the environment. Therefore, this study assessed the effect of stone mining on species diversity the perception of the nearby communities around the mining sites. Mining is one of the main sources of livelihoods for many people. During the last decades, there has been phenomenal increase in the mining of foundation and dimension stones, causing large-scale destruction and deterioration to the local habitat of the areas.

Open cast mining cause unnecessary air pollution as they produce huge quantities of wastes other than underground mining. 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. The top soil especially gets seriously damaged during extraction process. The other vital ecological issues related to mining of sandstone along with noise pollution, 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 flora and change in land topography, degradation of agriculture land, and also the soil and rock masses. Certainly, reclamation is mostly used to refer to re-vegetation of highly degraded site such as mined lands. 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. 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. It has also caused serious social and environmental impacts, like displacement of local people, dust generation, air and water pollution, land degradation, harm to livestock and wild life, and reduction in the agricultural productivity. A comprehensive plan has been formulated involved the planning and implementation of a series of preventive and suppressive measures in addition to the dust extraction system (Martin et al., 1980). Different abatement measures are enumerated as plantation of trees is one of the best measures for controlling air pollution. For inhibiting dust, trees with compact branches, pilose closely arranged broad leaves, shiny or waxy leaves and high praline content are preferred. Maiti and Banerjee (1997) found that plants can acts as filters of dust of pollutants in mining areas, reporting that a 8-m wide green plants roads and buildings can reduce dust fall by two to three times; conifers reduce dust fall by up to 42% in temperate urban areas. They also indicated that evergreen plants with shiny

International Journal of Global Science Research
Vol. 11, Issue. 1, April 2024, pp. 2239-2250
Available Online at www.ijgsr.com

ISSN: 2348-8344 (Online)
DOI: 10.26540/ijgsr.v11.i1.2024.260

leaves like *Alstonia scholaris*, *Ficus lunea*, *F. benghalensis* and *Mangifera indica* are the best dust catchers.

In present study the investigation of floral diversity of open cast mining areas of Bundelkhand region would help in understanding the influence of mining activities on variety of plant species. The mining zone and its adjacent areas in under investigation have been undermining from quite a while, therefore, the present study deals with phytodiversity and impact of open cast granite mine activities in and around Lalitpur and Jhansi of Bundelkhand region of Uttar Pradesh of India.

Materials and Methods:

The Bundelkhand region of Uttar Pradesh comprises of 7 districts of Jhansi and Chitrakoot Dham divisions and are Jhansi, Lalitpur, Jalaun , Hamirpur, Mahoba, Banda and Chitrakoot [Fig-1]. Bundelkhand agro-climatic zone of Uttar Pradesh is located in SW corner of U.P. extended between 24^0 11′ N to 26^0 27′ N latitudes and 78^0 17′ E to 81^0 34′ E longitudes with an average altitude ranging 250-300 in above MSL. The Bundelkhand plateau has a gently undulating surface broken occasionally by low, flat-topped hills, which form the specific topographical feature of the region. A number of lower Vindhyan hill ranges are seen in the south and south East and central portions of Bundelkhand with a maximum height of 2000 feet. The general slope of the region is towards north to east in southern part, apart from the regular hill range and small rock outcrops on hillocks. In northern part some small rock outcrops here and there and high ravines along the river banks are characteristics of this region. The landscape of the Bundelkhand region is rugged, featuring undulating terrain with low to medium level rocky outcrops, narrow valleys and plains. Climatically this region falls under a semi arid climate, with two main seasons: Monsoon and Dry. The monsoon brings over 90% of the annual rainfall between the months of June to September. Peak summer (may-June) brings excessively high temperature often topping 40^0C, as the hot, dry loo winds sweep in from the desert.

Figure – 1: Shows the Bundelkhand region of Uttar Pradesh and Madhya Pradesh.
(Site-I: Bundela Bandhu; Site-II: Pitambara Granite; Site-III : Saroj Granite; Site-IV: Karari)

SITE-I – Bundela Bandhu in Lalitpur near the village known as Kalapahar. Its distance from Lalitpur is 10 km.

SITE-II – Peetambra Granite in Lalitpur near the village known as Durjanpur. Its distance from Lalitpur is 3 km.

SITE-III – Saroj Granite in Jhansi near the village known as Laxmanpura. This site is located on national highway NH-39 known as Jhansi-Khajuraho highway.

SITE-IV – Karari in Jhansi. Its distance from Jhansi is around 8 km. This site is

International Journal of Global Science Research **ISSN: 2348-8344 (Online)**
Vol. 11, Issue. 1, April 2024, pp. 2239-2250 **DOI: 10.26540/ijgsr.v11.i1.2024.260**
***Available Online* at www.ijgsr.com**

located on national highway NH-75 known as Jhansi- Gwalior highway. It is 500 m far away from the highway.

Results and Discussions:

In the present study a plant community survey of four sample sites in and around the open cast granite mine area (Figure – 1) identified a total of 81 plant species, including trees, shrubs and herbs. The plant diversity of selected open cast mining areas with nearly 1 km adjacent surrounding villages has been investigated. In terms of total number of species present (Table – 1) the Site –I showed maximum number of species i.e. 53 species followed by Site – III and Site II and Site IV shows least number of species i.e. only31 species. The study also found that there are 36 family and maximum number of species belonging to Fabaceae and followed by Rutaceae, Apocynaceae, Poaceae, Myrtaceae, Moraceae, Asteraceae, respectively.

In Site – I out of 53 species the following 10 species may be considered as First category i.e. *Acacia nilotica, Bambusa vulgaris, Butea monosperma, Calotropis procera, Cynodon dactylon, Eucalyptus globules, Jatropha curcas, Lantana camera, Ocimum gratissimum* and *Ziziphus mauritiana* (Table – 2). Following 19 species may be considered as Second category as *Acacia catechu, Aegle marmelos, Azadirachta indica, Carissa carandas, Citrus limetta, Citrus limon, Citrus medica, Dalbergia sisoo, Emblica officinalis, Ipomoea fistulosa, Leucaena leucocephala, Mangifera indica, Parthenium hysterophorus, Pennisetum glaucum, Polyalthia longifolia, Pongamia pinnata, Psidium guajava, Tectona grandis, Terminalia arjuna* and rest all species are found very less in number.

In Site – II out of 39 plant species following 7 species are most dominant and they are - *Butea monosperma, Cynodon dactylon, Dalbergia sisoo, Eucalyptus globules, Lantana camera, Ocimum gratissimum* and *Vachellia nilotica.* Following 15 species may categorized as Second Choice as *Allianthus excelsa, Alternanthera ficoidea, Calotropis procera, Datura metel, Euphorbia hirta, Ficus hispida, Jatropha curcas, Polyalthia longifolia, Pongamia pinnata, Solanum nigrum, Tectona grandis, Tephrosia purpurea, Typha domingensis, Xanthium strumarium* and *Ziziphus mauritiana* and rest all species are found very less in number.

In Site – III out of 46 plant species following 9 species are most dominant and they are as follows - *Adhatoda vasica, Allianthus excelsa, Butea monosperma, Datura metel, Jatropha curcas, Lantana camera, Nerium oleander, Ocimum gratissimum* and *Tecoma stans.* Following 13 species namely *Aegle marmelos, Azadirachta indica, Bombax ceiba, Calotropis procera, Dalbergia sisoo, Dendrocalamus strictus, Emblica officinalis, Ficus hispida, Ipomoea fistulosa, Leucaena leucocephala, Pongamia pinnata, Tectona grandis* and *Ziziphus mauritiana* have been considered as Second choice of species and rest all species are found very less in number and considered as Third choice of species on the basis of their abundance.

In Site – IV out of 31 plant species following 6 species are found luxuriant and they are as follows - *Butea monosperma, Calotropis procera, Dalbergia sisoo, Jatropha curcas, Lantana camera* and *Ocimum gratissimum* considered as First choice of species. Following 7 plant species i.e. *Adhatoda vasica, Datura metel, Leucaena leucocephala, Polyalthia longifolia, Pongamia pinnata, Solanum nigrum* and *Ziziphus mauritiana* are to be considered as Second choice of species and rest all species are found very less in number also considered as Third choice of species.

ISSN: 2348-8344 (Online)
DOI: 10.26540/ijgsr.v11.i1.2024.260

Generally mining shows a negative impact on diversity of plant species. In present investigation, species abundance has been occurred in the non-quarry areas i.e away from excavation areas as compared to the quarry areas. Therefore, attention should be given by all relevant stakeholders towards minimizing the negative impacts of quarry for further sustainable natural resources management. Stone mining can affect biodiversity by disturbing plant growth by settling of dust on leaves and hinder photosynthesis also disrupting food chains (Akanwa et al. 2017; Gabarrón et al. 2019). Letheren (2008) in their research on the comparison of woody vegetation species abundance on quarry surrounding and reference area found that highest abundance in the reference area as compared to the quarry areas. The mining sites have incredibly influenced the natural environment and it has been evident that the mining action reasonably ruins the vegetation cover. The plant diversity of the mining site showed the big difference to non-mined site. The adjacent of investigation sites having rich sources from floral biodiversity purpose of perspectives. In mining activities excavation, transportation, loading etc. technique also produces harmful gases and dust particles (as SPM). Studies showed that 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. 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. The outcome of investigation shows that mining tasks are directly or indirectly influences the vegetation composition, air quality, water quality, noise, 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. Furthermore, the waste materials that remain after the extraction of the stone are dumped on the surrounding land, thus causing loss of topsoil, nutrients and supportive microflora and vegetation (Hammond 1988; Singh et al. 2002). The present study is limited to opencast mining area and villages of its surrounding vegetation which showed the depletion impact on floral diversity. The dominant species of study site I having *Acacia nilotica, Bambusa vulgaris, Butea monosperma, Calotropis procera, Cynodon dactylon, Eucalyptus globulus* respective species. At site II Peetambra Granite, consisting dominant species i.e., *Butea monosperma, Cynodon dactylon, Dalbergia sisoo, Eucalyptus globulus, Ocimum gratissimum, Vachellia nilotica* respective species. At site III Laxmanpura of Jhansi having dominant species i.e., *Adhatoda vasica, Allianthus excelsa, Butea monosperma, Datura metel, Jatropha curcas, Lantana camera* respective species. At site IV Karari of Jhansi which having lowest composition of floral diversity dominant species i.e., *Butea monosperma, Calotropis procera, Dalbergia sisoo, Jatropha curcas, Lantana camera and Ocimum gratissimum, etc.* It is necessary to conduct further research on other types of mines to get satisfactory information about mining impacts on surrounding floral diversity.

International Journal of Global Science Research
Vol. 11, Issue. 1, April 2024, pp. 2239-2250
Available Online at www.ijgsr.com

ISSN: 2348-8344 (Online)
DOI: 10.26540/ijgsr.v11.i1.2024.260

Table – 1: Abundance of Plant species at respective selected sites.

S.No	Species Name	Local name	Family	Site I	Site II	Site III	Site IV
01.	*Acacia catechu*	Kher	Fabaceae	++	-	-	
02.	*Acacia nilotica*	Babul	Fabaceae	+++	-	-	+
03.	*Achyranthes aspera*	Chaff flower	Amaranthaceae	+	-	-	-
04.	*Adhatoda vasica*	Malabar nut	Acanthaceae	-	-	+++	++
05.	*Aegle marmelos*	Bael	Rutaceae	++	-	++	-
06.	*Albizia lebbeck*	Indian siris	*Fabaceae*	+	-	+	-
07.	*Allianthus excelsa*	Adu Ghoda Neem	*Simaroubaceae*	+	++	+++	+
08.	*Alternanthera ficoidea*	Parrot leaf	*Amaranthaceae*	-	++	-	-
09.	*Annona squamosa*	Custard apple	Annonaceae	+	-	+	-
10.	*Artocarpus heterophyllus*	Jackfruit	*Moraceae*	+	-	-	+
11.	*Azadirachta indica*	Neem	Meliaceae	++	+	++	+
12.	*Bambusa vulgaris*	Bamboo	*Poaceae*	+++	+	-	-
13.	*Bauhinia variegata*	*Kachnar*	Fabaceae	+	-	-	-
14.	*Bombax ceiba*	Semul	Bombacaceae	-	+	++	+
15.	*Bougainvillea glabra*	Paper flower	Nyctaginaceae	+	-	+	-
16.	*Butea monosperma*	Palas	Fabaceae	+++	+++	+++	+++
17.	*Callistemon viminalis*	Bottle brush	Myrtaceae	-	-	+	-
18.	*Calotropis procera*	Giant milkweed	Apocynaceae	+++	++	++	+++
19.	*Canna indica*	Canna Lily	Cannaceae	-	-	+	-
20.	*Carissa carandas*	Karonda	Apocynaceae	++	-	+	-
21.	*Cassia siamea*	Kassod tree	Caesalpiniaceae	+	+	+	-
22.	*Cestrum nocturnum*	lady of the night	Solanaceae	-	-	+	-
23.	*Citrus limetta*	Sweet lemon	Rutaceae	++	-	-	-
24.	*Citrus limon*	Lemon	*Rutaceae*	++	-	+	-
25.	*Citrus medica*	Citron	*Rutaceae*	++	-	-	-
26.	*Citrus sinensis*	Orange	*Rutaceae*	+	-	-	-
27.	*Cynodon dactylon*	Doob ghas	Poaceae	+++	+++	-	-
28.	*Dalbergia sisoo*	Biradi	Fabaceae /Leguminosae	++	+++	++	+++

ISSN: 2348-8344 (Online)
DOI: 10.26540/ijgsr.v11.i1.2024.260

29.	*Datura metel*	Datura	Solanaceae	-	++	+++	++
30.	*Dendrocalamus strictus*	Bamboo	Poaceae	-	-	++	-
31.	*Desmodium scorpiurus*	Scorpion Tick Trefoil	Fabaceae	-	+	-	-
32.	*Emblica officinalis*	Amla	Phyllanthaceae	++	-	++	+
33.	*Eucalyptus globules*	Tasmanian bluegum	Myrtaceae	+++	+++	-	-
34.	*Eucalyptus urophylla*	Gum trees	Myrtaceae	-	-	+	-
35.	*Euphorbia hirta*	Asthma Weed	Euphorbiaceae	-	++	-	-
36.	*Ficus benghalensis*	Banyan	Moraceae	+	-	+	+
37.	*Ficus hispida*	Country fig	Moraceae	-	++	++	-
38.	*Ficus religiosa*	Peepal	Moraceae	+	+	+	+
39.	*Hibiscus rosa sinensis*	Gudhal	*Malvaceae*	+	-	-	-
40.	*Hypnodendron comosum*	Palm tree	*Arecaceae*	+	-	-	-
41	*Ipomoea fistulosa*	Purple morning glory	*Convolvulaceae*	++	+	++	++
42.	*Jatropha curcas*	Barbados nut	*Euphorbiaceae*	+++	++	+++	+++
43.	*Lantana camera*	Lantana	*Verbenaceae.*	+++	++	+++	+++
44.	*Leucaena leucocephala*	Lead Tree	Fabaceae	++	+	++	++
45.	*Madhuca indica*	Mahua	Sapotaceae	+	+	-	-
46.	*Mangifera indica*	Mango	Anacardiaceae	++	+	+	+
47.	*Maytenus emarginata*	Thorny staff tree	Celesrtaceae	+	-	-	-
48.	*Murraya koenigii*	Kadipatta	Rutaceae	-	-	+	-
49.	*Musa paradisiacal*	Banana	Musaceae	+	-	+	-
50.	*Neolamarckia cadamba*	Kadam	Rubiaceae	-	-	-	+
51.	*Nerium oleander*	Kaneer	*Apocynaceae*	-	-	+++	+
52.	*Ocimum gratissimum*	Clove basil	Lamiaceae	+++	+++	+++	+++
53.	*Parthenium hysterophorus*	Carrot grass	Asteraceae	++	-	-	-

ISSN: 2348-8344 (Online)
DOI: 10.26540/ijgsr.v11.i1.2024.260

54.	*Pennisetum glaucum*	Bajra	Poaceae	++	-	-	-
55.	*Pennisetum purpureum*	Uganda grass	*Poaceae*	+	-	-	-
56.	*Phoenix dactylifera*	Date palm	Arecaceae	-	+	+	+
57.	*Physalis grisea*	Strawberry-tomato	*Solanaceae*	-	+	-	-
58.	*Pithecellobium dulce*	Jungle jalebi	Fabaceae	+	-	-	-
59.	*Polyalthia longifolia*	Ashok	Annonaceae	++	++	+	++
60.	*Pongamia pinnata*	Pongame oiltree	Fabaceae	++	++	++	++
61.	*Prunus amygdalus*	Almond	Rosaceae	+	-	-	-
62.	*Psidium guajava*	Guava	*Myrtaceae*	++	+	+	+
63.	*Punica granatum*	Pomegranate	Punicaceae	+	-	-	-
64.	*Rosa rubiginosa*	Rose	Rosaceae	-	-	+	-
65.	*Senna occidentalis*	coffee senna	Fabaceae	-	+	-	-
66.	*Solanum nigrum*	European black nightshade	*Solanaceae*	+	++	-	++
67.	*Syzygium cumini*	Jamun	Myrtaceae	+	+	-	+
68.	*Tabernaemontana divaricata*	Chandni	Apocynaceae	-	-	+	-
69.	*Tamarindus indica*	Imli	Fabaceae	-	-	+	+
70.	*Tecoma stans*	Yellow bells	Bignoniaceae	-	-	+++	-
71.	*Tectona grandis*	Saguan	Lamiaceae	++	++	++	+
72.	*Tephrosia purpurea*	Wasteland weed	*Fabaceae*	-	++	-	-
73.	*Terminalia arjuna*	Arjun	Combretaceae	++	-	-	-
74.	*Thevetia neriifolia*	Kaneer	Apocynaceae	-	-	+	-
75.	*Thuja occidentalis*	Eastern white cedar	Cupressaceae	-	-	+	-
76.	*Tridax procumbens*	Coatbuttons	Asteraceae	+	-	-	-
77.	*Trifolium alexandrinum*	Berseem	Leguminosae	+	-	-	-
78.	*Typha domingensis*	Cumbungi	Typhaceae	-	++	-	-
79.	*Vachellia nilotica*	Babul	Fabaceae	-	+++	-	-
80.	*Xanthium strumarium*	Rough cocklebur	Asteraceae	-	++	+	+
81.	*Ziziphus mauritiana*	Indian jujube	Rhamnaceae	+++	++	++	++

(Site-I: Bundela Bandhu; Site-II: Pitambara Granite; Site-III : Saroj Granite; Site-IV: Karari)

International Journal of Global Science Research
Vol. 11, Issue. 1, April 2024, pp. 2239-2250
Available Online at www.ijgsr.com

ISSN: 2348-8344 (Online)
DOI: 10.26540/ijgsr.v11.i1.2024.260

Table – 2: Categorization of Species for Green Belt design in opencast mining areas on the basis of Species survibility.

Site	Ist Choice	IInd Choice	IIIrd Choice
Site – I	*Acacia nilotica, Bambusa vulgaris, Butea monosperma, Calotropis procera, Cynodon dactylon, Eucalyptus globulus, Jatropha curcas, Lantana camera, Ocimum gratissimum, Ziziphus mauritiana.*	*Acacia catechu, Aegle marmelos, Azadirachta indica, Carissa carandas, Citrus limetta, Citrus limon, Citrus medica, Citrus sinensis, Dalbergia sisoo, Emblica officinalis, Ipomoea fistulosa, Leucaena leucocephala, Mangifera indica, Parthenium hysterophorus, Pennisetum glaucum, Polyalthia longifolia, Pongamia pinnata, Psidium guajava, Tectona grandis, Terminalia arjuna.*	*Achyranthes aspera, Albizia lebbeck, Allianthus excelsa, Annona squamosa, Artocarpus heterophyllus, Bauhinia variegata, Bougainvillea glabra, Cassia siamea, Citrus sinensis, Ficus benghalensis, Ficus religiosa, Hibiscus rosa sinensis, Hypnodendron comosum, Madhuca indica, Maytenus emarginata, Musa paradisiaca, Pennisetum purpureum, Pithecellobium dulce, Prunus amygdalus, Punica granatum, Solanum nigrum, Syzygium cumini, Tridax procumbens, Trifolium alexandrinum*
Site –II	*Butea monosperma, Cynodon dactylon, Dalbergia sisoo, Eucalyptus globulus, Ocimum gratissimum, Vachellia nilotica.*	*Allianthus excelsa, Alternanthera ficoidea, Calotropis procera, Datura metel, Euphorbia hirta, Ficus hispida, Jatropha curcas, Lantana camera, Polyalthia longifolia, Pongamia pinnata, Solanum nigrum, Tectona grandis, Tephrosia purpurea, Typha domingensis, Xanthium strumarium, Ziziphus mauritiana.*	*Azadirachta indica, Bambusa vulgaris, Bombax ceiba, Cassia siamea, Desmodium scorpiurus, Ficus religiosa, Ipomoea fistulosa, Leucaena leucocephala, Madhuca indica, Mangifera indica, Phoenix dactylifera, Physalis grisea, Psidium guajava, Senna occidentalis, Syzygium cumini, Tamarindus indica, Thevetia neriifolia.*
Site –III	*Adhatoda vasica, Allianthus excelsa, Butea monosperma, Datura metel, Jatropha curcas, Lantana camera, Nerium oleander, Ocimum gratissimum, Tecoma stans.*	*Aegle marmelos, Azadirachta indica, Bombax ceiba, Calotropis procera, Dalbergia sisoo, Dendrocalamus strictus, Emblica officinalis, Ficus hispida, Ipomoea fistulosa, Leucaena leucocephala, Pongamia pinnata, Tectona grandis, Ziziphus mauritiana.*	*Albizia lebbeck, Annona squamosa , Bougainvillea glabra, Callistemon viminalis , Canna indica Carissa carandas, Cassia siamea, Cestrum nocturnum, Citrus limon, Eucalyptus urophylla, Ficus benghalensis, Ficus religiosa, Mangifera indica, Musa paradisiacal, Murraya koenigii , Phoenix dactylifera, Polyalthia longifolia, Psidium guajava,*

ISSN: 2348-8344 (Online)
DOI: 10.26540/ijgsr.v11.i1.2024.260

			Rosa rubiginosa, Tabernaemontana divaricata, Tamarindus indica, Thevetia neriifolia, Thuja occidentalis, Xanthium strumarium.
Site –IV	*Butea monosperma, Calotropis procera, Dalbergia sisoo, Jatropha curcas, Lantana camera, Ocimum gratissimum.*	*Adhatoda vasica, Datura metel, Ipomoea fistulosa, Leucaena leucocephala, Polyalthia longifolia, Pongamia pinnata, Solanum nigrum, Ziziphus mauritiana.*	*Acacia nilotica, Allianthus excelsa, Artocarpus heterophyllus, Azadirachta indica, Bombax ceiba, Emblica officinalis, Ficus benghalensis, Ficus religiosa, Mangifera indica, Neolamarckia cadamba , Ocimum gratissimum, Phoenix dactylifera, Psidium guajava, Syzygium cumini, Tamarindus indica, Tectona grandis, Xanthium strumarium*

(Site-I: Bundela Bandhu; Site-II: Pitambara Granite; Site-III : Saroj Granite; Site-IV: Karari)

Acknowledgement:
The authors are very thankful to the all Managers and staffs of respective Mines for their kind hearted cooperation during survey periods.

References:

Akanwa, A. O., Okeke, F. I., Nnodu, V. C .and Iortyom, E. T. (2017) Quarrying and its efect on vegetation cover for a sustainable development using high-resolution satellite image and GIS. Environ Earth Sci 76(14), 505. https://doi. org/10.1007/s12665-017-6844-x.

Aslam, M., Minocha, A. K., Kalra, P. D. and Srivastava, R S (1992) Fugitive dust emissios from stone crusher. *Indian J.Environ.Health*, 34(3), 186-191.

Chakraborty, M. K., Ahmad, M., Singh, R. S., Pal D., Bandopadhyay C. and Chaulya S. K. (2002) Determination of the emission rate from various opencast mining operations. Environ Model Softw17, 467–480

Chaulya, S. K., Chakraborty, M. K. and Singh, R. S. (2001) Air pollution modeling for a proposed limestone quarry', *Water Air Soil Pollut.* 126, 171–191.

CMRI (1998) Determination of emission factor for various opencast mining activities, Report GAP/9/EMG/MOEF/97, Central Mining and Fuel Research Institute, Dhanbad, India.

Gabarrón, M., Zornoza, R., Acosta, J. A., Faz, Á. and Martínez-Martínez, S. (2019) Chapter Five—Mining environments. In: Pereira P (ed) Advances in Chemical Pollution, Environmental Management and Protection, vol 4. Elsevier, Amsterdam, pp 157–205.

Ghose, M. K. (2007) Generation and quantification of hazardous dusts from coal mining in the Indian context. *Environmental Monitoring and Assessment*, 130, 35–45.

Hammond, A. A. (1988) Mining and quarrying wastes: a critical review. Eng Geol 25(1), 17–31. https://doi.org/10.1016/0013-7952(88)90016-6.

International Council on Mining & Minerals (2005) Biodiversity Offsets-A Briefing paper for the Mining Industry.

Langer, W. N. (2001) Environmental impacts of mining natural aggregate, in Bon, R. L., Riordan, R. F., Tripp, B. T., and Krukowski, S. T., eds., Proc. 35th Forum on the Geology of Industrial Minerals—The Intermountain West Forum: Utah Geol. Survey Misc. Publ. 01–2, p. 127–138.

Letheren, B. (2008) Planning the rehabilitation of a sandstone quarry in Rajasthan. Citeseer, Princeton.

Maiti, S. K. and Banerjee, S. P. (1992) A comprehensive study of dust collecting potential of plants growing in Jharia Coalfield, *Eastern India*. Transactions 89.

Martin, D. J., Brookman, E and Hirsch, L (1980) Control Methods for Fugitive Area Sources. Report No. EPA-600/9/80-041, Research Triangle Park, NC: USEPA, Industrial Environmental Research Lab.

Singh, A., Raghubansh, A. and Singh, J. (2002) Plantations as a tool for mine spoil restoration. Curr. Sci. 82(12), 1436–1441.

Singh, G., Pal, A. and Khoiyangbam, R. S. (2008) Impact of mining on human health in and around Jhansi, Bundelkhand region of Uttar Pradesh, India. Journal of Ecophysiology & Occupational Health, 9, 47 – 54.

Sinha, S. and Banerjee, S. P. (1994) A Method for Estimating Fugitive Particulate Emission from Haul Roads in Opencast Coal Mines and Mitigative Measures', in S. P. Banerjee (ed.), Proceedings of Second National Seminar on Minerals and Ecology, Dhanbad, India, pp. 217–227.

Tadesse, S. (2000) Environmental Policy in Mining: Corporate Strategy and Planning for Closure. *A contribution to published book*. ISBN 1–56670-365-4. pp 415–422

Vallack, H .W. and Shillito, D. E. (1998) Suggested guidelines for deposited ambient dust. Atmospheric Environment, 32 (16), 2737–2744.