



ISSN : 0973-7057

Int. Database Index: 616 www.mjl.clarivate.com

Land degradation due to black stone mining in Pakur: Need Eco restoration

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Received : 5th January, 2021 ; Revised : 4th February, 2021

Abstract:- Pakur is a small district of Jharkhand and is well known for its Asiatic fame black stone mine. The history of mining dates back to the British period in Pakur. Probably the black stone mining activities initiated here in 1912. Owing to the finest quality of black stone, the boulders and stone chips were being sent to different part of country including present day Bangladesh (The old British India). It is also sent to different parts of India for major construction project. Since 1912 till date approximately 775 black stone mines have been used for the extraction of black stones. At present 114 mines are operational. This is important to note that only two years back the number of black stone mines were 145. But due to reasons like failing to meet the compliance criteria of environmental law, land lease etc. The number of mines has come down. Some of the closed mines are restarted after fulfilling the required documents or meeting the compliance criteria whereas some of the mines are still inoperative/closed or turned as abandoned. If the average mines area considered as 5.5 acres. The total mining area comes to $5.5 \text{ hectare} \times 775 = 4262.5 \text{ hectare}$, out of that area presently the mine activity going on in $5.5 \text{ hectare} \times 114 = 627 \text{ hectare}$, where as rest of the mines where mining activity has been ceased are abundant and these closed mines posing a great threat to environment as well as human life. There is enough scope to eco restore these closed mines, so that local enjoyment can be replenished, beside it will open an avenue for income generation activities. There are ample scope of fisheries, aquaculture, and water sports in these abundant mines of the district. The large amount of water remains stored in these abundant mines, and so far is not being utilised for any purposes, it can be utilised for agriculture, silviculture and end numbered uses. There are various scopes to develop park and these may develop into tourist spots. In the current paper an eco restoration plan for the abandoned degraded black stone mined out mines has been proposed.

Key words: land degradation, black stone mines, eco restoration, Pakur.

INTRODUCTION

Mining of black stone in Pakur is going on with only dictum of making profit without any safety measures and conserving environment. This type of haphazard 'slaughter mining' and un-systematic mining over a period of time in the black stone mining areas of Pakur has resulted in

relentless land degradation. The landscape resulted into remnants of old abandoned quarries, spoil dumps, subsided depressions, etc. thus resulting into disturbance of biodiversity.

A three tier ecological restoration is needed to restore the degraded and mined out lands by means of afforestation choosing the natural and native species. In fact the Ecological Restoration involves three tier plantations with indigenous plant species with lower level grasses, middle

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level shrubs or bushes trees at the top. The main objective of this to bring back the original normalcy of function, structure, potential, service and process of eco system as existed prior to mining activity by establishing a natural forest eco-system with biodiversity. For this purpose first of identification and selection of the local native species is required there after tie up with forest department to procure and plant the concerned species.

A single layer plantation is also useful in bringing greenery however this provides the green canopy in aerial view only and is not very effective in control erosion, recharging ground water and establishing bio-diversity. For eco restoration purpose the selection of species is not considered to meet socio-economic obligation of the local community. Ecological restoration is the process of short-circuiting the natural recovery of degraded ecosystems through ecological interventions. The ecological restoration is to establish a three-tier vegetation comprising of native species grasses as lower tier, shrubs and bushes as middle tier and trees as upper tier with an objective to establish biodiversity and food chain; to improve the local climate regime and socio-economic conditions. Removal of invasive weeds and addition of biomass to the degraded land creates an opportunity for the native species to germinate and establish biodiversity. Ecological restoration enhances biodiversity at faster rate and over time, end number of species may develop creating natural forest over burden dump. Therefore ecological restoration of mined out areas is the most appropriate ecologically and socio-economically compatible measure. Such restored area can serve as replacement of Reserve forest below which the presence of mineral is found in future. These dumps are profusely invaded by exotic weeds like *Parthenium hysterophorus*, *Croton bonplandianus*, *Xanthium Strumarium*, *Chromolena odorata*, *Eupatorium odoratum*, *Lantana camara*, *Panisetum padicellatum* etc. Due to several years of mining and severe land degradation, there is no soil cover on the dumps and are poor in nutrients.

MATERIALS & METHOD

The mining sites, currently operational as well as mined out, abandoned, closed mines were visited from the year 2016-2020. The conditions of the closed mines sites were observed closely, monitored and plan for eco restoration is proposed.

There are approximately 775 mines existed in Pakur district from which the black stone extraction took place

since 1912 till date. If the average mines area considered as 5.5 acres. The total mining area comes to $5.5 \text{ac} \times 775 = 4262.5 \text{ac}$. Out of that area presently the mining activity going on in $5.5 \text{ac} \times 114 = 627 \text{ac}$. whereas rest of the mines where mining activity need eco restoration for the effective ecosystem services of the mined out area. Same time to bring back conditions prior to the mining.

REVIEW OF LITERATURE

Very less work on eco restoration has been done in Jharkhand, the eco restoration work has seen initiated and done by BCCI in 1912 at some of its mining site, Hindalco is doing eco restoration at Bagru, Lohardaga in their Bauxite mining site. However some the work of national and international paper has been referred here Amishaebal (2017)¹ worked Impact Assessment of mining achvited on tree diversity at Limestone & Dolomite mining area-BSLC mines, Biramitrapur, Anderswiderland & Bjornohlander (2014)². Environmental Aspects of mining, Bhargava, D.N. (2001)³, Strategy for Environmental Management in Mining and Associated Operations, Indian Bureau of Mines, Ministry of mines, Government of India. A detailed aspect of mining has been published in district mining survey of Pakur (2016)⁴, Dubey & Dubey (2011)⁵ worked on Impact of mining on tree diversity of, the silica mining forest area at Shankargarh, Allahabad, M S Li (2005)⁶ worked on particular reference to the metalliferous mine wasteland in China, Pawan Kumar (2013)⁷ worked on mining activity and its impact on Plant biodiversity.⁸ Mining Plan of Fatehpur Stone Mine of M/s Mishra Stone Works, Mouza-Fatehpur.⁹ Published Paper on Ecological Restoration of Coal Mine Degraded Lands, Energy, GnY. Unanaonwi & Amonum (2017)¹⁰ also worked on Effect of mining. Verma *et al.* (1989)¹¹ worked on Impact of Mining on the flora of Motijharna, Rajmahal Hills.

RESULT & DISCUSSION

Proposed Plan

Restoring a damaged habitat or ecosystem is rarely as straight forward as just planting a few trees. It is often necessary to determine how to propagate and establish key species. Developing appropriate substrates, particularly when there is insufficient soil, is also a challenge. In a troubled nature of mine sites, some time it is important to grow the alien invasive species in the mined out area for the fast cover and to reduce the soil erosion of the degraded lands. Once the soil will be enriched with the nutrients the native species can thrive well.

The Society for Ecological Restoration (SER 2004) defines ecological restoration as 'the process of assisting the recovery of an ecosystem that has been degraded, damaged or destroyed'. The process of natural succession, which happens concurrently with ecosystem development takes time. Several ecosystem functions of mined land require a long time to develop through natural processes.

Eco restoration planning and implementation:

For eco restoration, re-vegetation planning is required, that requires types of vegetation cover. This depends on characteristics of the plant, nature of mine soils, quality of existing topsoil, closeness to the nearby natural seed banks, climatic conditions like rainfall, temperature and proneness to anthropogenic disturbance. It is necessary that a clear objective of restoration and final land use at the end of mining operation is clearly defined by mine authority along with the consultation of regulators and local bodies. The restoration planning should be well planned. Eco restoration planning involves the following steps-

Ensuring involvement of local community:

Mining is a temporary activity and as temporary occupiers of the land, the black stone miners should plan a better post-mining land use by as per the requirement of the local community.

Transplantation and preservation of flora and development of flora bank:

This involves the transplantation of important native species and their documentation. The information need to display owing to its conservation. Utmost care has to be taken while transplanting the plant to the new site. Protection of remaining patches of the original vegetation should be encouraged so as to increase seed propagation and regeneration of native species.

Management of the top soil:

Accumulation of topsoil plays a vital role in establishing a self-sustaining cover during eco restoration process. This requires the preservation wherever possible and its quality should be protected while transferring and storage. The topsoil management includes inventory and removal of topsoil, concurrent reuse and storage of topsoil (if required) including preservation of topsoil fertility by vegetating grass-legume mixture.

Planning for revegetation

The establishment of a succession based vegetation cover is the key element of booming restoration. This

requires the plantation using grasses and legumes seeds. A list of preferable plant species is given in table -1.

A total of 39 plant species have been proposed for the plantation in lieu of eco restoration. Out of these 39 species 23 species are of tree, 8 are of herb and 8 species are of shrub. These species are selected on the basis of their presence in and around mining sites and their related growth.

Amalgamation of ecological succession: This approach promotes development of native plant species, initially planted species will restructure dump plane and support colonisation of native species. It acts as a link between primary colonisers and afterward mounting vegetation.

Table 1. List of Plant species selected for the eco restoration of the degraded mined our areas

Sl. No.	Scientific Name	Family	Habit
1	<i>Acacia arabica</i>	Fabaceae	Tree
2	<i>Acacia catechu / Senegalia catechu</i>	Fabaceae	Tree
3	<i>Aegle marmelos</i>	Rutaceae	Tree
4	<i>Agave americana</i>	Asparagaceae	Shrub
5	<i>Alangium salvifolium</i>	Cornaceae	Small tree
6	<i>Albizia lebeck</i>	Fabaceae	Tree
7	<i>Alstonia scholaris</i>	Apocyanaceae	Tree
8	<i>Anacardium occidentale</i>	Anacardiaceae	Tree
9	<i>Azadirachta indica</i>	Meliaceae	Tree
10	<i>Bambusa arundinacea</i>	Poaceae	Tree
11	<i>Bauhinia purpurea</i>	Fabaceae	Tree
12	<i>Bauhinia variegata</i>	Fabaceae	Tree
13	<i>Bombax ceiba</i>	Malvaceae	Tree
14	<i>Butea monosperma</i>	Fabaceae	Tree
15	<i>Caldenia procumbens</i>	Boraginaceae	Herb
16	<i>Calotropis gigantea</i>	Apocyanaceae	Shrub
17	<i>Calotropis procera</i>	Apocyanaceae	Shrub
18	<i>Clerodendron infortunatum</i>	Lamiaceae	Shrub
19	<i>Chromola odorata</i>	Astraceae	Shrub
20	<i>Croton bonplandianus</i>	Euphorbiaceae	Herb
21	<i>Cynodon dactylon</i>	Poaceae	Herb
22	<i>Dalbergia latifolia</i>	Fabaceae	Tree
23	<i>Dalbergia sissoo</i>	Fabaceae	Tree
24	<i>Dendrocalamus strictus</i>	Poaceae	Tree
25	<i>Deris pinnata</i>	Fabaceae	Tree
26	<i>Diospyros melanoxylon</i>	Ebenaceae	Tree
27	<i>Ficus religiosa</i>	Moraceae	Tree
28	<i>Flemingia chappar</i>	Fabaceae	Shrub
29	<i>Lagerstroemia parviflora</i>	Lythraceae	Tree
30	<i>Lantana camara</i>	Verbanaceae	Shrub
31	<i>Leucas aspera</i>	Lamiaceae	Herb
32	<i>Madhuca latifolia</i>	Sapotaceae	Tree
33	<i>Opuntia dillenii</i>	Cactaceae	Shrub
34	<i>Saccharum munja</i>	Poaceae	Herb
35	<i>Saccharum officinarum</i>	Poaceae	Herb
36	<i>Solanum xanthocarpum</i>	Solanaceae	Herb
37	<i>Tephrosia purpurea</i>	Fabaceae	Herb
38	<i>Zizyphus jujuba</i>	Rhamnaceae	Tree
39	<i>Zizyphus mauritiana</i>	Rhamnaceae	Shrub

Biospectra : Vol. 16(1), March, 2021
An International Biannual Refereed Journal of Life Sciences
Plates showing degraded black stone mines to be restored



An abandoned mines site near police line, Pakur



Mines site at Malpahari filled with water



An abandoned mines site at Mali Para, Pakur



Mines site at Malpahari filled with water



An abandoned mines site at Mal Pahari, Pakur



An abandoned mine at Raddipur, with some of aquatic plants adding beauty to it.



An abandoned mines filled with water at Mal Pahari, Pakur



The mines is being filled with OB at Sidpahari

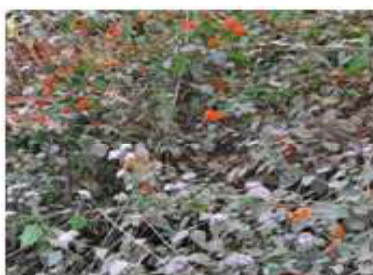


An abandoned mine at Sidpahari

Plants species recommended for Eco restoration



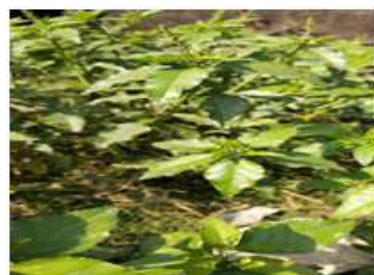
Acacia nilotica



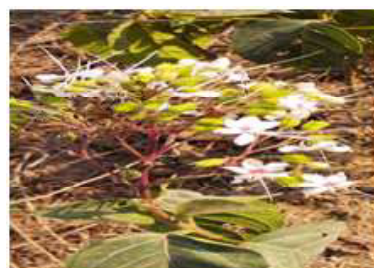
Lantana camara



Opuntia dillenii



Croton bonplandanus



Clerodendron infortunatum



Aegle marmelos



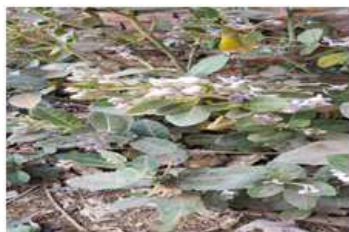
Azadirachta indica



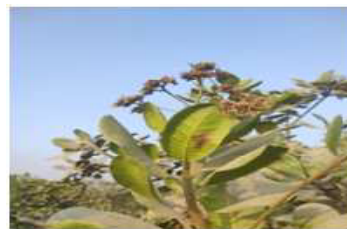
Butea monosperma



Solanum xanthocarpum



Calotropis procera



Anacardium occidentale



Alstonia scholaris

CONCLUSION

There is a close relationship between ecological understanding and successful eco restoration. Technical aspects of restoration are the keys of ecological restoration of mine soils, which should be carried out in an orderly manner. Miners are now realising that reclamation by simple plantation of fast-growing trees are not going to restore a degraded ecosystem. There should be a paradigm shift to restore a degraded ecosystem through an ecological restoration approach. In fact every mine closure plan of a working mining plan an environment management plan is mentioned, that after the complete extraction of the reserve the mined out area will be filled out and plantation will be done, but after the completion of the project , this is hardly followed.

REFERENCES

1. **Amishaebal. 2017.** Impact Assessment of mining activities on tree diversity at Limestone & Dolomite mining area- BSLC mines, Biramitrapur, Odisha. *Journal of Pharmacognosy and Phytochemistry*. **6(5):1902-1905**
2. **Anderswiderland And Bjornohlander. 2014.** Environmental Aspects of mining, Lulea Uni. of Technology Franke Ecke, Swedish univ of agricultural science.
3. **Bhargava, D.N. 2001.** Strategy for Environmental Management in Mining and Associated Operations, Indian Bureau of Mines, Ministry of mines, Government of India.
4. **District Survey Report of Minor Minerals, Pakur. 2006.** Prepared in accordance with Para 7 (iii) of S.O.141 (E) Dated 15th January 2016 of Ministry of Environment, Forest and Climate Change Notification. Government of Jharkhand, District of Pakur.
5. **Dubey K, Dubey K P. 2011.** Impact of mining on tree diversity of, the silica mining forest area at Shankargarh, Allahabad, *India Journal of Forestry Research*. **35:319-327**.
6. **M S Li. 2005.** Particular reference to the metalliferous mine wasteland in China: *A Review of Research and Practice*, PMID: 15992864 DOI: 10.1016/j. scitotenv.
7. **Pawan Kumar. 2013.** "The mining activity and its impact on Plant biodiversity a case study at Bhiwani open cast mining zone- Haryana, India. **3(6):78-83** Pelagia Research library ISSN: 2249 -7412.
8. **Radha Nand Singh, Reg. No. RQP/ RNC/ 145/ 2011/ A, 2016.** *Mining Plan of Fatehpur Stone Mine of M/s Mishra Stone Works, Mouza-Fatehpur*
9. **Subodh kumar Maiti. 2017.** Ecological Restoration of Coal Mine Degraded Lands, Energy, GNY.
10. **Unanaonwi OE & Amonum JI Jan-fib, 2017.** Effect of mining. Activities On vegetation composition and nutrient Status d Forest Soil benue Cement Company, Benue state, Nigeria. *IJEAB Vol-2.1-1* ISSN: 2456-1878
11. **Verma, S.K., R.R. Jha and A.K. Pandey. 1989.** Impact of Mining on the Flora of Motijharna, Rajmahal Hills, Bihar, *The India Forester*, Vol.**115 (12)**.