LAND DEGRADATION DUE TO MINING IN INDIA AND ITS MITIGATION MEASURES

By
Dr. H. B. Sahu and Er. S. Dash

Presented by
Dr H. B. Sahu
Associate Professor
Deptt. of Mining Engineering
NIT, Rourkela, India

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Land degradation

Actual land mass available to mankind: 30% of total global surface area

For India
• Land area is about 2-3% of the global land area
• but supports more than 16% of the global population
• The poor per capita land holding stands at 0.32 hectares

- Calls for due attention to restoration/reclamation of land after mining

Mining and its subsequent activities degrade the land to a significant extent.

Overburden removal results in a significant loss of rain forest and the rich top soil
Impact of mining on land environment

- Water scarcity due to lowering of water table
- Soil contamination
- Part or total loss of flora and fauna
- Air and water pollution
- Acid mine drainage

More damages go on proceeding in accelerated rates

The cumulative effects push the land towards complete degradation.

The process works through a cycle known as land degradation cycle

The magnitude of impact on environment

- varies from mineral to mineral
- the potential of the surrounding environment to absorb the negative effects
- geographical disposition of mineral deposits
- and size of mining operations
Figure 1: Land deterioration cycle

1. Water scarcity
2. Temperature rise, Drying of greenery
3. Generation of barren lands
4. Direct effect of Sun, wind & rain on land
5. More erosion
6. More siltation
7. Drying of surface water bodies
8. Decrease in irrigation potential
9. Drying up of land
10. Gradual land degradation
11. Gradual desertification
Table 1. Mineral Production, waste generation and land affected in 2005-06

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Mineral</th>
<th>Production (MT)</th>
<th>Overburden / waste (MT)</th>
<th>Estimated land affected (ha.)</th>
<th>Norms used (land in ha/MT of coal/ore)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Coal</td>
<td>407</td>
<td>1493</td>
<td>10175</td>
<td>25</td>
</tr>
<tr>
<td>2</td>
<td>Limestone</td>
<td>170.38</td>
<td>178.3</td>
<td>1704</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>Bauxite</td>
<td>12.34</td>
<td>7.5</td>
<td>123</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>Iron ore</td>
<td>154.4</td>
<td>143.9</td>
<td>1544</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>Others</td>
<td>9.44</td>
<td>18.61</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
LAND RECLAMATION METHODS

• Rehabilitation
• Reclamation
• Restoration

Key features to be studies for effective land reclamation and restoration:

Mapping:
scaled maps, remote sensing and aerial photographs etc.

Geological and geotechnical investigations
the toxicity of the soil, stability of waste dumps

Meteorological and climatological investigation
temperature, amount of rainfall, humidity and wind patterns etc.

Hydrological conditions
quantity, quality, movement and storage of water above and below the surface.
Soil condition
soil’s water holding capacity
directly influences plant productivity, leaching potential and ground water replenishment.

Vegetative condition
quality, quantity and diversity of vegetation
reflect the entire environment setting in addition to the past and present human activities.

Topographic conditions
rugged, rolling, gentle or smooth.
The reconstructed surface must blend with the undisturbed landscape.

The plant community in area may be native and introduced, sensitive and tolerant, common and endangered species.
RECLAMATION PROCEDURE

Topographic Reconstruction
Reconstruction of drainage basins comprising of hill slopes and stream channels
Care to be taken to minimize erosion and runoff
Special flood-control and sediment-control measures to prevent damage

Will provide the foundation for resulting landforms upon which other reclamation practices are executed and eventual land uses take place

Replacement of Topsoil and Soil Reconstruction
Revegetation of the reclaimed surfaces require a suitable growth medium
Top soil layers are higher in organic matter, microbial activity, and nutrients than underlying subsoil or geologic material.
Contain significant seed bank that can be used to great advantage

The top soil should be stored with proper precautionary measures
Revegetation

Is the principal goal of reclamation
Must sustain without attention or artificial aid, and support native fauna.

In the initial stages:

quick growing grasses with short life cycle, legumes and forage crops will improve the nutrient and organic matter content in soil
plantation of mixed species of economic importance after 2-3 years of growing grasses.

Selection criteria for plant species:

✓ Planting pollutant tolerant species.
✓ Plants of fast growing with thick vegetation foliage
✓ Indigenous/exotic plants species with easy adaptability to the locality
✓ Socio economic requirement of the people of the surrounding area
Figure 2: Role of greenery in protecting environment

1. Protects air quality
   - by absorbing and reflecting sound waves
   - supply corps and food products
   - by their existence

2. Protects land drying and desertification
   - by dust suppression and O2 supply
   - by generating shade

3. Decreases surface runoff and flood peaks
   - by increasing percolation and obstacle
   - by anchoring soil particles

4. Protects land degradation
   - due to facts no 2 and no 5
   - due to previous three facts

5. Protects draught
   - due to facts no 2 and no 5
   - through evaporation and facts no 2, 6 etc.

6. Protects draught

7. Stabilises climate

8. Increase aesthetic beauty

9. Improve socio-economic condition

10. Protects noise and vibration

Waste Dump Management
Old Waste Dump Plantation

WASTE DUMP MANAGEMENT BY PLANTING SAPLINGS
Panchpatmali Bauxite Mine (NALCO)
Plantation
with selected forest and fruit bearing species in the back filled areas
seedlings raised in mother beds
transplanted to poly pots containing soil, sand, farmyard manure (2:1:1)
with suitable amendments.
The spacing adopted for planting purpose is 2 M x 2M (2500 plants per hectare.)

Niger Cultivation (Agro-Forestry)

Tribals in this hilly area engage in Podu cultivation
grow Niger, Ragi etc. since land is scarce

Niger is a conventional crop of this area

Has high commercial demand

After harvesting of Niger
stems used in bed preparation in mushroom cultivation

Niger seeds and other inputs have been provided to them.
CONCLUSION

Reclamation should be an ongoing activity throughout the life of the operation as well as after decommissioning.

Mining industry, Government and the local people must work together to care for future generations.

Better planning of reclamation/restoration system to bring back the derelict land in short time for use.

Presently no specific legislation in India for environmental protection during mine closure.

MoEF, may specify / approve plans for reclamation work to be carried out on closure of mines indicated in the EIA/EMP of the project.

MoEF has introduced a system of demanding a closure plan from the mine operators to be submitted 5 years before actual closure of mining operations.
Questions
Thank You

hbsahu@nitrkl.ac.in
hbsahu@yahoo.co.in