



**4.0**

**Optimizing Biodiversity and  
Social Security in Indian Mining Areas**

**An Earthy Vision**

**2011**

**Volume - II**





## Volume - II

2011

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English

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### **Woodman, spare that tree!**

Woodman, spare that tree!  
Touch not a single bough!  
In youth it sheltered me,  
And I'll protect it now.  
'Twas my forefather's hand  
That placed it near his cot:  
There, woodman, let it stand,  
Thy axe shall harm it not!

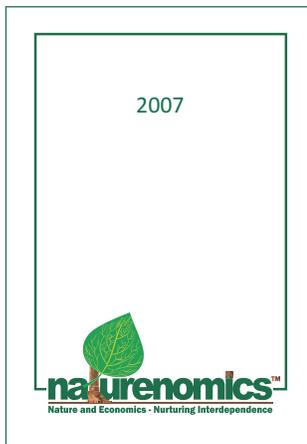
That old familiar tree,  
Whose glory and renown  
Are spread o'er land and sea,  
And wouldst thou hew it down?  
Woodman, forbear thy stroke!  
Cut not its earth-bound ties;  
Oh, spare that aged oak,  
Now towering to the skies!

When but an idle boy  
I sought its grateful shade;  
In all their gushing joy  
Here too my sisters played.  
My mother kissed me here;  
My father pressed my hand  
Forgive this foolish tear,  
But let that old oak stand!

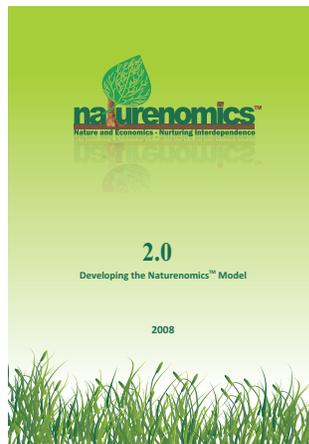
My heart-strings round thee cling,  
Close as thy bark, old friend!  
Here shall the wild-bird sing,  
And still thy branches bend.  
Old tree! the storm still brave!  
And, woodman, leave the spot:  
While I've a hand to save,  
Thy axe shall harm it not.

**- George Pope Morris**

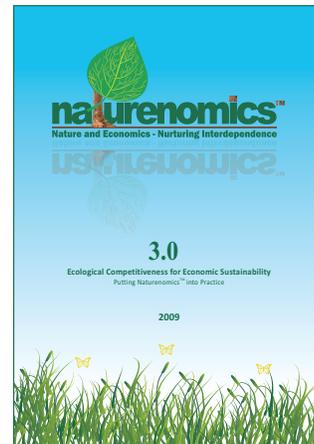




- ◆ We launched a collection of articles titled - Nurturing Interdependence between nature and economics as the first in a series of articles in 2007.
- ◆ The collection identifies itself with our natural inheritance and tries to highlight the overuse and misuse of nature leading to near collapse of our ecosystems.
- ◆ The articles highlight the deteriorating balance between nature and economics resulting in a stress around Food, Water and Energy.
- ◆ We have covered attempts to create nature driven economics models including Green Accounting.
- ◆ Attempts have been made in the articles to understand global warming, both mitigation and adaptation
- ◆ The compilation concludes with an interesting article on Philanthropy's role in the fight against global warming.



- ◆ Our second publication "Naturenomics™ 2.0" takes a step further to address the need for a changed economic model to address the changing circumstances of our Natural Resources.
- ◆ An introduction to the concept of LEWWAC - Land, Energy, Water, Waste, Air, Carbon and the measurement of these resource utilization and patterns of consumption thereof.
- ◆ We have focused on articles highlighting the current wealth of nations and genuine progress indicators.
- ◆ The most challenging concern of our time if food security therefore focus has been on whether food shortage will bring down our civilization!
- ◆ Fascinating concepts have been presented on sustainable design planning of urban areas, optimizing natural resources.



- ◆ Our third publication "Naturenomics™ 3.0" is a focused series of case studies of real diagnostics and implementation done on various green initiatives across various vintals in Indian Industries.
- ◆ An introduction to the concept of LEWWAC - Land, Energy, Water, Waste, Air, Carbon and the measurement of these resource utilization and patterns of consumption thereof
- ◆ We are hoping to create a bio-diversity knowledge bank and the chapter 'eco-restoration through bio-diversity parks' is another step towards this.
- ◆ The compilation highlights - 'green industry is smart industry' to be achieved through ecological competitiveness for ecological sustainability
- ◆ NATURESCRIPT is an addition in the series and highlights amongst other useful tips the Naturefirst's Ecological Code for Sustainable Development.



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## Volume - II

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Section - 2

## **Optimizing Biodiversity and Environmental Security**





## Optimizing Biodiversity & Social Security in Indian Mining Areas - 'An Earthy Vision'

Ranjit Barthakur

### Retaining a Better Earth for Biodiversity Security

Dear reader of Natuenomics™ 4.0 Volume II, I would like to apologise for repeating around 20 paragraphs from my earlier introductory note in Natuenomics™ 4.0 Volume I, before highlight the features that I will be presenting in Natuenomics™ 4.0 Volume II.

In the last decade India as a country has achieved many developmental milestones: Industries have prospered, road infrastructure has improved, markets are flooded with products and economic indices are on the upswing. But on the reverse of the coin, we see a contradiction in most of our vast population devoid of basic necessities, often denied primary rights, living in urban and rural areas unable to take advantage of improved educational and medical facilities.

Human migration especially to urbanized areas has increased manifold and as a consequence social and cultural conflicts and problems have increased. Similarly, biodiversity and quality of water, air and soil have depleted at the cost of ill-managed developmental projects and the combination of the social and environmental upheavals, conflicts among different sections of the society have increased leading to great divides among groups which co-existed peacefully in the past.

When we started discussing the various socio-environmental issues, we chose the mining industry because we came face to face with the reality of extractive technologies never being able to achieve biodiversity neutrality. Mining leads to large-scale changes in a landscape and all its elements, though some are positive, most tend to be negative, especially if the management of the process has not been sensitive enough to the social and environmental neutralisation paradigms.

To validate our thoughts, we launched a series of consultations tilted "Optimizing Biodiversity & Social Security in Indian Mining Areas – An Earthy Vision 2010" at the following locations:

Pune (Maharashtra)	Regional level	28 <sup>th</sup> September 2010
Ranchi (Jharkhand)	Regional level	7 <sup>th</sup> October 2010
Bhubaneswar (Orissa)	Regional level	28 <sup>th</sup> October 2010
Balipara (Assam)	National level	2 <sup>nd</sup> & 3 <sup>rd</sup> December 2010
Canada, Europe, South Africa	International	2010 - 2011

**First Approach:** Subjective and Objective Social Security with the well being of displaced people with a fair allocation both in terms of monetary and non-monetary needs with a special focus on Health, Education, Sanitation, Woman and Child Welfare

**Second Approach:** Measurement of Biodiversity Security with natural and man made assets like Land, Energy, Water, Waste, and Air & Carbon (LEWWAC)

**Third Approach:** Economic well-being increased by real per capita income, measure, energy, increased resources coupled with valuation of natural assets. The Challenges of illegal mining negatively impacts, the economic wealth from both the local communities and stake holders, and thereby challenges the very ethos of economic value-add

**Fourth Approach:** Using the case studies approach to view and identify good practices and models to address issues in the areas of Biodiversity and Social Security



## Balipara Tract & Frontier Foundation Consultations process 2010

Since the launch of Naturenomics™ in 2007 the world has moved towards the discipline of discussing, if not achieving the management of our valuable natural resources in more effective and sustainable manner.

During this period 2007-2010, Naturenomics™ 1, 2 & 3 made an attempt towards emphasizing: -

- ♦ A major paradigm shift for displacing economics at the heart of all activity, and replacing it with **natural assets** as the soul of all activity and we have already achieved some success in this.
- ♦ Appealing for a common system and methodology of valuing natural assets- a list of nature parameters to measure biodiversity value and performance, and we have progressed much into the idea of green accounting.

During this consultation, many biodiversity issues were brought to fore, which show that biodiversity concerns need to be specifically emphasized. Biodiversity and the linkages of abiotic and biotic components of this earth have great influence on the human society and hence its conservation should be a common objective in all projects.

With government and industry discussing the concept of "Consumption Neutrality", i.e. lowering their footprints with initiatives focused on improving efficiency and enhancing productivity, avoid or replace processes that are dependent on resources intensive inputs and offset or neutralize the impact through a suitable implementation program, including compensatory mechanisms.

New regulations also started a series of debates with each company now having to remain even more competitive in this new regulated market. In order to do this some companies are already creating comprehensive strategies to address the following questions:

### **1. Targets and Roadmaps**

What resource utilization targets are the companies ready to announce? What type of roadmap is required to reach those targets and who are the stakeholders involved? How can the organization contribute towards for Energy, Water, Waste, Biodiversity security?

### **2. Continuous Monitoring and Audits**

How will the company ensure effective monitoring and improvement? Will they subscribe to third party audits? Publicly disclose their emissions data? What type of tools will they require to track and manage this data?

### **3. Responsibility Integrated into KPIs**

What training is required among employees to implement green practices? What capabilities already in the employee base that can be leverage? How can the organization motivate the middle management to create importance around the environmental sustainability strategy?

### **4. Investment and Research/Development**

How much is the organization willing to invest in sustainability? Are there opportunities to develop cutting edge technologies? Can investment or research translate into new revenue streams or increased brand value from enhanced products and services?

### **5. Governance**

Who will be accountable for the company's emissions? Will they appoint a Chief Responsibility Officer? Hold the CEO directly responsible or individual Administration Heads?

### **6. Illegal Mining**

How should illegal mining be stopped? Will NGO's and Government agencies monitor illegal mining?



## Naturenomics™ 4.0

Our endeavor was to bring together opinions from the society on sustainability issues in mining industry and deliberate on issues and resolutions on two volumes:-

- ♦ Naturenomics™ Volume I – Focusing on Social Security
- ♦ Naturenomics™ Volume II – Focusing on Ecological and Biodiversity Security

***Mining in biodiversity rich, culturally diverse areas in India leads to large landscape-level changes and affects local communities and their livelihoods in many complex ways. In recent years, there has been growing opposition to mining on the grounds of biodiversity loss and social issues. There is also an inter-generational issue, since gainers tend to be from the younger generation, while the losers are from the older.***

**The key 'Take-aways' from the Consultations 2010 were:-**

- ♦ **Remedial Measures:** Environment/ Biodiversity degradation not measure in the past and also never even today. Consistent degraders must be made to pay with corrective programmes.
- ♦ **Biodiversity Costing:** effective measurement of cost of biodiversity degradation and encouragement of players who performed genuine value addition and offset negative impact of mining.
- ♦ **Compensation of Biodiversity loss:** compensation for loss of biodiversity due to mining in proven forest area should be made compulsory on an accepted sharing basis between various stake holders of the concern area. Although such measures may not be adequate to assess the value of forest, a thorough understanding of ecosystem and ecosystem services is required.
- ♦ **Ecosystem Valuation:** value of ecosystem services needs to be quantified and incorporated in the project document.
- ♦ **Preservation of Heritage Zones:** heritage zone must be treated under a special dispensation. Mining by giant mine operators calls for critical evaluation on current practices of allowing mining in eco-sensitive and heritage zones that are home to multiple wildlife species and tribal groups. All this are under the threat of displacement and extension.
- ♦ **Unchecked diversion of forest lands:** rampant diversion of forest land under the pretext that non-forest lands are unavailable, for an important project must stop. Forest lands are taken for industrial purposes as it is the least resistant and Mining / Industrial houses in connivance with forest and state officials get these forest lands for there use, with environmental laws being twisted.
- ♦ **Ecological Compliance:** The Indian Government is stepping up to the need for emissions control, and our businesses are making this a part of their triple bottom line. Even before hand we see companies taking on voluntary compliances or reporting (like the Global Reporting Index) and practicing pre-compliance to avoid bigger setbacks later.

### **Biodiversity Security issues covered by Naturenomics™ 4.0 Volume - II**

#### **Biodiversity and Environmental Aspects**

- ♦ The Wildlife Protection Act aims at the protection of the components of biological diversity like the Wild animals, plants, birds, etc.

#### **Administrative Challenges in Mining in India**

- ♦ Issue in Mining Industry in India is mitigation of environmental degradation, social justice and use of efficient technology for optimizing minerals reserves.



### **Biodiversity Impact Assessments of Development Projects: Clues from a case study in Jharkhand**

- ♦ Biodiversity Impact assessment demands a more sophisticated investigation and analysis of potential impact on a biodiversity unit and the species and communities within it.

### **Biodiversity and some Issues related to Mining in upper Assam.**

- ♦ Mining is an indispensable part of the development process of the country, while preserving biodiversity is important for ecological security of people. Sustainable use of biodiversity in mining areas is difficult in the true sense as current mining practices eradicate the biodiversity and leave abandoned land full of pollution

### **Environment Impact Assessment and Environmental Management Planning in Iron Ore Mining**

- ♦ Careful planning and implementation of proper environmental management practices are essential for sustainable development.

### **Biodiversity and Ecological Restoration Norms and Compliance by the Indian Mining Industry**

- ♦ Need for sustainable development framework for mines and restoration and mitigation measures for mines have been stressed but there are still serious inherent conflicts within these areas, both with local people and for wilderness conservation.

### **Habitat Restoration in Bauxite Mines: Case Study of Two Mines of Hindalco Industries Limited.**

- ♦ Choice of restoration model should be based on local conditions rather than a single tree-plantation model.

### **Issues Related to Impact on Land use due to Mining in Power Grade Coalfields in India and Reclamation Approaches**

- ♦ Indian Regulation leaves ample freedom for mine operators to decide on backfilling based on geomining conditions.

### **Ecological Study of Re-vegetated Mine Spoil of Dry Tropical Environment**

- ♦ Restoration strategies must address soil structure, microbe population and nutrient cycling in order to return the land as closely as possible to its pre-disturbance condition.

### **Enhancement of Carbon Sequestration Potential of Coal Mined Soils through Management Practices**

- ♦ Successful restoration of mined soils not only lead to successful restoration of soil and vegetation but also enhance biomass productivity and offset CO<sub>2</sub> emission through the photosynthesis process.

In conclusion, we have endeavored to align our thoughts to the spirit of the pre-eminent political and ideological leader, *Mahatma Gandhi*, who reminded us that “*There is enough for everyone's need but not for everyone's greed*”.

Towards this end, we hope that the outcomes recorded in Naturenomics™ 4.0 (Vol. I & II) will help in retaining a better earth.





### 1. Wildlife Protection Act, 1972

The original Wildlife Act was enacted in the year 1972 and thereupon amended several times to further improve the objective of protection and the conservation of the wildlife. The term 'wildlife' as per the Act means 'any animal, bees, butterflies, crustacean, fish and moths: aquatic or land vegetation which forms part of any habitat' {sec.2 (37)}.

The Wildlife Protection Act aims at the protection of the components of biological diversity like the wild animals, plants, birds etc. It aims primarily at the maintenance of ecological and environmental security of the country as a whole. It is a comprehensive legislation dealing with the wildlife and the protection of the same effectively. The Act consists of 66 sections and 6 schedules. As the title of the Act suggests it mainly aimed at the protection of the wildlife but with the amendment to the Act in the year 1991, specific species of plants were brought under the Act for protection. The main objectives of the Wildlife protection Act are:

- ♦ The State Government is given the power to declare the Sanctuaries National Parks aimed at the protection of the wildlife.
- ♦ Conservation and protection of the flora and fauna of the protected areas.
- ♦ Regulation of the hunting of the wild animals and the birds.
- ♦ Regulation of possession, acquisition or transfer of, or trade in wild animals, animal articles and trophies and taxidermy etc.
- ♦ Constitution of authorities to achieve the objectives of the act.

#### 1.1 Wildlife (Protection) Amendment Act, 2002

The Amendment has deleted a few sections and has inserted a few. The changes that were brought about in the Act were not too gigantic, but it did make a considerable change aiming towards the conservation of the wildlife in a better manner. It also tried to make a lot of cosmic changes. The 1972 Act had the concept of 'closed areas', which was completely deleted in the 2002 amendment Act. Some features include:

- ♦ The hunting of the wild animals is prohibited by the Act except in special situations :  
The Act not only deals with the aspect of wildlife protection, it also concentrates on the protection of the plants.
- ♦ Penalty and forfeiture of property derived from illegal trade or hunting.

### 2. Forest Conservation Act, 1980

The Forest Conservation Act came into force on the 25th day of 1980. It is considered to be one of the most important legislations as far as the conservation of the forests is concerned.



The main objective of the act was the conservation of the forests and matters connected therewith, which was completely ignored by the Indian Forest Act of 1927.

The Forest Conservation Act was amended again in 1988. Some of the important objectives of the Act are:

- ♦ Imposition of restrictions on de-reservation of forests
- ♦ Restriction on the use of forest land for non forest purpose
- ♦ Conservation of the forest wealth
- ♦ Check further reforestation
- ♦ Maintenance of ecological balance

#### The key features of the Act:

- ♦ **Role of the authorities:** Punishments for the contravention of the provisions of the Act by the head of the departments or other concerned authorities however they are not liable to any punishment if proven that the offence was committed without his knowledge or that due diligence was exercised to prevent the commission of such offence.
- ♦ **Conversion of land from forest to non-forest purposes:** The Act lays certain restrictions on the diversion on the use of land from forest to non-forest purpose taking into account the interest of the nation as a whole. It requires the prior approval of the Central Government before doing so (See box: process of forest clearance).

As far as the implications of the Act are concerned, it has been able to regulate the diversion of the forestland for non-forest purposes. The Government does allow the conversion/diversion of the lands for developmental needs. The developmental needs railways, defence related projects are normally given permissions without stipulated conditions. To mitigate the ill effects of such diversion for other projects like industries, power, multipurpose river valley projects, the government has come up with the concept of Compensatory Afforestation.

#### Process of forest clearance for mining

When forest land is involved in any project, forest clearance needs to be sought from the Ministry of Environment and Forest prior to the environmental clearance itself. This is mandatory under the Forest Conservation Act, 1980. The steps specified in the Supreme Court order (Writ Petition No. 202 of 1995 (T. N Godavarman Thirumulpad Vs Union of India), dated 4.8.2006 for seeking forest clearances and temporary working permit are as follows:

##### For forest clearance

A proposal seeking clearance under the Forest (Conservation) Act, 1980 need to be filled (in case of renewal, the application has to be filled two years prior to the expiry of the mining lease).

If additional information is required, the State Government will ask for the same within 90 days after the receipt of the proposal by the mining company.

The state government will forward the proposal to the central government along with their recommendations within 9 months of the receipt of the proposal.

The central government (MoEF) will dispose of the application for grant of permission within four months of its receipt, under ordinary circumstances. If it is unable to do so, the special reasons for the same would need to be recorded explaining the delay.



### For obtaining a Temporary Working Permit (TWP)

If the application is delayed at the MoEF level, the user agency or applicant can apply for grant of a TWP. In such cases it can apply to the state government in the proforma prescribed by MoEF with an advance copy to the MoEF. Such applications can be made any time after the expiry of 13 months from the date of filing of the proposal with the State Government but not later than 9 months prior to the expiry of the existing approval under the Forest Conservation Act.

In cases where lease/renewal was granted prior to 1980 and the lease period has not expired, the application shall be made at least 9 months prior to the expiry of lease period.

The proposal seeking TWP would be processed and forwarded by the state government to the MoEF within 3 months and the MoEF will place it before the Forest Advisory Committee (FAC).

If the state government fails to forward the application, the advance copy will be placed before the FAC. The FAC will allow for an opportunity to the State Government and user agency to be heard before giving its final recommendations.

If the state government refuses to grant TWP (reasons to be recorded in writing), then FAC will give an opportunity to both the state government and the user agency to present their views and pass orders.

If no recommendation is received by the state government then the FAC will pass the appropriate orders after giving an opportunity to the state government to be heard.

A few other directions were also provided by the court related to both forest clearances and TWPs. Some of these directives are as follows:

FAC will consider all proposals for forest clearances and TWPs. If it recommends grant of clearance or TWP, then MoEF will issue orders within 4 weeks, listing the terms including that of payment of Net Present Value of forest land diverted for non forest use.

The decision on grant of forest clearance would need to be conveyed to the user agency before the expiry of TWP.

In case MoEF disagrees with the FAC recommendation, they will give it in writing to the FAC for consideration. If there continues to be a disagreement, then the Supreme Court may be approached.

In cases where FAC makes recommendation without state government inputs, the TWP will be effective only after the facts are confirmed by the state government. If there is a variance, the state government can refer it back to the MoEF. The MoEF, if so advised can suspend the TWP.

Kohli, K. Orissa's aluminum mining costs are steep, India together  
<http://www.indiatogether.org/2005/mar/env-alumina.htm>, 17/07/2008

### 3. National Forest Policy, 1988

The Parliament on December 1988 passed the new forest policy, which was much more progressive than the earlier policies. Concept of community participation in the protection and the maintenance of the forests was the highlight of this policy. Some key features:

- ♦ Preservation and restoration of the ecological balance by environmental stability.
- ♦ Conservation of the natural heritage.
- ♦ Fulfilling the basic requirements of the people dependent on forests like fuel, wood, fodder etc.
- ♦ Protecting the customary rights of the people who are dependent on the forests.



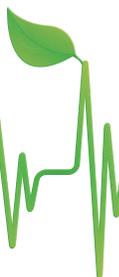
- ♦ The most important aspect of the policy was the recognition of the interrelationship between the tribals and the forests.
- ♦ It encouraged public participation and involvement of women in the management of forests.
- ♦ It also encouraged a time bound afforestation programme. It extended certain rights including grazing rights and deals with shifting cultivation, forest based industries, forest extension, education and research etc.
- ♦ An important development was the formalisation of the Joint Forest Management Programme, which involved the local people in the management of the Forests

#### 4. Mineral Conservation and Development Rules 1988, Rule – 33.

- ♦ Every holder of prospecting license or a mining lease shall take steps so that the overburden, waste rock, reject and fines generated during prospecting and mining operations or tailings, slimes and fines produced during sizing, sorting and beneficiation or metallurgical operations shall be stored in separate dumps.
- ♦ The dumps shall be properly secured to prevent escape of material there from in harmful quantities which may cause degradation of environment and to prevent causation of floods The site for dumps, tailings, slimes shall be selected as far as possible on impervious grounds to ensure minimum leaching effects due to precipitation
- ♦ Wherever possible the waste rock, overburden etc shall be backfilled into the mine excavations with a view to restoring the land to its original use as far as possible
- ♦ Wherever backfilling of the waste rock in the area excavated during mining operations is not feasible, the waste dumps shall be suitably terraced and established through vegetation or otherwise.
- ♦ Fines, Rejects or tailings from mine, beneficiation or metallurgical plants shall be deposited and disposed in especially prepared tailing disposable area as such they are not allowed to flow away and cause land degradation or damage to agricultural field, pollution of surface water bodies and ground water or causes flood.

#### 5 Coastal Regulation Zone Notification (1991)

As per the Environment Protection Act, 1986 a notification was issued in February 1991, for regulation of activities in the coastal area by the Ministry of Environment and Forests (MoEF). Central Government declared the coastal stretches of seas, bays, estuaries, creeks, rivers and backwaters which are influenced by tidal action (in the landward side) upto 500 metres from the High Tide Line (HTL) and the land between the Low Tide Line (LTL) and the HTL as Coastal Regulation Zone; and imposed with effect from the date of this Notification, the following restrictions on the setting up and expansion of industries, operations or processes, etc. in the said Coastal Regulation Zone (CRZ). For the purposes of this notification, the High Tide Line means the line on the land upto which the highest water line reaches during the spring tide.



## 6. Biological Diversity Act, 2002

The government of India in the year 2002 enacted this piece of legislation. The introduction of the Biodiversity Act of India however is nothing but the reflection of the obligation India has to meet as signatory to the Convention on Biological Diversity, 1992. It is designed as a complementary act that would go hand in hand with the other legislations like the Wildlife Protection Act (1972), Forest Conservation Act (1980) and Indian Forest Act, etc.

### Objective of the Act:

- ♦ Protection of India's rich biodiversity and associated knowledge from being used by foreign individuals and organisations without sharing the benefits arising out of such use.
- ♦ Conservation, sustainable use and equitable sharing of benefits of India's biodiversity resources
- ♦ Promote at all levels good documentation of biological diversity, its uses and associated knowledge.
- ♦ Development of a well-designed Biodiversity Information System for India to serve as the knowledge base.
- ♦ Establish a three-tier management system i.e., a National Biodiversity Authority, State level Biodiversity Boards and local level Biodiversity Management Committees.
- ♦ Check Bio-piracy.
- ♦ The Biodiversity Act of 2002 stipulated setting up of a National Biodiversity authority and State Biodiversity Board and Biodiversity Management committee at the local level (Panchayat and Municipality level).
- ♦ The act also specifies offences and penalties. The court can take cognizance over the complaints under this Act only if the complaints go through the central government. The offences that are committed under this act are cognizable i.e., the offender can be arrested without warrant and non-bailable warrants. The penalties fixed by the act have been fixed much higher than other acts.
- ♦ The fine is one lakh rupees and in case of second offence it is two lakh rupees and for a continuing offence it is prescribed as two lakh rupees for each day of such disobedience or noncompliance. In case of commission of an offence by a company all those who are responsible for the management and conduct of the company will be held liable.

The Union Ministry of Environment and Forests (MoEF), India, passed the Biological Diversity Act, 2002, with an objective to regulate access to genetic resources and associated knowledge by foreign individuals and institutions and ensure equitable sharing of benefits arising out of resources and knowledge available in the country. In short, the Act is aimed to protect and regulate access to plant and animal genetic resources and traditional knowledge (TK). A three-tiered system of regulation is envisaged under the Biological Diversity Act, which consists of the National Biodiversity Authority (NBA) at the head, followed by State Biodiversity Boards (SBB) and local-level Biodiversity Management Committees (BMC).

### 6.1 Biological Diversity Rules, 2004

After two years of the enactment of the Biodiversity act, government notified the Biodiversity Rules. The rules were formally notified in the official gazette on 15th April 2004. The Biodiversity Rules are the executive orders made by the Government in order to carry out the purposes of the Act (Section 62) which states that:

Every rule made under this Act is to be placed in the Parliament for a period of thirty days and the houses can make changes in the rules (sec 62(3)).



The key features of the rule are:

The rules laid down procedures regarding the application to be made to have access to the biological resources and the traditional knowledge, situations when the application for access will be revoked or withdrawn, their Intellectual Property rights protection, the procedures involved in the transfer of the research findings, the transfer of the access right to a third party etc.

The rules also dealt with the establishment of the **Biodiversity Management Committees (BMCs)** by the local bodies and their functions. The maintenance of the **People's Biodiversity Register** in consultation with the local people is one of the important functions of the BMC. The Register contained comprehensive information on availability and knowledge of local biological resources, their medicinal or any other use or any other traditional knowledge associated with them. The Act and the Rules set up the road map for National Biodiversity Fund, State Biodiversity Fund and Local Biodiversity Fund.

### 7. Scheduled Tribes and Other Traditional Forest Dwellers Act (Recognition of Forest Rights), 2006

The **Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006**, is a key piece of forest legislation passed in India on December 18, 2006. It has also been called the "**Forest Rights Act**", the "**Tribal Rights Act**", the "**Tribal Bill**", and the "**Tribal Land Act**." The law concerns the rights of forest-dwelling communities to land and other resources, denied to them over decades as a result of the continuance of colonial forest laws in India.

A little over one year after it was passed, the Act was notified into force on December 31, 2007. On January 1, 2008, this was followed by the notification of the Rules framed by the Ministry of Tribal Affairs to supplement the procedural aspects of the Act

.The Act grants four types of rights:

- ♦ **Title rights** - i.e. ownership - to land that is being farmed by tribals or forest dwellers as on December 13, 2005, subject to a maximum of 4 hectares; ownership is only for land that is actually being cultivated by the concerned family as on that date, meaning that no new lands are granted;
- ♦ **Use rights** - to minor forest produce (also including ownership), to grazing areas, to pastoralist routes, etc.;
- ♦ **Relief and development rights** - to rehabilitation in case of illegal eviction or forced displacement and to basic amenities, subject to restrictions for forest protection;
- ♦ **Forest management rights** - to protect forests and wildlife.

Eligibility to get rights under the Act is confined to those who "primarily reside in forests" and who depend on forests and forest land for a livelihood. Further, either the claimant must be a member of the Scheduled Tribes scheduled in that area or must have been residing in the forest for 75 years.

### International Conventions and India

In addition to this, following Biodiversity related conventions and programmes are also relevant to the biodiversity in India.

#### 1. The Ramsar Convention on Wetlands, 1971

The Convention on Wetlands was signed in Ramsar, Iran, in 1971. It is an intergovernmental treaty which provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. There are presently 158 Contracting Parties to the Convention, with 1754 wetland sites, totaling 161 million hectares, designated for inclusion in the Ramsar List of Wetlands of International Importance. Wetlands are areas where water is the primary factor controlling the environment and the associated plant and animal life. They occur where the water table is at or near the surface of the land, or where the land is covered by shallow water.



The Ramsar Convention takes a broad approach in determining the wetlands which come under its aegis. Under the text of the Convention (Article 1.1)<sup>28</sup>, wetlands are defined as “ **areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres**”.

"The Convention's mission is the conservation and wise use of all wetlands through local, regional and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world" (Ramsar COP8, 2002)<sup>29</sup>. The convention uses a broad definition of the types of wetlands covered in its mission, including swamps and marshes, lakes and rivers, wet grasslands and peatlands, oases, estuaries, deltas and tidal flats, near-shore marine areas, mangroves and coral reefs, and human-made sites such as fish ponds, rice paddies, reservoirs, and salt pans. India signed the Ramsar Convention in 1981. Parties to the convention are obliged to have at least one wetland listed as being a Ramsar site, with a commitment to maintaining its conservation and wise use. Other obligations include to incorporate wetland conservation considerations in national land-use planning, to promote as far as possible, “the wise use of wetlands in their territory” establishing nature reserves and training of personnel for wetland management, and consulting with other parties especially for the conservation of trans-border wetlands.

Any treaty is only as effective as its weakest member, and the Ramsar convention is no exception. If the world's threatened wetlands are to survive, the requirements of the convention must be taken more seriously by its present members - and more countries have to become signatories without delay.

## **2. Convention on Biological Diversity, 1992 (CBD)**

The unchecked loss of bio-diversity in the world over was one of the important reasons for the emergence of the Convention on Biodiversity. CBD was signed by 150 government leaders at the 1992 Rio Earth Summit, the Convention on Biological Diversity is dedicated to promoting sustainable development. Conceived as a practical tool for translating the principles of Agenda 21 into reality, the Convention recognizes that biological diversity is about more than plants, animals and micro organisms and their ecosystems – it is about people and our need for food security, medicines, fresh air and water, shelter, and a clean and healthy environment in which to live. The three most important objective of CBD are the conservation of biological diversity, the sustainable use of its components, and the equitable sharing of benefits arising from the utilisation of genetic resources.

The agreed text of the CBD was adopted by 101 governments in Nairobi in May 1992 and was signed by 159 governments and the European Union at the UNCED held in Rio de Janeiro in June 1992. The Convention finally entered in to force on December 29, 1993, which has since then been signed by 184 countries. India became a signatory to the Convention by signing it on June 5, 1992.

India became a signatory to the CBD in December 1993 and ratified the Convention in February 1994. The Ministry of Environment and Forest was nominated the focal point for the CBD.

The main objectives of the CBD, to be pursued in accordance with its relevant provisions, include conservation of biological diversity, sustainable use of its components and the fair and equitable sharing of benefits arising out of the utilisation of genetic resources by means of:

- ♦ Appropriate access to genetic resources;
- ♦ Appropriate transfer of relevant technologies, and,
- ♦ Appropriate funding.

These pivotal issues were firmly set on the agenda of each signatory country and led to the need of a close analysis of all the issues raised by the provisions of the convention and a search for ways in which they can be implemented effectively. India, being a signatory to the CBD, has three positive obligations to meet:



- ◆ Submission of a status report: A report titled 'Status of Biodiversity in India' was prepared in 1997 and submitted in 1998. Periodic submission of updated Status Report followed. Subsequently, a Biodiversity Action Plan was published in 2008 by MoEF.
- ◆ Preparation of National Biodiversity Strategy and Action Plan (NBSAP): The report was prepared over a period of three years and submitted in October 2002.
- ◆ Enacting laws to protect biodiversity of the country: The Biological Diversity Act, 2002, was passed on December 11, 2002.

### 3. World Heritage Sites: The World Heritage Convention

The 1972 World Heritage Convention is an international legal instrument for the protection of **cultural and natural heritage** of 'outstanding universal value'. The convention is an important instrument in heritage conservation. Threats to the very survival of the world's heritage have increased over the last three decades as a result of neglect, poverty, civil unrest and military conflicts as well as ill-advised planning in many regions. These increasing threats demand improved implementation of the convention by the states that are party to it. They are encouraged to adopt a national policy that gives cultural and natural heritage a function in the life of the community and to integrate the protection of that heritage into comprehensive planning programmes. One of the most important protective mechanisms of the World Heritage Convention is the List of World Heritage in Danger. The inclusion of properties on this list is intended to highlight the need for urgent attention by the whole international community. In the past, many World Heritage sites have faced threats to their values and integrity as a result of mining development projects and disasters. The project proposal has to be vigilant in efforts to protect world heritage and always ensuring the protection of the 'outstanding universal values' of heritage sites.

Since 2000, a constructive dialogue has taken place with the mining industry, including international meetings presenting case studies of World Heritage sites under threat, publications and presentation of results on web sites. The ICMM statement on World Heritage sites as '**no-go areas**' was widely recognised as a landmark commitment from leading companies in the mining industry. There are enormous conservation benefits from such co-operation and from sensitive, well-planned projects.

#### Heritage Sites (Natural) in India

The entire list of natural and cultural sites is available at, World heritage convention webpage of UNESCO (<http://whc.unesco.org/en/statesparties/in>). The declaration or proposal dates in parenthesis.

#### Natural

- ◆ Kaziranga National Park (1985)
- ◆ Keoladeo National Park (1985)
- ◆ Manas Wildlife Sanctuary (1985)
- ◆ Nanda Devi and Valley of Flowers National Parks (1988)
- ◆ Sundarbans National Park (1987)

#### Proposals Submitted on the Tentative List

- ◆ River Island of Majuli in midstream of Brahmaputra River in Assam (2004) ·
- ◆ Western Ghats (sub cluster nomination) (2006)
- ◆ Namdapha National Park (2006)
- ◆ Wild Ass Sanctuary, Little Rann of Kutch (2006)
- ◆ Kangchendzonga National Park (2006) · Great Himalayan National Park (2009)
- ◆ Bhitarkanika Conservation Area (2009)
- ◆ Neora Valley National Park (2009)
- ◆ Desert National Park (2009)



## Other Ecologically Sensitive Areas

### Important Bird Areas (IBA)

Many areas have been identified as Important Bird Areas of exceptional bird diversity. (<http://www.birdlife.org/action/science/sites/index.html>) These areas have potential for earning revenue from ecotourism. The list of IBAs in India can be found in Zafar-ul Islam & Rahmani (2004).

### Mangrove Areas

Mangrove ecosystems are considered ecological sensitive owing to high productivity and serves as breeding ground of large number of marine biota, making it important for the fishery industry. Any slight change in pH, water quality esp. pollution of metals is dangerous for this ecosystem. The Sundarban mangrove area is protected as Biosphere Reserve. Many areas of mangroves get the benefit of coastal protection under CRZ.

### Sacred Groves/ Sacred Habitats

Traditionally protected vegetation patches are seen across the India. Local communities in many cases consider certain natural features like springs, river origins, ponds, lakes, grasslands as sacred. They may be dedicated to certain deities at times. These sites have tremendous value in local culture and religion. The recent category of Community Conserved Areas in Protected Areas takes account of these, but they may not always be listed or have any special legal protection. Many of these are being considered as “Biodiversity Heritage Site” under the Biological Diversity Act, 2002.

### Corridor areas

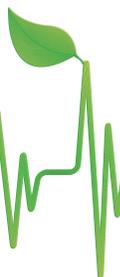
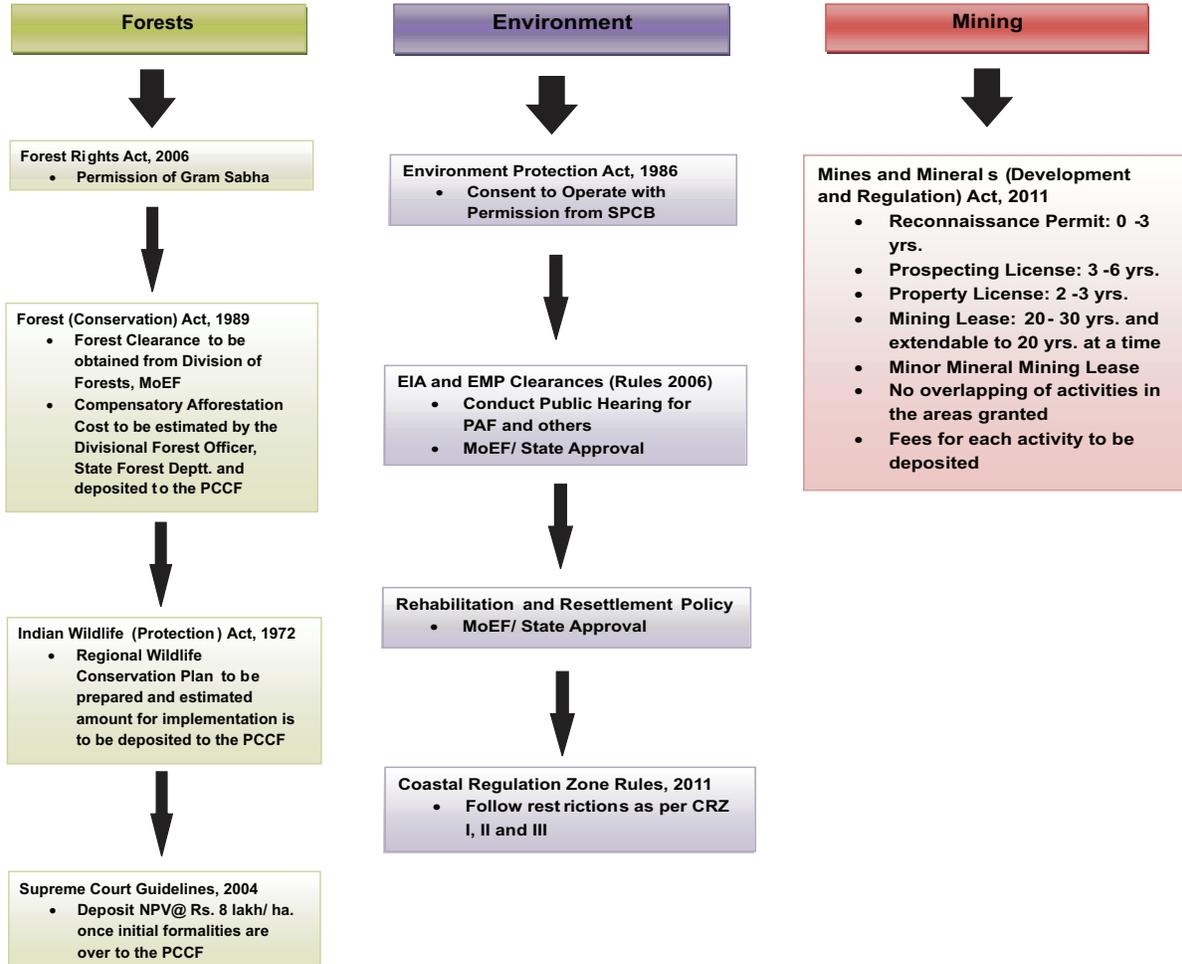
Areas of wilderness linking major forest areas or protected areas form a corridor for wildlife species like elephants, tigers or migrant birds to pass in between. Legal protection may not be completely uniform but only as Village forest/Reserved Forests/Wildlife Sanctuary etc. The place is of high biodiversity value, as corridor and as buffer. Currently, Wildlife Conservation Plan calls for separate payment by the developers/ mining companies towards maintaining such areas provided Forest Clearance has been obtained from competent authorities.

### Why protect certain sites?

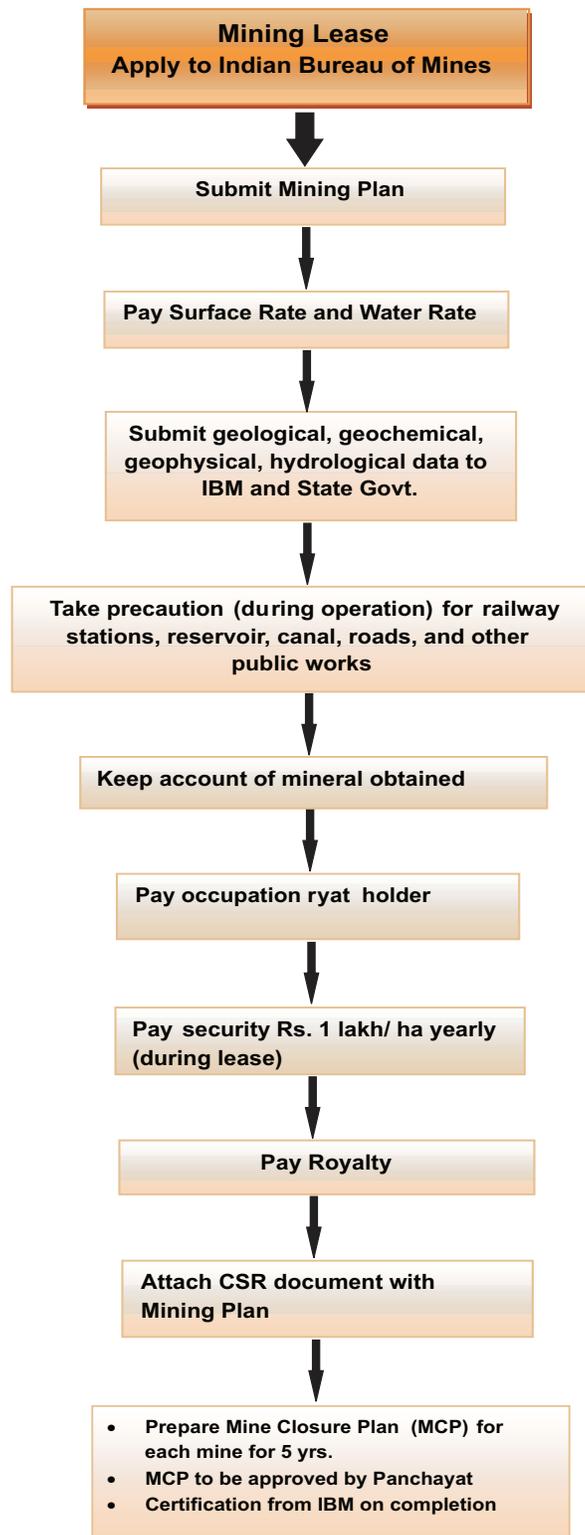
- ♦ Aesthetic values
- ♦ Ecological values (origin of water source)
- ♦ Biodiversity values (endangered, endemic flora and fauna)
- ♦ Ecological security (wild food sources)
- ♦ Ecotourism industry
- ♦ Spiritual values



## Forest, Environment and Mining – Rules and Regulations



## Pre-Mining Permission





### 1.0 Biodiversity of India

India ranks amongst the top ten mega-diversity nations in the world. The Western Ghats, Northeast India and the Andaman-Nikobar islands are globally recognized wilderness areas of high endemism in flora and fauna. They are designated as **hotspots** owing to the richness of endemic biological diversity and also because of the high degree of biotic threat to the same.

Approximately 18644 species of higher plants (Earthtrends, 2003) and 91,307 (MoEF, 2008) species of animals have been reported in India. The fungal and microbial diversity exceeds 50,000. The number continues to grow even today as new areas are explored and scientific research leads to discovery of new species. The species numbers are highest in the Western Ghats, North eastern India and Andaman Nicobar islands. However, other areas such as Himalayas, seacoasts and deserts have their own unique species of plants and animals.

India has large number of endemics, i.e. species seen only in India and nowhere else in the world. The endemic biodiversity is often limited only to a small geographic range within India such as a single mountain peak or a single wetland or single forest area.

#### Examples of Endemics In India

- A. The Asiatic Lion: once seen across the Indian grassland plains, is now limited only to a single forest area: the Gir forest of Gujarat. The habitat is threatened by mining around the Gir forest area. The conflict between mining mafia and the environmental activists opposing it has led to the shooting of Amit Jethwa (environmentalist) by unknown gunmen in 2010.
- B. Sengai: The Brow-Antlered Deer is known only from a highly specialized wetland ecosystem in Manipur. It is under threat from pollution of the water bodies and loss of good habitat.
- C. *Nepenthes khasiana*: the carnivorous pitcher plant is only present in Meghalaya state. Indiscriminate coal and limestone mining in the region can threaten its habitat.
- D. *Aponogeton satarensis*: a plant growing in monsoon puddles is seen only at 5 locations in Maharashtra, on Tableland Mountains at altitude 1100m. Together it is seen only in an area of about 1 square kilometre. Its habitat is under threat from bauxite mining and windmill farming.



\*Earlier version edited by A. K. Ghosh and circulated as Biodiversity Issues in Indian Mining Areas at the Balipara

The government has taken many steps to protect and conserve the endemic biodiversity and fragile ecosystems of India. Species conservation and recovery programmes are planned targeting umbrella species and keystone species. International efforts have also focused on protecting Indian wildlife and wilderness. Some of the major initiatives have been the Tiger and Elephant conservation programmes ongoing across India in various states. Several policy decisions have been taken to conserve the Indian biodiversity. Ministry of Environment and Forest (MoEF) is the central government body functioning as nodal agency with decision-making power about the Indian biodiversity and environment.

All the plant and animal species exist as communities of interdependent organisms. They also depend upon and are able to modify the abiotic environment in which they exist i.e. their habitat. Therefore conserving a species necessitates conserving its associates and also its habitat. The recent approaches to conservation have focused on conservation of species as well as landscapes which they inhabit. E.g. WWF's species and landscape programme for tiger and Indian elephant. The most important policy of conservation has been designation of certain areas as **"Protected Areas" (PA)**, which are established by legal procedures and the law governs activities within and in the immediate surroundings of PA.

## 2.0 Why is Biodiversity Important For Humans?

Biodiversity sustains human livelihoods and life itself. Biological diversity has allowed massive increases in the production of food and other natural materials, which in turn have fed the growth and development of human societies. Through close interaction and manipulation of biodiversity, humans have created thousands of new crop varieties and livestock breeds, with distinct development benefits. Biodiversity is also the basis of innumerable environmental services that keep us and the natural environment alive – from the provision of clean water and watershed services to the recycling of nutrients and pollination. It is through the myriad interactions among and between these organisms and the biotic environment that the possibility for adaptation arises.

- ♦ Genetic diversity within a single crop such as rice, has led humans to cultivate its diverse varieties in various eco-regions. It feeds large population across the world and also has many other uses apart from food
- ♦ More than 1000 varieties of pulses are known in the world and they satisfy protein needs of the human
- ♦ Many organisms perform critical ecosystem functions e.g. pollination of crops by the insects, control of insect pests by the birds
- ♦ Fungi, and microbes have provided many important antibiotics for disease resistance
- ♦ Humans have often designated spiritual values to certain plants, animals or habitats (sacred rivers, sacred groves)
- ♦ Natural fibres, dyes, have been in use for several centuries
- ♦ Vegetation controls the water cycling on earth
- ♦ Aesthetic values of biodiversity are recognised by horticulturist
- ♦ Intrinsic value of biodiversity needs to be recognised
- ♦ Humans are part of the environment and thus linked in myriad complex ways with the other organisms.

Loss of biodiversity will ultimately affect human populations in adverse way. Biodiversity of India is a natural resource. The diverse local communities in India rely upon the biodiversity for food security, water and energy security.



### 3.0 Why Should Mining Companies Consider Biodiversity?

(Based on Good Practice Guidelines for Mining and biodiversity, IUCN, ([www.cbd.int/development/doc/Mining-and-Biodiversity.pdf](http://www.cbd.int/development/doc/Mining-and-Biodiversity.pdf)))

Ethical and moral considerations are increasingly the subject of corporate policies. But in recent times it has become important for mining companies to take biodiversity into account as a good practice of business. International giant mining companies have internalized management of biodiversity as part of their commitment to society for 'licence to operate' (See Box on Rio Tinto). Adoption of responsible practices of biodiversity management is important with respect to:

- ♦ **access to land,**
- ♦ **access to capital,** particularly where project finance is to be obtained from one of the investment banks that are signatories to the Ecuador Principles,
- ♦ **reputation,** which can influence the perceptions of communities, shareholders, NGOs and other stakeholders of mining operations

In addition, good biodiversity management can bring benefit to mining companies, including:

- ♦ Better acceptance from society, civil society organizations
- ♦ Better relations with investors
- ♦ Timely licenses from regulatory agencies, making the project efficient
- ♦ Improved community relations allow better functioning of long term projects like mining
- ♦ Commitment from employees and reduction in liabilities.

#### A Strategic Response to Biodiversity Conservation – Rio Tinto

Rio Tinto has developed a strategic response to biodiversity conservation and management, designed to enable the company to meet the wide range of expectations of many different constituencies with interests in the company and its activities.

As a first step in developing a biodiversity strategy, partnerships were formed with leading conservation organisations. These relationships provided a conservation perspective on the opportunities and challenges raised by the mining process and were an essential part of designing how to proceed. After a detailed survey of the level of awareness and management of biodiversity issues a paper setting out a strong business case for developing a biodiversity strategy was put to senior management.

The development of the strategy was managed by a Rio Tinto steering group formed in 2002 and supported by an external advisory panel. The elements of the Rio Tinto biodiversity strategy have been developed to help corporate and operational staff improve biodiversity performance through:

- ♦ Identification of biodiversity risks and opportunity
- ♦ Development and implementation of biodiversity programmes
- ♦ Recognition of synergies and challenges with sustainable communities programmes
- ♦ Identification and development of strategic and operational partnerships, and,
- ♦ Effective corporate assurance



The strategy provides a framework to bring together the interests and concerns of several groups, including indigenous landowners, affected communities, investors, employees, NGOs, regulators, scientific and finance communities. Outputs from the strategy include a Position Statement, guiding principles, a detailed guidance document and case studies. The Strategy was launched at the World Conservation Forum in Bangkok in November 2004. It is being implemented across the Rio Tinto Group, with particular emphasis on new projects.

The company's biodiversity partner organisations are actively involved in implementation. They are supporting group businesses in the design and development of biodiversity programmes appropriate to local biodiversity risks and opportunities. Working groups have been formed to continue the development of additional guidance on biodiversity indicators, metrics and targets, and on the issues surrounding the use of **biodiversity offsets**.

#### 4.0 Who Are Biodiversity Stakeholders In Mining?

Stakeholders are groups and individuals who affect or are affected by the activities of development projects like mining. Depending on the scale and significance of a mining project, the stakeholders with an interest in biodiversity may include the following:

- ♦ Local communities;
- ♦ A range of government and multilateral institutions with an interest in or responsibility for the management or protection of natural resources;
- ♦ Investors or providers of insurance, who may impose environmental requirements or standards;
- ♦ Conservation interests, including international, national or local NGOs as well as academic or research institutions; and employees.

#### *Some Key Issues To Consider For Effective Stakeholder Engagement*

*[Source: Business Partners for Development (2000)]*

Stakeholder engagement in the minerals sector has occurred in a variety of ways. The strategic approach recommended, '**Go beyond compliance**' is:

- ♦ Build relationships with stakeholders through consultations (also required for compliance with legislation)
- ♦ Build long-term, continuing and sustainable relationships and trust
- ♦ Recognize cultural differences particularly within indigenous communities.
- ♦ Involvement of a neutral third party.
- ♦ Capacity building of community relations staff
- ♦ Ensure prior consent for Access to Biodiversity and develop Benefit Sharing.

#### 5.0 What are the Threats to Biodiversity and Environment?

The term environment encompasses land, soil, water, air and climate within India. The natural environment is inseparable from the biodiversity. Indian biodiversity is threatened by various activities like logging for timber, poaching and trade in wildlife, growing demand for agricultural land, fuel wood, landscape level changes due to urbanization, infrastructure, dams, increased use chemicals, pollution to mention a few.



Growing industrialization and urbanization changed the landscape irreversibly. In recent times, increased pollutants and increased carbon emissions have led to green-house effect, global warming and climate change.

Amongst the various pressures, mining of mineral resources is considered one of the biggest threats. Being extractive in nature, it leads to large-scale changes in the landscape, affects land & soil, water and air due to pollutant and toxic waste. The severe modification of the local environment has major adverse influence on the local biodiversity. The biodiversity at the mining location is completely lost while that in the surrounding area is affected. The actual area over which mining has adverse influence varies with the nature of mining (open/closed), nature of associated activities (infrastructure, housing), duration (short/long) and processing of mineral resources (generation of waste, pollutants).

In addition to above, the impact of mining on biodiversity depends very much upon the location of mine (Vagholikar, et al. 2003). Mining in biodiversity rich areas or hot-spot areas has adverse impact disproportionate to the actual area covered. This is because such areas have large number of species and special habitats in relatively small geographical areas.

### 6.0 How Does Mining Affect Biodiversity?

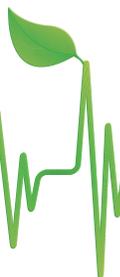
Impacts on biodiversity may occur at any of the following levels:

- ♦ **Ecosystem level:** if a potential project changes the size, diversity or spatial variation of the ecosystem. An impact to an ecosystem can occur if its ability to provide long-term function or services is changed.
- ♦ **Species level:** Loss of species in certain area can reduce its area of occupancy and fragment populations changing distributional range
- ♦ **Genetic level:** Diversity within an ecosystem is also associated with genetic diversity of populations. Ecosystem level and species level changes can lead to genetic level changes which are difficult to measure

**6.1 Cumulative Impacts:** In situations where multiple mining projects (or other projects, such as industrial or infrastructure projects) are being implemented within a broad geographic area (such as a watershed or valley area), it is important to consider the cumulative impacts on biodiversity (that is, the additive effects of other projects, such as multiple coal mines in a coal basin, together with any associated infrastructure). Good Practice Guidance for Mining and biodiversity, (ICMM) suggests that while assessing cumulative impacts, attention should be given to:

- ♦ Existing or proposed activities in the area and the likely effect on biodiversity of those proposals in conjunction with the proposed mining activity;
- ♦ Synergistic effects of individual project impacts when considered in combination; and
- ♦ Known biodiversity threats in the area and the likely contribution of the proposed mining activity to increasing or decreasing those stresses.

**6.2 Loss of Ecosystem Services:** Mining may result in the removal of ecosystems or habitats. Permanent habitat loss may occur due to extensive clearing for the mine location, while temporary habitat loss may occur due to limited clearing for exploration access. Changes in ecosystem affect the ecosystem services. E.g. clean water for the local communities, fuel wood and fodder availability, loss of non timber forest produce like bamboo, edible fruits and vegetables etc. It is very complicated to assess the loss of some ecosystem services like pollinator services. Loss of habitat may affect the pollinator populations which in turn will have a negative impact on the fruit and grain crops owing to the non-availability of appropriate pollinators.



**6.3 Habitat Fragmentation Impacts:**The isolation or fragmentation of ecological habitats can have significant impact on biodiversity. Fragmentation may disrupt ecological processes critical to the maintenance of biodiversity especially if over long periods. Hence, rehabilitation of areas within short period and maintaining ecological corridors become necessary mitigation measure.

**6.4 Alteration of Ecological Processes:**The alteration of ecological processes like hydrological regime, changes in structural diversity, vegetation, disruption of predator-prey relationships, disruption of soil structure, introduction of burning as weed control can disrupt natural ecosystem recovery processes, making recovery difficult or impossible

**6.5 Pollution Impacts:**Pollution of air, water and soils at or around a mine will directly and indirectly affect biodiversity by altering the optimal environmental conditions required by the organisms

**6.6 Disturbance Impacts:**Disturbance provides competitive advantage to invasive species of plants and animals. Mining activities like digging, soil removal, noise, artificial lighting and vibrations may also disturb wildlife by creating difficulties in roosting, nesting, dispersal etc.

Concerns over impact on biodiversity in the mining areas have led to formulation of various precautionary measures, regulations and laws. These have been modified and amended at times. It is necessary under the current laws to carry out biodiversity assessment and impact analysis as part of an Environmental Impact Assessment (EIA) of the mining project, to obtain environmental clearance, define an environmental management plan (EMP), including biodiversity management and mitigation measures and mine closure plan.

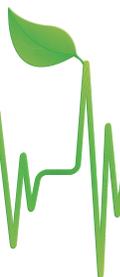
## 7.0 Policies and Laws

Various biodiversity related laws and policies need to be considered while carrying out mining cycle in India. They are:

1. Wildlife Protection Act, 1972 and Wildlife (Protection) Amendment Act, 2002
2. Forest Conservation Act, 1980
3. National Forest Policy, 1988
4. Mineral Conservation and Development Rules 1988, Rule – 33.
5. Coastal Regulation Zone notification (1991)
6. Biological Diversity Act, 2002 with Biological Diversity Rules, 2004
7. Scheduled Tribes and Other Traditional Forest Dwellers Act (*Recognition of Forest Rights*), 2006

In addition to this, the following Biodiversity related conventions and programmes are also relevant to the biodiversity in India:

- ♦ The Ramsar Convention on Wetlands, 1971
- ♦ Convention on Biological Diversity, 1992 (CBD)
- ♦ World Heritage Sites : The World Heritage Convention
- ♦ Important Bird Areas (IBA)
- ♦ Mangrove Areas
- ♦ Sacred Groves/ Sacred Habitats
- ♦ Corridor areas



### Need for a Database

EIA process requires documentation of biodiversity and sites of importance in the zone of influence of a project. However, many a times, information on these is not readily available at any one source. This often leads to ignorance of mention of such values in project areas. The time span of EIA being short is often cited as a reason for lack of detailed information on biodiversity, its distribution in an area and its value.

In view of this, it is necessary that a spatial database of all the areas with high biodiversity and ecological value should be compiled and made openly available. This will allow categorization of areas of India into protection categories. The areas of highest priorities can be then identified as **No-go zones** and it will be easier for the development project authorities to take immediate decisions on leasing out areas, which are not in the higher protection categories. A national database will make it possible to identify sensitive zone for the EIA consultants, and there will be no lapses. Overlapping this with mining areas will help in identification of future lease areas, without giving rise to conflicts. Ministry of Environment and Forests of India has already started this process by demarcating no-go zones especially in the forested and ecologically sensitive regions.

## 8. What are the Conflicting Issues in Mining and Biodiversity Conservation?

### 8.1 Mining Inside or in the Vicinity of Protected Areas:

Most conflicts between mining industry and environmentalists start because most of the minerals resources and deposits in India are beneath the forest and tribal dominated area. The top 50 major mineral producing districts of the country account for as much as 18 per cent of total forest cover in the country. Mineral rich states like Chhattisgarh and Jharkhand have forest cover as high as 43 and 30 per cent of their land respectively. Many of these are areas with large National Parks, Wildlife sanctuaries and community conserved areas.

### Some Recent Examples of Mining In Or Around PAs

- ♦ The Bhagwan Mahaveer Wildlife Sanctuary, Goa, has at least 100-150 mines in a 10-km radius of the protected area. In fact, mine leases are spread over more than 40 per cent of the forest area in Goa.
- ♦ The Gir Wildlife Sanctuary and National Park in Gujarat, the last home of the Asiatic lion, has 100 odd mines in a 10-km radius of the protected area. The Gujarat government denotified the Narayan Sarovar Wildlife Sanctuary reducing its size from about 766 sq km to about 444 sq km to allow limestone and lignite mining
- ♦ Kudremukh National Park has iron-ore mining in vicinity
- ♦ Goa has large number of iron-ore mines in the vicinity of all the wildlife sanctuaries

In forest areas, mining requires diversion of large amount of forestland for mining. According to the estimated data, Orissa has diverted maximum forestland for mining, which account for more than 16 per cent (15387 ha) of the total forest land diverted for mining in the country (see table) followed by Chhattisgarh which diverted 14421 Ha of forest land.



**Forest land diversion by states (total for India 95003 ha) (Behar, A. *et al*, 2005)**

Sl.no.	State	Forest land diverted for mining (ha)	Sl.no.	State	Forest land diverted for mining (ha)
1	Orissa	15,387	11	Goa	1,282
2	Chhattisgarh	14,421	12	Himachal Pradesh	1,228
3	Andhra Pradesh	13,532	13	Tamil Nadu	436
4	Madhya Pradesh	10,058	14	Bihar	414
5	Gujarat	9,664	15	West Bengal	277
6	Jharkhand	9,059	16	Uttarakhand	247
7	Karnataka	7,558	17	Arunachal Pradesh	142
8	Rajasthan	4,996	18	Assam	87
9	Maharashtra	4,057	19	Kerala	29
10	Uttar Pradesh	2,110			

To regulate the process of forest land diversion, and minimizing the impact of degradation caused due to mining the MoEF has laid down various approval conditionality under the Forest Conservation Act 1980. The major conditionalities are:

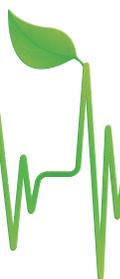
- ♦ Compensatory Afforestation – to pay the cost of compensatory Afforestation
- ♦ NPV of the Environmental Loss – pay for the loss of NPV
- ♦ Clear demarcation of the Mining Lease Area
- ♦ Restoration and Reclamation of Worked out Areas
- ♦ Maintenance of Safety Zone
- ♦ Treatment of water to be discharged
- ♦ Free Supply of Coal to Labourers and Staff Members
- ♦ Afforestation in Blank Areas
- ♦ Managing Surface Subsidence
- ♦ Contribution to Regional Wildlife Action Plan

Conflict can arise due to non-compliance with any of the above conditionalities.

Singh and Mehraj (2010) found that out of 9 coalmines surveyed in MP and Chhattisgarh, all had paid for the compensatory afforestation but only two had implemented it. Compliance with environmental norms was poor and the biodiversity was given almost no priority.

### **8.2 Lack of Comprehensive EIA With Incomplete Representation Of Biodiversity**

Environmental impact assessments (EIAs) are used widely to integrate environmental, economic and social concerns into decision-making processes. But they often address biodiversity issues in only a general way, sometimes, without baseline surveys or consideration of possible indirect or cumulative impacts of a proposed project on biodiversity in an area. Companies can play an important role in improving the coverage of biodiversity concerns in EIAs.



Within the EIA, it is required that a full assessment of ecological and environmental factors in the zone of influence (10 –15 kms radius as per requirements) is done. There have been many recent amendments in the law. In spite of this the completed EIAs are often considered sketchy by the biodiversity experts and environmentalists. This is because “biodiversity” in its true sense is not assessed completely. The EIA is limited by time and does not always cover a complete seasonal cycle of nature. It relies on secondary literature of the region on flora and fauna, and hence has limitations in areas where extensive scientific research has not been done.

However, some improvements have been made in the assessment after introduction of new EIA notification as it is the appraisal committee which now decides the framework for the biodiversity assessment (Rajavanshi et al. 2007). Prior to this (as per the 1994 EIA notification), even the framework of assessment was decided by the project proponent and therefore many significant issues related to biodiversity were suppressed or ignored intentionally. All mining projects do not require exhaustive biodiversity assessment. To decide whether project requires biodiversity assessment or not, the process of screening is an influential step and plays a crucial role to judge the requirement and depth of biodiversity assessment. Following checklist for biodiversity assessment scoping has been suggested

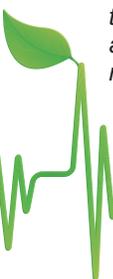
In order to take into account various aspects of biodiversity, an environmental impact assessment should:

- ♦ Consider all the relevant levels of biodiversity – bioregional, landscape, ecosystem, habitat, communities, species, populations and (when appropriate) individuals and genes;
- ♦ Consider connections between the levels of biodiversity by looking at structural and functional relationships (such as connectivity, fragmentation and disturbance, hydrologic and demographic processes) and their relationship to biodiversity study areas likely to be affected by different impact types;
- ♦ Collect more detailed abundance and distribution data on certain aspects of biodiversity without necessarily surveying everything in detail, but focusing on key biodiversity receptors;
- ♦ Consider the full range of potential impacts, including indirect, cumulative and induced impacts;
- ♦ Consider the social dimension – the importance of community and indigenous knowledge of local biodiversity aspects, traditional uses of resources and habitat and stakeholder participation; and
- ♦ Set out clear criteria to judge the extent, magnitude and importance of impact.

ICMM in its case study on improving coverage of biodiversity in EIA ([www.icmm.com/page/903/improving-coverage-of-biodiversity-in-eias](http://www.icmm.com/page/903/improving-coverage-of-biodiversity-in-eias)) states that -

*“Ideally, assessments should be done at the exploration stage. However, the inherent redundancy of the process (only 0.1 per cent of targets represent potentially economic mineral deposits) means that there is resistance to spending survey money when the odds are that the area will be released with no further interest. On the other hand, early knowledge of critical biodiversity issues in a given project would provide very pertinent insights and should have some weight in the decision balance of the sustainability of the development project. In fact, some money could be saved by stopping the project at an early instead of a later stage. General understanding of biodiversity issues in an area before bidding on exploration licences can be important.*

*An important step in gaining an understanding of how the system might be changed by a proposed project is to survey existing conditions – the baseline environment. The baseline survey should provide the necessary information on the site-specific environmental setting of the project. It should cover the different seasons, migrations, breeding and so on and should be, if feasible, long enough to establish pre-project trends. One important challenge in assessing baseline conditions is the limited timeframe for a thorough assessment. Biodiversity field surveys require sufficient time and resources. And to be of significant value in the EIA, survey work needs to be initiated early in the process. There should be scope to take as long as necessary and appropriate to cover aspects such as migrations, breeding seasons, rainy seasons and so on.”*



### 8.3 Widespread Impact on Ecosystems

In specialized ecosystems such as wetlands, the zone of influence of mining extends far beyond the zone surveyed under EIA. The effluents or leachates that enter river ecosystem spread over long distances. Many of the mining areas in Western and Eastern Ghats and northeast India are located at higher altitudes in the mountains. These are the catchments for major rivers that are lifelines for the lower plains. Mining leads to adverse changes in the river water quality such as increased metal content, sedimentation, turbidity and other pollutants. This affects biodiversity over large areas as flora and fauna of river ecosystems which are highly sensitive even to minor changes in water quality (pH, nutrient content, sediments, temperature, etc.)

#### **Impact of Iron Ore Mining in Kudremukh on Bhadra River Ecosystem** (From Krishnaswamy et al. 2004)

The Bhadra River, the Bhadra reservoir further downstream and the catchment provides critically important resources for wildlife in Kudremukh National Park and Bhadra Tiger reserve. It supports the livelihoods of a large human population of the region. Therefore the issue of sediment load and sedimentation caused by the mining operations is a critical aspect of the impact of mining operations on the protected area. This study was carried out during the monsoon of 2002 which is the first rigorous study done in the wet-season to assess the impacts of mining and associated activities in Kudremukh on the sediment load in the Bhadra river. The estimated contribution of this small sub-catchment (< 6 % of total Bhadra catchment) to the total load entering the reservoir in 1985 and 1986 was estimated to be 53 and 67 % respectively. Sediment loading since the beginning of mining in the early 80's increased successively from 1,197 tons in 1984 to 49,429 tons in 1986 measured at Malleswara. From this study in the 2002 monsoon alone, more than 68,000 tons of sediment loads was estimated at Nellibeedu, downstream of the KIOCL mining area at Malleswara, including one event in which over 19,900 tons was discharged in a single day.

These results prove that mining in Kudremukh National Park is the primary cause of very high sediment loads, and that a major proportion of the total load can occur from just a few very high rainfall events each monsoon. This study clearly demonstrates the adverse impact of mining in Kudremukh on sediment discharge in the Bhadra River and the Bhadra basin far beyond the devastation within the Kudremukh National Park.

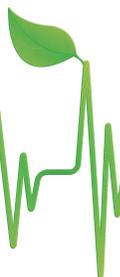
#### **Impact of Opencast Mining on Forest Area**

1. Total removal of all the vegetation and associated species from mining and dumping areas
2. The blasting causes noise, vibration and dust which disturbs the wildlife
3. Changes the landscape
4. Damages the aquifers, affects surface and underground water bodies
5. Acidic water discharge

#### **Impact of Underground Mining on Forest Area**

1. Removal of vegetation is comparatively less in case of underground as the surface area required for carrying out the mining operation is very less.
2. Depressions can lead to roof collapse and vegetation loss
3. Surface drainage pattern change due to water logging
4. Underground fires and in some cases surface fire
5. Aquifer Damage reducing the availability of water in the surrounding areas
6. Water higher hardness and presence of bacteria

*Based on Singh and Mehraj (2010)*



#### 8.4 Habitat Fragmentation

The division of existing habitats (forests, plains, wetlands) into fragments is caused by infrastructural development like building of roads, electric supply lines etc. The impact assessment of mining, often does not address this issue fully. Fragmentation of habitats has large impacts on plant and animal species. Contiguous plant populations get divided into smaller units which often cannot sustain on their own leading to reduction in population and ultimately local extinction. For animal populations, mobility reduces due to loss of safe crossing areas. Ex. Road kills increase on newly constructed highways. This causes division of originally continuous population into smaller subsets leading to reduced exchange in germplasm and compromises species health.

Many iron ore mines in Jharkhand have been operating in elephant reserve such as Sarai Kela Kharsawa elephant reserve. It is also being undertaken in Saranda, Kolhan and Porhat, which are a major habitat for elephant.

Mining and related infrastructural development has significantly affected wild elephant population in Orissa. The elephant population in the state has dropped at an alarming rate. In 2002, the numbers of elephants were 1841, which had gone down to 1600 in 2005.

#### 8.5 Loss of Traditional Wilderness Dependent Livelihoods

The local communities especially tribals are largely dependent on wilderness for existence. They traditionally use large number plants from wild for food, medicine and other necessities. Collection and sale of wild resources such as bamboo, hirda, behda, mahua, tendu and honey provides important source of livelihood. The traditional agricultural practices involve use of organic manure such as leaf litter from nature. The traditional agriculture involves use of local seed varieties leading to conservation of agrobiodiversity and germplasm of indigenous crop varieties. Displacement due to mining, changing land use and agricultural practices endangers agrobiodiversity, traditional wilderness dependent livelihoods and practices. Very often changes brought about at community level post-mining cause changes in traditional sustainable livelihood practices. The forest use becomes more exploitative and unsustainable causing more impact on biodiversity than expected in the EIA. These are not included or represented during the environmental or socio-economic impact assessments of the project.

#### 8.6 Environmental Impact Mitigation is Inadequate and does not Focus on Biodiversity Restoration

Environmental Management plan for mining requires proper documentation of processes and a stepwise mitigation plan. This depends a lot on efficiency of the EIA conducted. Very often the impacts are not clearly identified or ignored. Regular monitoring of the progress of mitigation measures is not conducted. Very often the focus is on simple processes like plantation, waste treatment, backfilling but not necessarily on biodiversity restoration in its true sense.

If mining operation is happening in or near sensitive natural environments special precautions need to be taken for mitigation. For this it is necessary to categorize the impacts based on distribution (widespread or confined), nature (direct or indirect), time period (permanent or temporary), and species dependent (positive or negative). For instance, certain ruderals or open area species might actually gain advantage in the mined out areas. It is hence important to identify target species, communities and habitats which should benefit as a result mitigation measures. The activities, needs and views of local communities in the region also need to be considered as these affect the biodiversity conservation on ground.

The requirements of efficient plan are:

- ♦ Identification of sensitive species and impacts during baseline surveys, EIA,
- ♦ Management of impacts through the mining cycle, and
- ♦ Including measures to ensure sustainability of the efforts.



Many examples of this relate to an operation's opening up access to remote regions, to migration and settlement of people in the region, and to the impacts these people have on the local biodiversity. Some types of mining might also restrict access to land that was previously used by local communities – uses that may have been linked to traditional subsistence livelihoods or to recreational uses in affluent societies. Either way, pressures for these land uses can be transferred to new undisturbed lands, with subsequent impacts on biodiversity.

To compensate, mining can also contribute positively to biodiversity beyond the impacts or activities of the operations, through a wide range of programmes such as through the Biodiversity Action Plan in the surrounding area. Such a plan needs:

- ♦ Regional flora and fauna surveys;
- ♦ Education and training;
- ♦ Research funding;
- ♦ Sponsorship of community environmental groups or projects; and
- ♦ Local and regional economic developments that have biodiversity spin-offs.

The major goal of sustainable rehabilitation is therefore the maintenance of land use options for future generations. Mine Closure and Reclamation Plan (MCRP) also need to take into consideration the long-term treatment of acid drainage, soil pollution on biodiversity.

In the Indian scenario it is very important to consider the social factors in restoration planning as the mines are never isolated from surrounding habitation and could be in a densely populated area. In such cases the rehabilitation objectives also need to include a component of eco-development for the natural resource dependent populations. This needs to be defined in close consultation with local communities, as they will be using the rehabilitated land after the mine is closed. This requires dynamic planning as the community's organization, aspirations and needs will change with the development of mining in an area and the planning needs to cater to the needs of 20-30 years later as most mines, especially in iron and coal areas have very long leases.

In India social and legislative context of mining requires some form of land rehabilitation goals to have been established post- mine closure. These are often determined prior to granting planning and operating permits for a new mine. Rehabilitation considerations are now incorporated into mine planning and have become a major factor governing mining operations, waste disposal and site closure. Yet there remains a considerable legacy of poor reclamation practices that, at best, have not provided any successful ecosystem development. Eco-restoration with special emphasis on biodiversity conservation in the mining area has not been implemented successfully in any area.

## 9. Ecological Restoration

### 9.1 Focus on Biodiversity Restoration and Conservation

Ecological restoration with focus on biodiversity conservation involves reconstructing landscapes and habitats in a degraded ecosystem, repairing ecosystem processes disturbed by mining and taking measures to optimise biodiversity returns. It requires re-establishing the fundamental ecological cycle of energy, water, nutrients and species in and ecosystem.

The eco-restoration practices will need to be innovative because of locale specific needs of an area or ecosystem. An ideal restoration would always be to achieve reinstating the pre-mining eco-system, there are practical constraints like time span, costs, capacity of the people to carry out the restoration, long-term stability, stakeholders needs. Ecorestoration planning is required right from the inception of mining. In most cases the restoration practices are limited to plantation often of exotic species of trees and treatment of wastewater.



Restoration of local biodiversity is a complex process and requires concentrated efforts, adequate knowledge of local ecosystem processes, monitoring and modification of environment. Most projects do not follow the time and effort intensive practices and go for short-term remedial measures. There is no serious assessment and evaluation of biodiversity post-mining.

### **Alcoa Mines Eco-restoration Project**

Alcoa World Alumina Australia operates two bauxite mines at Willowdale and Huntly in the Darling Range of southwestern Australia, 80–140 kilometres south of Perth. The Huntly mine is the largest bauxite producer in the world. The mine pits range in size from one hectare to tens of hectares. Alcoa has been rehabilitating its bauxite mines since 1966; today some 550 hectares are mined and rehabilitated annually. The technology of rehabilitation has been improved continuously over the years – from plantations of exotic pine trees to a sophisticated state-of-the-art rehabilitation programme. Alcoa's aim after bauxite mining in these areas is to re-establish all the pre-existing land uses of the forest: conservation, timber production, water production and recreation. Re-establishing a Jarrah forest on the mined areas that is as similar to the original forest as possible was determined to be the best way to achieve this goal.

#### **The Jarrah Forest**

The Jarrah forest is renowned for its diverse flora, being one of the most plant-species-rich forests in the world outside of tropical rainforests. It has a high conservation value, is the basis of a major sawmilling industry and is widely used for recreation pursuits. Restoring botanical richness is thus seen as an important component of re-establishing a Jarrah forest. A Jarrah forest contains at least 784 plant species. Alcoa's research and monitoring showed that among the vegetation types mined by the company there were approximately 300 plant species. Monitoring of rehabilitated bauxite mines found that the long-term vegetation of the site was controlled by the species first established there. The vegetation and the individual plant species are very resilient to natural forms of disturbance, so it is important to establish the correct flora early on.

#### **A Good Record – But Not Good Enough**

Efforts to improve plant richness in rehabilitated mines commenced in the mid-1970s, when the first studies were made of the seed content of forest soils. Ways to preserve seed viability in the soil and to separate the seed-rich topsoil from the remaining overburden were soon developed. In the late 1980s Alcoa started to monitor botanical richness in rehabilitated mine areas regularly. In 1990 the company recorded 65 per cent as many plant species in newly rehabilitated areas as in adjacent native forest – and this was using best practice rehabilitation methods of the time. The company's determination to do better than 65 per cent led to a 10-year research and development programme to improve rehabilitation practices. Alcoa developed and implemented many innovative practices and technologies in the areas of seed treatment, seed application, topsoil handling, mine planning and native plant propagation. Collaborative projects to develop the science further were established with academic staff and students.

#### **The Rehabilitation Process**

The rehabilitation process starts with shaping the mine pit to produce a landscape that blends with the surrounding forest. Seeds of local plants are spread throughout the rehabilitated mine pit. Nursery-grown plants are also added, in the case of species for which seed is not a viable method of establishment. Research in the late 1970s and the 1980s established that directly returning topsoil to a rehabilitated area greatly increased botanical richness. But planning for direct topsoil return can be complex, and operational constraints can result in topsoil being stockpiled. So part of the challenge was to improve planning processes and to implement plans to maximise the direct return of topsoil. Improvements had to be made at all stages of rehabilitation. This involved refining existing practices, developing new practices, developing better mine planning tools, developing new technology and further increasing environmental commitment.

*Based on: Grant K. and J. Gardener (undated)*



## 9.2 Environmental Management Systems

Some companies especially the international companies do work on Environmental Management Systems. Their effort is to

- ♦ Integrate biodiversity into the environmental policy;
- ♦ Documenting and assessing local
- ♦ Assessment of biodiversity aspects like uses and return and risks;
- ♦ Documenting legal and other requirements, including legally designated protected areas;
- ♦ Planning and developing preventative and mitigative measures for significant biodiversity aspects;
- ♦ Implementing preventative and mitigative responses to identified biodiversity aspects;
- ♦ Monitoring, measuring and reporting performance on biodiversity management;
- ♦ Adopting a continuous improvement approach

## 9.3 Biodiversity Action Plan

A Biodiversity Action Plan (BAP) is a mechanism by which the objectives and targets for biodiversity conservation can be achieved.

- ♦ **Control of access to areas of importance for biodiversity:** Access areas of high biodiversity value are to be controlled to avoid destruction of habitats or disturbance of species. Corridors of fauna must be protected and maintained, especially where larger animals may move through the area (such as elephants in India). Effective controls to prevent further fragmentation and isolation of fauna populations.
- ♦ **Clear demarcation of all protected areas** is required to avoid inadvertent destruction through ignorance or carelessness. Diversity of protected areas have been mentioned in the first part. Most of these are not well demarcated in Indian landscape. It is therefore necessary to devise a detailed map of the mining area and overlay it with the protected areas in the region, checking carefully for areas in categories like ecologically sensitive, traditionally protected and of high conservation significance locally. Special measures can then be adapted for protection. In some areas this will require fencing practical or social.
- ♦ **Controls on removal during mining phase :** control over removal of vegetation or fauna while mining helps to maximize the use of seed and other plant propagules, soil nutrients and soil biota, decaying organic matter, logs and other potential fauna habitat that can be valuable for rehabilitation.
- ♦ **Management of pest plants and animals:** Introduction of pest species in the form of weeds and feral fauna species has often accompanied expansion of mining into natural areas. In some cases these pests can have significant impacts on local species well beyond the mine lease area. There have been a number of examples where rehabilitation has introduced weed species that have become pests due to their success in colonizing disturbed areas. Mining dumps are often colonized by fast growing weeds such as *Lantana camara*, *Chromolaena odorata* that are tolerant of disturbance and can establish and propagate fast. In India, these weeds can then spread into surrounding natural vegetation, competing with indigenous species. To avoid this special care must be taken to stop introduction and spread of weeds, taking immediate measures for mining dump reclamation so that the weeds cannot establish there.
- ♦ **Management of community biodiversity uses and other ecosystem services:** In areas where communities are directly dependent on biodiversity for 'provisioning services', particular attention may be needed to ensure the management and maintenance of the aspects of biodiversity that communities depend on (fisheries, fuel wood, medicinal plants, and so on). More generally, other ecosystem services (such as the role of wetlands in the vicinity of the mine in regulating water quality) may need to be explicitly considered within a BAP.



**Research and development programs:** In the initial environmental survey phase, gaps in knowledge of biodiversity on the site and in adjacent areas may have been identified and addressed to the extent necessary to gain project approval. In the operational phase, that knowledge base can be further developed through ongoing research. This research is usually targeted towards gaining additional knowledge that improves eco-restoration.

**Revegetation trials:** These are a specific subset of research programs aimed at gaining more information on the nuances of the requirements and techniques for successful rehabilitation.

#### 9.4 Rehabilitation implementation and maintenance

Good practices for rehabilitation operations should include the following considerations:

- ◆ Topsoil conservation for the soil seed bank
- ◆ Invasive species control
- ◆ Successional aspects must be considered when rehabilitating
- ◆ Good seeding practice
- ◆ Follow-up maintenance of plantings
- ◆ Provision of suitable habitat for fauna
- ◆ Baseline and ongoing monitoring of un-mined reference areas
- ◆ Documentation of the rehabilitation procedures carried out
- ◆ Initial establishment monitoring,
- ◆ Long-term monitoring

#### Positive Industry Contributions to Biodiversity Conservation

##### **Onsite**

- (a) Carry out full scientific assessments of biodiversity to inform decisions on new projects, existing operations and closure options;
- (b) Establish Biodiversity Action Plans on each site, integrate these into management systems and implement programmes that protect priority species and habitats
- (c) Create refuges for important species through effective control on land-use within owned/managed land (control hunting, development, resource use, access, vehicles, etc)
- (d) Monitor biodiversity components to track the effects of mine activities and presence against predictions and to characterise the effect of other processes (climate change, demographic change, etc).
- (e) Enhance conservation value of owned/managed land by undertaking reclamation programmes on degraded land, including the reconstruction of functioning ecosystems of higher value where appropriate.
- (f) Develop and implement sustainable arrangements for biodiversity management upon closure, taking into account scientific and community priorities.

##### **Offsite**

- (a) Engage in formal offset land swaps to compensate for the unavoidable loss of biodiversity value at the project or operation
- (b) Provide biodiversity data obtained by survey and monitoring to the scientific public to enable better decision-making and priority setting across the region.
- (c) Contribute to training and other capacity building for national academic, regulatory and NGO staff, in technical and managerial skills.



- (d) Support local, national, regional and global biodiversity priority-setting processes and assessments (e.g., Protected Area Management Plans, National Biodiversity Strategies and Action Plans, meetings of the Convention on Biological Diversity, Millennium Ecosystem Assessment, etc).
- (e) Undertake community conservation initiatives (sustainable harvesting, equitable marketing etc.)
- (f) Contribute financing towards priority conservation actions, including management of protected areas.

*Source: Richards and Houston, 2004.*

## 10.0 Biodiversity Offsets

Where permanent destruction of a valuable ecosystem is unavoidable, other compensatory options may be considered as a last resort. These are commonly referred to as 'offsets'. The concept was first developed in the United States during the 1970s, Offsets might involve funding the protection of a local nature conservation area or the purchase of an equivalent area of land for protection. A biodiversity offset amounts to a 'payment' (and possibly other forms of support) to protect biodiversity within a designated area. The ICMM briefing papers on biodiversity offsets (July 2005) provide detailed background on offsets, which provide an opportunity for integrating mitigation measures into regional conservation planning strategies.

### Defining a Biodiversity Offset

Sustainable “conservation actions intended to compensate for the residual, unavoidable harm to biodiversity caused by development projects, so as to aspire to no net loss in biodiversity. Before developers contemplate offsets, they should have first sought to avoid and minimise harm to biodiversity.”

*From ICMM, 2005.*

The supporters of offsets include conservation organizations, mining companies, investors and some government agencies, which see mutual advantage in their development. Companies view offsets as a mechanism to effectively mitigate impacts, secure their licence to operate and engage constructively with conservation organizations. Governments see offsets as playing a role in helping to reconcile competing demands for development and protection of biodiversity.

Opponents, however, challenge the efficacy of the often-stated objective of 'net gains' for biodiversity and the basis for such comparisons showing that secondary impacts are often ignored. Offsets should be approached with caution and should be carefully designed to ensure their full beneficial potential is achieved in practice. The following factors to be borne in mind:

- ♦ Offsets do not justify or compensate for poor environmental management practices
- ♦ Compensatory protected area(s) should be ecologically similar, of equivalent biodiversity values
- ♦ Offsets should complement other programs be responsive to conservation priorities outlines in national or regional initiatives to implement the Convention on Biological Diversity.
- ♦ Offsets should result in a net gain for biodiversity over time and sustainable
- ♦ Offsets should be quantifiable and targeted
- ♦ They should be enforceable through the development of consent conditions, licence conditions, covenants or a contract.
- ♦ Biological criteria are always the primary consideration, in preference to mixing threat and biological criteria.
- ♦ Determination of acceptable offsets requires consultation with stakeholders.
- ♦ Offsets will of necessity be site- and project-specific.



The biodiversity offsets concept has not been widely discussed or used anywhere in India. A large scale consultation process on biodiversity offsets needs to be carried out further define the principles, set out the mechanisms and lay principles of biodiversity offsets suitable for Indian context.

Concepts, issues and solutions proposed for biodiversity conflict points in Indian mining areas are reviewed in this short paper. The problems and conflicts are often locale specific, threatening from the complex bio-cultural diversity of our country. Although the laws and policies provide clear guidelines of good practice, implementing and monitoring them is difficult in India owing to diversity of opinions, attitudes and ever growing corruption of the society. The solutions proposed such as effective eco-restoration, biodiversity offsets are in principle useful but arise from experience and consultation of experts outside India. Although they are important as guiding principles, it is necessary that Indian experts of biodiversity, ecology and environment together with Indian mining experts devise solutions which are appropriate for the Indian society and biodiversity.



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### 1.0 Introduction

India is the largest democracy in the world sustaining the second largest population of the world over 975 million. Industrial revolution in India practically started in fifties after getting independence in 1947. Indian economy is the fifth largest in the world and second largest among developing countries based on purchasing power. India is trying to become a developed nation by the year 2025. The mining sector is one of the greatest employers. This paper is mainly focusing on issues relating to mining and challenges thereof. In India statutory obligations relating to protection of forest and environment are considered inhibitory to development. In the present paper all the acts and rules pertaining to forest and environment have been discussed in the light of their practical challenges and utility.

### 2.0 Issues and Challenges in Mining

The major issues concerning the mining industry in India are environmental degradation due to mining and its mitigation; social and ethnic acceptability; augmenting the mineral resources base through main investment in exploration efforts and high technology; and innovation in technology for bulk mining.

The mining industry of not only in India but worldwide is accused of environmental degradation. There is no denying the fact that mining will definitely lead to environmental degradation varying in extent. In India most of the mining areas are rich in biodiversity. The mining areas are mostly located in forest land. The mining will lead to loss of biodiversity and reduction in forest areas. A study in the upper Topajos River basin of the Brazilian Amazon showed that some 245 mining operations employing 30,000 people and producing 35 tonnes of gold per year, were removing 67 million cubic meter of sub soils per year and releasing 12 tonnes of mercury to the air, sub and river. A number of ecological disasters have been caused all over the world including India. It is usually found in coal mining area in spite of damage of sub soil no effort is being taken to protect it.

The mining changes the social and economic fabric of the area. It is generally said that miner is exploiter which creates wealth for the person far away from the site and leaves the local people with a token benefit. Most of the time they leave the place after mining. Due to major investment and innovation in technology there is manifold increase in mining.

India is a democratic country. It will have to take care of the people and environment after due care of mining for economic development of the nation. In mining the statutory obligation needs to be taken care while establishing.

### 3.0 Statutory Obligations for Mining Related to Forest and Environment

#### 3.1 Historical Perspective

All the development projects till 1980 were implemented with very little or no environmental concerns. The State Governments were diverting forest land for non forestry purpose. Practically there was no regulation for diverting forest land for non forestry purpose.



Practically there was no regulation for diverting forest land for non forestry purpose. The Environmental issue for development projects begins receiving attentions when a national committee on Environmental planning & co-ordinations was set up under the 4<sup>th</sup> Five year plan (1969-1978) with the constitutions amendment forest was brought under concurrent list of the constitution. Prior to 1980 the subject of environment and forest were concern of the department of science and technology & Ministry of Agriculture. Subsequently after coming into existence of Ministry of Environment it was attended by Ministry of Environment Govt. of India. The Ministry was upgraded to Ministry of Environment & forest in 1985.

Initially department of Environment and forest Govt. of India issued Guidelines for Environmental assessment of river valley projects. In 1980, Forest Conservation Act, 1980 was enacted which was given administrative teeth in 1988. In 1986, Environment protection Act, 1986 come into existence. Major legislative mean and regarding forest conservation came in 1980 amended in 1988 as for environmental Clearance in 1994 when specific notification was issued under section 3 and rule 5 of the environmental Protection Act, 1986 called the **“Environment Impact assessment Notification 1984”**. The first step in seeking environmental clearance for a development projects is to determine what statutory legislation apply to a particular project. : Ministry of Environment and forest, GOI has brought out several notifications restricting the development of Industries in specified ecologically sensitive areas.

Both forest, in case of forest land being used for non forestry purpose an environment clearance for the development project can be obtained at the state level or at the central level depending on certain criteria concerning the characteristic of the project. In case of forest consent must be taken from state Govt. and central Govt. and environment from state pollution control Board and central pollution control board.

The Acts concerning mines may be classified into two parts.

### 3.2 Acts Related to Forest and Biodiversity

- ◆ Forest Act, 1927
- ◆ Forest Conservation Act, 1980
- ◆ Forest Conservation Rules, 2003
- ◆ The Wild Life Protection Act, 1972 ( as amended 2006
- ◆ The Biological Diversity Act, 2002
- ◆ The Biological Diversity Rules, 2004
- ◆ The Schedule Tribes and other Traditional Follower (Recognition of Forest Rights) Rules, 2007.
- ◆ Guidelines for Felling of Trees from Non Forest Areas

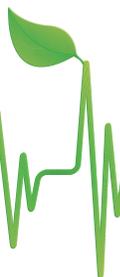
### 3.3 Acts Related to Protection of Environment

- ◆ The Air (Prevention) act central of pollution Act. 1981
- ◆ The water (Prevention) act control of pollution Act, 1974.)
- ◆ The environmental (Protection) act 1986
- ◆ The environmental (Protection) Rules 1986
- ◆ The Noise pollution ( Regulation and control rules, 2000
- ◆ The hazardous waste (management and handling )
- ◆ The ozone Depleting substance ( Regulation & ) Rules, 2000

There are various other act and rules relating to regulation of Environmental pollution.

#### 3.3.1 Indian Forest Act, 1927

This is the first act relating to forest and Environment in India. The act mainly deals with constitution of reserve forest and its maintenance, transport of forest product. This act deals less with forest conservation.



### 3.3.2 Forest (Conservation) Act, 1980 (with amendments made in 1988)

This is an act to provide for the conservation of forest and for matter connected there with or cancelling or incidental there of the main content of the acts are as follows:

The acts provide restriction on diversion of forest or use of forest for non forestry purpose. This is a regulatory clause and allows use only with the prior approval of central Government.

Section 3 of the act describes constitution of Advisory Committee while 3A and 3 B describes penalty for contravenes ion of the provisions of the area and offences by the Authorities and Government departments respectively. There is lack of awareness regarding penalty for contravention of the provisions of the Act. The Act reads "whoever contravenes or abets the contravention of the provisions of section 2, shall be punishable with simple imprisonment for a period which may extend to 15 days." Section 3B speaks about the contravention by the Authorities and Government department and reads "(1) where any offence under this Act has been committed by any department of Government b. the head of the department or b. by any authority, every person who, at the time the offence was committing, was directly in charge of, and was responsible to, the authority for the conduct of the business of the authority as well as authority.

This section has been highlighted to emphasize that for any violation Govt. agency is responsible not the labourer or contractor. The order issuing authority is responsible for violation of the Act.

### 3.3.3 The Forest Conservation Rules, 2003

Under the provision of forest conservation Act, 1980the forest (Conservation) Rules, 2003 were enacted. The rules provides for the constitution of the committees for giving approval of the project by the central Govt. For use of forest land for non forestry purpose section 3, 4, 5 speak about the composition of committee, Terms of appointment for non official member and conduct of the business of the constitution. Section 6 speaks about submission of the proposals seeking approval of the central government under section 2 of the Forest conservationAct, 1990.

There is general apprehension that it takes long time for getting proposal cleared under Forest conservation Act, 1980. As per rules state Govt. is to send to central Govt. within 90 days of the submission of proposal after completing all the formalities. In most of the cases the user agency does not submit proposal as per provision of the Act and rules.

Secondly time delay also depends on the area required for forest clearance. More than 40 ha. area the proposal is required to be sent to secretary, MOEF Gol with a copy to Regional office and less than 40 ha the proposal is to be sent to regional office of the MOEF, Gol.

### 3.3.4 The Wildlife Protection, Act 1972 (as amended up to 2006)

This is an act to provide for the protection of wild animals, birds and plants and for matters connected there with or ancillary or incidental there to with a view to ensuring the ecological and environmental security of the country. Any diversion of forest land from the protected areas requires clearance from empowered committee appointed by Supreme Court of India in addition to Gol.

### 3.3.5 The Biological Diversity Act, 2002

The biological diversity Act, 2002 is the Indian response to the convention of Biological diversity, 1992. India is one of the 12 mega biodiversity of the world. India is having only 2.5% of the total land area but accounts for 7 % - \*% of the recorded species of the world. The act provides for conservation of biological diversity & sustainable use of its components and fair and equitable shoring of benefits, resulting from the use of genetic moons. The Act envisages a three tier structure to regulation to the biological resources comprising of (i) National Biodiversity authority (ii) State Biodiversity Board (iii) Biodiversity management committee at the local level.



### 3.3.6 The Scheduled Tribes and other Traditional Forest Dweller (Recognition of Forest Rights) Act, 2006

The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, is a key piece of forest legislation passed in India on December 18, 2006. It has also been called the "Forest Rights Act", the "Tribal Rights Act", the "Tribal Bill", and the "Tribal Land Act." The law concerns the rights of forest-dwelling communities to land and other resources, denied to them over decades as a result of the continuance of colonial forest laws in India.

Supporters of the Act claim that it will redress the "historical injustice" committed against forest dwellers, while including provisions for making conservation more effective and more transparent. The demand for the law has seen massive national demonstrations involving hundreds of thousands of people.

However, the law has also been the subject of considerable controversy in the English press in India. Opponents of the law claim it will lead to massive forest destruction and should be repealed (see below).

A little over one year after it was passed, the Act was notified into force on December 31, 2007. On January 1, 2008, this was followed by the notification of the Rules framed by the Ministry of Tribal Affairs to supplement the procedural aspects of the Act

### 3.3.7 Guidelines for Felling of Trees

The guidelines for felling of trees from Non forest Areas issued in compliance of Supreme Court of India order dated 12.05.2001. Most of the State Govt. has framed rules.

### 3.3.8 The Environment (Protection) Act, 1986

This is an act to provide for the protection and improvement of environment and for matters connected the therewith.

In June 1972 decisions were taken at the united Nation conference on the Human Environment held at Stockholm, in which India, participated to take appropriate steps for the protection and improvement of human environments. The Act is in pursuance of the conference. The Act is enactment of general legislation on environment protection. The Act enables co-ordination of activation of various regulatory agencies creators of an authority or authorities with adequate powers for environment protection, regulation of discharge of environmental pollution and having of hazardous substances, especially response in the event of accidents, threatening environment and deterrent punishment to those who endanger human environment, safety and health.

### 3.3.9 The Environment (Protection) Rules, 1986

Under the environment protection Act, 1986 Environmental protection rules, 1986 has been made.

#### Drawbacks in implementation of Environmental Act

- ♦ Some industries are exempted from environmental clearances which are required to take up. The analysis is not very objectives. Exempted industries comes environmental pollution.
- ♦ The Environmental pollution potential can't be based on project.
- ♦ There is lack of proper study for determining ecological and socio –economic indication for Impact assessment.
- ♦ Lack of reliable data sources. Most of the time even secondary data not reliable.



- ♦ The credibility of the agency collecting data is doubt full.
- ♦ Details regarding the effectiveness and implementing of mitigation measures are not provided.
- ♦ For projects require site clearance it is often assumed that by site clearance environmental clearance is granted. It is specified in EIA notification that this is violation of environmental protection Act, 1986.

### Conclusion

Mining industry has a vital role to play in terms of economic growth, social progress and protection of henvironment. Let us follow the administrative and statutory obligation.

  
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- ✦ *Main issue in mining industry in India is mitigation of environmental degradation, social justice and use of better technology for making most of mineral reserves*
- ✦ *Statutory obligations for mining related to forest and environment are continuously updates as new concepts emerge*
- ✦ *The acts can be divided into those related to forest and biodiversity and related to protection of environment*
- ✦ *The paper discusses main acts and problems faced in its implementation and different view points about their efficacy*





## Biodiversity Impact Assessment of Developmental Projects: Clues from a Case Study in Jharkhand

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### 1.0 Introduction

An Environmental Impact Assessment (EIA) is an assessment of the possible positive or negative impact that a proposed project may have on the environment, together consisting of the natural, social and economic aspects. The purpose of the assessment is to ensure that decision makers consider the ensuing environmental impacts when deciding whether to proceed with a project. EIA is an exercise to be carried out before any project or major activity is undertaken to ensure that it will not in any way harm the environment on a short term or long term basis. Any developmental endeavor requires not only the analysis of the need of such a project, the monetary costs and benefits involved but most important, it requires a consideration and detailed assessment of the effect of a proposed development on the environment.

In India many of the developmental projects till as recently as the 1980s were implemented with very little or no environmental concerns. The environmental issues began receiving attention when a national committee on environmental planning and coordination was set up under the 4th five year plan (1969- 1978). The first EIA was ordered, during early 1980s, on the Silent river valley hydroelectric project, which was a controversial project proposed by the Kerala State Electricity Board (KSEB) to build a 130m high dam across the Kuntipuzha River and a reservoir (Valappil *et al.*, 1994). However, EIA was introduced in 1994, through a major legislative measure for the purpose of environmental clearance when a specific notification was issued under Section 3 and rule 5 of the Environment Protection Act, 1986, called the **Environment Impact Assessment Notification 1994** by the Ministry of Environment and Forests under Environmental Protection Act (EPA), 1986. This notification made EIA mandatory for 29 highly polluting activities and later on three more activities were added to this list (Appendix A) (MoEF, 1994; MoEF, 2004). Subsequently, public hearing became mandatory for environmental clearance vide April 4, 1997 amendment to EIA Notification. EIA Notification after a recent amendment on 27th January 2001 includes a list of 30 categories of projects in sectors as diverse as power (hydro, thermal and nuclear), mineral extraction and processing industries, tourism, transportation (rail, road and air), petrochemical, manufacturing and handling of chemicals and synthetic products e.g. rubber, paint and yarn.

### 2.0 Key Elements of EIA

EIAs are unique in that they do not require adherence to a predetermined environmental outcome, but rather they require decision makers to account for environmental values in their decisions and to justify those decisions in light of detailed environmental studies and public comments on the potential environmental impacts of the proposal (Holder, 2004). Overall the key elements for effective EIA studies include following:

- ♦ EIA must be undertaken **early** in the development of proposed projects, plans, and programs, and must be completed **before** a decision to proceed is made.
- ♦ EIA must be an **objective, impartial** analytical process, not a way of promoting or “selling” a proposal to decision-makers—it must use accepted scientific principles and methods.
- ♦ EIA must analyze all **reasonably foreseeable** environmental impacts or effects of a proposed action—effects may be short-term, long-term, direct, or indirect.



- ♦ The process of EIA must be **open** – to government officials at all levels, to potential stakeholders (those with direct interests in the proposed action), and to the **public**.
- ♦ In all EIA processes, effective **mitigation measures** must be identified and included—to avoid, minimize, or reduce the adverse effects of all potentially significant impacts.
- ♦ EIA reports must include an **Environmental Management System (EMS)** or Action Plan to **monitor** the implementation phase of the project, plan, or program and provide for **corrective** actions—such action plans must have assured **funding** and be legally enforceable.

However, EIA experience in India indicates that the lack of timely availability of reliable and authentic environmental data has been a major bottle neck in achieving the full benefits of EIA. The environment being a multi-disciplinary subject, a multitude of agencies is involved in collection of environmental data. EIA studies need a significant amount of primary and secondary environmental data. The primary data are those which need to be collected in the field to define the status of environment (like air quality data, water quality data etc.). The secondary data are those data which have been collected over the years and can be used to understand the existing environmental scenario of the study area. The EIA studies are conducted over a short period of time and therefore the understanding the environmental trends based on few months of primary data has its own limitations. Ideally, the primary data has to be considered along with the secondary data for complete understanding of the existing environmental status of the area. In many EIA studies, the secondary data needs could be as high as 80% of the total data requirement.

### 3.0 EIA and Biodiversity

The Convention on Biological Diversity (CBD) defines biodiversity as **the variability among living organisms from all sources including inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems**. In other words, it is the variety of life on earth at all levels, from genes to worldwide populations of the same species; from communities of species sharing the same small area of habitat to worldwide ecosystems. There are different levels of biodiversity and countries that have signed the CBD are required to implement policies to protect biodiversity at all levels:

- ♦ Ecosystems containing rich biodiversity, large numbers of threatened or endemic species, with social, economic, cultural or scientific significance, or relevant for key processes such evolutionary processes, and ecosystems of relevance to migrating species.
- ♦ Species and communities of species that are threatened in their existence, related to domesticated or cultivated species, and species with medicinal, agricultural, or other economic, social, cultural or scientific significance, and indicator species.
- ♦ Genotypes with social, scientific or economic significance.

Impact on status of biodiversity has often been poorly considered in impact assessments. Thompson *et al's* (1997) analysis of 179 British environmental statements found that in many cases the ecological information provided was so limited in quantity, or of such poor quality, that it was not possible to assess the ecological implications of proposed schemes. Traditionally, EIAs have focused on impacts upon protected species and habitats. They have been less likely to address other aspects of biodiversity such as diversity between species and habitats, trends over time, species abundance and distribution, and the functional components of biodiversity.

Le Maitre *et al.* (1998) found that impacts on biodiversity were not being adequately addressed in South African impact statements, and that functional biodiversity in particular, was inadequately addressed. Positive conservation measures such as the rehabilitation of degraded ecosystems are also unlikely to receive explicit attention. Bagri *et al.* (1998) conclude that components of biodiversity which are already protected, either by



established protected areas or by a listed status, are more likely to be included in an EIA study than components which have been given less attention but may be important to the long term productivity of ecosystems and maintenance of biodiversity. We should address the following question in impact assessment process:

- ♦ *Loss of valuable wildlife species (e. g. through hybridization, transgenic pollution, disease)*
- ♦ *Loss of endemic species (e. g. endemic races or cultivars replaced by introduced crops or removed for other forms of development)*
- ♦ *Loss of species with potential future value for medicine, new agricultural crops, new breeds of livestock*
- ♦ *Loss of disease resistance*
- ♦ *Introduction of new diseases to which native species are unadapted*
- ♦ *Reduced viability of endangered species (critical variation)*
- ♦ *Loss of 'elite trees' through poorly regulated logging of forests with consequent loss of future production*
- ♦ *Loss of local tree provenances*
- ♦ *Loss of microbial associations essential for viability or production (e.g. mycorrhizal associations or soil microbial associations)*

#### 4.0 Biodiversity Impact Assessment

Biodiversity Impact Assessment therefore demands a more sophisticated investigation and analysis of potential impacts on an ecological unit and the species and communities within it. Biodiversity Impact Assessment should therefore be seen as part of existing impact assessment systems, and not promoted as a separate entity, purely because of the difficulties that other disciplines, such as social impact assessment, have encountered through trying to 'go it alone'. There is an impetus behind the biodiversity agenda, and so the term 'Biodiversity Impact Assessment' can be used to raise awareness of these issues within the impact assessment community. This enables a focus on the more positive aspects of biodiversity, looking at the ecosystem approach, dealing with fragmentation issues and so on, not just the traditional EIA approach of mitigating impacts. Biodiversity is not just about rare species and habitats, but about enhancing degraded areas, reversing species declines, and creating new habitats.

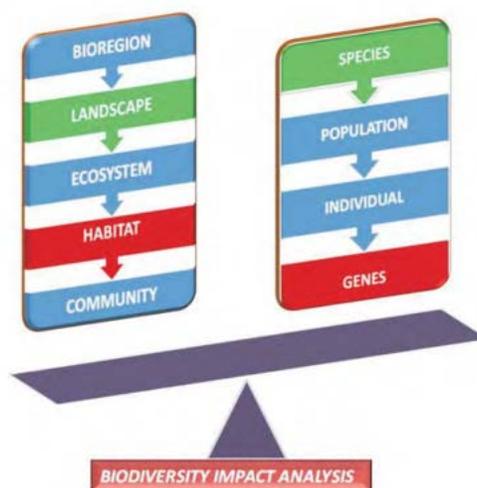


Fig. 1 - Levels of biodiversity and associated structural and functional relationships that may need to be considered in EIA (modified after Byron, 2000)



#### 4.1 A Case Study of Biodiversity Impact Assessment

Mining of coal both surface and subsurface causes enormous damage to the flora, fauna, hydrological relations and soil biological properties of the systems. Destruction of forests during mining operation is invariably accompanied by an extensive damage and loss to the system. The overburden of coal mines when dumped in unmined areas creates mine spoils which ultimately affects the surrounding vegetation. Coal mining result in conversion of mine spoils, large scale denudation of land use changes, forest cover, and scarcity of water, pollution of air, water and soil; degradation of agricultural lands are some of the conspicuous environmental implications of coal mining.

India is witnessing a rapid economic growth, and so with it are the growing energy needs of the country. The demand for power is set to soar as much as 315,000 MW by 2017 at an average GDP growth rate of 8% per year, which is more than double the demand for power from now. To meet this humongous energy demand, the nation has to scale up its power generating sources rapidly. Thermal power stations account for nearly 60% of India's total power generation and these power stations are predominantly coal-based. India has got domestic reserves of coal but unfortunately around 80% of coal available in India is characterized by high ash content of 35-45%.

Essar Power (Jharkhand) Ltd has proposed for Chakla captive Coal Block in North Karanpura and thermal power to Chandwa in Latehar district of Jharkhand with the view to contribute in the energy demand and has signed Power Purchase Agreement (PPAs) with the state electricity authorities of Jharkhand. Considering the need for an integrated ecosystem approach to offset adverse impact of coal mine and the thermal power plant on the various habitats in the project site, Essar has awarded the study of biodiversity assessment to the Indian Council of Forestry Research and Education, New Forest, Dehradun. The study includes assessment of baseline data of terrestrial (agro, domestic and wild) and aquatic biodiversity; predication of possible impact and to formulate appropriate mitigation measures. The approach and methods used in this report are consistent with increased emphasis on preserving the biodiversity. The study was undertaken during August/September, 2009 and as per the norms of the EIA notification, 2007 of MoEF, Government of India.

The project site approachable with highway is 2 km. away from N.H 99 and N.H 75 and the railway station is at a distance of 4 km. The nearest railhead is Tori on the Dehri-on-Sone –Barkakhana-Gomoh Broad loop of the Eastern Railway, 10 km southwest. The State Highway 51 (Chandwa-Balumath) passes through the western part of the adjoining Chitarpur sector.

The project site Chakla Sector, South Dhadhu Block falls under the North Karanpura Coalfield of Latehar district in Jharkhand. It is located at latitude 23° 43' 03" to 23° 44' 55" and longitude 84° 47' 23" to 84° 50' 18". Latehar is a predominantly tribal district with almost 40% of the population belonging to the schedule tribes and more than 66 % of total population comprises SCs and other. The villages are scattered amidst the dense forests, hilly terrains and agricultural fields. The important rivers flowing through Latehar district are Barakar, Poanchkhara, Keso, Akto, Gurio, Gukhana, Nadi and Sakri.



Fig: 2: Location of Chakla Coal Block Area



A team of specialists from different ICFRE institutions carried out comprehensive studies which encompassed following mandate:

- ♦ To assess the ecological status;
- ♦ To generate baseline information;
- ♦ To predict the probable impacts due to the proposed project activity on the biological environment.

#### 4.1.1 Vegetation in the Study Area

Based on Champion and Seth's classification, the forests of the site can be grouped in dry peninsular Sal type (5B/C1). Though the mine area and power plant area are spread in forested and non forest areas, the impact of mining and power plant will have bearing on the vegetation in the adjoining areas also. The forests in the tract have several non-wood forest products like Sal seeds (*Shorea robusta*), Chironji (*Buchanania lanzan*), Mahua flowers and seeds (*Madhuca longifolia* var. *latifolia*), Beedi leaves (*Diospyros melanoxylon*) and several medicinal plants. The local people depend on these products for their livelihood.

The forests of Palamau division in Latehar district in Jharkhand are dominated by Sal and represent the climatic climax; however we could see various levels of degradation in these forests. Main causes of the degradation are high pressure of grazing, illicit mining of coal and firewood collections. Important tree species found this type of forest are *Aegle marmelos*, *Anogeissus latifolia*, *Bombax ceiba*, *Boswellia serrata*, *Buchanania lanzan*, *Butea monosperma*, *Casearia tomentosa*, *Cassia fistula*, *Croton roxburghii*, *Dalbergia paniculata*, *Diospyros melanoxylon*, *Erythrina suberosa*, *Haldina cordifolia*, *Holarrhena pubescens*, *Lagerstroemia parviflora*, *Lannea coromandelica*, *Madhuca longifolia* var. *latifolia*, *Mitragyna parvifolia*, *Nyctanthus arbor-stristis*, *Phyllanthus emblica*, *Schleichera oleosa*, *Schrebera swietenoides*, *Semicarpus anacardium*, *Syzygium cumini*, *Terminalia bellirica*, *T. chebula*, *T. elliptica* and *Wrightia tinctoria*.

Important species of lianas recorded were *Ziziphus oenoplea*, *Combretum roxburghii* and *Spatholobus parviflorus*. The shrubs layer consists of *Desmodium gangeticum*, *Flueggea virosa*, *Helicteres isora*, *Indigofera cassioides*, *Lantana camara*, *Woodfordia fruticosa*, *Asparagus racemosus*, *Cryptolepis buchananii*, *Gymnema sylvestre*, *Ichnocarpus frutescens*, *Cissus repanda* and *Phoenix acaulis*. Some of the important herbs were *Achyranthes aspera*, *Alloteropsis cimicina*, *Alysicarpus procumbens*, *A. vaginalis*, *Andrographis paniculata*, *Arthraxon lancifolius*, *Asparagus racemosus*, *Barleria cristata*, *Biophytum sensitivum*, *Blainvillea acmella*, *Bothriochloa pertusa*, *Brachiaria ramosa*, *Atylosia scarabaeoides*, *Cassia absus*, *C. pumila*, *Cissampelos pareira*, *Cleome chelidonii*, *Crotalaria calycina*, *C. prostrata*, *Curculigo orchoides*, *Cyperus iria*, *C. monocephalus*, *C. niveus*, *Desmodium gangeticum*, *D. latifolium*, *D. triflorum*, *Digitaria abludens*, *D. ciliaris*, *Elephantopus scaber*, *Emelia sonchifolia*, *Evolvulus alsinoides*, *E. nummularius*, *Fimbristylis dichotoma*, *Glossocardia boswellia*, *Hackelochloa granularis*, *Hedyotis herbacea*, *Hibiscus lobatus*, *Holostemma adakodien*, *Hybanthus ennaeaspermus*, *Indigofera linifolia*, *Leucas cephalotes*, *Melochia corchorifolia*, *Mitracarpus hirsutus*, *Mollugo nudicaulis*, *Murdannia spirata*, *Ocimum americanum*, *Oplismenus burmannii*, *Phyllanthus urinaria*, *P. fraternus*, *Pygmaeopremna herbacea*, *Sida cordata*, *Spermacoce hispida*, *S. pusila*, *Sporobolus indicus*, *Tephrosia purpurea*, *Tridax procumbens*, *Triumfetta rhomboidea*, *Uraria picta*, *Vernonia cinerea* and *Zornia gibbosa*. The study was conducted to enumerate the plant resources in this tract in three different situations like coal block area, power plant site and area of influence of the project.

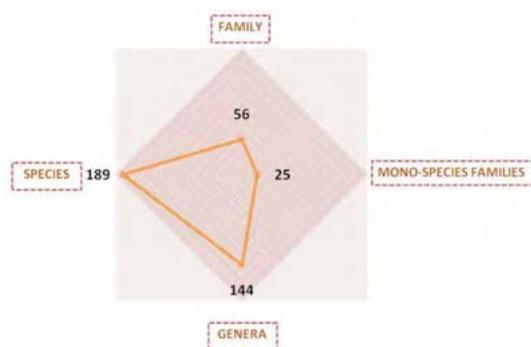
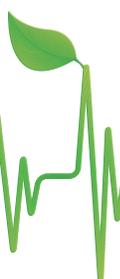


Fig. 3 - Taxonomical composition of the area



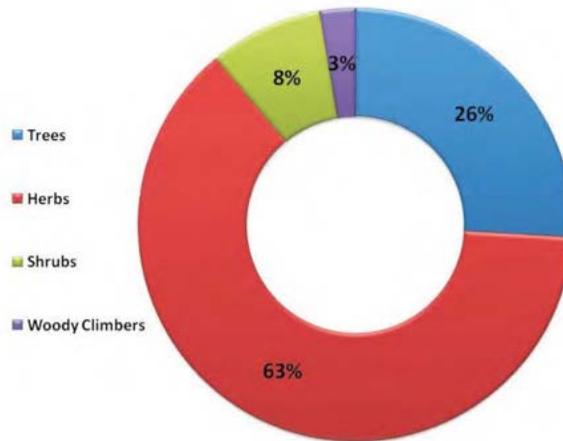


Fig. 4 - Growth form spectrum of the area

#### 4.1.2 Sectoral Impact Assessment

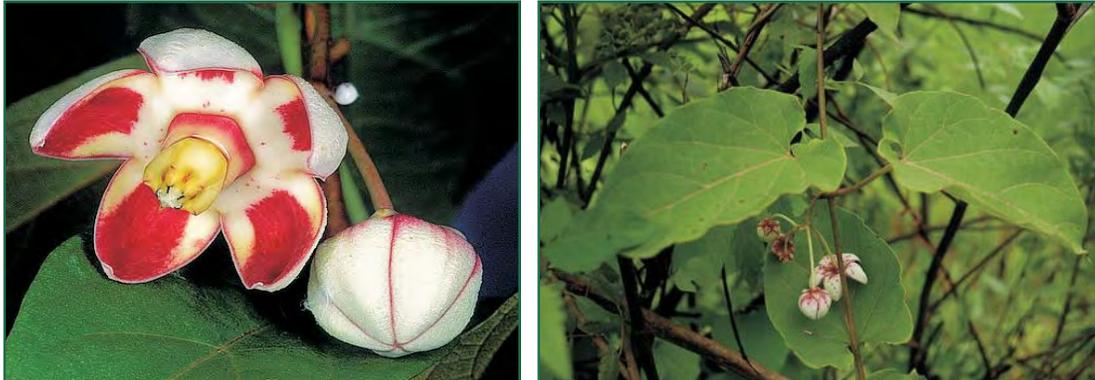
##### ♦ Impact on Flora

The impact of coal mining and power plant on floral wealth are addressed taking into account the mine lease area, surrounding mine lease area and power plant proposed in the study area. Mining operation will undoubtedly bring wealth and employment opportunities in the area, but simultaneously lead to extensive environmental degradation and erosion of traditional values in the society. Environmental problems associated with mining have been felt severely because of the region's fragile ecosystems and richness of biological and cultural diversity. It is understood that consequent to mining, vegetation in the mine area will completely disappear. Any such mining activity will not only remove the thick vegetation of Sal and other plant species from the mining and power plant sites, but also on vegetation in the adjoining areas, hillocks and slopes.

The vegetation on the hillocks forming the dominant community invariably consists of open forests with coverage of trees, shrubs and herbaceous plants including grasses. The composition of species drastically changes immediately after monsoon showers. Apart from floristic diversity, the predominant Sal vegetation has a great ecological role in conservation of moisture and soil nutrients. During rainy season, the vegetation and the underneath strata of soil act as a sponge in holding the moisture and help in percolation of water. The water is released from this ecosystem slowly even after the end of rainy season. As a result, the streams and rivulets in the slopes below the forest of Sal and other miscellaneous species get continuous supply of water. The rivulets and soil moisture not only help in growth and regeneration of the Sal on the hillocks and slopes, but also act as the sole drinking water source for adjacent villages and help life-sustaining activities downstream. The mining activities including power plant emissions will affect the availability of ground water and also pollute the surface water. It is also to be noted that Sal vegetation is characteristic of all hillocks in this region. The project affected area and surrounding mine lease areas have good capacity for regeneration of woody species through root suckers and helps other seedlings to come up under its shade. These areas also showed that regeneration of most of the woody species were high, which will get affected due to mining.



As the proposed mining is open type, it generates huge quantity of overburden; an equivalent extent of area will be used for the deposition of the overburden. In the era of climate change, loss of even a small bit of vegetation cover and burning of the coal for production of electricity will add more pressure on the environment. Further, this mining activity will lead to complete depletion of resources like forest produces, on which village people were depending for years. The area is important in view of occurrence of two rare plant species, namely, *Holostemma ada-kodien* and *Pygmaeopremna herbacea* in the mine lease area, surrounding mine lease area and one species, namely, *Pygmaeopremna herbacea* in the power plant area. These rare plant species will be affected due to mining and power plant.



**Fig. 5 - *Holostemma ada-kodien*, a rare plant species**

#### ♦ **Impact on Fauna**

None of the species sampled in the study area are threatened globally as per IUCN Red List of Threatened Animals (2009). Only one species of butterfly (Striped Blue Crow, *Euploea mulciber*) is protected by law as it is listed in Schedule IV of the Indian Wildlife (Protection) Act 1972. Species richness of butterflies was low in general. Species richness and diversity of birds was low in general and all the sites showed low similarity for birds suggesting different bird communities in these habitats. Mammals' species were represented by only one species which is a scavenger.

All these findings suggest that species diversity of the study area is low owing to lot of disturbance/ anthropogenic pressures prevalent in the area due to grazing by cattle, lopping of trees for fuel wood and fodder and mining of soil for making bricks and mining for stones. The only habitat that was found to support faunal diversity was mixed Sal forest at Nagar which still has some good habitat for wildlife and connectivity with other forest areas in Latehar Forest Division that should not be disturbed.

#### ♦ **Impact on Microflora**

The soil and root samples collected from 10 different sample plots of proposed mine lease area, surrounding mine lease and power plant areas were processed to study the status of soil microflora and the symbiotic fungi (*Arbuscular Mycorrhizal fungi or AMF*). Among them, the symbiotic microbes, especially the AMF are distributed in both the sample plots and were creened during the period of observation. The spore population and types of AMF distributed in proposed coal mine lease areas are low as compared to outside the mine lease areas and peripheries of the study area.

Due to mining activity, the microorganisms in the proposed mine lease areas will be removed along with the overburden. However, the microbial species that have been recorded in the proposed mine lease areas also occur outside the periphery of the mine lease areas. Hence, there will not be a significant loss of the microflora. In addition, these beneficial microorganisms are to be introduced at the time of mine reclamation and rehabilitation activities through planting of suitable tree seedlings inoculated with AMF and other beneficial microorganisms (*Rhizobium*, *Azospirillum*, *Phosphobacterium*, *Frankia* etc.) in the nursery.



Revegetation of mined out areas is often difficult due to its chemical and physical traits. Absence of topsoil is the most common feature of the mine spoils or dumps. If present, it is very poor in nitrogen, which is essential for plant growth. This is due to the absence of soil organic matter produced by decay of dead plant material. Moreover, dearth of soil microflora restricts the decay of plant material. In addition, the stony nature of mine wastes aggravates the situation further for vegetation establishment by developing low infiltration rates and water retention. Since the progress of natural vegetation process is very slow on mine spoils, selective plantation of suitable native species is desired in most cases.

The top soils collected from the proposed mine lease areas and adjoining forest areas are found to contain several effective Arbuscular Mycorrhizal Fungi (AMF), Ectomycorrhizal fungi (ECM) and other beneficial microorganisms (*Rhizobium*, *Azospirillum* and Phosphate Solubilizing Microbes, etc.) that are helpful for the plant growth. Hence, the top soil must be dumped separately at a predetermined area for its subsequent utilization during the process of degradation.

As a part of overburden rehabilitation, the top soil containing beneficial microflora of the site must be spread over external dumps as well as over the back filled areas. Necessary precautions have to be taken to preserve the fertility and shelf life of the microflora in the top soil by adopting suitable height to the top soil dumps and preventing losses due to erosion during temporary storage phase. The overburden and top soil which contains most of the soil organic matter, nutrients, microbes and seeds are stockpiled for future use or directly re-spread on areas ready for rehabilitation. In addition, adopting the following management techniques using these beneficial microorganisms will be effective during the mine spoil rehabilitation programme.

#### ♦ Impacts on Aquatic Fauna

Coal mining is one of the core industries that contribute to the economic development but leads to deterioration of environment. Major threat to the aquatic system due to mining activities at the vicinity of aquatic sources is the pollution of water body. Pollution mainly depends on the topography of the area, intensity of rainfall, method of mining and processing, etc. Acid drainage may be a consequence of coal mining. The acidity of coal mine drainage is caused primarily by the oxidation of the mineral pyrite, which is found in coal, coal over burdens, etc. The mine water may be acidic or neutral depending on the pyrite content in the coal. It degrades water quality in terms of lowering the pH and increasing the level of total suspended solids and heavy metals. Mine drainage is a complexity of elements that interact to cause a variety of effects on aquatic life that are difficult to separate into individual components. Toxicity depends on discharge volume, pH and concentration of dissolved metals. pH is the most critical component, since the lower the pH, the more severe the potential effects on aquatic life (Warner, 1971). Lower pH facilitates increase of biologically available heavy metals resulting in increased toxicity. The above conditions will adversely affect the aquatic fauna as changes in water chemistry will alter the composition of the fauna. It will also result in alteration of habitat resulting in changes in feeding and breeding habits of fish.

As mining progresses, localized pits are formed in the mining areas and they are filled with water during heavy rains. These result in the formation of water bodies laden with suspended solids derived from within the pit and the water is let out into nearby water bodies, thus increasing turbidity of water. Turbidity of water in high amount at the water sources will result lesser plankton productivity by disturbing the sunlight penetration at the photic zone of the water body. This would lead to disruption of the community ecology leading to severe disturbances in the food chain. The sedimentation/siltation also leads to reduction in the depth of the stream by increasing sediment load to deposit at the bottom.

This will alter the water flow rate. The biotic community will suffer from the reduction in number of aquatic species, smothering of benthic fauna, die back of vegetation, etc. Change in land use pattern generally occurs due to the runoff from mines during monsoon to the nearby agricultural fields. The runoff will lead to the deposition at the agricultural fields and will alter the soil quality resulting in poor yield of produce. Addition of mine waste to the streams will also result in alteration of water chemistry.



Sedimentation due to mixing of fine powder from coal mine dumps in the water body during rainy season creates problems in aquatic system. The pit water draining from the mine benches contain heavy load of sediments. The main source of sediment drain into water bodies is the mine overburden. It is recommended that the mine overburdens are stacked far away from the water bodies, so that washing off of mine waste into water bodies is minimized. Construction of settlement tanks is recommended wherein the drain water will first be passed into the tanks, and allowed to remain till sediments are settled at the bottom. The clear water should then be let into the nearby water bodies slowly to minimize sedimentation resulting in increased turbidity. The mine discharge should be treated in water treatment plant, where the acid mine discharge is first dosed with lime to neutralize the acid and then passed through settlement tanks and finally released into water bodies.

The top soil which is removed at the time of mining is to be stacked separately and be used for back filling the mined pits after the extraction is over. Afforestation of the area should be taken up to prevent erosion of soil during monsoon and draining them into the aquatic bodies. Afforestation is to be done with the locally available plant species so that the regeneration and growth of the plants would be high. Transportation of mined material is to be done with extreme care. It is advisable to have transport of mined materials through closed transport. If not, then the haul roads are to be sprinkled with water regularly to prevent possible dispersal of mine dust to the nearby streams.

Water is the most essential medium for the sustenance of all life forms in earth. The contamination of the water body at the source itself will lead to the pollution throughout the entire water course and will deteriorate the quality of water for utility for other life saving purposes. In mining environment the water is the medium through which sediments and pollutants are transported and dispersed. Therefore, effective water management and monitoring measures are to be implemented from time to time and regularly monitored to prevent the loss of environmental quality.

### 5.0 Management and Conservation Measures

Generally, any species conservation programme involves conserving the species in their natural habitat “*in-situ*” and growing the species outside the natural habitat “*ex-situ*”. In the present situation, *ex situ* strategy needs to be followed for the species, namely, *Holostemma ada-kodien* and *Pygmaeopremna herbacea* as they occur in the mine lease, surrounding mine lease and power plant areas. These plants need to be rehabilitated in the surrounding mine lease area within their natural habitat. If any mining activity is allowed in the proposed mine lease area, all the multipurpose plant seedlings including NTFPs have to be collected and planted near the surrounding mine lease area. Further, it is also recommended that the seedlings of multipurpose plants, particularly, medicinal, food and commercially important species, have to be collected from the mine lease area and planted in nearby surrounding mine lease areas with the participation of local people, so that sustenance of the dependent population is ensured.

In order to minimize the impact of mining and power plant emissions on the vegetation surrounding mine area, it is important that adequate protection measures are followed. They include assisted regeneration in the forest area and soil and water conservation measures.

As mining involves movement of vehicles and increased anthropogenic activities, project affected area (Mine lease area) should be fenced. Mine dust should be suppressed by regular sprinkling of water on the mine overburden dumps and haul roads. It is essential to create a green belt of 30m around the proposed mine lease area and 50m of around power plant site well before initiation of the mining activities.

Eleven rows of tall tree seedlings have to be planted (3m x 3m spacing) to mitigate dust pollution from the mine area and power plant. The green belt will act as a barrier and trap the suspended dust particles while suppressing the air pollutants. It is also important to establish a green belt with tall seedlings (of more than 1m height) of indigenous multipurpose plant species including medicinal, food and commercially important species so as to create the green belt at the earliest with good survival percentage.



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- *EIA experience in India indicates that the lack of timely availability of reliable and authentic environmental data has been a major bottle neck in achieving the full benefits of EIA.*
- *Biodiversity impact assessment therefore demands a more sophisticated investigation and analysis of potential impacts on an ecological unit and the species and communities within it.*
- *Case study of Chakla captive Coal Block of Jharkhand showed that mining will affect two rare plants, but faunal diversity in general was low. Soil microbes will be disturbed, for which measures were suggested. Aquatic ecosystems will also be affected.*
- *Remedial measures have been suggested.*





### 1.0 Introduction

People depend on biodiversity for future and present. And mining – it takes biodiversity forever. Biodiversity and mining - these two cannot go hand in hand. When we talk about biodiversity conservation it means keeping everything as it is and mining means eradication of biodiversity.

On the other hand when we consider development process of our country, mining is an indispensable part of the development process of the country. Sustainable use of biodiversity in mining is not acceptable in true sense. Since mining eradicates the biodiversity and leaves abandoned land full of pollution.

### 2.0 Impacts of Mining

Mining activity in our country has direct impact on the social, cultural, traditional and right of livelihood issues of the people/community in and around mining areas. We can consider the coalfields under open cast mining in Tinsukia District for example. These are surrounded by villages of tribal and indigenous people (*Khamti, Khamyang, Turong, Duonia, Aitonia, Tangsa, Singphow, Sema, Tai Phake, Tai Khamyang, Deori, Sonowal Kachari, Hazong, Moran, Muttock, Nakte*). Population of this area is small and people live in small pockets. These people are living there for centuries. Forest area including protected area like Dihing-Patkai Wildlife Sanctuary lies in this part of Tinsukia and Dibrugarh District of Assam. This Protected Area is a part of the rain forest of the region. This part of Upper Assam in Tinsukia and Dibrugarh District is declared as Dihing-Patkai Elephant Reserve. Human-Elephant Conflict is a major concern in this area due to the developmental pressure on the forests as well human pressure. Several Important Bird Areas are marked in this area.

Mining is the cause of the respiratory diseases of the people in and around mining areas. Mining activities pollute air, water and soil in an area as well as cause crop failure, loss of livestock, loss of right to livelihood of the people. In this part of Tinsukia District, number of cases of respiratory diseases is high. It was raised by local people in the Public Hearing on 9th May, 2008 of Tikok Open Cast Mining project of Coal India Limited at Ledo.

### 3.0 Discussion

The overall sentiment of the people can be measured by the question raised by the village headman (*Gaonburah*) of Malu Gaon in the above Public Hearing – “*What will happen to our future and to the coming generation?*”

CIL disclosed in above Public Hearing that a part of the above mining project falls in the proposed Saleki Reserve Forest. Mining pressure on forest land reduces the habitat for wildlife especially for elephants. Mining has a relation in increasing human-elephant conflict in Upper Assam.



Because of development project Bogi Bil at Dibrugarh, stone (boulder) was collected at Bihora Stone Quarry of Golaghat District at the cost of an Elephant Corridor between Kaziranga National Park and Nambar-Doigrong Wildlife Sanctuary. Is there no alternative at Bogi Bil like sea side of Mumbai (where RCC blocks were used as wave breakers)?

In 2006, Oil India Ltd. proposed Seismic Survey project for Oil and Gas exploration on the Brahmaputra River Bed. People rejected the project at the public hearing fearing the project would cause loss of livelihood to the people and a great threat to the Gangetic River Dolphins (Hiho in vernacular- our national aquatic animal) of River Brahmaputra. The proposed project area under Seismic Survey covers both Assam and Arunachal Pradesh and has Protected Areas like Pani-Dihing Bird Sanctuary, Dibru-Saikhowa National Park and Biosphere Reserve, Di-Ering Wildlife Sanctuary, several Reserve Forests like Dihingmukh, Poba, Pasighat Reserve Forest and Important Bird Areas.

There are laws, rules and regulations for mining but after the mining activity started these look obsolete. Effective monitoring is the main problem.

Now, in our country, illegal mining outnumbered legal mining. Joipur Reserve Forest is a major part of the rainforest and adjacent to Dihing-Patkai Wildlife Sanctuary. It faces a constant threat from coal, oil and gas mining. This Joipur Reserve Forest is recorded as a habitat for several cat species including Tiger.

All about mining is covered in regional, national media. All the problems are similar. About the drawbacks of Open Cast Mining in Tinisukia District of Assam was published in Assamese Magazine *Prantik* in 1987 (four years after the starting of Open Cast Mining process by CIL in Assam).

Any project authority goes for study, collects data before a proposed project under the banner Environmental Impact Assessment (EIA) Study using consultants. It is seen that this type of EIA study are done using old and inadequate data. In OIL's proposed Seismic Survey project in 2006 used map of 1967 It is not clear the reason behind this. The consultant prepares the study report at the cost of project authority. So the project authority should receive the study report checked by a competent authority and make public the report for consultation.

It is the high time how we will accept biodiversity and mining. We must study the positive and negative aspects of underground and open cast mining. We must review and reformulate the existing policies, rules and regulations on mining of our country to conserve biodiversity as well as to do mining.

Otherwise the people's voice will be the same from loud to louder – what will be our future?

#### NaturalGist

- *Mining is an indispensable part of the development process of the country, while biodiversity is important for ecological security of people. Sustainable use of biodiversity in mining areas is difficult in true sense as current mining eradicates the biodiversity and leaves abandoned land full of pollution.*
- *Protected areas in Upper Assam are home of traditional communities. These are also important bird areas and biodiversity rich areas.*
- *Mining activities in the area have polluted air, water and soil as well as caused crop failure, loss of livestock, loss of right to livelihood of the people.*
- *People in this area have opposed projects of coal india ltd. And oil india ltd. Fearing loss of livelihood, causing threat to region's diversity. They have repeatedly raised the question of social and ecological security for themselves and their future generations*
- *Large companies like Coal India Ltd. have disturbed the nature by mining near Protected Areas. Even more threatening is illegal mining in North East and needs to be curtailed.*





## Environmental Impact Assessment and Environmental Management Planning in Iron Ore Mining

*P.R. Chaudhari, Project Advisor & Ex-Deputy Director, NEERI, Nagpur*

### 1.0 Introduction

Mining has become essential for the development of mankind. The supporting base of modern technology is minerals, especially steel. History shows that mankind's great progress was possible after the invention of extraction of iron and steel from iron ore. However the process of excavation and mineral processing has impacted the environment and natural resources to a great extent. Thus mining may be termed as essential evil that needs to be controlled to conserve and protect the environment.

With the spurt in development, the mineral sector in India is on the threshold of expansion with more and more open cast iron ore mines being opened-up in the state of Jharkhand, Orissa, Karnataka and Chhattisgarh. Under such scenario, systematic and scientific exploitation of iron ore, compatible with environment is essential for survival of our future generation. Mineral resources need to be extracted in a sustainable manner by use of recent advances in the mining technology which are environmental friendly in nature.

### 2.0 Impacts of Open Cast Mining

Presently, iron ore mining is carried out by open cast mining method in India. Open cast mining affects all the components of environment disturbing ecology and resulting in various pollution problems. In India, as most of the iron ore mines are located on the top of hills and in dense forest areas, the environmental problems are more significant

The major impacts of the mining are related to air, noise and water pollution, land degradation, destruction of forest and wildlife habitat, and health hazards.

Environmental management plan can be prepared and implemented at each and every step of mining from inception stage to reduce the pollution of different environmental components.

### 3.0 Impacts of Air Pollution and Mitigation Measures

The major air pollutions from mining area are particulate matter ( $PM_{10}$ ,  $PM_{2.5}$ ) due to drilling, blasting, movement of HEMM/Vehicles/dumpers and Gases -  $SO_2$ ,  $NO_x$  and CO from vehicular exhaust.

Dust may be a significant nuisance and potential health risks for surrounding population. Dust emission may be reduced by sprinkling water on roads before movement of dumpers/vehicles, and at ore transport points.

Gaseous pollution may be minimized by advanced versions HEMM/dumpers and regular maintenance of vehicles. Similarly overhead transport of ROM/ore, use of rail for carrying the ROM and finished product will eliminate truck transport which is greatly responsible for dust and gaseous pollution.



#### 4.0 Impacts of Noise Pollution and Mitigation Measures

Noise is produced during drilling, blasting excavation, sizing and transportation of Rom/ores. In case of beneficiation plant, noise is produced due to crushing, screening, washing, storage and dispatching of ore. The noise generating sources can be grouped into two categories viz. fixed plant and mobile plant sources.

Noise has significant impact on the wild life as most of the iron ore mines are present in forest areas. Secondly, if the human habitation or village is near to mining areas, the local people feel the impact of noise disturbing their physical and mental condition depending upon the intensity of noise

Fixed plant machineries may be properly installed in buildings to reduce noise and vibration. Mobile sources such as drilling, blasting should be done with recent technology while loading, haulage and service operations can be done carefully to minimize the noise. The transport facility should avoid the residential area in case of truck transport. Overhead belt conveyor or rail transport will reduce the intensity of noise pollution to a great extent.

#### 5.0 Vibration and Air Blast and Mitigation Measures

Vibrations and air blast cause community concern due to sudden impact on physical well being, structured damage to the buildings and structural items of heritage value. Vibrations are measured as peak particle velocity (ppv) in mm/sec.

In India, DGMS prescribed 10 mm/sec as the safe limit of ground vibration at the foundation level of the structures within a distance of 300 m. Now-a-days, this standard is complied by using high strength explosives and improved blasting technology.

#### 6.0 Water Pollution

The major impacts are water pollution from erosion of waste dumps/mining areas, oil and grease contamination due to discharge of effluents from workshops, pit water discharge, and pollution from domestic effluents resulting in pollution and sedimentation of rivers and other water bodies, etc which is unfit for use by wildlife and surrounding population.

##### 6.1 Effluent from Ore Processing Plant

The effluent from ore washing plant is treated in the classifier of the plant itself to recover the coarser particles as ore fines. The overflow of the classifier, mainly consisting of finer solids i.e. tailings, is sent to thickener for solid liquid separation. The clarified overflow water (about 60 %) is reclaimed and recycled to the system. Underflow tailings are discharged to Tailings Pond for further solid – liquid separation. Clarified water from the Tailing Pond are also reclaimed and recycled back to the system in most of the major iron ore mines in India. In some mines, where there is no provision of reclaiming water from the pond, the clarified water is discharged through a weir.

##### 6.2 Pit Water Discharge from Mines

Iron ore mines, which are operating below water table or just above the confined aquifers, water accumulated in the mine pit is required to be pumped out to facilitate the mining operation. The pumping of pit water creates a cone of depression around the mine area, which give rise to drying of nearby wells and springs and lowering of agricultural yields in the neighbouring villages. A large percentage of iron ore in the Goa region is located below the water table and a number of mines are now operating below the water table.

In most of the big mines, the pit water is being discharged to the exhausted pits and being utilized for ore washing purpose.



### 6.3 Surface Runoff

Surface run off from the mining and other areas gets laden with aluminous lateritic soil from mine benches, exposed outcrops etc., thus becoming highly turbid. Direct discharge of the surface runoff to the natural nallas will certainly affect the water quality of the nallas as well as rivers in the region.

In most of the big mines, sedimentation basins have been provided for treatment of the surface runoff or diverting to the tailings ponds. In addition to this, garland drains around the waste dumps along with retaining walls and toe bunds and check dams across the nallas were provided to arrest the runoff, besides establishing vegetation cover over the waste dumps.

### 6.4 Effluent from Workshops and Garages

The effluent generated from workshops and auto garages mainly consists of oil and solids.

Separate effluent treatment plants have been provided for treatment of these effluents in most of the big iron ore mines. The effluent is treated in series of sedimentation tanks with oil traps. As the effluent generation is very low, these treated effluents are discharged to the nearby lands where it is evaporated.

### 7.0 Groundwater Pollution due to Tailing Pond

The mine may have wet processing plant and a tailing pond to store tailings generated from processing plant. These tailing ponds require huge area and may cause pollution of groundwater and surface water bodies.

The tailing pond should be scientifically designed by selecting an area with deep ground water special treatment of tailing pond bottom to make it impervious to water to avoid groundwater pollution.

### 8.0 Management of Land Degradation

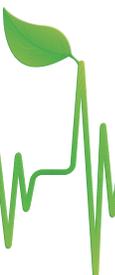
Out of all the impacts, impact on land is one of the most important impacts which is irreversible but may be repairable to some extent during and after mining activity.

There are no alternatives to select the mining site as the mining is site-specific and changes the land use pattern of the area. However, the infrastructural facilities related to mining and processing of the iron ore may be planned at such sites suitable from economic and environmental point of view so that the natural resources should not be affected.

Mining is the temporary phase and once the mineral is exhausted, the land should be returned with such modification that it should match the land-use of surrounding area or the land use useful for the local surrounding people. The land use changes can be minimized by careful planning the surface layout of the mining areas and planning and design of land reclamation programme right from the inception, including the development of post mining land use compatible to the surrounding land use or socioeconomic need.

Long term planning is required to minimize the land degradation due to mining activity. The planning includes detailed exploration of the mineral reserve so that wasteful mining will be avoided. Mine closure plan should be ready before the start of mine. An outline of decommissioning as well as final land use should be decided before the start of the mine.

Loss of top rich soil (non-renewable resource) from mineral zone for mining activity along with overburden is another impact which is irreversible. The top soil should be carefully scraped and securely stored for plantation/ green belt development/ vegetative stabilization of overburdens. Reclamation of filled – up mine pit by vegetative cover.



Mining activity should be designed in such a way so that drainage pattern should not be changed which are responsible for recharge of nallas and rivers of the area.

### 9.0 Management of Ecology

Ecology, wild life habitat and biodiversity are affected by the mining activity. The mitigative measures for impacts on ecology are compensatory afforestation, green belt development, stabilization of overburden dumps, conservation of rare and endangered plant species, medicinal plants, and avoiding intrusion in wildlife habitat/home range of wildlife/breeding & roosting places etc. There should not be disposal of polluting substances in water courses, estuaries and open sea. Though cent percent success is not achieved, some methods can be applied to reduce the impact on ecology. Alternate habitats may be prepared by compensatory afforestation, provision of good wildlife habitat, plantation of fodder and fruit plants in forests, creation of grasslands, water holes with mud-bath arrangement etc.

### 10.0 Solid Waste Generation and Management

The mining waste is classified as sub-grade rejects, wastes, tailings from ore processing plant, and wastes from service facilities.

Sub-grade material are mined out separately and dumped in designated waste dumps keeping in view its further use if techno-economics permit.

The OB and IB are required to be dumped separately provided with garland drains, and stabilized with contour bunding and plantation of trees and shrubs. The iron ore deposits of eastern, central and southern zones do not contain much waste/rejects except laterite and some low grade ferruginous shall and BHQ patches. Whereas in western zone (Goa), the waste generation is very high to the tune of 2.5 to 3.5 times per tonne of ore excavated.

Tailings can be palletized in Pellet Plant and reused in blast furnace. Tailings can be used in road making, brick making, tile making or for filling up voids in underground mining.

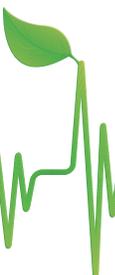
There are 3 types of wastes being generated from service centers, metallic, non-metallic and oil contaminated waste. The metallic waste from workshops (iron and steel scrap are collected, stored and sold. The non-metallic saleable wastes like tyres, tubes etc. are also stored separately and sold. The oil contaminated wastes which contain waste cotton, oily muck oil filters etc. are categorized as hazardous waste and may be burnt in small mines or sent to secured hazardous waste landfill in case of big mines.

### 11.0 Cleaner Technologies

As mechanized open cast iron ore mines are becoming larger, deeper and more capital intensive, containing efforts should be to improve upon the open cast mining activities through advances in the equipment size/designed practices and also through introduction of innovative technologies:

The application of following **cleaner technologies** holds out almost unlimited opportunities for upgrading the performance of opencast iron ore mining in India.

- ♦ High capacity surface mining techniques to harder formations
- ♦ New concept of high angle belt conveying system
- ♦ Input crushing systems (mobile and semi-mobile)
- ♦ High capacity of dumpers
- ♦ Automatic truck dispatch system
- ♦ Non-electric blast initiation techniques, and
- ♦ Developments in the area of bulk explosive systems



In addition, the following **proved cleaner technologies** need to be implemented in Indian ore mines considering their suitability to the particular site.

- ♦ Adoption of wet drilling
- ♦ Use of ripper dozer as an alternative to drilling and blasting
- ♦ Use of hydrolytic hammer/rock breaker as an alternative to the secondary boulder blasting
- ♦ Use of Opti Blast Technology and split charge blasting techniques with air decking by the gas bags.
- ♦ Use of non electric (NONEL) initiation devices (EXEL of ICI and RAYDET of IDL)
- ♦ Application of in pit crushing and conveyor transport system as an alternative to all dumper transport system in deep mines.
- ♦ Dry fog dust control system at the crushing, screening and material handling or processing plant as an alternative to de-dusting system with bag-house.
- ♦ Use of hydro cyclones and slow speed classifiers in the wet beneficiation circuits to maximize recovery of iron ore mines.

The feasible technologies suitable for Indian Ore Mines, which need to be used in all the mines to improve efficiency and to reduce the pollution levels are wet drilling, Ripper Dozer- Alternative to Drilling and Blasting, Hydraulic Hammer/Rock Breaker, Environment Friendly Blasting Technology (Opti-blast technology, Split-charge Blasting Technique with Air Decking by Gas Bags), Environmental Friendly Blast Initiation Devices (NONEL and NONEL type systems), Stemming Control during Blasting Operation, Dry Fog Dust-Control System, Transportation System by Trolley Assisted Dumpers, Utilization of Tailings

### 12.0 Socio-Economic Issues

- ♦ Improvement of local & national economics, economic benefit to the society and govt. while earning profit to share holders
- ♦ Some people are directly benefited through employment & business opportunities
- ♦ Other people may be aggrieved due to impact on ecology, environment pollution, loss of land or house or earning source
- ♦ Measures are available to address adverse side effects, to improve positive aspects of mining, community infrastructure, employment & land use planning

### 13.0 Environmental Management Practices

High standards of environmental management for mining projects are expected by the people and statutory bodies. Statutory bodies have also taken stringent measures to tackle this problem by adopting/imposing certain conditions during planning stage itself and monitoring continuously. Now it has been realized that careful planning and implementation of proper environmental management practices are essential for sustainable development.

### 14.0 Environmental Monitoring

Regular environmental monitoring is necessary as per the guidelines of CPCB to see the benefits of implementation of environmental management plan.



- *Mines cause pollution of air, water, land and forest resources. Noise pollution is also one result of mining.*
- *However, use of cleaner technologies of mining will help in reducing the environmental impacts of mining*
- *Measures are available to address adverse side effects, to improve positive aspects of mining, community infrastructure, employment & land use planning*
- *Careful planning and implementation of proper environmental management practices are essential for sustainable development.*
- *Regular environmental monitoring is necessary as per the guidelines of CPCB to see the benefits of implementation of environmental management plan.*





## Biodiversity and Ecological Restoration Norms and Compliance by the Indian Mining Industry

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### 1.0 Introduction

The environmental impacts of mined areas have been a major concern for multiple stakeholders. It has led to several minor and major conflict issues over the last decade. In the recent past this has escalated into serious socio-political-environmental conflicts. The need for more and more mining outputs has escalated as industrial growth of our country spurred by rapid economic development has led to more intensive mining. However mining zones are frequently important forests and other wilderness areas in hills, mountains, plateaus, grasslands, river systems and semiarid regions. They are also the areas where tribal communities have lived for generations, eeking out a meager livelihood, from consumptive use resources from their land.

The conflict of interests between the needs of these people and the natural resource and biodiversity conservation oriented scientists as against that of industrial growth based on mining, has now created a new flash point. There is also a subsidiary conflict of interest between the views within the environmental lobby. There is the perception of the social activist group who rightly feels strongly in favour of retaining forest resources for local people's use. There is the alternate lobby of those NGOs or scientists for conserving biodiversity, which requires preservation of habitats and long-term protection for all of biodiversity. The biological variety within natural ecosystems is now valued at a much greater long term economic benefit than timber or the non-timber forest products. The forest is now considered to act as a mother of water resources, provider of soil fertility, cleaning mechanism of polluted air, mitigation for climate change and the preserver of all the complex evolutionary processes that keep the machinery of nature alive and in good health.

Thus when mined areas are to be 'restored', the debate should center around restored to what, for whom, how and in what time frame. These questions should really be addressed not as end of line strategies but clarified during the mitigation aspects when an EIA is done. If this is preplanned during the EIA it would make life easier for all the stakeholders concerned. Unfortunately EIAs are done to get mining projects passed, thus creating enormous problems for the future i.e. after the mining has been initiated or has been completed leaving local people, to fight one more battle and conservation conscious groups on a war path towards litigations and public hearings. Ultimately it means enormous losses for mining groups, societal losses with non-compromisable situations and loss of precious biodiversity. Rather than a win – win situation it ends up as a conflict of interests.

There are two aspects that at times lead to confusion. An 'ecore restoration' program should mimic the natural biodiversity to return to a near climax forest or grassland for example. This is what is expected as the final outcome of a biodiversity conservation oriented ecore restoration process. On the other hand if the outcome is to support local people's resource – use needs this must flow out of an 'ecodevelopment' initiative. Both are considered different tools for sustainable development. While several of the objectives of ecore restoration and ecodevelopment are common, and the way to get there may be similar, there are concerns in the two processes that differ greatly in detail.

A simple example is of restoring a mined area for example in the Western Ghats. Neither the local people nor the nature conservation conscious group will be satisfied by a plantation program of exotic fast growing trees. This would provide only a certain level of erosion prevention, hydrological management and carbon sequestration. It



will not supply the resource needs of local people which are inherent in a natural forest. Nor will it provide the optimal habitat needs for even common faunal species. The more endemic or endangered plant and animal species would become locally extinct and may never be able to recover if there are no linked natural patches of wilderness, or corridors for species to repopulate and get rehabilitated in the 'restored' area. Thus there are innumerable issues in which there are parallels and disparities between the needs of biological diversity and resource needs of local people.

In fact the process of achieving these two objectives of Ecorestoration and ecodevelopment are different from the early planning stages of land and hydrological management, (soil and water conservation) and biodiversity enhancement.

Another concern is what the restoration is expected to achieve at the end stage of ecorestoration. Are major mammals expected to return? Should it be 'good' for the birds and the bees?' Is it to be used as a site for nature education? Is it to be a park or garden like a recreational area? Is it to serve the needs of wildlifers, trekkers, joggers, rock climbers, golfers? Who will be the end users? What about the displaced, disadvantaged people whose main objective would be the collection of fuelwood, fruit, roots, medicinal plants?

Just as ecodevelopment is for local people, ecorestoration also has a constituency – one key stakeholder which is frequently forgotten is the silent wild flora and fauna itself. For both forms of 'restoration' the end point is invariably limited to 'rehabilitation' and not 'restoration' into wilderness.

The desired level of restoration must be planned at initiation, not as an end of line outcome of a restoration process that has cost time, effort, money and led to an inadequate outcome which satisfies no one. A combination of ecorestoration and ecodevelopment may be the desired outcome. If so, the project proponent and its ecologically oriented experts must find the parallels between the two processes which must be embedded in an action mode. The extent of concerns that are mismatched must be debated to bring about a compromise based on least resistance and greatest possible value.

Such processes are rarely if ever thought through when mitigation measures suggest that 'ecorestoration must be done'. At this point one has already missed the bus. The costs of poor implementation are litigation, unrest, closure, unhappiness and an all round disaster. In the final analysis, managing mined areas is an example of sustainable development. The answer comes from an appreciation of this term which has three pillars precariously balanced on a central axis. They include economics, societal, and environmental (ecological) concerns balanced on 'good governance'. These issues are related to a wide array of concerns that include the ecosystem intactness, fragility levels (ecological sensitivity) presence of endangered or endemic species of the area that is to be mined. It must capture concerns related to water, catchment areas of lakes, rivers, mountains, hill slopes, plateau tops and other unique ecosystems that account for ecological sensitivity. After mining is completed it must consider to what degree these can be reversible and in what time frame. Will the balance of the ecosystem, (its community of plants and animals) be able to return to its environmental pre mined status? These are some of the concerns of the biodiversity oriented constituency that support the silent wild species that are equal stake holders of these bio-rich regions. Biodiversity conservationists are struggling to bring home their issues to policy makers and Government officials. The wild creatures watch speechlessly as human – kind, (the most un-kind of species) destroys their habitat, their lives and even annihilates, the whole of the ecosystem and the irreplaceable wilderness of the of the ecosystem which is the home of the endangered and endemic species of flora and fauna. It took millions of years for these species to evolve; the mined area can destroy them within a few short years.

A variety of minerals, especially iron, coal, bauxite and manganese are frequently mined at ecologically sensitive forested sites. While it is mandatory in terms of an EIA for mine lands to be restored during and after mining as a part of mitigation strategies, it is generally inadequately addressed as issues of local people and biodiversity conservation remain unanswered. It is expected that the damaged areas must be reforested, restored or rehabilitated. The extent to which the mined out land has been successfully restored and the area ecologically, socially and biologically rehabilitated remains questionable. Some questions that should be explored are:



- ♦ What was the ecological status of previously mined lands?
- ♦ What is the ecorestoration strategy that has been used?
- ♦ Is the effort oriented towards restoring biological diversity?
- ♦ How have issues of local people been addressed?
- ♦ What has been the cost of the ecorestoration to the mining company?
- ♦ What can be done to improve the level of restoration to a desired level of ecological repair?
- ♦ What parameters can be used to judge the level of restoration?

These are some of the unanswered questions. While this requires a long term and widespread study, a quick overview of existing research, such as mining company reports and other related industry reports, is a good starting point to assess the situation and answer at least some of these questions. Perhaps the most relevant concern is to establish if and when the afforested area begins to be recolonized by species of wildlife that once existed before the areas was mined. This can be ascertained by looking at old records and satellite images to assess the state of the forest, as well as by comparing the area's biodiversity to that of a contiguous patch of undisturbed forest in a Protected Area or Reserved Forest patch.

Another concern is related to the outcome of the afforestation project in relation to its utilization by local people who were once intimately connected to the natural resource base of the forest for their subsistence. To answer this question one needs to compare strategies aimed at ecorestoration as well as ecodevelopment.

In recent times several new norms have been evolved to bring about a more appropriate outcome for mined lands (Cooke and Johnson 2002, Singh et al. 2002, Singh 2008). This is especially relevant for mined lands as many areas that are mined lie in ecosensitive wilderness areas in several ecologically and biologically important habitats. The newer norms are expected to bring about 'least damage to the natural resources.' This is to be implemented through a 'Sustainable Development Framework (SDF) for mines, to be implemented by the mining industry. However there are still serious inherent conflicts within these areas, both with local people and for wilderness conservation. Strategies to mitigate this are referred to as ecodevelopment and ecorestoration respectively.

Ecorestoration for biodiversity conservation has specific strategies towards achieving success. This is based on an understanding of habitat restorative tools and processes that require clearly defined objectives for implementation and monitoring post mining activities. These aim at reviewing the current status of norms and compliance by the Indian mining industry.

The objectives are

1. Study the background information and the use of various terminologies used for pot mining activities
2. Review current norms of the Ministry in a historical context
3. Identify practical steps towards restoring mined out areas

### 1.1 Biodiversity in the Context of Mining

Biodiversity is the variety of life that evolution has produced over millions of years. It deals with the diversity of animals, plants, fungi and microbes in natural undisturbed landscapes in the wilderness and in modified land use patterns such as agriculture and urban environments. In the context of this paper, it is the flora and fauna that is a desired outcome in lands that have been mined. This suggests the recreation of a 'natural' ecosystem with its community of species- flora and fauna, with all their genetic diversity that existed before mining was done in a natural or semi natural setting.



## 1.2 Ecorestoration and Ecodevelopment in the Context of Mining

There are differences and parallels between ecorestoration and eco-development. The term 'ecorestoration' has been used over the last several decades. It is essentially an overarching term used in landscape restoration techniques wherein degraded ecosystems are to be brought back to a more natural state. In this sense a plantation of fast growing trees in a deforested landscape can also be defined as a restorative strategy. However, this does not mimic the natural characteristics, high levels of biodiversity, or ecological processes inherent within the pre-mined 'natural' landscape. Most ecosystems today are however man modified to a lesser or greater degree and to expect restoration to mimic what it would have been like in the absence of any human intervention is rather unrealistic. The idealistic purpose of the term ecorestoration would indicate the return of as 'natural' an ecosystem as possible with its full complement of wild native species and ecological or evolutionary processes.

'Ecodevelopment' is a term popularized in India since the 1970s and 1980s to bring about an ecologically oriented sustainable economic development for local people. It expects that natural resources are regenerated locally for both consumptive and productive use of local inhabitants whose dependence on life support systems depends essentially on nature. It embodies the equitable use of water, forest resources such as fuel wood, fodder, food etc. It also establishes the need for good land management to enhance resources used by local people. As its purpose is to support economic development as well as ecological processes, its strategy includes a dependence on the integrity of the local ecosystem.

Most restorative operations do not stress on the need for biodiversity conservation. They expect that the mined area is "restored" once soil and hydrological conditions are restored with micro catchment treatment, bunding nalla courses, contouring and plantation of a rapidly growing tree cover mostly of hardy exotic species that can grow easily in a mined area. If however, restoration is to be focused on creating a natural ecosystem with all its biodiversity one has to identify to what level this is to be achieved. What species of plants and animals can be introduced and which species are likely to recolonize the area spontaneously from the adjacent forests or grasslands.

## 2.0 Recent History

In 2003 Indian Bureau of Mines Advisory Board identified abandoned and orphaned mine sites for rehabilitation and restoration. These mines had led to serious alterations in landscapes, non-use of degraded land, loss of soil, changes in ground water regimes, contaminations and changes in vegetation. The terms used by the Bureau include rehabilitation and restoration, which indicates an awareness that there are differences in the levels of expected 'naturalness'. Restoration indicates the need to bring back the level of naturalness to what it was in the pre-mined ecosystem. While for rehabilitation the level can be preselected, to what is expected. This has left the expected outcome rather ambiguous (Maiti and Singh 2007, Cairns 2005).

In 2005 a High Level Committee under Anwarul Hoda – Member Planning Commission, suggested standards within a land planning framework for a Sustainable Development Framework (SDF) for mines. In 2008 the National Mineral Policy took a new comprehensive view to protect 'the forests, environment and ecology'. It ensured that reclamation and afforestation would proceed concurrently with mineral extraction. By 2009 a draft Sustainable Framework Development document was to be provided by M/S ERM India Pvt. Ltd. The last aspect of the TOR included that the outcome of the development strategy was aimed at '**Ensuring minimal ecological disturbance, in terms of biodiversity, flora, fauna and habitat.**' It is also stated that it is intended to address 'Promoting restoration and reclamation for benefit of local communities.' Thus both ecorestoration for biological enhancement and ecologically oriented development for local inhabitants should become a part of future mining processes.

## 3.0 Current Norms for Mining

In 2010 the Ministry of Mines has issued a set of guidelines and norms for mining which includes the need for their 'sustainable management'. It bears in mind the need for 'inclusiveness through social, education, health and other interventions.' It ensures that 'Mining is done in a way that causes least damage to the natural



resources.' These guidelines provide a more precise set of objectives that would reverse the biological ecological and societal ill effects of mined out lands.

The Mines and Minerals (Development and Regulation) Act – June 2010, ensures that sustainability is addressed through its Section 45. This deals with a 'Sustainable Development Framework'. It stipulates that the mining plan must include a 'Corporate Social Responsibility Document' to benefit the host population in adjoining panchayats. This is a new additional activity that requires a social sciences approach in addition to landscape restoration which is essentially a natural science approach.

The sustainable development framework guidelines include ensuring minimal ecological disturbance, in terms of bio-diversity, flora, fauna and habitats. Promoting restoration and reclamation activities so as to make optimal use of mined out land for the benefit of the local communities. While there are several parallels between the objectives of these two strategies there are significant variations in the expected outcome. The framework also suggests a peoples' initiative to reward whistle-blowers on illegal mining.

#### 4.0 Sustainable Development in the Context of Mining

The three pillars of sustainable development are economic development, addressing societal concerns and ensuring environmental protection that would meet current aspirations of people without endangering the lives and livelihoods of subsequent generations of people. This must be based on a foundation of good governance.

In mining operations the natural resource is not renewable. Once the mines have extracted all the raw material, the earth cannot regenerate the resource. Thus, what we as users of consumer products utilize in our daily lives comes essentially from mined raw material. As this is non-renewable these products must be used with caution, reused whenever possible, and recycled so the raw material can remain within the earth's usable resources for the longest possible time.

The process of mining alters landscapes and land-use, this must be reversed once the mining has been completed. Thus actions need to be taken by society at large as well as by the mining industry to attain sustainable lifestyles and sustainable landscapes. Both deal in many ways with the 'quality of life' of people everywhere.

Economic Issues		Social Issues		Environmental Issues	
Unsustainable	Sustainable	Unsustainable	Sustainable	Unsustainable	Sustainable
Overexploitation of minerals for their very high economic value, at the cost of forests or other landscapes	Overexploitation should be prevented by strict EIAs and eco-restoration norms	Mining poses several long term occupational hazards to the miners and surrounding people	Proper health protection measures for the miners and preventive healthcare for surrounding people	Extraction of the mining products from the lithosphere has a variety of side effects on the environment.	Differences between exploitation and overexploitation should be understood by mining companies.
Treating diseases caused by mining is expensive	Preventive health measures are cheaper than curative medicine	Safety of the miners at the mining sites is a serious concern.	Proper safety measures for the workers should be implemented	Non renewable energy sources will be used up permanently once utilized.	Shifting our dependence from non-renewable to renewable energy sources is an urgent need to enhance environmental safety.
Short term gains, but long term losses in the national economy due to overexploitation	Long term gains should be maximized by reducing overuse of national raw materials	Loss of tribal forests and farmlands because of mining activities is a long term loss of resources.	The requirement of tribal communities should be kept in mind to prevent inequitable use of resources.	Depletion of available land, waste and pollution of different kinds are the side effects of mining.	Eco-restoration of mines and dumpsites; global public awareness; government actions are environmentally positive measures.



## 5.0 The Etiology of Conflict in Mining

Mines are usually areas within forests, grasslands, hills, mountains, plateaus and other natural areas frequently linked with water bodies and rivers all of which are Ecologically Sensitive Areas. (Example: Western Ghats, Himalayas, Central Indian forests). Many of these mining areas are places in which tribal communities live. Most of these natural landscapes are habitats of threatened endangered and endemic flora and fauna. Thus there are inherent conflicts in the land to be utilized for mines. Conflict resolution is more complex than conflict prevention. The measures required to mitigate possible causes of conflict must be foreseen and managed through debate between potential adversaries before the situation necessitates difficult negotiations or a deadlock. This adversely affects local people as well as mining companies. It also affects the wildlife which is a cryptic and underrepresented silent stakeholder.

Mining verses environment protection and biodiversity conservation groups (or the Forest Department), is a frequent issue which cannot be resolved later as it can lead to loss of species which never return to the mined area. It thus requires initial proactive planning and management.

## 6.0 Conflict Prevention and/or Mitigation

### 6.1 Restoration

**Restored to what? for whom? and how?:** Ecorestoration has different connotations. It can imply recreating an optimal habitat for wildlife, or the reemergence of locally useable forest resources for local inhabitants, or greening using rapidly growing exotic trees to stabilize soil and maintain water regimes. It is thus related to the mitigative measures suggested in the EIA.

**Possible time frame:** Most mining operations are completed within a few years, but appropriate restorative measures take decades. Thus financial inputs into restorative programs may be required for much long periods of time, frequently even after the lease period is over.

**What are the objectives of restoration:** The objectives are frequently not clearly expressed in EIAs. The EIAs that are normally carried out do not specify the real desirable level to which mined lands are to be rehabilitated/restored. In certain areas greening with a rapid plantation is considered a sufficient measure. In an area which forms a wildlife corridor between Protected Areas the restoration however would require far greater attention to reestablishing a habitat for important species.

#### Restoration of Mined Areas

Ecorestoration for preserving natural resources and biodiversity conservation

+

Ecodevelopment for local people through alternate income generation

=

Planning both strategies as a combined action plan or at the same site, or by zoning the area into separate restoration or eco-development areas.

### 6.2 Defining Post Mining Activities

While there are a large number of definitions of eco-development and ecorestoration as well as varied objectives and expected outcomes, the common usage of these terms over time has made them acceptable for post mining activities. Mining regulations and rules have still not been able to define these terms in more unambiguous terms.

#### Commonly Accepted Definitions

##### Ecorestoration

An intentional activity that initiates or accelerates the recovery of an ecosystem which has been degraded, damaged, transformed or destroyed directly or indirectly by human activities, and that attempts to return an ecosystem to its historic trajectory (Clewel et al 2005).



### **Ecodevelopment**

Development at regional and local levels, consistent with the potentials of the area involved, with attention given to the adequate and rational use of natural resources, technological styles and organizational forms that respect the natural ecosystems and local social & cultural patterns. (United Nations 1997)

While these terms indicate that the strategy acts as either mitigation of environmental degradation, or the reversal of all effects on human lives and livelihoods, the final outcome that is expected remains ambiguous. There should be a much clearer perception of not only the expected mitigative measures but the process by which it is to be achieved.

### **6.3 Ecorestoration/Ecodevelopment: Different Strategies for Reclaiming Mined Lands**

These activities are usually implemented under the Environmental Management Program, or are considered a part of the mining operations good intentions towards local people in the form of community services.

Ecorestoration is expected to reverse ecological degradation to the original ecosystem's structure and function. This implies that the landscape's naturalness is restored. Wildlife habitats are to be recreated. Species that have moved out are to be reestablished and the biodiversity values of the ecosystem are to be restored. While in Ecologically Fragile Areas this may never be completely achievable within a few decades, the ideal aim should be to achieve a high level of 'naturalness'.

Several eco-development initiatives have been practiced in India for Protected Area surrounds and rehabilitation of resettled villages for decades. There are several good models and many bad ones. The EIA must specify the process through which a participatory approach is to be developed with local people. This could prevent misunderstandings between the project affected people and the implementers of a project in future.

#### **Steps Towards Restorative Actions**

Site specificity – Restore prior condition of natural resources within the mined areas

Identify level of desired restoration

Initiate monitoring to processes and ensure it is carried out to the desired level

There is no agreement on terminology of restoration – it is a continuous **process**, not a product of mining activities that is local specific

#### **Terminologies Used for the Mining Industry**

**Reclamation:** Ensures some visible form of use that transforms wasteland to productive or consumptive utilization patterns.

**Restoration:** Involves the recovery of ecological integrity of the mined areas.

**Reinstatement:** Usually refers to mined land that is returned to the pre-mining ecosystem in its structure and function.

**Rehabilitation:** Usually used to indicate that mined lands are moving towards reinstatement.

**Replacement:** A term used when post mining activity leads to creating an alternate ecosystem.

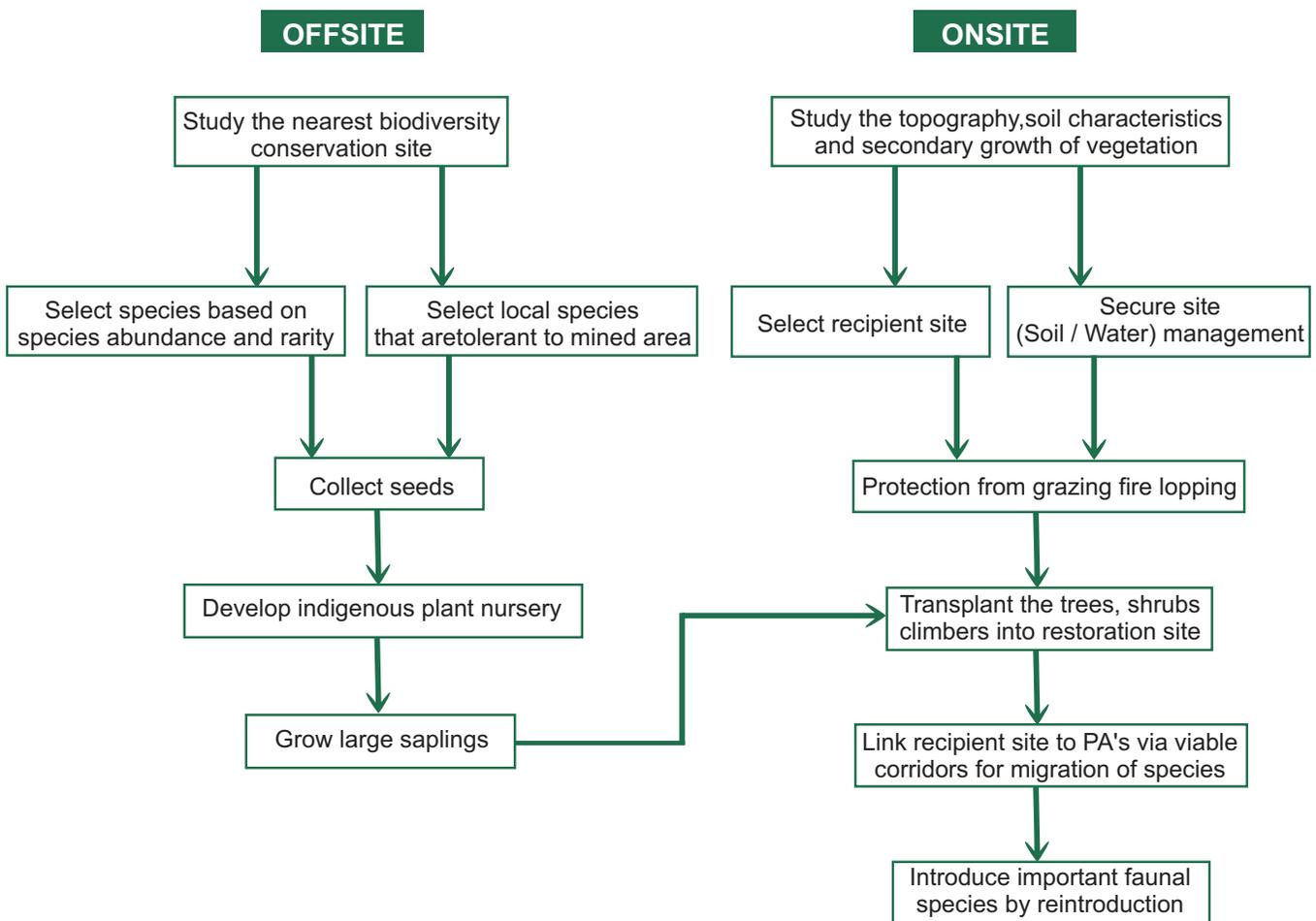
All these terminologies are frequently used loosely or are used interchangeable for similar but essentially different processes. In practical terms, a soil and water management of an area, with a greening by a plantation of exotic fast growing trees, is not ecorestoration in its true sense. Restoring an area must go beyond the realm of greening, to the preservation of biological diversity and ecological and evolutionary processes.



**Ecorestoration of mined lands and the final outcome of this process requires setting up of benchmarks and specified timeframes.**

Ecorestoration must achieve a high level of 'naturalness'. This is NOT about greening – but is related to biodiversity enhancement. It must look ideally at the whole ecosystem, its structure and function, and the reemergence of the community of flora and fauna in a wilderness-like habitat. This must cater to all its wild denizens that were using the area before mining was initiated. In many situations, the mining may have been done on agricultural or pasture lands which must be restored to their prior utilization patterns. While these are ideal outcomes, in certain situations the mined lands in ecologically sensitive areas has been degraded so seriously that a compromise solution is necessary. While this is not desirable, if it is inevitable, the mining operators must be forced to use the 'polluter pays' principle. This financial burden must be higher than the expected cost of restoration.

**Tools and Methods for Biodiversity Conservation in Ecorestoration**



## 7.0 Practical Steps towards Restoring a Degraded Habitat

### A. Planning

Identifying the required outcome is the first step and must be done along with the EIA. The key components of the local ecosystem must be studied even before a plan for restoration can be developed. This does not entail only a list of flora and fauna but a comprehensive ecological assessment of species richness and abundance of flora and fauna. If the area is already in a semi-degraded state a study of a neighbourhood wilderness ecosystem such as a Protected Area and its biodiversity, is a prerequisite. This is best done in the nearest core area of a National Park within the same biogeographic zone. The process of restoration is initiated at the pre-mining stage. All top soil must be shifted, protected and maintained so it can be used to cover the mined areas after mining is completed. The existing hydrological regime must be mapped so that it can be re-established during restoration. A study of plant tolerance for their growth in mined areas is necessary as mining changes the quality of soil and the hydrology of the area. This needs to be predetermined and locally relevant species that are selected must be predetermined based on their ability to grow in the mined area.

### B. Implementation

- ♦ Establishing a control over the site, in the form of soil and water conservation, is an essential first step to restore a mined-out land.
- ♦ A nursery of local trees shrubs climbers' including important ground flora must be initiated during the active mining period so that locally relevant plants are available on site when the mined area is to be restored.
- ♦ Re-vegetation on an extremely degraded location may have to be initially done using hardy exotic fast growing trees to hold soil and moisture. However, this is a compromise that does not fit into the strategy for an ideal ecorestorative project.
- ♦ Habitat improvement must be done within the area that has been initially planted with exotics even after several years.

### 7.1 Selection of Appropriate Species Based on Local Ecological Principles

Plant species must include trees shrubs climbers and ground flora. These must be based on the biogeographic location. As soil quality is altered after mining certain species may not be able to grow in mined out lands. Rare and endemic plants should be important components of the restoration process.

### 7.2 Key Issues

Habitat restoration is a site specific issue. It includes restoring forests, grasslands, hill slopes, mountains, plateaus, rock outcrops, semiarid systems, and deserts. Water bodies and rivers require special attention as they are important sensitive ecosystems. Ecosensitive Areas (ESAs) are landscapes that require habitat specific restorative techniques. Restoring mined areas in evergreen forests of the Western Ghats for example has severe limitations.

Linkages to local people's use that is a part of a restorative process would require a PRA before the mining is done to understand the local resources that support their life and wellbeing. This includes developing potable water resources, preventive health measures, housing and other concerns that are responsible for the 'quality of life' in the region. The ecological and social footprint of mining activities is far wider than the actual mining site. This must be taken into account during the planning, implementation and post mining phases.



### 7.3 Biodiversity Conservation Issues Related to Mining in Ecosensitive Areas

Mining results in the creation of gaps – fragmentation and isolation. The theory of island biogeography suggests that biodiversity conservation in its true sense requires large continuous tracts of land in as inviolate a condition as possible. Mining results in honey-combing of bio rich natural ecosystems for many decades after it is completed. There are several examples even from historical times. Mining for iron ore in the plateau forests of the crestline of the Western Ghats to manufacture high quality implements and weapons of war, was done during the Peshwa period. This has left blanks in the forests around Mahabaleshwar even to this day. Old mining concessions in the Ghats for bauxite and manganese have created large gaps in the evergreen and semi evergreen forests long after the activity has been abandoned, around protected areas of Goa and Maharashtra (BVIIEER 2010). Thus, orphaned mines, even if left alone for decades do not undergo succession to a desired level of naturalness. Climax ecosystems seem unobtainable even after years of effort. Evergreen and semi evergreen forests are the most fragile ecosystems. These areas are also the most resistant to standard rehabilitation techniques and are highly susceptible to re-degradation after restoration efforts have been made. Attempts to plant these areas with indigenous climax species to 'hop step and jump' towards a natural forest could take decades and is a costly process.

### 7.4 Destruction of Corridors: Retaining Minimum Viable Populations and Migration Routes

Several of India's mining concessions are situated in the forested corridors between Protected Areas. These tracts of mined lands are important corridors that connect the PAs, forming a vitally essential interconnected network. These corridor forests permit species like tigers and elephants and many other mammals, birds and other taxa to disperse from source populations to adjacent sink areas. This establishes a viable number of interbreeding animals for genetic purposes. Mined areas are invariably tracts of land which animals require for migration for their survival. They must cross and move seasonally to alternate areas for food. Elephants for example must move seasonally between forest areas to grasslands through well-defined corridors. A study of satellite images of mined regions demonstrates the disastrous effects on forest through mining concessions in ecologically and biogeographically sensitive locations.

### 7.5 Landscape Level Planning

To be able to secure the integrity of networking Protected Areas, especially in ecologically fragile regions such as the Western Ghats, the regional carrying capacity of mining must be an initial exercise. As in many situations mines area already present, the intervening forest ecosystems may be the last refuges, corridors, or jump sites, for a variety of endangered or endemic flora and fauna. Thus rather than individual EIAs there should be a comprehensive Carrying Capacity Study to appreciate the impacts of all the mining projects, roads, industry etc. in the region.

### 7.6 Impacts on National Parks and Wildlife Sanctuaries

The impact of mining on PAs is not limited to the fringe of Protected Areas, but is from peripheral mining activities several kilometers from the PAs. This has led to the MOEF stipulating that a buffer must be declared as an Ecologically Sensitive Area where no mining or other damaging activities may be permitted. Whereas a 10 km buffer was initially recommended this has been modified wherever necessary, often to the detriment of wildlife.

The MOEF stipulates the need for maintaining Critical Wildlife Habitats as a long term biodiversity conservation strategy. These are frequently within the surroundings of PAs or Tiger Reserve which are also sites for existing and potential mining concessions. Using such buffer areas around PAs or Tiger Reserves for mining will have disastrous consequences for biodiversity preservation due to direct impacts on ecosystems and species as well as destruction of corridors.

### 7.7 Expected Outcomes of Ecorestoration

The expected outcome of ecorestoration as a means of supporting biodiversity conservation in potentially minable, or mined out landscapes, has now become of critical importance. Islands of forested lands isolated



from each other will be incapable of preserving biodiversity in the long term. Thus a wider landscape approach to mining leases must become part of mining policy and regulation. The areas that are mined out and are being restored will require constant monitoring and evaluation of the mining leases must become part of mining policy and regulation. The areas that are mined out and are being restored will require constant monitoring and evaluation of the mined area and its surrounds. While there are several good indicators of successful rehabilitation, the benchmark must be set even before mining is undertaken (BVIEER 2010).

### **Monitoring and Evaluation**

Growth of natural vegetation after rehabilitation

Recolonization by local flora through natural processes of succession

Reappearance of Indicator species of Fauna: Mammals / Birds / Reptiles / Amphibia / Insects.

Reformation of microhabitats and niches:

Restoration of the local ecosystems - Microhabitats: Aquatic: Streams; Pools; Terrestrial: Canopy cover; Shrub layer; Climbers; Ground flora.

Natural recolonization by fauna through corridors

Reappearance of unwanted exotic weeds

A review of some mined areas in India has demonstrated that the issue of using indigenous species to recreate biologically appropriate ecosystems is under represented in most mined areas. Whereas the plantations have consisted of using varieties such as eucalyptus, subabul, acacia auriculoformis, which grow rapidly, they do not support the recolonization by local fauna. In areas where experimental plots of local species have been used for plantations the results are slow and relatively more costly. Successful outcomes need to be evaluated and best practices relevant to individual biogeographic zones have to be documented, so that they can be replicated. In some areas where the tree plantation program has used local species the saplings have remained stunted even after a period of five or more years. Thus much greater effort and care over a prolonged period is probably an essential strategy to achieve a greater degree of success. While the plantation is monitored for its tree cover, its utilization by fauna is not quantified, thus the true value of a biodiversity oriented restoration strategy remains ambiguous. Natural areas are invariably formed by a heterogeneous mosaic of microhabitats. This is essential for the maintenance of a biologically sustainable and self-regulative ecosystem. Indicators and tools to evaluate the real success of a restorative strategy for a mined area need to be evolved.

### **Implementation of a Biodiversity-oriented Strategy for Mines**

- ◆ Enhancing local species composition and vegetation structure – species richness, biomass, and carbon sequestration
- ◆ Maintaining heterogeneity and mosaic of multiple landscape elements
- ◆ Recreating a functioning ecosystem: Water regime, nutrient cycling, evolutionary process,
- ◆ Supporting interconnectedness in the ecosystem: Food chains, ecological pyramid, pollination, seed dispersal and other processes
- ◆ Enhancing succession towards a climax vegetation
- ◆ Reducing risk of stochastic events: Floods, draught, fire and climate change
- ◆ Managing low NPK levels and soil characteristics altered by mining
- ◆ Preventing invasion by weeds and exotic species of plants
- ◆ Support for environment education and public awareness
- ◆ Final outcome – Reproducing a natural ecosystems of great value



## 8.0 Conclusion

There is a long way to go before mining restoration can become a biodiversity oriented process. It entails new policy initiatives, creation of expertise in eco-restorative management, and evolving monitoring and evaluation procedures.

This requires a clearer vision of what is required after the rehabilitation of a mined area. While this requires new guidelines and norms to be established, it will necessitate site specific alterations as mined lands suffer from different levels of degradation. There are areas where good restorative efforts are achievable to a high degree of success. Others which are ecosensitive and fragile, are resistant to restorative management. The final outcome that forms a benchmark is the occurrence of natural species richness and abundance through the eventual spontaneous colonization of locally relevant flora and fauna. The presence of endangered and endemic species of plants and animals is a sensitive indicator of the success of the program.

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- *Environmental mitigation measures by the mining industry have been inadequate and have not led to appropriate conservation of natural resources and biodiversity.*
- *Need for sustainable development framework for mines and restoration and mitigation measures for mines has been stressed but there are still serious inherent conflicts within these areas, both with local people and for wilderness conservation.*
- *Ecorestoration of an area must go much beyond the realm of greening, to the preservation of biological diversity and ecological processes and need to be locale specific.*
- *Ecodevelopment' refers to ecologically oriented sustainable economic development for local people.*
- *Ecorestoration as well as ecodevelopment for local inhabitants should become a part of future mining processes.*
- *Appropriate restorative measures take decades. Thus financial inputs into restorative programs may be required for much long periods of time, frequently even after the lease period is over. Hence, monitoring of restoration sites and surroundings is required.*
- *The ecological and social footprint of mining activities is far wider than the actual mining site. This must be taken into account during the planning, implementation and post mining phases.*
- *A clear vision of what is required after the rehabilitation of a mined area must be part of regional planning process.*





## Habitat Restoration in Bauxite Mines: Case Study of Two Mines of Hindalco Industries Limited

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### 1.0 Introduction

Durgmanwadi and Kasarsada are two captive operational mines of Hindalco Industries Limited in Kolhapur District of Maharashtra. They are located in the Western Ghats of Maharashtra, which is among the 25 biodiversity hotspots across the globe (Myers et al 2000).

As a company committed to environmentally friendly mining, Hindalco had been carrying out concurrent restoration at both the mines since the inception of the mines. In 2007 Hindalco invited Envirosearch to participate in the Mine Restoration Activity.

Envirosearch proposed the following objectives for the mine restoration project:

- i. Restoration of vegetation cover on the mine
- ii. Restoration of native ecological diversity on the mine site including vegetation and faunal diversity
- iii. Return the land to a productive state

#### Location Map of Durgmanwadi and Kasarsada



### 2.0 The Ecology of Lateritic Plateaus

Bauxite occurs at the top of lateritic plateaus known locally as 'sada'. The plateaus occur at a height above 1000 m at or near the crest line of the Western Ghats. Bauxite is found on these plateaus under a cap of laterite that is generally a few metres thick. Below the bauxite is a layer of lithomarge clay.



Because of their geographical location, lateritic plateaus experience high rainfall during the monsoon. During these months it rains continuously and the plateaus are covered with clouds, rarely experiencing sunlight. During the rest of the year the plateaus do not receive much rainfall. Lateritic plateaus are rocky in nature with a thin layer of soil interspersed with bare rock. Trees occur in thickets, wherever there are pockets of deep soil, interspersed with rocky, open stretches. The slopes bordering the plateaus are generally covered with thick forest, unless they have been cut by the local community.

Because of these harsh conditions, the unmined plateaus appear barren and lifeless during the drier months. But in monsoon the plateaus come to life and are covered with ephemeral herbaceous plant species. Towards the later part of the monsoon the unmined plateaus are covered with a carpet of flowers and looks very beautiful. The ephemeral monsoon flora is very diverse and contains several endemic species, i.e. species that are found only in this part of the Western Ghats. The flora of lateritic plateaus is considered unique because of their endemic nature and some of them are in the category of endangered species.

### 3.0 Challenges of Mine Restoration in Bauxite Mines

The challenges for restoration of bauxite mines are different from other opencast mines because of the unique conditions on these plateaus. Firstly the high rainfall and wind velocity is not tolerated by many plant species of the lowlands which are commonly used for restoration. Secondly the clay substrate remaining behind after extraction of bauxite is inert and poor in nutrients. It also has low permeability and poor drainage owing to its texture. Though the topsoil is saved and stored before removal of the lateritic cap the quantity is generally small and not sufficient for restoration.

Considering these conditions, rehabilitation of these mines poses a big challenge. In order to overcome these hurdles, we decided to follow a two pronged approach – rejuvenation of substrate and selecting native species for rehabilitation.

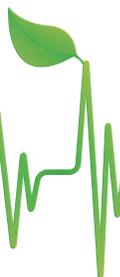
### 4.0 Rejuvenation of Substrate

Two types of substrates were considered for restoration, in situ clay substrate and areas backfilled with overburden. Plantation on back-filled areas is preferable because it is more conducive to plant growth; restoration was carried out on backfilled areas wherever possible. However, since there was a shortage of overburden for back-filling, restoration was carried out on in-situ clay substrate at other places.

A combination of bagasse and pressmud, which are by-products of the sugar industry, was used for amelioration of the substrate. They provide organic material which is lacking in the substrate. Farmyard manure and vermi-compost was also added to the substrate for introducing bacteria and earthworms that are helpful to accelerate the process of soil formation. Soil is also very important in the restoration process so we used mine topsoil whenever it was available or tank silt transported from nearby irrigation tanks. All these were procured at considerable cost by the company. Experiments were carried out with various proportions and combinations to determine the best mix.

### 5.0 Selection of Suitable Species for Rehabilitation

In the first year of the restoration project we carried out a biodiversity survey of the mines and surrounding lease area. This helped us in setting the goals of the restoration program and gave us insights to species selection. Based on the biodiversity survey, around 35 species were short-listed that grow in surrounding forests. This list is a mix of pioneering, fruit-bearing and locally important keystone species as well as some species of conservation importance. The pioneering and fruit-bearing tree species include Gholi (*Trema orientalis*), Chandada (*Macaranga pultata*), Bhoma (*Glochidion ellipticum*) and Kumbhi (*Careya arborea*). Besides these species we used ecological keystone species such as Jambhul (*Syzigium cumini*), Anjani (*Memecylon umbellatum*), Nana (*Lagerstroemia microcarpa*), Umbar (*Ficus racemosa*), and economically and medicinally important species like Hirda (*Terminalia chebula*), Narkya (*Nothapodytes nimmoniana*), Awala (*Phyllanthus emblica*) and Karanj (*Pongamia pinnata*) in the rehabilitation and restoration program. The short-listed species also include shrubs like Karvi (*Carvia callosa*), Dinda (*Leea indica*), Baman (*Colebrookia oppositifolia*) etc.



These species do well because of their hardy nature and adaptation to the local climate. Though some of them are slow-growing they have high survival rate because of their suitability for local conditions. This mix of species has helped in restoration of the area, reestablishment of native floral and creation of floral diversity. In the long run it will help to recreate a habitat for fauna of the area such as birds and small mammals.

### 5.1 Nursery Development and Capacity Building of Local Nursery Owners

Obtaining seedlings of these species was difficult; commercial nurseries do not stock them since they are not commonly used for plantation. Forest Department nurseries stock some of these species but not all. We used a variety of propagation techniques for creating seedlings of these forest species and were successful in developing many of the desired species.

Some of the techniques we tried and tested in our nursery include,

- ♦ Propagation with the help of cuttings: Some species can easily be propagated by cuttings and this technique turned out to be a major breakthrough.
- ♦ Propagation using naked seedlings: Includes transplanting seedlings from the wild to nursery
- ♦ Seed sowing: Collection of seeds of native plants round the year and propagation using this material

The company established a nursery of native plants in their Chandgad colony and the nursery workers were trained in propagation techniques. At Durgmanwadi, enterprising local nursery owners were trained in these techniques and they now supply the seedlings of these plants. It is a year-round activity that includes collection of seeds, seedlings, their germination and propagation. It was started with 10-12 species in first year and now almost 40-45 species are used in the rehabilitation program.

### 6.0 Restoration Model

Several restoration models can be used such as forest, grassland, wetland, agriculture, horticulture etc. Since one of the mines is on forest area and the other is adjoining a sanctuary it was logical to restore them to a natural habitat. Two natural models were available. The first model is the thick forest that is found on the slopes surrounding the plateaus on which the mines are located while the second model is the ephemeral monsoon flora habitat that is found on lateritic plateaus of Maharashtra Western Ghats.

At the outset a decision was taken in consultation with the company, to recreate a forest ecosystem, since this was an easier model to restore to and tree plantation is a well established technology. So far 11 ha area has been rehabilitated using the forest ecosystem model at both the mine sites. The following photographs are time lapse images of certain rehabilitated plots. After creating conditions suitable for growth of plants evidences of natural re-colonization were found of the restored area. In the first year only shrub and herb species grew there. In subsequent years seedlings of shrub and tree species have started colonising the area. This is a very desirable development because natural re-colonisation will help to create a rich ecosystem with more diversity than is possible by tree plantation alone.



Before restoration October 2007



After restoration October 2009



The monsoon flora model of lateritic plateaus is more complex so it was decided to take it up at a later stage. At present experiments are carried out to recreate this ecosystem also. It was started with a small plot on which the meadow ecosystem was replicated with moderate success. The photographs below show the results of these trials. It is planned to continue these trials so that more native species colonise these plots and the ecosystem approaches closer to the natural ecosystem found on lateritic plateaus.



**Results of trial plot for restoration of herbaceous flora (meadow vegetation) of lateritic plateaus**

Monitoring is done in the restoration area on a monthly basis. The main focus of the monitoring is re-colonization and re-establishment of native biodiversity. The growth of the plants annually is measured so that the success of our interventions can be evaluated. This is an important feature of the restoration project.

### 7.0 Achievements so far

The main achievements of the project are given below:

- ♦ Area of 11 ha area restored at Durgmanwadi & Kasarsada Mines (Plantation of nearly 22000 plants).
- ♦ More than 80% survival rate in most plantations
- ♦ Growth rate superior to past restoration areas that did not receive the amelioration treatment
- ♦ Presence of more than 60 tree species in the plantations including tree species that have re-colonised naturally
- ♦ Colonization of several native shrubs and trees such as Rametha (*Gnidia glauca*), Pangli (*Pogostemon deccanensis*), Baman (*Colebrookia oppositifolia*), *Leucas stelligera*, Gholi (*Trema orientalis*), Umbar (*Ficus racemosa*), Ran tambaku (*Lobelia nicotifolia*), Rantoor (*Cajanus lineatus*), *Flemingia strobilifera* etc.
- ♦ 55-60% of natural meadow herbs have colonised in the restored area including some of the ground orchid species and insectivorous plants such as *Utricularia* and *Drosera*.
- ♦ We have found several evidences of wildlife presence such as Gaur, Sambar, Hare and Civet in restored areas

### 8.0 Discussion

During the past few years of the implementation of this project with Hindalco, several lessons have been learnt and people have become aware of several policy issues that affect mine restoration in general. Some important issues in this respect are discussed in this section.

Ecological restoration is a slow process and needs years of aftercare after the initial intervention. Under the present rules the company's presence on the mine ends once they complete the mining. The restoration process therefore suffers once the company leaves the mine. In fact all the efforts may be completely reversed in a few years.



There is no requirement for a restoration plan by the Indian Bureau of Mines (IBM). The mine closure plan is the only document that IBM requires so this is the closest approximation to a mine restoration plan. Mine closure plans rarely have any ecological component. Their restoration component generally consists of a tree plantation schedule. The final ownership and probable land use are rarely considered in the mine closure plan. Management of the mine after mine closure is also rarely discussed.

Since there is a general lack of environmental awareness and expertise, the most common restoration model is tree plantation. Alternative restoration models are rarely found. The ecological setting of the mine is also rarely considered. This dilemma was experienced when deciding the model for restoration at Kasarsada and Durgmanwadi. Though we suggested restoration of plateau flora as one of the models the company was reluctant to accept it because the visiting officers and dignitaries do not recognise this as an acceptable restoration model. At present the tree plantation model and carrying out experiments on plateau flora restoration on small plots is being carried out.

Overall there is a tremendous lack of expertise and awareness regarding the issue of ecological restoration in the industry and also within the only monitoring body, IBM. Hence it is not possible at present to prepare elaborate mine restoration plans. There is a need to create a department within IBM exclusively for ecological restoration. This department should be responsible for approval of restoration plans and for monitoring their implementation. IBM should take the lead in creating awareness and expertise within the industry on this front.

The existing rules for mine restoration are loosely worded and leave loopholes for companies to avoid restoration or implement it in cursory manner. Several mines are closed without proper restoration or with very casual restoration. The monitoring and enforcement mechanism is weak so mines can get away with poor restoration. There is a need for guidelines describing restoration models and design of restoration models. There is a need for manuals for selecting restoration models, devising restoration technology and preparing restoration plans. There is a need for standards for monitoring quality of restoration. There is a need for introducing mechanisms for monitoring and enforcement of mine restoration.

Operation of mines needs environmental clearance from the Ministry of Environment and Forests based on their EIA reports. Since many mines are on forest land permission for diversion of forest land under Forest Conservation Act, 1980 is often required from the Forest Department besides applying with Forest Rights Act, 2006. While granting these clearances and permissions the track record of the company is not taken into consideration. The local Forest Department, while appreciating the efforts of the company, has also not engaged with the company in a constructive manner. Companies like Hindalco, who have invested considerable resources in ecological restoration, are therefore likely to be discouraged and lose interest in carrying out good quality restoration. This will be a loss for the mining industry and for environmental and biodiversity conservation. There should be a reward mechanism for recognising the efforts of companies like Hindalco. There is also a great need for various stakeholders to engage constructively on this subject and to evolve consensus and improve the quality of mine restoration.

### **Acknowledgements**

We are grateful to Hindalco Industries Limited for involving us in their restoration project and their support and cooperation in its implementation.



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- *Ecorestoration of the bauxite mines in the Western Ghats of Maharashtra was a major challenge owing to the physical conditions being unsuitable for vegetation post-mining.*
- *Rejuvenation of substrate, choice of plantation species, followed by development of saplings of the species were the important steps in ecorestoration programme. This had to be accompanied by capacity building of staff and local communities to manage the restoration programme. It met with good success due to the effort of company and consultants.*
- *Based on the experience, it is suggested that,*
  - a. *choice of restoration model should be based on local conditions rather than a single tree-plantation model*
  - b. *a proper ecorestoration plan should be required in addition to mine-closure plan, prepared by competent experts and reviewed by a separate expert panel in IBM which needs to be created*
  - c. *monitoring and enforcement mechanism for ecorestoration of mines should be introduced*
  - d. *incentives especially financial incentives for the industry can be given for compliance to ecorestoration norms*
  - e. *various stakeholders need to be engaged constructively to evolve consensus and improve the quality of mine restoration*





## Issues Related to Impact on Landuse due to Mining in Power Grade Coalfields in India and Reclamation Approaches

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### 1.0 Introduction

With its contribution of nearly 60% of the total commercial energy consumption in the country coal continues to play a pivotal role in shaping the profile of National economy of a developing nation like India. A share of such magnitude in the commercial energy spectrum of the country is in conformity with comparatively favourable resource potential of coal vis-à-vis other energy resources like oil and natural gas. To make coal industry more efficient Government and private sector players mostly in power and also in cement and steel are being allocated coal blocks for mining. Coal Mines Nationalisation Act already amended in 1993 for captive mining by private entrepreneurs is expected to undergo further amendment to pave entry for private sectors more freely. A huge energy demand projection [950,000 MW by 2030] from present installed capacity of 147,000 MW places a phenomenal increase of demand of power grade coal in the country.

Keeping in pace with rapid growth of power grade coal demand, power grade coalfields are likely to be subjected to a compounded environmental pressure. Power grade coalfields in India are in river valleys that host rivers and large tract of forests and agricultural lands amid a majority of tribal population. The pristine environmental quality in typical rural set ups are impacted due to large scale open cast mining and also due to coal based industries viz., thermal power plants. McCarthy (2002) observes that in the liberalised era, on one hand, government agencies must help reduce the barriers to private-sector by addressing the uncertainties created by four major issues: legal liability for contamination, uncertain cleanup standards, availability of funding for redevelopment and complicated regulatory requirements; on the other hand, coalfields must be connected to wider community efforts to achieve environmental protection, central city revitalisation and reduced suburban sprawl. Share of surface mining which is more instrumental to land degradation is rising decade after decade. At present, in coal sector the figure is 87%. Land degradation in coal sector, at a very fast rate, compounded with the problem of huge waste generation due to aging (increase in stripping ratio) of the opencast mines, have made it abundantly clear that backfilling of the surface mined land has paramount importance in the context. Unfortunately no co-ordinated attempt so far has been made to evolve a strategy for maximization of backfilling in various geomining conditions, in India.

### 1.1 Increased Coal Demand Primarily for Power Grade Coal

When the coal industry was nationalised in 1973, the production of coal from surface mines of Coal India Limited was only 16.4 million tonne (Mt) but over the years this figure has grown by about 33 times in 2009-10. The domestic coal production in 2009-10 was 532 million tonne. Production grew at a compound annual growth rate of 5.8 per cent between 2000-01 and 2009-10.

The total domestic coal consumption is mainly driven by three sectors – power, steel and cement. These three sectors corner about 84 per cent of the total coal despatched in the country. The growing dominance of the power sector in coal consumption (77 per cent share as on date) has led to clamour for organised lobby groups by other sectors.



## 1.2 Rising Share of Open cast Mining

At present, open cast mining accounts for 87.10 per cent of coal production making it the dominant method of mining in India. Underground mining has been consistently losing its share in total coal production over the ten year period. CIL production from underground mines has been declining while SCCL production has remained in the range of 12.5 to 14 million t. Open cast mining production by both companies have increased consistently.

## 1.3 Power Grade Coalfields will Drive the Coal Production Movement

Coal resources in India are mainly distributed along the river valleys viz. Damodar valley, Sone-Mahanadi valley, Pench-Kanhan valley, Wardha-Godavari valley etc. The bulk of the coal reserves are located in the South-eastern quadrant of the country bounded by 78° 8' East Longitude and 24° 8' North Latitude in West Bengal, Bihar, Jharkhand, Orissa, Chhatisgarh and eastern Madhya Pradesh. In all, 57 coal basins exist in these areas. Total spread of Gondwana coalfields is approximately 64,000 sq.km. A total of 194 billion tonnes of coal reserves are estimated of which non-coking coal reserves are as much as 165 billion tonnes (CIL, 1993). 99.5 % of the resources occur in Gondwana formations. Open cast mines are planned normally for deposits within 300 m depth. Deposits of coal in Talcher, Ib Valley, Korba, Singrauli and North Karanpura within 0-300 m range are given in **Table 1**. This table indicates that in all the power grade coalfields, substantial reserve is reachable by open cast mining. In fact, in these coalfields coal exploitation is carried out mostly by open cast mining. This trend is to continue in the unforeseeable future.

**Table 1: Depth-wise Coal Deposits in Major Power Grade Coalfields**

Coalfield	Depth (m)	Reserve (Million t)*
Talcher	0 – 300 m	22028 (86.8%)
	Below 300 m	3337 (13.19%)
Ib river	0 – 300 m	12986 (62.39%)
	Below 300 m	7828 (37.60%)
Korba	0 – 300 m	6980 (76.85%)
	Below 300 m	2102 (23.15%)
Singrauli	0 – 300 m	2152 (54.63%)
	Below 300 m	1787 (45.36%)
Rajmahal	0 – 300 m	8638 (77.78%)
	Below 300 m	2464 (22.21%)
North Karanpura	0 – 300 m	7579 (74.15%)
	Below 300 m	2641 (25.84%)

\*Total of Proved, Indicated and Inferred categories



Resources, infrastructural and geological characteristics of the power grade coalfields present a significant similarity. The coalfields are drained by major rivers which serve as water sources for thermal power plants and down line coal based industries. Thermal power plants require substantial water quantity. Each of the power grade coalfields have strong communication network through rail and road link which is a prerequisite for industrial development. The power grade coalfields host a number of thermal power plants. The power grade coalfields are in the State of Orissa, Madhya Pradesh, Bihar and Jharkhand where climate is tropical to sub tropical. Rainfall is plenty (1200-1600 mm annually) through a distinct south west monsoon ranging predominantly from June to August. Temperature in summer peaks at 48-50°C whereas in winter it drops down to as low as 5°C in some of the coalfields. The power grade coalfields exhibit the following general site related features:

- ♦ Valleys amid undulated hilly topography. The plains have elevation range of 250-300 mRL and the hill tops are, in general, at 500-600 mRL.
- ♦ Protected and reserve forest cover especially in the hill tops.
- ♦ Valleys have substantial agricultural fields because of good drainage at river basin.
- ♦ The coalfields have a similar socio-economic profile with predominance of migration economy and agriculture as the second alternative employment.

Lower Barakars are main host formations for power grade coal. The coal seams in all the coalfields are thick, have gentle dips (3° - 8°); seams disturbed by moderate to intense faulting and in all cases the faults are responsible for repetition of coal seams. **Table-2** lists infrastructural simile of the identified power grade coalfields.

**Table 2: Resources and Infrastructures in Power Grade Coalfields**

Coalfield	Major river	Major road network	Major Railway branch	Power stations
<b>Talcher</b>	Brahamani	NH-23 and NH-42 and network of State Highways	Puri-Talcher branch line of South-eastern Railway	NTPC TPS at Talcher and Kaniha. Captive PPs of NALCO, FCI
<b>Ib Valley</b>	Ib	NH-42 and network of State Highways	Howrah-Mumbai main line	NTPC TPS
<b>Kobra</b>	Hasdeo	Bilaspur-Kathgora-Ambikapur State Highways	Champa-Korba-Gevra road branch line of South-eastern Railway	NTPC TPS at Korba, Captive PP of Balco.
<b>Singrauli</b>	Gopad, Rihand, Moran and Dhanser	Network of State Highways	Katni-Chopan Raiway line	NTPC TPS at Singrauli, Vindhyachal, TPS at Renusagar, Anpara, Obra
<b>Rajmahal</b>	Ganga	Network of State Highways	Sahebgunj loop of eastern Railway	NTPC super TPS at Farakka, Kahalgaon
<b>North Kanapura</b>	Damodar	NH-33 and network of State Highways	Dehri-on-sonne- Gomoh loop line of eastern Railway	Patratu TPS



It has been estimated that total coal bearing areas under various coalfields are 22,549 km<sup>2</sup> (Kadekodi, 1989). Major portion of the reserves in Orissa and Madhya Pradesh are still unopened. In India, about 519 coal mines are working at present and the actual area covered by past and present coal mining is 3614 km<sup>2</sup>.

## 2.0 Thermal Power and Coal Mining

### 2.1 Gradually Shrinking Usable Land in Coalfields

Among the major resources available in India, the most important is land comprising soil, water and associated plant and animals involving the total ecosystem. The country's demand for food, energy and many other needs has to depend on optimal utilisation of this natural resource. With about 15% of the global population and only about 2.5% of the global land resources, the pressure on land is obvious (Mukhopadhyay & Sinha, 2001). Per capita availability of land declined from 0.9 ha in 1951 to 0.5 ha in 1980-81, 0.26 ha in 2001 and slated to be 0.17 ha in 2015. The availability of cultivable land is even worse. Per capita availability of cultivable land has declined from 0.48 ha in 1951 to 0.26 in 1980-81 and expected to be 0.08 ha by 2015 AD (NLWDC, 1985). Along with various natural and anthropogenic causes for land degradation, like relentless pressure of increasing human and cattle population, reckless exploitation of forest resources by irrigation, river valley and various other industrial projects etc., mining also, to some extent, has contributed towards gradual depletion of agricultural, forest and pasture land due to increased demand for fossil fuels and minerals in the last four decades. Actual land area degraded due to mining may be around 0.2% (Choudhuri, 1995) of the total land surface area of 304 million ha (Dhar, 1990).

Although these figures look fairly small, the issue cannot be neglected as the local effects of mining, e.g. degradation of forest land, drying of ground water, loss of agricultural land etc., are very much intensive. From a different angle, when the percentage of mining land disturbance (of total land) in India is compared with that of advanced countries like Australia and US (Table 3), our figure looks disappointing (Bell, 1986). Most of the coal occurs under good agricultural lands in West Bengal, Jharkhand and Orissa.

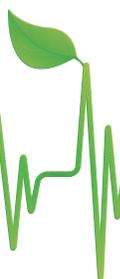
In absolute terms, the local land degradation effects and thus, loss of mined area is quite substantive and alarming taking the future needs into account (Choudhuri, 1995). Currently the coal industry alone is rendering about 1500 ha of land biologically unproductive every year in addition to the land areas rendered derelict due to past activities. Land degradation is largely responsible due to more and more dependence on surface mining. Virtually all surface mining methods produce dramatic changes in the landscape due to large scale excavation.

A study (Sachdev, 1995) has revealed that coal mining done in the past has generated 1728 ha void land and another 2120 ha land locked under overburden dumps.

**Table 3: Extent of surface disturbance coal mining in Australia and the USA**

Australia			USA		
Area distribution		Proportion of land surface	Area distribution		Proportion of land surface
(ha)	(%)	(%)	(ha)	(%)	(%)
29,000	28	0.0038	635,000	43	0.069

It is estimated that out of the total additional land required for coal mining, 35-40% is agricultural and another 30% are forest stands (NLWDC, 1985).



Another study carried out by CMPDI, Ranchi, on restoration of old abandoned mines reveals that backlog of quarry backfilling exists mainly in ECL and BCCL. In BCCL although all the voids are reclaimable but in ECL only 36% of the voids are reclaimable. Extent of maximum possible backfilling in 20 important ongoing and forthcoming projects have been listed (CIL, 1995) in **Table 4**. Alongwith other influencing geomining factors, almost all the coal deposits in India occur in flat to moderately undulating, gently sloping or rolling ground.

## 2.2 Increased Backfilling for Land Restoration is the Only Way

U.S. National Academy of Science Study Committee (NASSC) has given precise definition (Anon, 1974) of Restoration, Reclamation and Rehabilitation. As defined by NASSC, restoration is the replication of the site conditions prior to disturbance; Reclamation renders a site habitable to indigenous premining condition organisms. Rehabilitation defines that disturbed land will be returned to a form and productivity in conformity with a prior land use plan including a stable ecological state that does not contribute substantially to environmental deterioration and is consistent with surrounding aesthetic values. The amount of maintenance required to achieve rehabilitation is the difference between the post mining goal and the sum of severity of disturbance and the environmental conditions governing the site ecology (Harthill and McKell, 1978).

The overall operational plan consists of two primary components, the mine operational plan and the rehabilitation plan. The operational plan represents the most rigid segment of the concept and may be viewed as the ultimate compromise between mining and rehabilitation proposals. The rehabilitation proposal may consider one or a combination of possible potential post mining land uses such as cropland, pastureland, grazing land, forestry, residential use, industrial/commercial use, recreation (parks or water based), pisciculture, conservation of natural wildlife habitat, developed water resources, landfill sites etc. Among the alternatives, except for the water based choices, all other land uses require backfilling as a prerequisite.



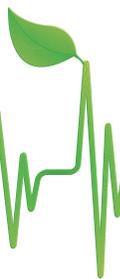
**Table 4: Backfilling status in some of the important ongoing and forthcoming open cast coal mining project**

Backfilling status												
Geomining particulars					Backfilling status							
Mine	Mining method	Stripping ratio	Max-Quarry depth	Nos. of seams	Seam gradient	Total area	External dump		Pit Backfilling		Void left	
							5 yrs. (ha)	Life (ha)	5 yrs. (ha)	Life (ha)	5 yrs. (ha)	Life (ha)
Production (Mt/yr) 1	2	3 (m <sup>3</sup> /t)	4 (m)	5	6	7 (ha)	8	9	10	11	12	13
Bina (4.5)	Dragline/Shovel-dumper	2.2:1	165	2	2°-5°	1284	60	60	471	877 (90.2%)	88	95
Dudhichua (10)	Dragline/Shovel-dumper	3.3:1	235	3	2-3°	1694	152	152	215	945 (77.4%)	80	275
Jayant (10)	Dragline/Shovel-dumper	3.5:1	215	3	1-3°	2468	119	119	452	1309 (91.9%)	80	114
Jhingurda (3)	Dragline/Shovel-dumper	1.5:1	290	2	9-11°	1200	214	260	0	0 (0%)	195	235
Nighai (10)	Dragline/Shovel-dumper	3.8:1	240	4	1-4°	3036	313	473	285	1875 (100%)	20	0
Ananta (5.5)	Dragline/Shovel-dumper	0.52:1	115	5	1-3°	810	14	29	141	226 (61.9%)	81	139
Belpahari (20)	Dragline/Shovel-dumper	2.31:1	67	2	2-3°	1601	90	90	180	356 (81.4%)	80	81
Bharatpur (5.0)	Shovel- dumper	0.8:1	130	3	3-5°	1237	40	50	63	227 (67.8%)	51	131
Jagannath (4)	Shovel- dumper	0.6:1	50	2	2-4°	793	36	36	120	285 (71.0%)	110	116
Lakhanpur (5)	Shovel- dumper	1.01:1	90	1	2-5°	1413	18	18	80	351 (74.6%)	90	119
Samleswari (3)	Dragline/Shovel-dumper	0.87:1	69	1	2-4°	906	49	49	61	166 (58.2%)	90	119



**Table 4: Backfilling status in some of the important ongoing and forthcoming open cast coal mining project**

Geomining particulars										Backfilling status			
Mine	Mining method	Stripping ratio	Max-Quarry depth	Nos. of seams	Seam gradient	Total area	External dump		Pit Backfilling		Void left		
						(ha)	5 yrs. (ha)	Life (ha)	5 yrs. (ha)	Life (ha)	5 yrs. (ha)	Life (ha)	
Production (Mt/yr)	2	(m <sup>3</sup> /t)	(m)	5	6	7	8	9	10	11	12	13	
Durgapur (1.89)	Shovel- dumper	3.5:1	105	1	1-3°	821	107	107	92	149 (67.7)	126	71	
Sasti (1.25)	Dragline/Shovel-dumper	3.4:1	109	1	2-4°	714	118	118	43	64 (45.3%)	32	77	
Umrer (2)	Dragline/Shovel-dumper	1.8:1	100	3	1-3°	807	82	82	100	104 (60.1%)	49	69	
KD Hesalong (4.5)	Shovel- dumper	1.2:1	120	7	1-2°	481	15	15	89	228 (75.7%)	69	73	
Parej (1.75)	Shovel- dumper	2.7:1	102	5	2-4°	395	35	35	0	122 (55.45%)	75	98	
Rajrappa (3)	Shovel- dumper	2.9:1	75	3	11°	1417	170	304	47	127 (179.5%)	181	101	
Bisrampur (1.10)	Dragline/Shovel-dumper	6.5:1	34	1	2-3°	1472	20	20	1102	1190 (94.2%)	70	72	
Dhanpuri (1.25)	Dragline/Shovel-dumper	4.1:1	70	1	3°	746	37	37	156	416 (93.2%)	26	30	
Dipka (10)	Shovel- dumper	0.96:1	140	1	2-4°	1744	144	191	47	440 (78.9%)	148	117	
Gevra (10)	Shovel- dumper	1.98:1 to 1.3:1	180	2	4-9°	2752	223	613	111	1012 (75.01%)	545	337	



### **Backfilling facilitates the followings:**

- ♦ Backfilling supports revenue earning post mining land use, thus, attaches/restores some economic value to the land that is otherwise considered lost.
- ♦ Backfilling helps maintain the aesthetic beauty by repairing ugly scars on earth's crust in the form of mined out voids and overburden dumps.
- ♦ In most cases backfilling generates the "non substitutable" land resource in two ways. First, the filled void and secondly, the saving in overburden disposal land.
- ♦ Reclamation engineers in advanced countries consider that it is not always a necessity that the premining land use need to be restored. A better need based land use can be planned.
- ♦ Surface air and water contamination as a result of air borne and water borne particulate erosion from overburden materials stacked in dumps, are reduced considerably when the materials are buried by backfilling.
- ♦ Backfilling in most cases, partially or completely precludes the formation of overburden dumps. Thus safety problems due to slope failure of dumps etc are avoided.
- ♦ Huge quantity of water accumulated in surface mine void acts as a potential threat to a nearby mine. This danger is avoided when the void is filled.
- ♦ Backfilling also caters to the social needs of ethnic people. Regeneration of forests offers them livelihood. Resettlement of the mining project affected people (PAP) also can be arranged in prepared site (backfilling) of a different nearby mine.
- ♦ When the coal seam dips at a high angle (>30 with horizontal), backfilling is believed to be difficult or only partially possible (IBM, 1995) in the Indian Coal mining industry. Following reasons are cited:
  - ♦ Overburden roll down and can jeopardise safety of man and machinery in work zone. In some cases a safe distance is maintained and also a barrier (boulder in mud) is erected but if dip is very high retention of overburden materials in position becomes difficult.
  - ♦ In case of coal seams, when dip is high, less effective space is available for accommodating overburden. In case of high dip excavation, as the excavation advances, the ratio of vertical dimension to horizontal dimension increases; consequently effective space decreases as compared to a flat or near flat deposit excavation of similar quantity. As such, with high dip excavation, effective space for overburden accommodation is less.

### **2.3 Approaches for Restoration of Mined Out Area**

Backfilling methodology depends mainly on deposit mineralisation, operational method, sequence of mining, available machinery, topography and also availability of overburden materials and soil. The planning engineer should also consider geologic, ground water and surface water conditions while developing the methodology. Backfilling methodology for each mine is unique and typical which makes any attempt to evolve a generalised methodology, if not futile, but definitely over averaged. In the following paragraphs conditional diversities for backfilling in coal sector have been discussed.

In general, where backfilling seems feasible the ideal approach is to first prepare the land profile sections at close intervals for the existing/proposed voids, internal and external overburden dumps, etc. These profiles should then be compared with the premining profiles with a view to bring back the original contour (approximate original contour) of the land to assess the requirement of overburden and soil and to study the feasibility of restoring original contours.

Besides geomining feasibility, economics is an important factor (Macpherson, 1987) which guides the decision of backfilling. An alternative to permanent external dumping may be rehandling of OB after mining ceases. But this is not followed anywhere in India because of very high unproductive cost involved.



## 2.4 AOC and Ideal Backfilling Approaches

In terrain with relatively flat slopes i.e. less than 15°, the requirement to achieve Approximate Original Contours (AOC) should not have a major impact on cost or operational procedures, provided there is sufficient overburden material to fill the pit and cover the highwall. In steep slope terrain, particularly for slopes steeper than 24° to 27° this requirement can be very costly and sometimes impossible to implement. While in India, IBM and other Government stipulations are not very specific about AOC, the US regulation is specific about AOC, including eliminating highwalls and any piles or depressions which do not fit into final contour. However there is some flexibility if sufficient overburden material is not available. US regulation insists meeting three conditions (i) satisfying (AOC) (ii) covering the highwall and (iii) providing a stable slope. Meeting all the three conditions especially in steep slope mining, under Indian conditions, can be economically prohibitive, in most of times.

AOC is a measure of the slope of hill side, mountain top, valley etc. Generally these measurements are expressed in slope angle, percent slope or slope inclination.

Considerable flexibility will be necessary in regards to eliminating highwalls and determining appropriate minimum factor of safety. Backfilling placement of spoil materials to attain higher shear strength (angles in excess of 40) is difficult and in fact, may be impossible in many regions, in which case factor of safety as low as 1.3 cannot be practically achieved even with the best control and the best placement practises. Under the best control and placement practises, spoil fills containing varying mixtures of competent and weathered rock and soil can experience total settlements of 1 to 2 percent of their height. Measures to minimise extent of settlements include (i) compaction of top spoil, particularly within the critical zone as much as possible (ii) the most free draining spoil should be placed along the highwall and haul road to promote good drainage and surface run-off or highwall seepage which penetrates the spoil (iii) sealing the top of the fill to minimise infiltration of surface run off (iv) avoiding clustering of boulders which create large voids, in between. The rock boulders tend to shift under the weight of the spoil and if they are mostly weathered rock, fines could migrate into voids causing more settlements.

## 2.5 Legal Requirements for Mined Land Reclamation

The Mineral Conservation and Development Rules, 1988, the Mineral Concession Rules 1960 and the Coal Mines Regulation 1957 are the principal legislations which provide for preventive and remedial measures against land degradation in mine area in the coal sector. The Mineral Conservation and Development Rules 1988 have detailed provisions for phased Restoration, Reclamation and Rehabilitation. The relevant provisions (IBM, 1995) in the Mineral Conservation and Development Rules 1988 are reproduced below:

Rule 33 (4): Wherever possible, the waste rock, overburden etc. shall be backfilled into the mine excavations with a view to restoring the land to its original use, as far as possible.

Rule 33 (5): Wherever backfilling of waste rock in the area excavated during mining operation is not feasible, the waste dumps shall be suitably terraced and stabilised through vegetation or otherwise.

Rule 34: Reclamation and rehabilitation of lands: Every holders of prospecting license or mining lease shall undertake the phased restoration, reclamation and rehabilitation of lands affected by prospecting or mining operations and shall complete this work before the conclusion of such operations and the abandonment of prospect or mine.

Forest (Conservation) Act, Forest Conservation Rules, Mines and Minerals (Regulation and Development) Act, Mineral Concession Rules, and Mineral Conservation and Development Rules provide for the regulation of mining to protect loss of vegetation and compensatory afforestation. The approval for conversion of forest land for non-forest purpose is a must under the Forest (Conservation) Act. The Mineral Conservation and Development Rules take care of the other aspects.

Legal requirements in respect of backfilling and land use are elaborate and stringent in advanced countries. U.S Surface Mining Control and Reclamation Act (SMCRA) of 1977 section 515(b) (3) states (Almes, 1979) that - "... with respect to all surface coal mining operations backfill, compact (where advisable to insure stability or to



prevent leaching of toxic minerals), and grade in order to restore the Approximate Original Contour (AOC) of the land with all high walls, spoil piles, and depressions eliminated (unless small depressions are needed in order to retain moisture to assist revegetation or as otherwise authorized pursuant to this Act)".

This section further states that if sufficient overburden, including the swell factor, is not available to completely backfill to original contour and eliminate the high wall, the operator "as a minimum, shall backfill, grade and compact (where advisable) using all available overburden and other spoil and waste materials to attain the lowest practicable grade but not more than the angle of repose, to provide adequate drainage and to cover all acid forming and other toxic materials, in order to achieve an ecologically sound land use compatible with the surrounding region".

The law is specific about AOC, including eliminating high walls and any piles or depressions that do not really fit into the final contour. However, there is some flexibility if sufficient overburden is not available.

Section 515 (b) (2) of SMCRA (1977): requires the operator to restore the affected area to a condition capable of supporting the uses which the land was capable of supporting prior to any mining, or to higher or better uses. Section 515(C) of the Act provides that a variance from the requirements of restoring original contour may be obtained in a mountaintop removal operation. Post mining land uses permitted are industrial, commercial, agricultural, residential, or public (including recreational facilities). Similarly, a variance may be obtained in steep slope mining (section 515 (e)). The permissible post mining uses under this variance are industrial, commercial, residential and public use (including recreational facilities). Regulations involving land use (George, 1983) are in section 779.22: Land use informations, 780.23: Reclamation plans and 816.133: Post mining land uses of the federal register (U.S. Department of Interior 1979). The federal law states that in the areas of less than 0.66 m annual average precipitation the operator assumes the responsibility for successful revegetation for 10 years after revegetation operation begins (Luebs and Stout, 1978).

## 2.6 Reclamation Practice in Indian Coal Industry

As explained in the earlier section, land reclamation related requirements are lenient in our country. Reclamation related approving authorities in coal mining sector mainly are Director General of Mines Safety (DGMS) and Ministry of environment and Forests (MoEF) [at the time of according environmental clearance for a project]. Indian Regulation leaves ample freedom for mine operators to decide on backfilling based on geominig conditions.

The following is a rough observed estimate of backfilling feasibility in Indian coal mining sector.

0-6°	Dip angle facilitates 100% backfilling.
6° - 15°	Dip angle facilitates 100% backfilling with 18% rehandling of initial overburden (although rehandling is discouraged due to pressure on economics)
>15° to 25°	Dip angle makes possible 50-65% backfilling.
>25° to 30°	Dip angle makes possible 30% backfilling.
>30°	Dip angle makes backfilling impossible.



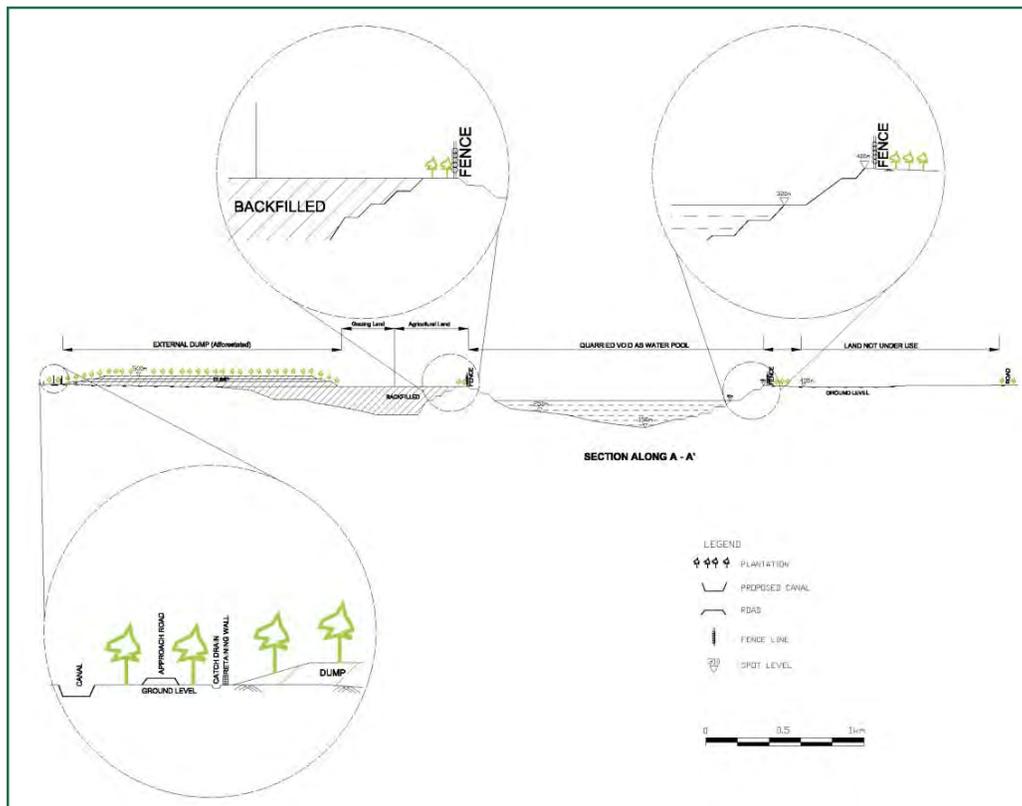
Following reclamation related aspects are recommended mainly in case of internal (backfilling)/external dumping:

Backfilled surfaces and external dumps are required to be terraced. The individual dump lifts should have maximum slope of 37° and the overall slope of the dump should not exceed 28°. Examples of maximum external dump height of 90 m are available in case of mega coal projects. Top surface of the external and internal dumps should be slightly sloped to collect water in garland drains in a systematic manner.

The external dumps should have stretches of retaining wall at suitable locations. The retaining walls are generally of boulder-in-mud construction. Retaining walls should have weep holes to drain out water. At the toe of dumps, few metres away from the dump toe beyond the retaining walls, garland drains should be constructed to receive storm water coming out of the weep holes and surrounding areas. Garland drains should be constructed wherever required on sides of quarries and external dumps depending on contours. The garland drains are routed through catch pits and settling tanks to settle out suspended solids in quarry discharged water and the storm water. The completed dumps and the back-filled areas should be gradually afforested to increase ground stability.

Reclamation details of a recently approved (by MoEF, New Delhi) 15 million tn coal project in North Karanpura coalfield has been shown in **Fig.1**. At the mega coal project, out of total 2098 Mm<sup>3</sup> of overburden to be excavated in 37 years mine life, 1485 Mm<sup>3</sup> would be accommodated in mined out void as mine backfill.

Topsoil does not adhere to slopes steeper than 27°. Top soil can be mechanically spread upto 19° slope. Maximum slopes (Anon, 2009) for various post mining land use types are: Forestry: 38°, Grazing: 28°, Pasture: 15°, Buildings and roads: 12°, Agriculture: 5°, Housing: 3°. Post mining Landuse Decision Matrix (LUDM) developed by Gorton and Yuill (1982) is explained at **Table 5**.



**Fig. – 1: Quarry cross section at post mining stage[ 15 Mt/y OCP at North Karanpura Coalfield**



LUDM is illustrated with the following example:

A certain site has the following conditions: Site area - 15 ha, most narrow site width – 100 m, not in floodplain, slope 6%, active surface mines not at a visible distance, active deep mines are not visible, incorporated area at 21 km distance, highway is at 8 km distance, railroad at more than 3 km, public water/sewer available at 3 km, no river is at 400 m. Also the site has the following Environmental/Health & Safety conditions:

Polluted mine drainage intermittently, the site has no subsidence potential, no impounded water, spoil configuration is graded. OB does not contain any toxic material. The region has less than 50% forest cover. No important structure exists nearby. The matrix for abandoned mine reclamation (**Table 5**) when tested for above conditions gives the following weightages to various landuse choices: Industrial (25), Commercial (24), Institutional (20), Residential (18), Recreational (15), Agricultural (19) and Forestry (13). Obviously, forestry is the desired landuse suitable for the site having above conditions.

Regarding biological reclamation, trenches (45 cm X 45 cm X 45 cm) are dug on the flat top of the internal and external dumps and the excavated material is used to form a bund on the dip side of the trenches to retain maximum water in the trenches during rains. Saplings are planted in these pits once monsoon has commenced to ensure maximum survival of the saplings. Initially hardy pioneer species are planted to help build up the soil. Plantation on slope of the internal / external dumps commences as soon as the first bench is ready. The terraces on the slopes are sloped inward. 60 cm X 60 cm pits are dug at 1.5 m intervals and filled with a mixture of topsoil and organic manure. Open masonry drains are constructed on the terraces. The drains receive water from the higher terraces and convey it to the next lower terrace. Before the commencement of the monsoon the slopes and terraces are covered with a layer of soil (held with suitable mechanical soil binder) and sprinkled with water. Just before the commencement of the monsoon, seeds of grasses and small shrubs can be sprinkled on the soil covering of the dump slopes or seedlings of such plants can be planted on the slopes.

Plant species selected for plantation on the mining benches (unfilled quarry) shall be draught hardy in nature, with fast growth rate and with glabrous/pendulous leaves, and with large crown volume to surface area of fluttering leaves. Species selected in case of power grade coalfield of Orissa and Madhya Pradesh can be: *Azadirachta indica*, *Pongamia pinnata*, *Acacia nilotica*, *Acacia leucophloea*, *Annona squamosa*, *Zizyphus mauritiana*, *Leucaena leucocephala*, *Ficus religiosa*, *Polyalthia longifolia*, *Albizia lebbeck* etc. Saplings can be watered using the effluent from the sewage treatment plant and treated discharges from mine pit. In addition kitchen waste from the town-ship and mine canteen can be used as manure either after composting.



**Table 5: Land Use Decision Matrix**

Sl. No.	Characteristics	Parameter ratings			Industrial	Commercial	Institutional	Residential	Recreation	Agriculture	Forestry
		0	1	2							
<b>A. SITE CONDITIONS</b>											
1.	Site area	>8 ha	4-8ha	<8ha	3	2	2	2	2	3	3
2.	Most narrow site width	>90m	30-90m	<30m	3	2	2	1	1	3	1
3.	Flooding hazard	No	Possible	Yes	3	3	3	3	1	1	1
4.	Slope with buffer zone	<5%	5-20%	>20%	3	3	3	3	2	2	2
5.	Adjacent to active surface mine	Not visible	Visible	<300m	1	1	2	2	2	1	1
6.	Adjacent to active deep mine	Not visible	Visible	<200m	1	1	2	2	2	1	1
7.	Proximity to city/ town	<2km	2-20km	>20km	2	2	2	2	2	3	1
8.	Adjacent to Highway	<2km	2-5km	>6km	2	2	1	1	2	1	1
9.	Adjacent to rail road	On site	<2km	>2km	2	2	1	1	1	1	1
10.	Access to public sewer	On site	<2km	>2km	2	2	2	2	2	1	1
11.	Access to river	On site	<500m	>500m	2	1	1	1	1	1	1
<b>B. ENVIRONMENTAL PROBLEMS</b>											
12.	Mine drainage	Inter -mittent	Perennial	Perennial with flow >10cfs	1	1	2	2	3	1	1
13.	Subsidence hazard	No potential	High potential	Evidence present	3	3	3	3	1	1	1
14.	Soil configuration	Graded	Partially graded	Not graded	2	2	2	2	1	1	1
15.	Impounded water	<1ha	1-10ha	>10ha	1	2	2	2	(-1)	2	1
16.	Toxic spoil on surface	<10%	10-50%	>50%	2	2	2	2	2	3	2
17.	Vegetation (tree cover)	80%	50-80%	<50%	2	2	2	1	(-1)	2	1
18.	Structures	No	Yes	Hazardous	1	2	3	3	3	1	1



## 2.7 Internalising the Reclamation Cost

When an Environmental constraint enters in the mining system in the shape of an additional work, it adds to costs, both average and marginal. Mining project's output will definitely be influenced if costs on account of this constraint involving additional material handling work increases and if the scale of output is a determinant of the pollution level or quantum of land to be rehabilitated. In the beginning, as the pollutant level or damage level may be negligible the output level can grow up to a certain level, and the average reclamation pollution cost, may in fact come down. But after a certain stage, the damage becomes apparent and needs correction. From this time, the average cost begins to rise.

A reclamation project aims at eliminating the adverse impacts of opencast mining. The damages inflicted on the environment are not accounted for while calculating cost of mining. Under the premise of conventional accounting reclamation costs are external costs. The 'external costs', should be internalised to account for the funds to be spent on reclamation of land. Over certain range, the direct benefits from reclamation which could be collected by a public corporation plus the tangible and intangible benefits accruing to others will often considerably exceed the cost of reclamation. In this way an opencast project may be socially and measurably profitable.

Backfilling is one of the most essential elements in surface mining land reclamation. Backfilling costs involve handling of overburden, fuel costs for machinery, transportation distance and costs of machinery involved etc. Two important points about backfilling / reclamation cost are:

- ◆ Backfilling is an essential and integrated element of mining and reclamation, and is one part of continuing process of environmental renewal, therefore, an attempt to isolate it, thus separately calculate backfilling costs, may be misleading. On a rough average backfilling cost is about 60-70% of the total reclamation cost (Chadwick, et al, 1986).
- ◆ Some phases of reclamation operation overlap with mining proper (eg. HEMM costs, transportation etc.), hence it can not be completely isolated from mining.

The cost of reclamation,  $C_R$  can be derived (Fleming and Adepoju, 1987) from

$$C_R = C_{MR} - C_{MNR}$$

Where  $C_R$  is cost of reclamation;  $C_{MR}$  is the total cost of mining operation requiring reclamation and  $C_{MNR}$  is the total cost of mining operation not requiring reclamation. Items of  $C_R$  include both capital ( $C_C$ ) and operating ( $C_O$ ) components. The value of reclaimed land ( $V_R$ ) can be computed as

$$V_R = V_D + C_R (1+i)^n$$

Where

- |       |   |  |
|-------|---|--|
| $V_R$ | = | the value of reclaimed land  |
| $V_D$ | = | the value of derelict land   |
| $i$   | = | Rate of return commensurate with the kind of post mining land use planned. $i$ should also be related to market demand for the ultimate after-use. |
| $N$   | = | Post reclamation period in years.  |

## 3.0 Conclusions and Justifications

Constraints inherent in backfilling and reclamation can be alleviated if enough pre-mine geomining and environmental data of sites are obtained and adequate sampling and data analysis are carried out to provide the designer and operators with the physical, biological and engineering behaviour of overburden rocks. Integration of backfilling/reclamation plan with mine planning would lessen many of the constraints. Mining techniques selected should facilitate maximum concurrent backfilling.

Land degradation due to coal mining in India assumes a significant dimension because the local effects of mining eg. loss of agricultural land, loss of ground water etc. are very intensive, power grade coalfields being situated in river valleys. Backfilling of a surface mined land is important in Indian context because of rising trend of opencast mining in coal sector. Geomining conditions in the coalfields, in general permits backfilling in varying



degree. Backfilling constraints in India are of two types – technical and techno-economic. Among the technical constraints most commonly encountered problem is high dip of coal seams. When a coal seam dips at more than 28°-30° backfilling becomes difficult or only partially possible. In general practise, when an abandoned adjoining quarry is available for overburden disposal, for higher dip angle (<30°) of the coal seam, OB allocation shifts from working quarry (internal dump) to the adjoining quarry (internal dump) for maximum environmental gain at minimum cost level. However, in absence of the adjoining quarry option, OB allocation is optimised at the working quarry internal dump. External dump, being environmentally disadvantageous, OB allocation is seldom optimised there.

While examining or considering the viability of backfilling, suitability of the generated land for a desired postmining land use should be given importance and a proper evaluation technique should be followed. Backfilling concepts for restoration of approximate original contour (AOC) should be integrated into mine planning. Mining regulations / stipulations for AOC are yet to be framed in the country. The stipulations on AOC should be such that they are not very stringent on restoring the exact premining contour. Efforts should be given to generate an acceptable land form utilising the waste and also elimination of highwall.

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- *Coal contributes to nearly 60% of the total commercial energy consumption in the India.*
- *The growing dominance of the power sector in coal consumption (77 per cent share as on date) has led to clamour for organised lobby groups by other sectors.*
- *The coalfields are drained by major rivers which serve as water sources for Thermal power plants and down line coal based industries and have many similar environmental characteristics and share similar environmental problems, like rendering land biologically unproductive, in addition to the land areas rendered derelict due to past activities.*
- *Backfilling methodology for each mine is unique and typical which makes any attempt to evolve a generalised methodology, if not futile, but definitely over averaged.*
- *Indian Regulation leaves ample freedom for mine operators to decide on backfilling based on geomining conditions.*
- *The damages inflicted on the environment are not accounted for while calculating cost of mining.*
- *Constraints inherent in backfilling and reclamation can be alleviated if enough pre-mine geomining and environmental data of sites are obtained.*



### 1.0 Introduction

India is endowed with diverse natural resources and known as the mineral bowl of the world. It inhabits the world's largest resource of coal and third and fourth largest resources of manganese and iron. Expansion of industrialization needs massive energy generation for which huge quantity of coal is extracted through mining, causing extensive landscape destruction. In India, total annual coal production estimated during 1994-1995 was 325 million tonnes and this was expected increase to 417 million tonnes by 1999-2000, of which the contribution of opencast mining would be about 252 million tonnes (Banerjee, 1990, Singh and Singh, 2006).

During the excavation of coal or surface mining, the overlying soil is removed and rock debris gets deposited in the form of overburden. These are mostly acidic in nature with very scarce organic matter contents. As far as the texture is concerned, mine spoils are not fit for plant growth, as they possess either very coarse texture which renders low water retention capacity to the spoils, or very compacted texture, resulting into poor drainage (Jha, et al., 1992). All these characteristics of mine spoils make them unfavorable for plants as well as microbial growth. Nevertheless, mine spoils also interfere with soil water relationship, consequently restricting plant growth. Mine spoils are contaminated in the sense that these are devoid of soil microbes, organic matter, soil moisture and plant available nutrients. Moreover, they consist of excess amount of heavy metals (Singh et al, 1996).

In disturbed habitats, the natural recovery takes much longer time through colonization of plant and animal species (Jha and Singh, 1992; Sharma and Sunderraj, 2005). According to the Society for Ecological Restoration (2002), "Ecological restoration is the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed". These restoration strategies must address soil structure, microbe populations, and nutrient cycling in order to return the land as closely as possible to its pre-disturbance condition and continue as a self-sustaining ecosystem. A restoration programme not only helps restore the soil fertility, but also enhances the biological diversity (Dobson et al., 1997; Singh and Singh, 2001; Singh and Singh, 2006).

Soil physical, chemical, and biological properties, such as soil organic matter (SOM), total nitrogen, water holding capacity, microbial biomass, mineralizable N, bulk density, nutrient retention capacity, pH, and electrical conductivity (Doran and Parkin, 1994; Larson and Pierce, 1994; Karlen et al., 1992; Parr et al., 1992) are the basic indicators of soil quality. According to Larson and Pierce (1994), soil organic matter content is one of the most important soil properties that contribute to soil quality and stability. Burger and Kelting (1998), and Williams and Schuman (1987) suggested the similar soil properties to be used as analytical parameters for mined land reclamation, along with P-availability, and heavy metal concentrations (Torbert et al., 1989; Daniels and Zipper, 1988; Daniels and Amos, 1981).

Plantations exert a catalytic effect in the mine spoil restoration, by changing the understorey microclimatic conditions (viz. increased soil moisture, reduced temperature, etc.), increased vegetational-structural complexity, and development of litter and humus layers, which occur during the early years of plantation growth (Singh et al., 2002).



Bradshaw (1987) envisaged the importance of achieving a stable and self-sustaining vegetative cover. Vegetation is a regulatory factor towards the reconstruction of an ecosystem and mine soil, as it improves the physical and biological diversity of disturbed sites. Tree plantation is supposed to be the best tool for reclamation of mine spoils, because the trees not only provide long-term ecosystem stabilization and render potential ameliorative effects on soil quality, but also have potential commercial and aesthetic value (Torbert and Burger, 1993; Fisher, 1990; Ashby, 1987). Five mechanisms, suggesting how the trees can ameliorate soils were defined by Fisher (1990). The five mechanisms that trees can affect are di-nitrogen (N<sub>2</sub>) fixation through symbiotic relationships or actinorrhizal growth in the root zone, efficient nutrient cycling by accessing ions deeper in the rooting zone, organic matter addition from litterfall, fine root mortality and root slough, micro-climate moderation, and rhizosphere interactions.

The objective of the present paper was to evince the long-term changes on re-vegetation of the overburden dump areas with respect to plant growth performance and nitrogen transformation in dry tropical environment of India.

## 2.0 Materials and Methods

### 2.1 Study Sites

The study was performed on three sites of coalmine overburden dumps (one site BCCL of Jharia coalfield under Bharat Coking Coal Limited, and two sites ECL1 & ECL2 of Raniganj coalfields area under the Eastern Coalfield Limited), a protected adjacent wasteland site and a forest site located about 30 to 120 km from Central Mining Research Institute, Dhanbad (23° 47' N latitude and 86° 43' E longitude).

### 2.2 Topography

Before mining, the study site was gently sloping to moderately sloping land, where the huge quantity of overburden was dumped. The dumping was done with a shovel-dumper combination. The age of the mine dumps was 5 years old in 1993 during the time of re-vegetation. The heights of the dump were 20-30 m and the slope angles were less than 35°.

### 2.3 Climate

The climate is dry tropical with a year divisible into three seasons, namely a cold winter (December to February), a very hot summer (April to June) and a rainy season (July to September). The annual rainfall averages 1,376 mm, 80% of which occurs between late June and September. The mean daily temperature within the annual cycle ranges from 10°- 28° C, while mean daily maximum ranges from 26°- 45° C.

### 2.4 Geology and Soil

The soil surface layer is 100 to 110 mm thick consisting of grey brown to very pale brown sandy loam, and clay loam with a sub angular blocky structure. The bed rock is formed of medium to coarse-grained sandstone, clay with ferruginous bands and carbonaceous shales. The sandstones often contain more or less feldspars. The soil surface layer is 10-11 cm thick, gray brown to very pale brown sandy loam to clay loam with sub angular blocky structure. The overburden consists of alluvium, loose sand, gravel, shale and sandstone (Husain et al., 1987).

### 2.5 Vegetation

The native typical mixed dry deciduous forest is dominated by tree species *Shorea robusta*, *Terminalia tomentosa*, *Butea monosperma*, *Dalbergia sisoo*, *Madhuca indica*, *Terminalia arjuna*, *Pongamia pinnata* and *Azadirachta indica*. The herbaceous vegetation rapidly spreads and covers the adjacent area of mine spoils during rainy season. On mine spoil, *Dalbergia sisoo*, *Azadirachta indica* and *Leucena leucocephala* among the tree species, *Lantana camara* and *Eupatorium odoratum* and *Leonotis neptifolia* among the shrubs and *Xanthium strumarium*, *Saccharum spontaneum*, *Tridax procumbence* and *Evolvulus* spp. among the



herbaceous species have been found to be the most frequently occurring plant species. The wasteland site is dominated by *Eupatorium odoratum* and *Leonotis neptifolia* plant community. Among the grass species the dominant species were *Saccharum spontaneum*, and *Heteropogon contortus* plant community. *Tridax procumbence* and *Evolvulus* spp are the frequent plant species.

## 2.6 Methodology

Three coal mine dump sites (3 plots of 0.5 ha in each site) and an adjacent wasteland site (3 plots of 1 ha each) and one forest site (3 plots of 1 ha each) were selected for the study. The soil samples were collected at random from each of the three replicate plots from upper 0-10 cm layer. Large pieces of plant material were removed by hand and the samples were composited to get one sample per plot. Each sample was divided into two parts. One part in its field-moist condition was used for determining nitrification, nitrogen mineralization and microbial biomass N, and the other part was air-dried for the analysis of physico-chemical properties, viz. moisture, bulk density (BD), water holding capacity (WHC), porosity, specific gravity, pH, electrical conductivity, organic carbon, available N, available P, available K, Fe, Cu, Mn, and Zn contents.

Species selection was done scientifically through pot experiment with different doses of soil and mine spoil ratio followed by field study (Singh, et al., 1998). Six best performer tree species were selected to re-vegetate the overburden dumps of ECL1& ECL2 a BCCL and a protected wasteland site. The selected tree species were *Dalbergia sisoo* (Shisham), *Albizia procera* (Siris), *Acacia nilotica* (Babool), *Leucena leucocephala* (Subabool), *Azadirachta indica* (Neem) and *Delonix regia* (Gulmohar). Seeds of the selected tree species were sown in polyethylene bags in the first week of May, 1993 at the CMRI nursery. Ten seeds of each species were dibbled at a depth of 15 mm in each bag. After one year the plants were transported to all the three sites of overburden (OB) dump and wasteland site.

The three mine spoils with flat surfaces were selected for biological re-vegetation and one wasteland site and a forest site were also selected for data comparison. The wasteland site was devoid of any vegetation. Only few grasses and forbs were present in patches during the rainy season. The pits of 30 x 30 x 30 cm. at a distance of 2m were dug at each site for plantation and each pit at all the sites was filled with the top soil mixed with farmyard manure (FYM) with a ratio of 5:1 (5kg soil + 1Kg FYM). Tree saplings were transplanted on the dumps and the wasteland after the onset of rain during July 1993 at all sites. The tree density at the time of plantation was 2500 individual/ha and the tree density declined between 1240–1626 individual/ ha after 12 yrs. The sites were monitored in the month of November in the years 1994, 1995, 1997, 1999, 2001, 2003 and 2005.

The length and diameter increments were measured after transplanting the plants in OB dump and a wasteland site at different ages (after plantation, two, four, six, eight, ten and twelve years). Belowground biomass (live + dead root) was measured at all the ages of mine spoils and a forest site by sampling five replicates of randomly selected monoliths of 15X15X10 cm size in each plot. The monoliths were washed with a fine jet of water using a 0.5 mm mesh screen. Belowground samples were oven dried at 80°C till the constant weight. The below ground biomass was also sampled at the intervals of 2 yrs.

Mineral N (Nitrate-N + ammonia-N) were determined at all the sites by sampling five replicates at zero days, i.e., the day of fresh sample collection and after 30 days of field incubation. Phenol-di-sulfonic acid method (Jackson, 1985) was followed for the estimation of nitrate and phenate method (Wetzel and Likens, 1979) for analyzing ammonium-N. Nitrification had been indicated by an increase in nitrate-N during the course of incubation. Net N- mineralization was calculated by taking into account the increase in the concentration of ammonium-N plus nitrate-N in between the period zero day and 30 days of incubation (Melillo, 1981; Pastor, et al. 1984).

Microbial N at all the sites by was determined by the chloroform fumigation extraction method (Brookes et al., 1985) sampling five replicates. Soil MB-N was calculated by subtracting the total N content of the K<sub>2</sub>SO<sub>4</sub> extract of unfumigated soil from that of fumigated soil and dividing this value by a k<sub>n</sub> (fraction of biomass N extracted after fumigation) factor of 0.54 (Brookes et al., 1985). The total N contents (inorganic + organic) of the K<sub>2</sub>SO<sub>4</sub> extracts of fumigated and non-fumigated soils were measured after Kjeldahl digestion (Brookes et al., 1985).



### 3.0 Results

#### 3.1 Physico-Chemical Properties

The physical properties of the forest, wasteland and mine spoil are given in Table 1. The soils of forest and wasteland were acidic, while the dump material at all the three mining sites was found to be slightly basic in nature. The moisture content, bulk density and porosity were found to be in the range 3.78-6.0%, 1.75-1.9 g/cc and 31.0-40.8%, respectively. After 12 years the range of organic carbon in mine spoils was found to be 0.62-0.7%. Total N, P, K and organic carbon content after one year and 12 years were lower than those in the surrounding forest soil (Table 1).

**Table 1 - Physico-chemical characteristics of forest, wasteland and mine spoil (before re-vegetation)**

Parameters	Forest	Wasteland	ECL	BCCL
<b>Physical</b>				
<b>Texture</b>				
Sand (%)	64±0.2	61±0.2	59±0.1	71±0.2
Silt (%)	28±0.4	25±0.3	10±0.4	22±0.2
Clay (%)	8±0.3	14±0.25	31±0.22	7±0.2
Moisture (%)	9.77±0.04	7.2±0.02	5.3±0.02	3.95±0.1
Bulk density (gcm <sup>-3</sup> )	1.06±0.1	1.35±0.14	1.75±0.22	1.76±0.16
Sp. gravity	2.91±00.02	2.99±00.03	2.53±00.02	2.44±0.05
Porosity (%)	36±0.03	34±0.024	33.8±0.12	34.21±0.01
Permeability	0.22	0.10	0.0248	0.0425
<b>Chemical</b>				
pH	5.38±0.014	6.2±0.01	7.13±0.023	7.52±0.02
EC	0.019	0.021	0.108	0.173
Organic C (%)	0.86±0.04	0.75±0.018	0.20±0.05	0.17±0.024
Total N (ppm)	0.32±0.012	0.24±0.02	0.062±0.04	0.032±0.03
Total P (ppm)	0.035±0.01	0.020±0.01	0.008±0.013	0.004±0.01
Availiable K (µgg <sup>-1</sup> )	46.36±0.2	57.29±0.32	177.6±0.48	131.2±0.29
Total Fe (%)	2.56±0.04	3.5±0.021	7.7±0.043	6.5±0.06
Total Cu (%)	0.21±0.02	0.18±0.02	0.55±0.02	1.84±0.041
Total Mn (%)	1.2±0.01	2.5±0.012	24.1±0.04	10.05±0.024
Total Zn (%)	0.26±0.021	0.21±0.02	0.85±0.034	2.58±0.016



### 3.2 Belowground Biomass

The below ground biomass in mine spoils ranged from 29-418 gm<sup>-1</sup>, respectively, being minimum in BCCL and maximum in ECL1, showing a gradual increase in root biomass along an age gradient (Table 2). However, the values were very less as compared to the belowground biomass value of wasteland and the forest.

**Table 2 - Root biomass (gm<sup>-2</sup>), available N (µgg<sup>-1</sup>) and Net N-mineralization (µgg<sup>-1</sup> mo<sup>-1</sup>) in forest, wasteland and mine spoils (after re-vegetation)**

Sites	Root biomass (gm <sup>-2</sup> )	Avail. N	Net N-Min.
Forest	566±18	18.5	25
Wasteland	425±24	12.3	19
<b>ECL Mine spoil</b>			
2 yrs.	40±7	2.4	2.15
4 yrs.	68±5.7	3.6	4.75
6 yrs.	192±12	5.4	7.96
8 yrs.	212±14	5.9	10.28
10 yrs.	260±12	6.5	14.5
12 yrs.	418±9	7.2	16.75
<b>BCCL Mine spoil</b>			
2 yrs.	28±5	1.6	1.5
4 yrs.	42.3±4.6	2.1	2.2
6 yrs.	112±6.4	2.96	3.8
8 yrs.	154±10.2	3.74	6.2
10 yrs.	187±12	4.92	9.8
12 yrs.	289±24	5.32	11.4

### 3.3 Mineral N and Net N-mineralization

The mineral N in mine spoils (Table 2) was found maximum in ECL1 site (ranging from 2.4-7.2 µgg<sup>-1</sup>) and minimum in BCCL (1.6-5.32µgg<sup>-1</sup>). However, mineral N in all the three mine spoils was much lower as compared to that in wasteland (12.3 µgg<sup>-1</sup>) and forest ecosystem (i.e., 18.5 µgg<sup>-1</sup>).



In ECL1 site, the N-mineralization was maximum followed by ECL2 and BCCL sites. The range of Net N-mineralization in ECL and BCCL was 2.15-16.75 and 1.5-11.4  $\mu\text{gg}^{-1}\text{mo}^{-1}$ . Net N-mineralization in mine spoils was much lower than that wasteland and in forest. The rate of N-mineralization was minimum in 1 year old dump maximum in 12 year old dump, showing a gradual increase with age.

### 3.4 Microbial Biomass N

Microbial biomass N was also found to be maximum in ECL1 site and minimum in BCCL; the values ranging from 9.38-26  $\mu\text{gg}^{-1}$  in ECL and 7.2-19.3  $\mu\text{gg}^{-1}$  in BCCL sites (Table 3). The rate of MBN was minimum in 1 year old dump and maximum in 12 year old dump, showing a gradual increase with age.

**Table 3 - Microbial biomass N ( $\mu\text{g/g}$ ) in forest, wasteland and mine spoils (after re-vegetation)**

Sl. No.	Age (yrs.)	Forest	Wasteland	ECL	BCCL
1.	0	69.8	33.2	9.38	7.2
2.	2	69.6	33.6	11.2	9.22
3.	4	70.3	34.3	12.4	10.2
4.	6	70.2	36.6	14.6	11.4
5.	8	71.6	37.1	15.7	12.6
6.	10	70.8	41.3	20.6	16.6
7.	12	71.2	48.8	26.2	19.3

### 3.5 Growth Performance

The heights of the trees at the three sites are given in Table 4, 5 & 6. These sites have shown the fastest growth (in terms of height) of Shisham and lowest growth of Gulmohar.

**Table 4 - Plant height (m) increment of selected trees on wasteland after different ages of re-vegetation**

Sl. No.	Species	0 yr.	2 yrs.	4 yrs.	6 yrs.	8 yrs.	10 yrs.	12 yrs.
1.	Shisham	2.1	3.15	5.26	6.50	8.90	10.23	11.75
2.	Siris	1.78	2.40	4.56	4.88	6.78	8.10	10.36
3.	Babool	1.05	1.07	2.86	3.53	4.18	6.60	5.64
4.	Subabool	2.00	3.20	5.60	6.40	8.20	10.80	11.36
5.	Neem	1.35	2.40	4.10	6.10	7.76	8.48	10.45
6.	Gulmohar	0.95	1.90	3.50	4.75	5.90	6.50	7.50



**Table 5 - Plant height (m) increment of selected trees on ECL OB dump at different ages of re-vegetation**

Sl. No.	Species	0 yr.	2 yrs.	4 yrs.	6 yrs.	8 yrs.	10 yrs.	12 yrs.
1.	Shisham	1.97	2.97	4.80	5.79	7.0	7.87	8.69
2.	Siris	1.72	2.43	3.85	4.88	5.86	6.99	7.32
3.	Babool	1.05	1.73	2.45	3.53	4.18	4.93	5.64
4.	Subabool	1.85	3.01	4.91	5.87	7.14	8.13	9.12
5.	Neem	1.30	2.30	3.79	5.12	6.18	7.22	8.12
6.	Gulmohar	0.91	1.73	3.08	4.05	4.82	5.52	6.01

**Table 6 - Plant height (m) increment of selected trees on BCCL OB dump after at different ages of plantation**

Sl. No.	Species	0 yr.	2 yrs.	4 yrs.	6 yrs.	8 yrs.	10 yrs.	12 yrs.
1.	Shisham	1.72	2.76	4.60	5.40	6.55	7.50	8.0
2.	Siris	1.50	1.60	2.90	3.80	5.10	5.80	6.20
3.	Babool	0.90	1.23	1.90	2.80	3.85	4.10	4.95
4.	Subabool	1.67	2.50	4.30	5.10	6.85	7.60	8.30
5.	Neem	1.22	2.06	2.80	4.0	5.45	6.25	7.60
6.	Gulmohar	0.80	1.50	2.10	2.95	3.90	4.30	4.90



**Fig. 1: A view of 2 yrs old revegetated mine wasteland**



**Fig. 2: A view of 5 yrs old revegetated mine wasteland**



## 4.0 Discussion

### 4.1 Physico-Chemical Characteristics

In the present study the mean bulk density of mine spoil sites were higher by 39.42-44.21% as compared to that of the native forest ecosystem and 22.8- 28.94% higher as compared to that of wasteland. Bauer and Black (1981), and Voroney et al. (1981) have also reported an increase in bulk density due to alternate land use. Moreover, organic carbon was declined after mining by 76.74- 80.23% as compared to forest and by 73.33- 83% as compared to wasteland. There exists an inverse relation between soil bulk density and soil organic matter content (Davidson et al., 1967). Several authors opined (Verma et al., 1982; Connell, 1986; Gill et al., 1987; Montagnini, 1990) that the plants increase soil organic matter, lower bulk density and moderate soil pH after their establishment on the spoil, while others (Bradshaw, 1997; Sanchez et al., 1985; Chakraborty et al., 1989; Sharma et al. 1989) suggested that the plants bring mineral nutrients to the surface of the soil and accumulate them in available form.

Nevertheless, the organic carbon content was found to increase gradually with the increasing age of the mine spoil and wasteland. The per cent increase in organic carbon content after 12 years was 71.42-72.6 in mine spoils, while in wasteland the increase was reported to be 1.3%. However, the mine spoils have still shown a less percentage of organic carbon as compared to wasteland. After 12 years the organic carbon content in mine spoils was found to be 7.89-18.42%, less than that of the wasteland soil. Total N was also lower in the mine spoils in comparison to that in wasteland and forest. In mine spoils, total N was declined after 12 years by 74.16- 86.66%, in comparison to wasteland and by 80.62-90%, in comparison to that in forest ecosystem.

### 4.2 Belowground Biomass

The below ground biomass in mine spoil has shown a sharp decline of 46.47- 63.76%, as compared to wasteland and 59.8-72.79% as compared to that of forest. With respect to age, the below ground biomass has gradually increased in mine spoil. However the values declined by 66.07-80.21% after 6 years and by 28.65-48.93%, after 12 years in comparison to that of forest belowground biomass. In comparison to wasteland, the decline in belowground biomass in mine spoils after 6 years was 54.82- 73.64% and after 12 years the decline was 1.65%, 27.52% and 32%, respectively.

The belowground biomass increased with age. This may be due to increase in leaf litter fall leading to increase in organic matter and decomposition of plant roots with increasing age of the spoil. Role of bird droppings may also not be ruled out. Rhoades et al. (2001) hypothesized that increasing spoil depth will enhance rooting volume and total fines, thereby increasing above - and belowground production. They also proposed that the spoil source chemistry and nutrient availability may also alter the above- and below-ground production. In the present study microbial N was positively related to the belowground biomass and total plant biomass ( $P < 0.05$ ) according to the regression equations:

- ♦ **ECL**

$$\text{Microbial N (gg}^{-1}\text{)} = 8.7446 + 0.0405 \text{ belowground biomass (g m}^{-2}\text{)}$$
$$R^2 = 0.9601$$

- ♦ **BCCL**

Microbial N ( $\text{gg}^{-1}$ ) = 7.7582+ 0.0404 belowground biomass and BCCL sites, respectively. Srivastava and Singh (1991) also reported a positive relation between microbial biomass N and belowground biomass in Indian dry tropical soils.

Below ground biomass was also found to be positively correlated ( $R^2 = 0.9317$ ,  $P < 0.05$ ) to the available soil N in all sites. The regression equation is:

$$\text{Root biomass (g m}^{-2}\text{)} = 82.845 + 26.85 \text{ Soil N (gg}^{-1}\text{)}$$



### 4.3 Mineral N and Nitrogen Mineralization

In the present study, mineral N was declined in ECL and BCCL sites by 23.57% and 54.87% respectively as compared to that in wasteland and by 49.18% and 70% respectively as compared to that in native forest soil.

N mineralization was found to decline in ECL and BCCL mine spoils by 50.57% and 69.42%, respectively as compared to the wasteland and by 62.44% and 76.76%, respectively as compared to that in native forest, which may be due to total nitrogen content in the mine spoils. However, N-mineralization in each site was found to increase with age of mine spoil re-vegetation. In ECL and BCCL sites, N-mineralization rates were increased respectively by 72.9% and 60.52% after 6 years and 87.16% and 86.8% after 12 years of re-vegetation, indicating a gradual recovery of N-transformation along an age gradient.

In mine spoils, nitrogen-fixing species have a very important effect on soil property by producing the readily decomposable, nutrient-rich litter and turn over of fine root and nodule (Montagnini, 1990; Bernhard, 1988). The litter is very rich in nitrogen contents, which is mineralized by the nitrogen-fixing species, thereby allowing substantial transfer of nitrogen to other species (Singh et al., 2002). Wild (1987) suggested that the leguminous tree *Leucena leucocephala* is of great importance as far as bio-reclamation is concerned. Under ordinary field conditions, it fixes about 100 kg ha<sup>-1</sup> yr<sup>-1</sup> nitrogen. Besides, *Acacia* spp. and *Albizia lebbek* are also found to be the promising spp. Sharma and Sunderraj (2005) have also suggested these two spp have to be grown on dumps and degraded areas, because of very high nitrogenous activity in their root nodules.

Nitrogen is usually deficient in mine soils and limits vegetation establishment and sustained productivity. Brady and Weil (1996) suggested that soil biological, physical, and chemical processes cause many changes in N. It is frequently the most limiting nutrient for crop production on mine soils (Roberts et al., 1988), so the nitrogen mineralization potential of a soil is an indicator of fertility and site productivity. N mineralization is a very important mechanism integral to soil function and provides an amenable growth medium. Harris (2003) reported that restoration can enhance the rate of N-mineralization. Kaye and Hart (1998a) also observed in their study that the restoration treatment had 2-3 times greater annual net N-mineralization and 3-5 times greater annual net nitrification than the control.

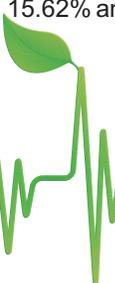
### 4.4 Microbial biomass N (MBN)

Microbial biomass N, in the present study was lower in mine spoils than in the wasteland and native forest soil. The mine spoils have shown a decline in MBN by 52.86% and 62.8% as compared to that in wasteland and 73.631% and 82.35% in ECL and BCCL sites, respectively as compared to that of forest soil. Srivastava et al. (1989) also reported a decline in microbial nutrients in mine spoils as compared to a virgin forest. The role and importance of microorganisms in mine soils and ecosystem restoration was studied by Tate (1985), in which it was concluded that soil structure development, nutrient cycling, and soil chemical and physical limitations to plant growth are mediated and mitigated by microorganisms. Visser et al. (1983) suggested that the reduced microbial nutrients in the mine spoils may be due to the lack of (i) a topsoil layer with its associated plant components, (ii) favorable nutrient levels, and (iii) active microbial system.

Microbial biomass N in mine spoil increased with time after plantation. There was an increase of 79% and 79.42% in MBN after 6 years and of 62.61% and 72.24% after 12 years of re-vegetation in ECL and BCCL sites, respectively. Ruzek et al. (2001) demonstrated a clear relationship between time since restoration and increases in soil microbial biomass. This was related both to organic matter content as a starting point in new reclamations and textural characteristics of the soils reclaimed (Harris, 2003).

### 4.5 Plant Growth

Tree heights and diameters depict a relative volume index of individual tree growth, basal area, and overall plot productivity. The growth was very fast in the first six years of plantation, but it became steady from 6-12 years. All the species have shown the similar trend. *Dalbergia sisoo* has been found to show the maximum height and *Acacia* sp., the minimum in all the three sites. Plant height in ECL and BCCL sites was lower as compared to wasteland. After 6 years the height of Shisham, which has shown maximum height, was declined by 9.53% and 15.62% and after 12 years by 23.5% and 29.57% in ECL and BCCL mine spoils, respectively. Babool has shown



a decline of after 6 years 22.37% and 20.67% and of 9.2% and 12.23% after 12 years in ECL and BCCL mine spoils, respectively, compared to wasteland.

There was an increment of 60.86% and 59.36% in the height of Shisham plant after 6 years and 27.5% and 30.78% from 6 to 12 years of plantation in ECL and BCCL sites, respectively. The growth may be higher in *D. sisoo* because it is the most tolerant tree species, having nitrogen fixing capacity to cope up with the impoverished, slightly alkaline overburden dump (Singh et al., 1996). The height of Siris increased upto 6 years by 58.67% and 59.45% and after 12 years by 33.7% and 40.8% in ECL and BCCL sites, respectively. The height increment of Babool after 6 and 12 years was respectively by 50.99%, 60.4% and 40.06%, 29.56%. Subabool has shown an increment of 53.69% and 61.24% after 6 years and of 32.15% and 29.12% after 12 years of plantation in ECL and BCCL sites, respectively. In Neem plant, the increment in height after 6 and 12 years was 64%, 56.17%, and 30.08%, 31.98% in ECL and BCCL sites, respectively. Gulmohar has shown an increment in height by 62.39% and 55.51% after 6 years and 34.47% and 37.31% after 12 years in ECL and BCCL sites, respectively. Torbert and Burger (1994), Ashby (1997) suggested in their study that spoil compaction has a severe negative impact on tree growth. They found that after 5 years of the tree stand development, trees growing on compacted soil grew only one-third as tall as those growing on loose spoils. They also found the negative effect of soil compaction on forest growth. The fast increase in plant heights in the beginning (upto 6 years) and being steady in the later stages (from 6 to 12 years) of growth may be attributed to the presence of plant available soil nutrients in the upper horizon of the dump, added as FYM and soil in the pit and to addition of plant litter after senescence of leaf.

Plant height was found to be positively correlated with the microbial biomass N at ECL ( $R^2 = 0.8338$ ;  $P < 0.05$ ) and BCCL sites ( $P < 0.05$ ;  $R^2 = 0.8695$ ) according to the following regression equations:

- ♦ **ECL**  
Plant height =  $5.4767 + 0.0194 \text{ MBN}$
- ♦ **BCCL**  
Plant height =  $4.8473 + 0.0182 \text{ MBN}$

## 5.0 Conclusion

Re-vegetation of mine spoil results into an increase in plant growth till six years and later the growth becomes steady. However, the soil fertility status with respect to nitrogen availability and microbial biomass has been gradually improved till the twelve years of the plant growth. Therefore, there is need of re-vegetation programme for ecosystem sustainability, economic benefits and also the clean environment.



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- *Overburden dump in coalmines are acidic and with very scarce organic matter content. Mine spoils are devoid of soil microbes, organic matter, soil moisture and plant available nutrients, have excess amount of heavy metals and thus are unfit for growth of plants in many ways.*
- *Restoration strategies must address soil structure, microbe populations, and nutrient cycling in order to return the land as closely as possible to its pre-disturbance condition.*
- *Total N, P, K and organic carbon content after one year and 12 years were lower than those in the surrounding forest soil (Table 1).*
- *Though values of below ground biomass and above ground biomass increase in a revegetation area as the years pass, at 12 yrs post revegetation, they were very less as compared to the same biomass value of wasteland and the forest.*
- *Net N-mineralization in mine spoils was much lower than that wasteland and in forest. The rate of Microbial Biomass N was minimum in 1 year old dump and maximum in 12 year old dump, showing a gradual increase with age.*
- *Even after 12 years, the mine spoils have still shown a less organic carbon, total N and microbial biomass as compared to wasteland and forest.*
- *Leucaena leucocephala, Acacia spp., Albizia spp. increase nitrogenous activity due to root nodules*
- *The growth was very fast in the first six years of plantation, but it became steady from 6-12 years. may be attributed to the presence of plant available soil nutrients in the upper horizon of the dump, added as FYM and soil in the pit and to addition of plant litter after senescence of leaf.*
- *Re-vegetation of mine spoil results into an increase in plant growth till six years and later the growth becomes steady. The soil fertility status with respect to nitrogen availability and microbial biomass has been gradually improved till the twelve years of the plant growth, but it is still less than wasteland or forest.*
- *Revegetation efforts, even with careful selection of tree species and plantation care, still have limitations of regaining the nutrient cycling efficiency of the forests or even wastelands in adjacent areas. Although more studies need to be done, it is still clear that restoration by revegetation will take much longer time and efforts to regain the original status of the land.*



### 1.0 Introduction

Greenhouse gases (GHG) trap the solar radiation and keep the earth's surface warm. Without this natural "greenhouse" effect, average temperatures at the earth's surface would fall below freezing point. However, since the past few decades, there have been noticeable increases in atmospheric concentrations of GHGs like carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), hydrofluorocarbons (HFC's), perfluorocarbons (PFC's) and sulfur hexafluoride (Sf<sub>6</sub>).

Human activities that release GHGs into the atmosphere is responsible for this increase. Carbon dioxide, a major GHG, is produced when generating energy from fossil fuels such as coal. Coal burning generates about one third of the world CO<sub>2</sub> emissions (Shrestha *et al.* 2009). Coal is the most abundant fossil fuel resource present in India. India stands fourth in the world in terms of identified reserves. There are 61 major coalfields located in India. The challenge of increasing coal production to meet the ever-growing needs of the economy has being met by a phenomenal increase in production from open mining, which currently accounts for 74% of total coal production (Chaulya, *et al.* 2000). It is India's least-cost source of primary energy and currently meets two-thirds of the country's energy needs. It is the only largest fuel source for the generation of electricity worldwide. About 40% of the electricity in the world comes from coal. Share of coal in world's energy consumption is 27%.

The coal production in India has risen from 73 Mt in 1972 to about 382 Mt in 2004-05. Coal demand as projected for the year 2006-07 is 448 Mt, for 2011-12 is 620 Mt and expected to 1061 Mt by the end of 2024-25. However, coal continues to be the major source of primary commercial energy worldwide and encourages developing countries use more, as its low cost compared to other energy sources. Coal therefore remains essential in achieving a diverse, balanced and secure energy mix. While coal is poised for significant growth, it faces significant and mounting social and environmental challenges (Singh, 2009).

### 2.0 Environmental Issues of Coal-mined Soils

Increasing coal mining waste and the accelerating pace of industrialization have stretched the self-sustaining capacity of the ecosystem to the point where its equilibrium is disturbed (Chaulya *et al.*, 2000). The mining operations like drilling, blasting, extraction, transportation, crushing and other associated activities are carried out in underground and opencast mines (Singh, 2009). The opencast excavation of coal deposits involves removal of overlying soil and rock debris and their storage in overburden dumps. Mining operations are polluting and degrading the soil, water environment and atmosphere to an unsafe to use. Opencast mining has more potential impact on land than underground mining. Opencast coal mining is being used extensively, because of its cost effectiveness and productivity though it results in large-scale land disturbance (Singh, 2009). Fugitive emissions of particulate matter and gases including methane, sulphur dioxide, oxides of nitrogen and carbon monoxide are major air pollutants in the mining areas.

Most of the mining operations viz., drilling, blasting, hauling, loading, transporting and crushing generate large quantity of dust. Opencast mining causes more severe air pollution than underground mining (Fig 1).





**Fig. 1 - Fugitive emissions of particulate matter and gases during coal mining**

High levels of suspended particulate matter increase respiratory diseases such as chronic bronchitis and asthma cases while gaseous emissions contribute towards global warming besides causing health hazards to the exposed population. The uncontrolled dust not only creates serious health hazard but also affects the productivity through poor visibility, breakdown of equipment and increased maintenance cost. The dust can also pollute nearby surface waters and reduces plant growth by shading.

The overburden dumps change topography and relief, affect drainage system and prevent succession of vegetation (Wali, 1987; Chaulya *et al.*, 2000) resulting in acute problems of soil erosion and environment pollution (Singh *et al.* 1994; Singh *et al.* 1996). Every million tonne of coal extracted by surface mining methods damage a surface area of about four ha in India (Ghosh, 2000). The coal industry alone accounts for rendering biologically unproductive area of about 500ha during 1994-95, which rose to 1400 ha by 2000 AD (Chari *et al.*, 1989). Land affected by direct mining (quarry alone) will about 67% (Kundu and Ghose (1997).

### 3.0 Characteristics of Coal-mined Soils

Mining causes drastic changes in profile arrangement, physical, chemical and biological properties of the soil. During the process of mining, the topsoil (about 30 cm) is removed and is stored separately for reforestation. Overburden soil is placed into already mined pits (Shretha *et al.*, 2000). The overburden dumps consist of gravel, sand, clay, and sandstone (Fig. 1).

Component size analysis revealed that sand particles increased, silt and clay particles decreased, with respect to unmined soil. This trend may be due to increased erosion. Dominance of sand particles led to low stability of aggregates and consequently a high rate of infiltration. The high bulk density of the dumps was influenced evidently by the use of machinery, which has serious implications for aeration and poor penetrability of roots (Ghose 2004). The porosity ranges from 31 to 42%, where as permeability of the dump soil ranging between  $0.194 \times 10^{-6}$  and  $0.069 \times 10^{-6}$  m/s. The available N, P and K of dump soils are lower than other surrounding soil (Chaulya *et al.* 2000). The soil moisture content, field capacity, WHC and the wilting coefficient that were found to be lower in the dump soils than those of unmined soil and decreased slightly with age due to the decrease in OC (Biswas and Mukherjee, 1989). Greater value of wilting coefficient of dump soil indicates the deficiencies of plant growth materials (Ghose, 2004).

The pH of soil dumps was acidic due to leaching of basic cations. Under such acidic conditions, H<sup>+</sup> toxicity, high availability of Al and Mn and unavailability of Mo are the principal deterrents of plant growth (Foy, 1974). Electrical conductivity decreased with increasing age of soil dump but was higher than the surrounding unmined soils due to mixing of lower surface horizons (Ghose, 2004). Organic carbon gradually decreased with increase in age of soil dumps, probably due to low humification by the lack of soil micro flora. It appeared that after 6 years OC reached a steady state condition. Available macronutrients (NPK) decreased considerably in comparison to unmined soil due to reduction of soil microbes (Miller and Cameron, 1976) and also decreased with increase in age of soil dumps (Ghose 2004). Mining and its associated activities not only uses a lot of water but also affects the hydrological regime, course of water flow and often affects the water quality. Weathering and leaching of sulphide minerals present in coal and associated strata result production of acidic water. Various toxic trace/heavy metals become soluble in acidic water (Singh 2009).



#### 4.0 Role of Soil Organic Matter (SOM) in Carbon Sequestration and Soil Quality Improvement

While the issues are serious and diverse, the common link among them is global C cycle as influenced by the terrestrial C pool and its dynamics through interactive effects of man-made and natural perturbations. Strategies to address these issues involve enhancing the terrestrial C pool for reversing the degradation processes and improve ecosystem functions. Soil Organic Matter (SOM) can be a source of sink for atmospheric CO<sub>2</sub> depending upon land use and soil management, vegetation and water resources. The historic loss of C from SOM pool between the 1850s and 2000 estimated at  $78 \pm 12$  Gt compared to emission of  $270 \pm 30$  Gt from fossil fuel combustion (Lal, 2009).

Numerous and wide ranging benefits of SOM for enhancing soil quality and influencing the pedological processes were documented by Jenny and others (Jenny, 1941; 1961; Jenny and Raychaudhary, 1961). Some of the direct benefits of the SOM are improvement of soil structure, retention of water and nutrients, increase in soil biodiversity, decrease in risk of soil erosion (Lal, 2009) and maintenance of optimum soil temperature. Ancillary benefits of SOM includes increase in use efficiency of input, soil's resilience and climate moderation through sequestration CO<sub>2</sub> in to stable SOM with a long residence time (Lal, 2009). Soil degradative processes viz., destruction of soil structure, nutrients depletion, and changes in soil temperature and moisture regimes lead to depletion of SOM pool.

Processes leading to restore SOM pool include increase in aggregation, improved nutrient cycle, and increase in soil biodiversity and erosion control (Lal, 2009). There is an urgent need to increase the SOM pool for restoring the quality of degraded soils. Management of SOM pool to improve soil quality and productivity has related to increase food production (Sanchez and Swaminathan, 2005) and to offset CO<sub>2</sub> level. There are c. 850 million food-insecure people in the world (Sanchez, 2002; Borlaug, 2007), the number may increase by another 100 million by 2015, and UN millennium goals won't be realized. Management of the SOM pool can play an important role in advancing food security (Lal, 2009). It is estimated that increasing the SOC pool by  $1 \text{ Mg ha}^{-1} \text{ year}^{-1}$  might increase food production by 6-12 million Mg year<sup>-1</sup> in Sub Saharan Africa and 24-40 million Mg year<sup>-1</sup> in all developing countries (Lal, 2006).

#### 5.0 Reclamation of Mined Soils (RMSs) through Phyto Remediation with Organic Manures Application

Self-sustainability and the regenerative capacities of abandoned mining areas should develop for the proper functioning of the ecosystems through revegetation (Jha and Singh 1994). The most important problems in the reclamation process of post mining soils is the formation of new organic matter in the surface layers, which is essential for restoration physical, chemical and biological properties of soil (Haigh, 1998; 1998a; Gilewska *et al*, 2001). Reclamation process of mine soils has three elements viz. every arable plant used as a pioneering plant, very high mineral fertilization needed as chemical treatment and an intensive mechanical tillage needed to improve the physical characteristics of the dump soils (Gilewska *et al*, 2001). According to Schuman *et al.*, (1985) top soil depth and quality can greatly influence the productivity and vegetation establishment on reclaimed dumps. The biological reclamation, if not done within the shelf life (period up to which the soil maintain its fertility status to support plant growth), the nutrients released by microbiological activity are lost continually due to leaching and erosion, nutrient cycle is broken down, and the soil ultimately becomes unproductive (Ghose, 2004). RMS could manage best to capture C from the atmosphere. Reclamation process includes three stages viz., pre-mining, reclamation and post reclamation (Ghose, 2004). To enhance SOM and C sequestration potential in mine soils, the following precautions are essential for successful reclamation of mined dumps, which detailed as under:

##### I) Pre-mining Stage

Remove uppermost top layer 30 to 100cm depth of top soil before mining. If possible, move top soil directly from mining area to the reclamation area as storage of top soil for long period prior to respreading can cause seed to lose viability and loss of C and nutrients. Otherwise, store properly near the reclamation site, protect from erosion, nutrient loss and C mineralization.

##### II) Reclamation Stage

Grading and contouring, top soil replacement, inoculation of beneficial microbes, sub-soiling, fertilization, soil amendments, reforestation, mulching, irrigation and soil and water conservation measures are the prime steps in the reclamation process.



- 1. Grading and contouring of overburden:** The overburden soil dumps are leveled and graded contours established at different level, if elevation of dump is high and large. Movement of heavy equipment on spoil material and top soil minimized as much as possible. The degree of compaction of the soil can be minimized by using small dozers, when soil is dry.
- 2. Topsoil replacement:** Spread top soil over the leveled dumps as soon as possible to maintain shelf life of top soil. Spread top soil for at least 30 to 50 cm depth. If possible, use native soil for upper layer of top soil, which can function as a donor seed bank that provides important sources of genetic plant material as well as microbial inoculums. For quick revegetation, soil depth needs minimum 1m for forest species and 30cm for grasses.
- 3. Inoculation:** Inoculation of beneficial microbes, especially N-fixing and P-solubilising in the top soil helps to enhance nutrient availability to the growing plants.
- 4. Sub-soiling:** Before planting/sowing of seeds, sub-soiling should be done up to 30 to 60cm depth to break up compacted soil layers and to improve aeration, water infiltration and root penetration. Reducing soil compaction increases root development as well as SOC sequestration in RMSs through increased biomass productivity.
- 5. Fertilization:** Nutrient deficiencies are one of the most universal attributes of RMSs. RMSs require significant amount of fertilizers for the establishment and maintenance of vegetation. Fertilizer recommendation depends on availability of nutrients, pH, soil type, species and nutrient loss. Optimum level of N application ranges 85-168 kg ha<sup>-1</sup> for revegetation. If N is less than 85 kg ha<sup>-1</sup>, suppress grass establishment and if more than 168kg ha<sup>-1</sup> growth of legumes suppressed. Phosphorus and K application ranges between 300 and 125 kg ha<sup>-1</sup>, respectively (Shrestha and Lal, 2009).
- 6. Soil amendments:** Soil amendments provide a better medium for plant growth by increasing macro- or micro-nutrients and SOM, bringing soil pH towards neutral, improving hydrologic properties, and reducing erosion. Soil amendments should be applied before seeding/planting. Common soil amendments used for RMSs includes bio-solids, compost, vermi-compost, manure, lime and coal combustion by-products. To enhance C sequestration, coal combustion by-products should be applied in conjunction with organic amendments like mulches of plant residues, and process waste materials, such as bio-solids, pulp and sludge from paper production. Application of compost and vermi-compost improves fertility, increase microbial diversity, soil structure, water infiltration rate, water holding capacity, and CEC, and decreases bulk density of RMSs (Bastin and Ryan 1986; Garcia et al. 1994).
- 7. Revegetation:** Plant species that are suited to the properties of mine soil, tolerate and establish quickly in harsh condition, control erosion and have fast growth and high biomass accumulation used in RMSs. Use of native species is preferable to assure successful revegetation. Fast growing species helps in maximum C sequestration. Recommended practice for seed bed preparation, time of seeding and seeding rate should be adopted. Vegetation aids in stabilizing the soil surface from erosion, enhances sequestration of atmospheric CO<sub>2</sub> into soil, increases SOM and biological activity, improves physical, chemical and biological quality of RMSs, and enhances profile development. Vegetation is also a factor in the hydrologic cycle and affects both surface and groundwater. Therefore, proper re-vegetation or land use adopted after grading of RMSs is an important step in the overall reclamation process and plays a major role in restoring the quality of RMSs. The establishment of vegetation is affected by topsoil depth, soil compaction, soil toxicity, type and age of species used, seedbed preparation, time of seeding/planting, fertilization, soil amendments, mulching, and weed control.
- 8. Irrigation:** Irrigate RMSs, after seeding, to encourage seed germination and growth, if soil is dry.
- 9. Mulching:** Mulches of organic materials are applied to the soil surface, usually after seeding the RMSs to improve moisture holding capacity, soil microclimate and nutrient availability to the plants. Common mulch materials are wood residue or chips, straw and hay.



**10. Soil and water conservation measures:** Short-term and long term soil–water measures can be undertaken for effective utilization of soil and water resources. Short term measures include degradable erosion control blankets such as planting of vegetation with good rooting network, and long-term measures includes construction of erosion control structures water ways, bunding and small field ponds/trenches. Stability of RMSs against erosion increased by reducing slope angles and breaks in the slope.

### III) Post-mining Stage

Regular monitoring of RMSs is required for successful establishment of vegetation. Respond-appropriate measures should be taken for invasive species or poorly established vegetation in time, if needed. Organic or inorganic fertilizer should be applied periodically to maintain fertility of soil. Take corrective measure in areas, which are showing evidence of erosion, sedimentation or slope failure.

## 6.0 Top Soil is a Key for Successful Reclamation of Mined Soils: Case Studies

Biological reclamation process of mined soils depends on quality, quantity (depth), shelf life (storage time) and method of handling of top soil. The essentiality of top soil for reclamation is described with independent case studies as follows.

### Case Study I: Reclamation of Over-burden with Native Top Soil

A field survey was carried out in the plantations that established in overburden dumps with top soil at Sikini Coal Field, Lathehar (Jharkhand) during month of October 2010. Before planting, over burden dumps were leveled with small dozers and bunds were established around the field. Then, top soil is excavated from the current mining site and put uniformly over the leveled dumps up to 1 to 1.5m height in the same year. Seeds of babul (*Acacia nilotica*) were sown along boundary of the field at close spacing that acts as live fence for grazing animals and as barrier to soil erosion. During monsoon season, six-month old seedlings of gamghar (*Gmelina arborea*), shisham (*Dalbergia sissoo*), teak (*Tectona grandis*), neem (*Azadirachta indica*) and karanj (*Pongamia pinnata*) were planted in 30cm<sup>3</sup> pits at 2 x 2m spacing in 2006 as pure plantations. At 5th year, total plant height and girth at breast height (GBH) and establishment percentage of trees were recorded in all plantations. The height of neem, shisham, karanj and teak were 9.75, 9.5, 8.5m and 7.4, respectively. The mean GBH and crown of neem was recorded maximum in five- year neem plantation. In is concluded from this study that neem, shisham, teak and karanj were most promising tree species (Fig. 2) for revegetation in RMSs with reference to total plant height, GBH and crown (ocular estimation).



Fig. 2 - Stages of reclamation process in Sikni coal mined field, Latehar, Jharkhand.



## Case Study II: Reclamation of Over-burden without Top Soil

Similar survey was conducted in the tree plantations established in the overburden dumps without top soil at Khilari Coal Field, Ranchi (Jharkhand). Here, the overburden dumps, predominantly consists of gravels and boulders, were leveled uniformly heavy dozers. Over burden soils without boulders was put over the leveled dumps up to about 50 cm height. Six month seedlings of shisham (*Dalbergia sisoo*), cherry (*Prunus sp.*), ber (*Ziziphus mauritiana*), bamboo (*Bambusa bamboo*), gamghar (*Gmelina arorea*), mahau (*Madhuca indica*), karanj, amla (*Embluca officinalis*), baikain (*Melia dubia*), khair (*Acacia catechu*), semal (*Bombax ceiba*), imli (*Tamarindus indica*) and teak were planted at 30cm<sup>3</sup> pits at 1 x 1m spacing in 2006-07 as mixtures. At the end of 5<sup>th</sup> year, performance of the plantation was studied. The data revealed that shisham, ber and bamboo were performed better than the rest of the species. The mean (n=10 trees) total height of best-performed ber, gamghar, shisham, and bamboo plants was 5.2, 4.8, 3.6, and 3.5m respectively. The mean GBH of established plantations of all species was observed lesser than 20cm. The percentage of survival and establishment were also poor in this RMSs. Severe rill - erosion was found in all plantations due to lack of sufficient ground cover and fibrous root system except bamboo and shisham plantations (Fig. 3). It is concluded that top soil and soil and water conservation measures are pre-requisite for revegetation.





**Fig: 3 Stages of reclamation process without top soil in Khilari coal mined field, Ranchi, Jharkhand**

### 7.0 Conclusion

The study finds that maintenance and application of top soil plays vital in success of revegetation and bio-reclamation of overburden soil (Ghose. 2002). Application of organic manures and soil and water conservation are not speed up re-vegetation and reclamation process but also enhance soil fertility, biomass productivity, while off-setting  $\text{CO}_2$  emission. Thus, both reclamation and revegetation activities offset  $\text{CO}_2$  emission from mining activities, miners could get incentives from carbon crediting (Sheathe et al 2009). It is a win-win strategy for sustainable environment without compromising energy needs.

#### List of Abbreviations

SOM	:	Soil Organic Matter
SOC	:	Soil Organic Carbon
RMSs	:	Reclaimed Mined Soils
Cm	:	centimeter
Kg	:	kilogram
Ha	:	Hectare
C	:	Carbon
N	:	Nitrogen
P	:	Phosphorus
K	:	Potassium



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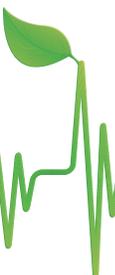
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- ▶ *Coal is one of the largest fuel source for the generation of electricity worldwide.*
- ▶ *Increased coal mining and associated industrialization has stretched the limit of resources.*
- ▶ *Pollution levels are high.*
- ▶ *Soil organic matter which is sink for atmospheric CO<sub>2</sub> is lost from mined out soil.*
- ▶ *Reclamation of mine soils involves enhancement of soil organic matter and carbon sequestration potential by careful planning.*
- ▶ *Successful reclamation of mined soils not only lead to successful restoration of soil, vegetation but also enhanced biomass productivity and off set CO<sub>2</sub> emission through photosynthesis process.*



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### 1.0 What is IUCN?

IUCN, International Union for Conservation of Nature, helps the world find pragmatic solutions to our most pressing environment and development challenges. It supports scientific research, manages field projects all over the world and brings governments, non-government organizations, United Nations agencies, companies and local communities together to develop and implement policy, laws and best practice.

IUCN is the world's oldest and largest global environmental network - a democratic membership union with more than 1,000 government and NGO member organizations, and almost 11,000 volunteer scientists in more than 160 countries.

IUCN's work is supported by more than 1,000 professional staff in 60 offices and hundreds of partners in public, NGO and private sectors around the world. The Union's headquarters are located in Gland, near Geneva, Switzerland.

### 1.1 IUCN at a glance

- ♦ Founded in 1948 as the world's first global environmental organization
- ♦ Today the largest professional global conservation network
- ♦ A leading authority on the environment and sustainable development
- ♦ More than 1,000 member organizations in 140 countries including 200+ government and 800+ non-government organizations
- ♦ Almost 11,000 voluntary scientists and experts, grouped in six Commissions
- ♦ A neutral forum for governments, NGOs, scientists, business and local communities to find pragmatic solutions to conservation and development challenges
- ♦ Thousands of field projects and activities around the world
- ♦ Governance by a Council elected by member organizations every four years at the IUCN World Conservation Congress
- ♦ Funded by governments, bilateral and multilateral agencies, foundations, member organizations and corporations
- ♦ Official Observer Status at the United Nations General Assembly

### 1.2 IUCN's vision and mission

*Our vision is a just world that values and conserves nature.*

*Our mission is to influence, encourage and assist societies throughout the world to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable.*



### 1.3 What does IUCN do?

**Knowledge:** IUCN develops and supports cutting-edge conservation science, particularly on biodiversity and ecosystems and how they link to human wellbeing.

**Action:** IUCN runs thousands of field projects around the world to better manage natural environments.

**Influence:** IUCN supports governments, NGOs, international conventions, UN organizations, companies and communities to develop laws, policy and best-practice.

**Empowerment:** IUCN helps implement laws, policy and best-practice by mobilizing organizations, providing resources and training, and monitoring results.

### 2.0 Biodiversity and why it is valuable

At the 1992 Earth Summit in Rio de Janeiro, the United Nations Convention on Biological Diversity (CBD) was signed by 157 governments; it has since been ratified by 188 countries. The CBD defines biodiversity as:

*The variability among living organisms from all sources including inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.*

Biodiversity encompasses the variety and variability of life on Earth. It refers to the differences within and between all living organisms at their different levels of biological organization – genes, individuals, species and ecosystems. Biodiversity embraces all living organisms and their genetic diversity, a vast and complex array of ecosystems and habitats, as well as the processes that underpin and result from this diversity, such as photosynthesis, nutrient cycling or pollination. Different species – plant, animal, fungal and microbial – interact with each other in a variety of ecological processes to form ecosystems. These processes are in turn the result of the interactions between species and with their physical and chemical environments.

### 2.1 Why is biodiversity valuable?

The crucial function in balancing of atmospheric gases through photosynthesis and carbon sequestration is dependent on biodiversity, with a estimated 40% of the global economy is based on biological products and processes! Biodiversity has also enabled humans to create thousands of new crop varieties and livestock breeds, with distinct development benefits. This has enabled large increases in the production of food and other natural materials, which have fed the growth and development of human societies.

Biodiversity is also the basis of innumerable environmental services that keep us and the natural environment alive – from the provision of clean water and watershed services to the recycling of nutrients and pollination. These services include:

- ◆ soil formation and maintenance of soil fertility (through nutrient cycling);
- ◆ primary production through photosynthesis, as the supportive foundation for all life;
- ◆ provision of food, fuel and fibre;
- ◆ provision of shelter and building materials;
- ◆ regulation of water flows and the maintenance of water quality;
- ◆ regulation and purification of atmospheric gases;
- ◆ moderation of climate and weather;
- ◆ detoxification and decomposition of wastes;
- ◆ pollination of plants, including many crops;
- ◆ control of pests and diseases; and
- ◆ maintenance of genetic resources (key to crop and livestock breeding, medicines, etc)



<sup>1</sup>WEHAB Working Group. 2002. "A Framework for Action on Biodiversity and Ecosystem Management." New York: United Nations. Available at [www.johannesburgsummit.org/html/documents/summit\\_docs/wehab\\_papers/wehab\\_biodiversity.pdf](http://www.johannesburgsummit.org/html/documents/summit_docs/wehab_papers/wehab_biodiversity.pdf)

In addition to these essential ecosystem services (classified as supporting, provisioning and regulating by the Millennium Ecosystem Assessment), biodiversity is also of value for aesthetic, spiritual, cultural, recreational and scientific reasons. The intrinsic value of biodiversity stems from a non-utilitarian philosophy that views biodiversity as intrinsically valuable in its own right, irrespective of its contribution to human well-being. More tangibly, in some parts of the world (particularly those with low agricultural productivity), the survival of many people depends on biodiversity.

## 2.2 Protected Areas And Biodiversity

The world's protected areas are the greatest legacy we can leave to future generations - to ensure that our descendants have access to nature and all the material and spiritual wealth that it represents. IUCN, defines a Protected area as:

*'A protected area is a clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long term conservation of nature with associated ecosystem services and cultural values'.*

Protected Areas perform many functions. They are essential for conserving biodiversity, and for delivering vital ecosystem services and in addition are important to local communities, especially indigenous peoples who depend for their survival on a sustainable supply of resources from them. Protected landscapes embody important cultural values; some of them reflect sustainable land use practices. They are important also for research and education, and contribute significantly to local and regional economies, most obviously from tourism.

## 2.3 Biodiversity And Its Relevance To Mining Operations

Mining has the potential to affect biodiversity throughout its life cycle, both directly and indirectly. Direct or primary impacts from mining can result from any activity that involves land clearance (such as access road construction, exploration drilling, and overburden stripping or tailings impoundment construction) or direct discharges to water bodies (riverine tailings disposal, for instance, or tailings impoundment releases) or the air (such as dusts or smelter emissions). Direct impacts are usually readily identifiable. Indirect or secondary impacts can result from social or environmental changes induced by mining operations and are often harder to identify immediately. Cumulative impacts occur where mining projects are developed in environments that are influenced by other projects, both mining and non-mining. Due to the continuing demand for minerals, the depletion of resources in readily accessible areas and changing technologies and economics in the mining sector, mining is increasingly being proposed in remote and biodiversity-rich ecosystems (protected areas) that were previously unexplored and undeveloped for minerals.

Despite the significant potential for negative impacts on biodiversity from mining operations, there is a great deal that companies can do to minimize or prevent such impacts in areas identified as being appropriate for mining. There are also many opportunities for companies to enhance biodiversity conservation within their areas of operations. Being proactive in the assessment and management of biodiversity is important not only for new operations but also for those that have been operating for many years, usually under regulatory requirements that were less focused on the protection and enhancement of biodiversity.

## 2.4 Why Mining Companies Should Consider Biodiversity

Setting aside any ethical or moral considerations, which are increasingly the subjects of corporate policies, it is important for companies to address biodiversity for a variety of sound business reasons. Many mining companies have adopted an increasingly sophisticated approach to managing biodiversity as part of their commitments to establishing and maintaining a social or functional 'licence to operate'. For example, adopting responsible practices with respect to biodiversity management is increasingly viewed as important with respect to:

- ◆ access to land, both at the initial stages of project development and for ongoing exploration to extend the lifetime of existing projects;
- ◆ reputation, which links to 'licence to operate', an intangible but significant benefit to business, and which can profoundly influence the perceptions of communities,



In addition, good biodiversity management can bring benefits to mining companies, including:

- ♦ increased investor confidence and loyalty;
- ♦ shorter and less contentious permitting cycles, as a result of better relationships with regulatory agencies;
- ♦ improved community relations;
- ♦ strong supportive partnerships with NGOs;
- ♦ improved employee motivation; and
- ♦ reduced risks and liabilities.

### 3.0 IUCN's work with the mining industry

#### 3.1 International Council on Mining and Metals (ICMM) Mining Dialogue

At the World Summit on Sustainable Development (Johannesburg, August 2002), The World Conservation Union (IUCN) and the International Council on Mining and Metals (ICMM) launched a joint dialogue on mining and biodiversity. The idea was to provide a platform for communities, corporations, non-governmental organizations (NGOs) and governments to discuss and seek the best balance between the protection of important ecosystems and the social and economic importance of mining. IUCN and ICMM have committed themselves to discussing a full range of issues with the objective of enhancing the contribution of the mining industry to biodiversity conservation. The overarching aims of the Dialogue are:

- ♦ to improve the performance of mining industries in the area of biodiversity conservation, with a focus on reducing the negative impacts of the industry's operations and enhancing the industry's positive contribution to biodiversity; and
- ♦ to raise mutual awareness and understanding between the conservation community and the mining industry, so that both can contribute to improved outcomes for conservation and development in areas where they interact.

The role of the Dialogue is to assist in the identification of the issues; ownership of the issue(s) identified rests with the Dialogue partner(s) raising them. Outcomes of the Dialogue so far include:

- ♦ The ICMM Position Statement on Mining and Protected Areas<sup>2</sup>
- ♦ The joint publication of case studies on biodiversity conservation and mining<sup>3</sup>
- ♦ Draft good practice guidance for the industry on biodiversity assessment and management<sup>4</sup>

The mining dialogue is set in the context of broader interaction between the conservation community and extractives industries on environmental and social issues. IUCN has established a **Working Group on Extractive Industries and Biodiversity** to explore common issues within the conservation community, and establish a means of working together towards a common goal.

#### 3.2 Nestlé Nespresso

IUCN and Nestlé Nespresso SA have entered into a five year programme of work (2010-2015), to promote sustainability in the aluminium value chain. The AluCycle™ Initiative will look at the entire lifecycle of the aluminium used in Nespresso capsules, from bauxite mining and the protection of biodiversity through to post consumer recycling of capsules. Aluminium has been identified by Nespresso as one of three central pieces of their sustainability strategy due to the use of aluminium in the capsules.

The main objectives of the partnership are:

- ♦ creating a market differentiation for sustainability performance throughout the aluminium value chain;
- ♦ measuring and strengthening the ecological outcomes of the Nespresso Ecolaboration commitments; and
- ♦ exploring new business models which are designed to minimize Nespresso's footprint on the environment.

<sup>2</sup>Available at [www.icmm.com/library\\_pub\\_detail.php?rcd=171](http://www.icmm.com/library_pub_detail.php?rcd=171).

<sup>3</sup>Available at [www.icmm.com/library\\_pub\\_detail.php?rcd=173](http://www.icmm.com/library_pub_detail.php?rcd=173).

<sup>4</sup>See [www.iucn.org/themes/business/mining/wpitem\\_gpg.htm](http://www.iucn.org/themes/business/mining/wpitem_gpg.htm) for a description of this project.



And, as with almost all of IUCN's business partnerships, the intention is also to ultimately influence change in the wider aluminium sector, from bauxite mining companies, to industrial and consumer users of aluminium products, to how this metal is recycled and re-used.

The AluCycle™ initiative is part of a broader sustainability partnership being launched by Nespresso that will include coffee and coffee machines.

### 3.3 Rio Tinto

Rio Tinto is a leading global mining group, combining Rio Tinto plc, a public company listed on the London Stock Exchange, and Rio Tinto Limited, which is listed on the Australian Securities Exchange. Rio Tinto is involved in every stage of the mining business. Products include aluminium, copper, iron ore, coal, and uranium. Activities span the world but are concentrated in Australia and North America. Rio Tinto made a public commitment, in 2004, to biodiversity conservation and a goal of having a “net positive impact” on biodiversity.

The overall purpose of the proposed IUCN – Rio Tinto relationship is to build a business focused collaboration that enables Rio Tinto to improve its delivery of conservation outcomes, strengthen IUCN and Rio Tinto capacities for market-based approaches to conservation, and contribute to industry-wide improvements in the mining and associated sectors.

In addition to the partnerships that have been briefly mentioned above, Annex 1 has details of other IUCN's engagement with extractive industries.

### 3.4 IUCN interventions thus far

- ♦ Continuing dialogue, within and beyond MMSD/ICMM,
- ♦ Best practice guidance (e.g. on all stages of the mining cycle; in different biomes, e.g. arid/semi arid zones; EIA; stakeholder involvement; mining, biodiversity and CBD),
- ♦ World Heritage & Mining (e.g. advice to WH Committee; case studies; industry commitment to respect WH sites),
- ♦ Information sharing,
- ♦ Innovative alliances, e.g. certification of mining operations.
- ♦ Over 20 publications on issues of mining and biodiversity conservation

### 3.5 Conclusion

For many years IUCN, together with many other organizations in the environmental and social/human rights movement, has drawn the world's attention to the need for fundamental change and reform in the mining industry. Bitter complaints and controversy have surrounded the impact of mining operations on affected communities and the environment.

IUCN, along with other environmental organizations, have a history of dialogue with the extractive industries that has sought to improve environmental practices within the industry. IUCN has produced a number of guidelines for oil and gas exploration and production in key ecosystems, such as mangroves, the arctic and sub-arctic regions and the tropics, and on mining in arid and semi -arid lands and has provided advice on the issue of mining and World Heritage sites. The IUCN membership has also expressed its views on mining and biodiversity conservation, through a series of resolutions and recommendations at IUCN General General Assemblies and World Conservation Congresses, which address not only environmental issues but also social and equity considerations – including the rights of indigenous peoples.

Governments and mining companies have been slow to respond and, despite selective changes for the better, many of the problems remain unresolved. IUCN's interest in facilitating a renewed dialogue with the mining sector reflects our sense of urgency in addressing these issues. It also reflects IUCN's assessment that recent



initiatives undertaken by key players in the mining industry to tackle some of the major issues of conflict represent an opportunity for an open and constructive engagement that needs to be explored and tested.

Among these is the Toronto Declaration signed by CEOs of 23 of the world's leading mining companies making a public commitment towards change and reform. A further step included the establishment of ICMM as a collective platform for the companies to engage in a series of specific initiatives and dialogues to implement the commitments articulated in the Declaration.

While IUCN does not believe that declarations and new institutions in themselves lead to change, it does signal a new effort on the part of some members of the mining sector to catalyze change from within. In responding to ICMM's request for assistance in facilitating a dialogue on mining and biodiversity, IUCN has followed a long tradition of seeking to provide open and independent forums for addressing key challenges and issues in sustainable development. Such dialogues do not imply any a priori endorsements or commitments beyond the principle of constructive engagement, which also defines the boundaries of the term partnership.

While such engagement always carries with it risks of failure and disappointment, it is also clear that there can be little progress if we do not explore new opportunities for dialogue, negotiation and cooperation. IUCN remains conscious of the need to retain its independence and integrity, whilst ensuring a transparent process.



## Annex 1.

### IUCN working with Business

#### Background

The business community is increasingly aware of the risks posed by biodiversity loss and is becoming a more important player in efforts to counter it. Rightly so: most business leaders recognize the close interdependence between conservation, sustainability and long term economic growth. In a world increasingly characterized by a global market economy, there are growing opportunities for IUCN to harness the power of business to help deliver its programme.

Since the creation of IUCN, through more than two hundred resolutions and recommendations, IUCN's members have been raising a variety of private sector related issues for the Union to address. Pursuant to these calls, efforts over the years have led to approval by IUCN's Council of an IUCN private sector strategy in early 2004. Later the same year, at the 3<sup>rd</sup> World Conservation Congress in Bangkok, Thailand and subsequently at the 4th World Conservation Congress held in 2008 in Barcelona, Spain, members passed several resolutions, providing further guidance for IUCN's private sector work.

IUCN's Private Sector Strategy groups businesses in four broad categories, mainly on the basis of relationship of the sectors to the natural environment; large footprint industries, biodiversity dependent industries, green enterprise and the finance sector. These categories do not necessarily define the limits of IUCN's work or exclude some sectors from its purview. The categorization is more to enable a structured approach to addressing the challenges of biodiversity conservation in different sectors of economy.

**Large footprint Industries:** such as mining, oil and gas, dams, ports and others traditionally require large amounts of land. Areas of operation often intersect with habitats harboring high levels of biodiversity. Therefore, these sectors continue to represent the main target for IUCN to approach and to help transform their biodiversity risk into conservation opportunities.

**Biodiversity-dependent Industries:** this includes productive sectors that use and are entirely dependent on products and services from nature. For example agriculture, fisheries, forestry and food retailing aquaculture, can potentially have negative impacts on biodiversity.

**Biodiversity Finance:** given the vast amounts of capital that financial services, banks, and insurance companies control, the leveraging potential for projects that conserve rather than impact on biodiversity is enormous.

**Developing Green Enterprises:** New ventures such as eco-tourism market based conservation mechanisms and bio-prospecting are emerging as new business models attracting interest and investment and are principally driven by rapidly growing consumer demand in developed countries for healthy and environmentally friendly goods and services.

#### IUCN's Engagements with the Extractive Sector

The extractive industries are among those industries which significantly impact on biodiversity through the course of their business activities. The IUCN Membership has clearly expressed a mandate through numerous Resolutions, Recommendations, and Council Decisions to engage on issues of biodiversity and non-renewable resource extraction. Some examples of IUCN's engagements with the extractive industries sector and potential benefits are highlighted below:

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<sup>5</sup>Defined here as industries extracting non renewable resources including minerals, oil/gas, coal and corals



### 1) IUCN Shell Relationship

The world's second largest energy company, Shell International and IUCN have signed a five year agreement (2007-2012) that lays the foundations for substantive collaboration on delivering conservation outcomes. After more than seven years of working together, Shell and IUCN have strengthened their relationship by means of an agreement that will enable greater collaboration at all levels all over the world. The relationship seeks to enhance the biodiversity conservation performance of Shell and its Affiliates; raise biodiversity performance standards in the energy sector and its supply chains; and strengthen IUCN's capacity for leadership in business and biodiversity.

Key milestones in this collaboration so far include:

- ♦ Shell-IUCN Arctic Cross-Sector Impact Assessment Project (**June 2010-December 2011**)
- ♦ Shell-IUCN Arctic Regional Management Approaches Project (**June 2010-December 2011**)
- ♦ IUCN Reviews Biodiversity Action Plans (BAPS) of Royal Dutch Shell (**2009-2010**)
- ♦ **2000-2007**: Shell and IUCN collaborated in a joint industry NGO initiative (The Energy and Biodiversity Initiative – <http://www.theebi.org> to develop tools and guidelines for integrating biodiversity into oil and gas development.
- ♦ **October 2006**: A joint study "Building Biodiversity Business", scoping out the potential for building biodiversity businesses.
- ♦ **August 2003**: Shell's Commitment to biodiversity which recognizes World Heritage Sites as "no go" areas for its oil and gas exploration and development

### 2) Independent Scientific Review Panel for Western Gray Whales in Sakhalin

The demand on IUCN to conduct independent scientific reviews of controversial development projects that affect conservation continues to grow. The independent Scientific Review Panel for the Western Gray Whales in Sakhalin was appointed by IUCN, to review the threat to the critically endangered Western Gray Whales from an oil and gas development project led by Sakhalin Energy Investment Company – the company set up to implement the Shell-led consortium. The Panel provided advice and recommendations on how the company can minimize risks associated with its operations on the whales and their habitat. The clash of cultures involved as IUCN, its NGO partners, Shell and Sakhalin Energy came together was probably inevitable. However, IUCN clearly demonstrated its unique value as a convener, broker and as a platform for independent scientific review, found ever more important as the environmental community works with the private sector to ensure that both advance sustainable development.

### 3) Chevron

- ♦ To improve and expand the IUCN Red List of Threatened Species™ assessment process, further development of the tools used is required. In order to support the new developments an IUCN Red List Corporate Support Group has been established. From the extractive sector, Chevron and Shell are members of the support group.
- ♦ IUCN Bangladesh forged a partnership with Chevron in 2008, in the interest of its state member the Government of Bangladesh, to monitor and advise Chevron on biodiversity sensitivity in their operational areas in the Lawachara Forest, Barisal, Patuakhali, Jhalokathi and Pirojpur districts, areas rich in migratory birds, dolphins, turtles, *hilsa* fish as well as mangrove plants. IUCN engaged in recording observations of marine fauna on-board the seismic survey vessels; developing fact sheets on turtles, dolphins and bird sightings; training and sensitizing Chevron staff on the significance of marine biodiversity and facilitating dialogue using its convening power between Government, NGOs and other stakeholders. IUCN's extensive scientific networks, the clear values set out in its mission statement, its moderation and disinclination to engage in active advocacy combined to make IUCN a neutral forum for objectively-based consensus seeking in this work.



- ♦ The Chevron Thailand Exploration and Production, Ltd and IUCN are working together in improving integrated waste management practices for conserving Koh Tao island's ecosystems and promoting participatory approaches to deal with such issues. Covering an area of about 21 Km<sup>2</sup>, Koh Tao Island is located about 70 km east of the coastline between Suratthani and Chumphon, in the Gulf of Thailand. The island is one of 10 top-diving destinations of the world visited by 400,000 people annually. It has been recognized that the island's ecosystem, including coral reefs which are spread over the area of approximately 1,199.38 rai, is facing serious threats due to unsustainable waste management practices. The objective of the interventions is to contribute to supporting a multi-stakeholder approach where a small grant model could be used to enhance capacity and build ownership amongst stakeholders. With additional investment from the private sector the project aims to address island ecosystem health through addressing critical issues related to sustainable island management with the involvement of communities.

#### 4) PTT Exploration and Production Public Company Limited (PTTEP) and TOTAL E&P Thailand

The PTT Exploration and Production Public Company Limited (**PTTEP**), the leading energy producer Thailand, energy producer and provider **TOTAL E&P Thailand** and **IUCN** have signed a Memorandum of Agreement to jointly launch a project on poverty reduction in the Doi Mae Salong Landscape, by improving local economic conditions through income generation opportunities. Located in Chiang Rai Province of Thailand, the Doi Mae Salong landscape, home to 35,000 people has diminished in ecosystem functions and services over the years as a result of social pressures. It has been recognized that the populations in the watershed are living in significant poverty and are vulnerable to unpredictable risks such as seasonal climatic variations which affect their crops and economic shocks such as market shifts.

This three year public-private partnership initiative to be implemented by IUCN will support affected populations by engaging in income generation and expenditure reduction opportunities using a participatory approach. Since 2007, IUCN through its Livelihoods and Landscapes Programme in co-operation with the Supreme Commander's Office of The Royal Thai Armed Forces has focused its attention on the most critical area, successfully implementing a Forest Landscape Restoration Project in this watershed. The work has been focused on forest rehabilitation and supporting the development of alternative income generating opportunities that aim to improve the ecosystem function and quality of life of the people living within the landscape. The current initiative will build on the existing structure and contribute to poverty reduction of the population by improving the economic situation at the village and household level, through promoting income generation and household expenditure reduction options.

#### 5) PTT Exploration and Production Public Company Limited (PTTEP) and Six Senses Resorts and Spas

As an eco-tourism based resort, Evason Hua Hin & Six Senses Spa prides itself as being a leader within the industry with the resort leading the way in environmentally friendly practices. Evason Hua Hin worked on a co-operative programme with PTTEP and the Mangroves for the Future (MFF) Programme in supporting the conservation and management of the Srinart Rajini Mangrove Ecosystem Learning Centre in Pranburi. The co-operation had dual benefits. It added value to the Mangrove Ecosystem Learning Centre in order to further facilitate sustainable mangrove forest management in the area and elsewhere with the participation of relevant stakeholder groups including local communities as well as pilot tested practical and relevant guidelines focusing on private sector use of protected areas for sustainable tourism.

#### 6) Holcim and IUCN

Holcim and IUCN have been working together since 2007, to develop robust ecosystem conservation standards for the Holcim Group and to encourage improvements in the wider cement sector. Through this partnership IUCN has reviewed Holcim's biodiversity conservation management and developed a more comprehensive corporate biodiversity policy and strategy for the group. This Biodiversity Management System is expected to systematically guide the company in its approach to biodiversity management. IUCN has been working jointly with Holcim's local operations in Sri Lanka, Vietnam, Costa Rica, Nicaragua, Spain and China in accelerating the restoration of biodiversity and landscape values at Holcim quarries. A second phase of the partnership agreement has been signed in 2011 for a further three years.



## 7) TATA Steel

IUCN and the Dhamra Port Company Limited (DPCL), a subsidiary company of Tata Steel in India in partnership with Larsen & Toubro Ltd., worked together on sound environmental management in the development and operation of the Dharma Port project, which will also promote longstanding positive industry–conservation relationships - a core principle of IUCN. The strategic objectives of the collaboration between the Parties was to avoid where possible, or minimize and mitigate the impacts of the development on Olive Ridley turtles and compensate or offset any residual impact that cannot be avoided or reasonably mitigated. This work also promoted improvement in the project's performance in other aspects of environmental management, such as terrestrial habitats affected by access roads, railway lines and other secondary developments, and has paved the way for raising national and global standards for environmentally responsible development of mega projects with a special reference to those proposed for the Orissa coastline

## 8) World Business Council on Sustainable Development

In 2005, IUCN and the World Business Council for Sustainable Development (WBCSD) have agreed to intensify cooperation in strengthening global efforts to protect the earth, its forests, its wetlands, its biodiversity and its vitality for human wellbeing and development. Both IUCN and WBCSD have a common objective to enhance cooperation between business and conservation groups to foster the conservation and sustainable use of ecosystems and the essential services they deliver.

This four years agreement sees the two organizations working together to develop and promote the business case for biodiversity; encourage and support NGO/private sector partnerships and dialogues; mainstream biodiversity conservation in the business operations of WBCSD members; enhance civil society understanding, recognition and support for biodiversity leadership by business; help develop, test and promote the use of market-orientated strategies and business actions that support sustainable management of natural resources.

### NaturalGist

- ✦ *IUCN works towards identifying solutions to environmental and development challenges.*
- ✦ *Through various studies it has been seen that good management of society and biodiversity issues leads to more sustainable mining and sound business strategy.*
- ✦ *IUCN together with ICMM has researched many examples and developed guidelines of good practices in mining.*



# Additional Reading



Madhukar Bachulkar From *Sakav 2011 Annual Marathi Issue of AERF*, translated into English by Santosh Shintre

Kolhapur district in Western Maharashtra is rich in biodiversity. It also holds ample reserves of Bauxite ore. It is a part of Sahyadris mountain range and the Western Ghats. Thick growth of forests on the mountain slopes, and plateaus on the mountain tops is a distinguishing feature of this terrain. They have huge Bauxite reserves contained within them. The lateritic plateaus may appear barren in dry season, but they harbour several rare, threatened and medicinal monsoon herbs and provide habitat to fauna. It is scientifically incorrect to allow their destruction because of this apparent lack of tree cover.

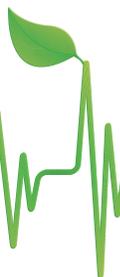
Government of Maharashtra had leased the mountainous region in the western provinces of Kolhapur district to Canadian multinational 'Indal' with a 30 year lease in 1968. Indal has been operative in the *Nangartas wadi* (Taluka Ajra) and *Kasar sada* (Taluka Chandgad) for past 20-25 years. These two are the sites, which lie in the reserve forest. It has also been operative in the *Durgamanwadi* region for past 5-6 years, which is a privately owned field. Yet another site *Idarganj* is a part of *Radhanagari* wildlife sanctuary. The lease ended in May 1998. *Durgamanwadi*, being privately owned, is still operative.

Even in these past extractions, Indal had caused massive destruction to the environment and natural resources at those places. The *Idarganj* site is situated at an altitude of 900 meters in the middle of *Radhanagari* sanctuary. Just to retain their lease rights, in January 1998, *Idarganj* became operative. A road of six kilometer paved a way to the mining site from the sanctuary by felling numerous trees. The road leading to the mining site totally passes through a dense forest-a habitat for Bison, Wild boar, barking deer etc. Forest department has recorded an existence of five tigers in this area. Two dams are situated near *Idarganj* – *Kalammawadi* and *Radhanagari*. The water reserves in these dams are largely dependent on the rainfall in this forest of *Idarganj*.

'Nisarg Mitra' from Kolhapur and 'Green Guards' from Mumbai jointly obtained a stay order from the Mumbai high court- which prohibited the mining in the sanctuary area. This suit is expected to conclude in next few months. While the battle for *Idarganj* is still in the courts, the state government recently diverted yet another 3000 hectare from the sanctuary area for mining of bauxite. This includes the villages of *Vasnoli*, *Kondoshi*, *Dublewadi* and *Savarde*. The decision reveals the total apathy of the state government towards the cause of nature.

Indal always claims their activities to be 'eco-friendly mining' citing the restoration of *Durgamanwadi* to support these claims. However, at *Nangartas* and *Kasarsada* the company has failed to complete the 'refilling' clause in the lease agreement. The overburden created at the time of mining has been whisked off on the mountain slopes. There are no protective barriers created at any of these sites to prevent this overburden from the loss of soil. During rainy season, the soil spills over along with the seasonal streams, ultimately flowing into the river and polluting it. Mining dust accumulates on the plant foliages and is harmful for both animals and plants. In the mining field a lot of noise pollution is seen with umpteen numbers of dozers and trucks ferrying away the mined product. On an average 250 to 300 trucks daily commute in this area. Drilling and blasting is used at the *Kasar sada* site. So the company claims of eco friendly mining are far from the truth. *Durgamanwadi* mine is illegal as it is within 25 km radius from *Radhanagari* sanctuary area, which is not allowed as per the forest laws.

The government, in past 2-4 years has not executed any development of these talukas. Encashing on this fact, Indal is posing itself as the savior and messiah for the reason with its paltry contribution of 0.1 % of the profits earned. It seems to have pocketed all the political parties, MLAs and government officials.



In past few years the company has earned phenomenal profits from this destructive mining. (Rupees fifty nine crores and nineteen lakhs to be precise - just by the sale of shares in last few years). Its claims about creating a local employment for truckers and transporters are false as most truckers are from outside the state.

Extracting Bauxite involves a digging of the top-level soil to an extent of 12 meters. To create this ecologically important layer of soil takes millions of years. Mining reduces the height of the *sadas* by 10 to 15 meters, affecting the drainage as well the adjoining jungle.

The area of *Radhanagari* sanctuary is less than even 0.01% of the total area of Western Ghats. Why Indal is so vehement and adamant in pushing its cause of destructive mining only from this area remains a matter of concern and action.



Recently a coal-based power plant in Gujarat got environment clearance from the state approval agency under the Environment Impact Assessment (EIA) Notification, 2006. This clearance letter ran into nine pages and listed 121 conditions that the company is expected to follow to keep its permission valid. Many of these relate to controlling the impacts on air, water, land, noise as well as allowing local fisherfolk access to their fishing space. Ironically, while appraising the environment impact of this proposed plant, the concerned regulatory body concluded that such power generation in a fragile marine habitat will have negligible impact. This logic made it possible to grant clearance.

This project is an addition to the 7,000-plus set of mines, dams, thermal power stations and highways that have received conditional clearances from the ministry of environment and forests (MoEF). While the onus lies with the project authority to comply with these conditions, their monitors are the regional offices of the MoEF or relevant state agencies. At present, six such regional offices of the MoEF monitor over 7,000 projects. A simple calculation reveals that the regional offices are able to monitor each project, with a site inspection, once every 3-4 years.

The MoEF has acknowledged this to be a problem. Their position and proposed solutions are articulated in a note that was put out for public comment in late August, 2010. But the note seems to fail to identify the root causes of the monitoring menace. MoEF's road forward circumvents two critical issues that make the compliance an impossibility.

The first is the nature of the conditions themselves. With the grant of clearances being the prime intent, clearance procedures result in creating conditions that make up for the shortfall in project EIAs. The conditions require studies, which should have been part of the initial assessment, to determine if the activity is environmentally viable. However, approvals are granted with conditions such as studying the downstream impact of a dam alongside the construction of the project. Similarly, is it viable to allow the construction of a thermal power plant with ex post facto assessment of how it will impact the alphonso mangoes that are the livelihood of the region? What if the study indicates that the impact will be irreversible? Will the project authorities be willing to undo their projects?

The second issue is the sheer number of projects that have been granted approvals. The MoEF simply fails to accept this as being the core of the problem of non-compliance. While the clearances of new projects such as POSCO and Vedanta are deliberated upon extensively, little attention is paid to the environmental performance of the projects that were cleared in the past and that lack any consistent attention, either from regulators or environmental groups. This high rate of clearance of high impact projects is not about to change because we seem to have more public hearings or because we now have a pragmatic ministry that speaks of finding a balance between environment and development. Over the years, the regulatory processes that govern environment clearances have been 'streamlined' for efficient functioning (granting clearances). With 10 expert appraisal committees meetings every month and reviewing an average of 40 projects in each two-day meeting, the clearance rate of about 100 a month is not uncommon.

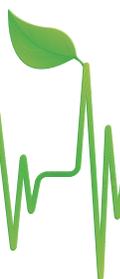


MoEF's note on monitoring issues requires us to believe that environment protection and development can happen simultaneously and the trade-offs needed to make this possible are benign. Such a conviction relies on the Environmental Kuznets curve, an econometric tool that allows us to undertake activities that cause environmental damage as we achieve high rates of growth and generate finances. Once there is sufficient amount of money created, it can be used to rectify the damage. The crucial thing to understand is that many affected people cannot afford to await the day when this shift takes place.

MoEF's new note also envisages the determination of penalties as an important deterrent for non-compliance. While some might consider it a useful addition to monitoring system, the Indian experience of penalties through the 'polluter pays' approach has only been a partial disincentive at best. It is not a surprise then that the Compensatory Afforestation Planning and Management Authority today boasts Rs 11,000 crore in its coffers, almost all of which has been collected from forest loss and related penalties. While the MoEF states that these funds will be used to regenerate forests, the performance on compliance so far offers no confidence that this will be done.

The country's vexed problems of environmental non-compliance will not disappear once monitoring becomes remote sensing complaint or self-assessments of project authorities are available online. A turn around to review the established ways of thinking about the environment clearance process is needed. Else, we will continue to suffer absurdities like the grant of clearance to a polluting industry with 121 conditions, most of which may never be monitored.

*The authors are members of Kalpavriksh Environmental Action Group.*



India is blessed with vast mineral resources - and it's but natural that a rapidly growing economy such as ours would want to extract value from them. At the same time, mining needs to be mindful of the impact on the environment and on the people who live on, and off, the land. Sadly, both concerns have been sacrificed at the altar of unbridled greed. Money and politics have come together in a manner rarely seen before. A new breed of robber barons is defacing the country's landscape - with dangerous political, social and ecological consequences.

Two weeks ago, the Raigarh district of Chhattisgarh turned into a garrison. More than a hundred policemen stood guard. School-children stayed home. Local newspapers warned of possible violence. The issue? Not the Maoists (or at least not directly) but the mines. The police had been deployed for a peaceful public hearing on the expansion of a coal mine and coal washery of Jindal Power Limited. Last month, a public hearing to expand mining by Hindalco was suspended after violence broke out in Sambalpur. People were protesting the excess mining from Talbira-1 coal mines for Hindalco's power plant at Hirakud. Stories of rebellion are pouring in from all over the country more than ever before. Tribals, farmers, activists and NGOs are agitating in different ways. Public hearings are flashpoints of anger and often require heavy police security. Frustrated villagers are openly turning to violence. It's hard to miss the emerging pattern. The mineral belt of the country is turning into a minefield of anger.

Put a red dot on India's map for every flashpoint and you will find the heart of the country pockmarked in red. There is a reason for this. The country is witnessing an unprecedented mining boom. Enormous swathes are being fenced off and even larger portions being divided as booty for officials and mining czars sitting far away from the heat and dust in state capitals and Delhi. The ground is being dug up with a craze that India has not witnessed since Independence. In the greed for what lies beneath, what grows on the soil or who lives off it is fast becoming irrelevant.

### Shock & Ore

Want to get an idea of India's Operation Ore? Take a look at these numbers. . . In the last 20 years, India's coal production has tripled. In 10 years, iron ore production has jumped by 286 per cent, bauxite by 350. In terms of the land used, coal, limestone, iron ore and bauxite mines currently occupy about 390, 000 hectares of land. Another 260, 000 million hectares are locked in power plants and refineries to turn this wealth into gold. This is the story so far. Look at what the miners want to take over in the coming years. The Union government has decided that 450 coal blocks covering about 3, 80, 000 hectares of forest land will be open to mining in future. That's roughly six times the size of Mumbai city. But the coal miners aren't happy with so modest a patch. They want land the size of 11 Mumbais. Never mind that this is just forest land one is talking about. There are other kinds of land: villages, government lands and public commons that will be swallowed up to build the infrastructure that a mine needs. This is just coal. India is engorged with mineral wealth. As many as 86 minerals, which include four fuels, 10 metallic, 46 non-metallic, three atomic and 23 minor minerals. Iron, bauxite, copper, gold, diamonds, limestone, granite, asbestos, chromate and more. And while the mineral wealth is spread through the country, it is concentrated most richly in the central belt. An estimate by the Centre for Science and Environment suggests that if the current rate of economic growth is maintained, 1, 85, 000 ha of additional land will have to be leased to mine coal by 2030. This is 50, 000 ha more than all coal mine leases granted



in the country so far. Iron ore mining will require an additional 56,000 ha; limestone mining 61,000 ha and bauxite mining 28,000 ha. When you mine you also refine or produce power. Another 252,000 hectares will be required to put up these power plants and industries. To cut costs and remain competitive, the industries and power plants will come up close to the mined lands.

### A Reason to Dig

There is a reason for the frenzy. It's not as if the miners have just woken up. There is a surge in international demand and the second fastest-growing domestic economy that needs to be constantly fed. The 9 per cent growth India aspires to comes at a cost that the finance ministry doesn't keep a ledger for - colossal environmental degradation and displacement, mostly of the poorest. Economists politely call it 'externalities'. The mismatch of demand and supply has sent the prices for minerals soaring in the past few years.

According to the International Monetary Fund, international metal prices rose by more than 400 per cent between 2000-07 and promise to continue rising after taking a hit for a year due to global recession. International iron ore prices have jumped by 700 per cent between 2000-2010, making a quick recovery from the recession. The wholesale price index of metallic minerals in India between 2000-10 has increased by nearly 11 times.

Logically, one would think: isn't it a good time for the country to sell its wares when they are the most in demand? Isn't it a national asset to be exploited for the country's economic development? But the world of mining and the regulations governing it do not operate on logic. They operate to make super-profits for miners and turn them into political czars who topple state governments and dictate policy that makes it easier to dig more. They provide peanuts to the state exchequer and the people.

Take the example of iron. The price of iron ore fines (what Indian miners mostly export) hovers between US \$120-200 per tonne (around Rs 4,500-9,000 per tonne). At the worst of times, the prices slumped to Rs 1,500-2,000 per tonne for a while. In comparison, the royalty that iron ore excavators paid up until 2008 ranged from Rs 4 to Rs 27 per tonne. There was no export duty. It cost roughly Rs 150 per tonne to excavate the ore and another Rs 250 per tonne to move it. The total cost to the miner: Rs 427. Let's inflate it a bit not to sound unreasonable or biased. Say Rs 500 per tonne. The profit to the miner comes to anything between Rs 1,500-8,500 per tonne. What did the state get? A measly Rs 27 per tonne at best.

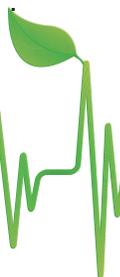
The government woke up a bit late in the day and with a lot of fanfare announced that it would link royalty on ore to sales price. The miners cried themselves hoarse and the government claimed it wouldn't back off. In 2009, it finally imposed a 10 per cent royalty on the sale price. The sale price was to be set by the Indian Bureau of Mines (IBM). In July 2010, the IBM sale price was Rs 2,228. At the time, the iron fines were being exported to China (the most favoured destination) at \$115-120 or Rs 5,175-5,400 per tonne, more than double what the government charged the royalty on.

No wonder, the iron ore miners of Andhra Pradesh, Karnataka and Goa became overnight millionaires and political satraps while the people who lived on the mined lands took to protests and agitation.

But the official figures tell only part of the story. The real profits lie in illegal mining, which is rampant across the country. The beleaguered Karnataka chief minister B S Yeddyurappa told the state assembly recently that in 2007-08 alone, 4.7 million tonnes of iron ore worth roughly Rs 2,500 crore was exported from the state without a license. It's hard to imagine how thousands of truckloads of ore just disappeared from the country unnoticed.

Illegal mining remains so rampant that the government has been forced to set up a commission of inquiry. The mining industry too operates in flagrant violation of the laws of the land. Take the famous case of Vedanta mining in Orissa. The alumina giants were building a plant 600 per cent bigger than what they had sought clearances for. Posco, the Korean steel king, was preparing to build a plant five times as large as that sanctioned. Chhattisgarh has seen scandals erupt over mining leases given to fictitious companies.

If you want to step into the realm of bizarre, look at Orissa's overall mining situation. A legal loophole allowed hundreds of mines to operate in the state without proper clearances. A Supreme Court committee discovered



this recently. The Central Empowered Committee recently found that 215 out of 341 working mines (more than 60 per cent) were operating without statutory clearances. Some had been in the business for more than a decade and several for more than two decades. The entire state-wide operation went on without anyone ever being booked for it. Oddly, the apex court committee too recommended letting them off the hook with a pittance of a fine. Does the word loot and systematic plunder sound too harsh?

Flouting laws is not a one-off thing. It's become the rule that makes overnight mining millionaires the new dons of crony capitalism in India.

### Collateral Damage

The casualties of this murky, corrupt world of mining are the people who get displaced and the soil that is degraded. It's always the poorest who get hit the worst because most of the mining zones are predominantly in the tribal belt of the country. The minerals are buried under some of the best forested lands that are used or inhabited by the tribal communities. With the rapid increase in mining, they are the ones who are bearing the brunt.

The average forest cover of the 50 major mineral producing districts, also the mineral-bearing districts, is 28 per cent while the forest cover of the country is 20.6 per cent. About half of these districts are also districts where tribal people live.

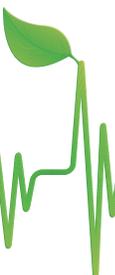
The Centre for Science and Environment cites the example of Dantewada in Chhattisgarh - the top iron ore producer in the state, accounting for 69 per cent of the total output. The forest cover is as high as 62 per cent, while the tribal population is 79 per cent in the district. It is also the hotbed of the armed Naxal movement in the state. In its book, *Rich Lands Poor People*, it notes that for every one per cent that it contributes to the GDP, mining displaces three to four times more people than all development projects taken together.

In India, to date, no one has even counted the hundreds of thousands of landless workers who have lost their livelihood and been displaced from these mineral zones. An estimate suggests mining projects displaced around 25.5 lakh people during 1950-91. More than half of these were tribals. Not even 25 per cent of these displaced got resettled. There are no official figures for displacement in the post-liberalisation '90s, but it's easy to note that the rate of mining and attendant industrialisation has increased rapidly with privatisation of the sector. Coal India Limited, in a report, notes rather candidly that the victims of resettlement often end up as exploited contract labourers trapped in perpetual poverty or they simply leave the area, to reappear in the slums of the city or as squatters.

Simultaneously, an efficient mining business has also become less labour intensive. Average daily employment in India decreased by almost 2 lakh people between 1994-95 and 2003-2004. Therefore, as it displaces more poor from their lands, it absorbs less and less people.

Some experts within the government suggest that privatisation also opened up prime or decent agricultural lands that the state corporations earlier were unable to access. While the tribals are a mute and politically fractured community, farmers have been more vocal and powerful in agitating against the land grab.

It would be stating the obvious to say that once the people are driven from their lands, mining turns any land into a dust-laden zone of grime and soot. It's the nature of the business. For every tonne of coal produced, roughly 3-4 times the amount of soil is excavated. During 2000-08, India produced 4, 096, 480 thousand tonnes of coal. We leave it to your calculators to figure out how much soil was dug up to produce this. Where did it disappear? It didn't. It's been dumped somewhere in India. Quite easy to guess: somewhere close to the mines, in someone's backyard very often in the lands of the poorest tribals, in rivers and on common property. An estimated 1.84 billion tonne of waste was generated from mining of major minerals in India in 2006. Mining and minerals-based industries consume as well as pollute water. Iron ore mining in India, for instance, used up 77 million tonnes of water in 2005-06, enough to meet the daily water needs of more than three million people. Just one mega-plant of the Korean giant Posco coming up in Jagatsinghpura is expected to squeeze out the entire water supply of Cuttack city.



All the mining regions of India are air-pollution hotspots. Towns like Korba, Bhilai, Satna and Dhanbad have been declared critical by the CPCB. Imagine the irony of having lived over a gold mine as a pauper before the state calls it national property and throws you out to work as a construction labour or housemaid in the city or - just as bad - force you to mine another poor man's rich land. Could there be a better recipe to prepare an army of angry youth to feed the Naxal violence that now grips the mining zones of India? Mineral wealth is essential to the country's economic growth, but the way it is being exploited for the political growth of a few mining czars promises to create strife and unrest across the hinterland like mainland India has never witnessed before.

*With additional reporting by Supriya Sharma in Chhattisgarh*



**EXECUTIVE SUMMARY**

Of the Report

**Scope, Structure and Processes of National Environment Assessment and Monitoring Authority (NEAMA)**

For Ministry of Environment & Forests, GoI

By

Prof. Kanika T. Bhal  
& Prof. Ravi Shankar



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**EXECUTIVE SUMMARY**

The project titled 'Scope, Structure and Processes of National Environment Assessment and Monitoring Authority (NEAMA)<sup>1</sup> given by MoEF to IIT Delhi consortium had the broadmandate for developing the objectives, structure and core processes of the proposed NEAMA.

The findings and recommendations of the project are based on a) an analysis of various research and committee reports, b) a critical review of the implementation of EIA notification 2006, CRZ notification 1991 and proposed CZM Notification 2010, c) a review of the international practices d) field visits to CPCB, SPCB (Maharashtra, Gujarat & Punjab), regional office of MoEF, Maharashtra Coastal Zone Management Authority, Punjab PCC, IA and CRZ divisions of MoEF; and e) stakeholder consultations with the industry, civil society and government representatives.

Major findings and recommendations in this summary are classified under three sections. Section I brings out the need, scope and fundamental principles for the design of NEAMA. Sections II and III present structure and process related recommendations respectively.

## MAJOR FINDINGS & RECOMMENDATIONS

### Section I: Need, Scope & Fundamental Principles for NEAMA

1. Though there are institutions like CPCB and SPCB for handling issues of pollution control and post commissioning monitoring of projects at the Centre and State levels respectively, the core processes of granting EIA and CRZ clearances, preparation of CZM plans and post clearance monitoring (till commissioning stage) have no well defined institutional framework and are housed in the Ministry of Environment & Forests, GoI. The need for a body like NEAMA arises from the rapid industrial and infrastructural development in the last decade, which has exerted tremendous pressure on environment. The number and complexity of the projects being processed for environmental clearance has increased multifold whereas the capacity and resources available with MoEF and its agencies have remained limited.
2. Clearance conditions have three key elements. They are objective and measurable, consistent and fair, and economically and technologically viable.
3. Our review of the international practices reveals most countries have independent, specialized institutions for conducting EIA, Coastal Zone Management and Post Clearance Monitoring.
4. We analysed the implementation of EIA 2006 notification and the proposed CZM notification 2010 in terms of policy, structure and process level issues. **Almost all the problems in implementing these notifications relate to structure and processes.** Key issues are mentioned below
  - a. The presence of MoEF in both the appraisal and approval processes leads to a **perception of conflict of interest**. The Member Secretary (who, according to the 2006 notification, was supposed to be the Secretary) is involved in the processing, appraisal and approval of the EIA applications.
  - b. Lack of permanence in the Expert Appraisal Committees leads to **lack of continuity and institutional memory** leading to poor knowledge management.
  - c. Current EIA and CRZ clearances rely predominantly on the data provided by the project proponent and the **absence of authenticated and reliable data** and *lack of mechanisms to validate the data provided by the project proponent* might lead to **subjectivity, inconsistency and inferior quality of EIA reports**
  - d. Though the EIA notification requires several documents like ToRs (for every project), minutes of public hearing meetings (for each project), EIA report (with clearance conditions) and self-monitoring reports to be put in public domain (predominantly on the website), this has not been done for lack of institutional mechanisms. This leads to a perception of **lack of transparency** in the processes.

<sup>1</sup>Earlier proposed to be NEPA, but with a modified scope of the organization, it is now named National Environment Assessment and Monitoring Authority to reflect the scope of its operation.

- e. Several studies have pointed toward the poor monitoring of the clearance conditions. Huge gaps in monitoring and enforcement of clearance conditions actually defeats the very purpose of grant of conditional environmental clearance.
5. Based on the observations made above (para 2), international benchmarks and a review of several committee reports, the following three principles are used as loadstars for the design of NEAMA.
  - a) Independence of appraisal and approval process (to address conflict of interest issues).
  - b) Objectivity/predictability in the appraisal process through use of authenticated, reliable and valid scientific (real-time/time series) data procured through independent agencies, institutional memory and permanence in the Appraisal committees. NEAMA to be scientific, economic and analytical tools driven.
  - c) Transparency in the process and outcomes of appraisal and monitoring by putting them in the public domain predominantly through the website.
  - d) The body should have a statutory foundation to ensure autonomy.

### Section II: Structure Related Recommendations

6. The three broad objectives of NEAMA would include a) Processing EIA, b) Processing CRZ clearances and preparing coastal zone management plans and c) Monitoring of compliance conditions in pre-commissioning stage and coordinate during the postcommissioning phase upto the validity period of the clearance.
7. Given the mandate of NEAMA, National Coastal Zone Management Authority (NCZMA) would be subsumed in NEAMA.
8. Authenticated data on air and water quality to reside with CPCB, on forest with the FSI and on coastal regime with the NCSCM.
9. Additionally, in view of the ambiguity in the functioning and control of State Environment Assessment Authorities (SEIAAs) and State/ Union Territories Coastal Zone Management Authorities, an additional objective of NEAMA would also be the coordination and guidance of these two bodies.
10. NEAMA would derive powers from the EP Act, 1986 (Powers of entry & inspection, Power to direct utilities to maintain registers and furnish reports, Authority to prosecute for offences, Power to take samples, Power to give directions and Power to appoint its own officers).
11. However certain amendments are recommended in EP Act, 1986 which include a) Power to Charge a fee from the Project Proponent; b) Power to take bank guarantees as a performance enforcement measure, and c) Power to determine and levy financial fines for non-compliance, non-filing of self-monitoring reports, false data, misrepresentation and any other violation of the EIA notification 2006 and proposed CZM notification 2010.
12. Charging of a suitable fee from the project proponent would provide financial autonomy to NEAMA.
13. The Chairman and Full Time Board Members are to be from technical/scientific or environmental economics or environmental management backgrounds and to be appointed by the Central Government.
14. Part-time members are to be drawn from various stakeholder groups. A representative from the civil society/NGO is to be present on the Board as a part time member.



15. A code on conflict of interest is proposed to further bring in accountability of the apex level Board members. Broad guidelines for developing a code on conflict of interest are proposed, which includes general principles, nature and process of disclosures, acceptance of gifts and procedure for public to raise conflict of interests. These codes would apply to all and particularly to the Board, Full and Part-time members and the TACs (including the invited experts).
16. Expert Appraisal Committees are renamed as Thematic Appraisal Committees (TAC) and are to consist of 8 full-time members drawn from different divisions of NEAMA (like Survey & Research, Economic Costs, database management, EIA and CRZ Divisions), to respond to the need of continuity and institutional memory. Drawing experts from different divisions would also address the need for including diverse skill sets in TACs. External experts from empanelled Institutes/agencies may be invited on TACs on a case to case basis. TACs to be chaired by the Chairperson or full-time Members of the NEAMA.
17. NEAMA includes Survey & Research, Economic costs, Database Management divisions (for scientific data, analysis, interpretation and use), for scientific and analytical rigour which will lead to objectivity and predictability.
18. It also has a dedicated IT division to make all the reports available on the website to increase the transparency. Monitoring, compliance and enforcement to be done through the six zonal offices of NEAMA.
19. Monitoring and enforcement of the CRZ regulations to be addressed by NEAMA in conjunction with the State/UT Coastal Zone Management Authorities.

### Section III: Process Related Recommendations

20. The appraisal of projects for EIA/CRZ clearances and review of coastal zone management plans is proposed to be done by NEAMA. Based upon the recommendations of NEAMA, the approval or otherwise shall be done at the level of MoEF.
21. Model ToRs are to be generated with the help of in-house Survey & Research, Economic Costs and Database Management divisions of NEAMA.
22. The entire process would be automated. Transparency in the EIA, coastal zone clearances and preparation of Coastal Zone Management plan, is sought to be increased by putting up a) ToRs ( for every project), b) Minutes of public hearing meeting (for every project), c) Final EIA report with clearance conditions, d) Self monitoring reports e) Reports of inspections done by NEAMA staff and empanelled inspectors, on the NEAMA website.
23. There are well-defined steps in the process that use real-time as well as time-series scientific data (from both in-house expert divisions and outside experts) for validating the data provided by the project proponent and decision-making.
24. Project proponents may get authenticated data (from accredited institutions/agencies like CPCB, FSI and NCSCM) on payment of fee.
25. Calculation of economic cost of compliance conditions is required to be a part of the EIA report. To ensure compliance, it is recommended that the project proponent be asked to furnish a Bank Guarantee (objectively linked to the total cost of compliance conditions). This would ensure a) compliance on the part of the project proponent and b) imposition of realistic and monitorable conditions by the TAC.
26. Services of NCSCM may be taken for preparation of draft Coastal Zone Management plans.



27. Public hearing is to be included in the process of preparation of Coastal Zone Management Plans.
28. It is proposed that a NEAMA observer be present in public hearing meetings and the report of these observers be considered along with the minutes of the public hearing meetings.
29. Monitoring, compliance and enforcement is to be the responsibility of NEAMA. Monitoring is to be done through three mechanisms a) six-monthly self-monitoring report; b) inspections by the NEAMA staff; and c) inspections by authenticated and suitably qualified inspection agencies. The information on compliance and enforcement should be made available on the website of NEAMA and MoEF in public domain for social audit. Monitoring has to be done with respect to the independent database, environmental standards and the conditions imposed in the clearance.”
30. By way of monitoring and enforcement, a warning is to be issued in the instance of failure to submit self-monitoring report in time. If the organization still does not respond, an economic fine is to be levied. For non-compliance, economic cost of non-compliance is to be assessed and charged from the organization for non-compliance. An amendment in the E(P) Act, 1986, may be needed for this purpose. In addition, directions under Section 5 of the Act, including directions of closure in extreme cases, may also be issued.
31. The competencies of the people in NEAMA need to reflect a) Scientific and analytical nature of the core processes and b) diversity of the skills required in the processes.





## कल्पवृक्ष

### Kalpavriksh Environment Action Group

15th December 2010  
Shri Jairam Ramesh  
Minister of State (Independent Charge)  
Ministry of Environment and Forests  
Paryavaran Bhavan, CGO complex  
New Delhi 110003

Subject: Response on the Discussion Paper on National Environment Assessment and Monitoring Authority (NEAMA)

Dear Shri Ramesh,

We are writing to you in response to the discussion paper dated 26th November 2010 put out by the Ministry of Environment and Forests (MoEF) seeking responses to the proposal for setting up a National Environment Assessment and Monitoring Authority (NEAMA). We would like to state at the outset that we appreciate the acknowledgement in the note that there has been tremendous pressure on the environment due to rapid industrialisation, infrastructure development and population growth. However, we remain disturbed with the MoEF's position to find solutions to this and other problems (as stated in the note), within the scope of institutional reform.

The articulation that the existing regulatory institutions have been unable to cope with the environmental challenges especially with regards to the environment and CRZ related approvals, has been often repeated. The 2006 reengineering of the Environment Impact Assessment (EIA) Notification and had brought on board the concept of State Level Environment Impact Assessment Authorities (SEIAAs) as an institutional change to reduce the pressure and burden on the MoEF to administer and appraise environment clearance applications. Today there are 23 functional SEIAAs in the country which are looking at clearances of several industrial and infrastructure projects. However, it cannot be said with any confidence that the quality of assessment, monitoring and compliance, public participation and final appraisal has improved. We have and continue to cite several instances where the constant increase in the number and faulty process of clearances has put ecological landscapes and peoples' livelihoods under continued distress.

We have stated in our earlier communication to you that these problems cannot be resolved through such limited institutional reform. In fact it may have the potential to worsen it. We believe that any institutional change should only come alongside addressing the core lacunae in the regulatory framework. Without this, any new institution will only fall prey to the same and long pending areas of concern.



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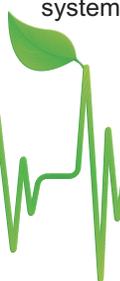
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### Our specific points with regards to the note are as follows:

- 1. EIA 2006 not an improvement:** We find the statement that the EIA notification, 2006 was a marked improvement its 1994 version deeply problematic. As you are aware, there was strong opposition to the content and drafting process of the 2006 notification. Detailed analysis had indicated that the 2006 notification limits the public hearing process from a decision making space to that which only involves feedback on a draft EIA report, the final version of which never reaches the affected people. The EIA 2006 also weakens the rejection of application clause on grounds of misleading information, which ironically never really gets used. It significantly reduces the extent of impact assessments that need to be carried out for real estate and construction projects, which is one of the biggest infrastructure industries today. There are several other issues with the 2006 notification which we have brought to the notice of the MoEF through various forums and mechanisms. We do not see this problem being resolved by the creation of an Authority that will grant clearances by following the existing procedures and formats of decision making.
- 2. Conditional Clearances:** The note quotes the Minister of Environment stating that the conditions levied at the time of clearance should be such that they are objective, measurable, fair and consistent as well as should not impose inordinate financial or time costs on the proponents. There is absolutely no mention or acknowledgment of the fact that the conditions are often seen as a way out to address the issues of environment and social impacts post facto, when in fact these impacts needed to be assessed and studied prior to public consultation and appraisal. The compliance of such conditions renders a *fait accompli* situation to whatever the result of post facto assessment might be, as by then, the projects are already well underway. While the NEAMA note sympathises with project authorities when it says that conditions should not add additional costs on them, it fails to recognise that absolute disregard that project authorities have currently shown to the compliance of conditions that are critical to mitigating environmental impacts. In our report Calling the Bluff we have highlighted several such instances to the MoEF. In its understanding of conditional clearances the NEAMA note is also oblivious to instances where clearances defy logic by say, laying down 121 conditions, almost forcing an approval from the SEIAA. We do not see how the setting up of the NEPA, NEAMA or any other body of a similar nature addresses the above mentioned issues.
- 3. Reasons of Conflict of Interest:** The NEAMA note mentions that the dual role of the Government in both appraisal as well as approval results in a perception of conflict of interest. It is ironic that the issue of conflict of interest has been dealt with in this manner. The concerns that have been raised have a much broader understanding. It involves two critical points, first when those in decision making positions in any of the expert committees have a direct stake in promoting a particular sector, project or project proponent/s. This may be a person or people affiliated to a government or nongovernment agency or even the industry. The second is with reference to the manner in which the composition of the expert committees have been designed and implemented. It has largely excluded those working on environmental, wildlife and social concerns. Thereby committees have essentially comprised technocratic and bureaucratic “expertise” and view of the environment. Even when the 1994 notification allowed for a much broader composition, the committees were very heavily made up of government affiliated bodies and even industry representation. Since 2005, we have been regularly analysed the composition of these committees and brought to the notice of the MoEF. The current format of the NEAMA only replicates the existing structure of Expert Appraisal Committees (EACs) and locates them outside the MoEF in the form of Thematic Appraisal Committees (TACs).
- 4. Issue of Autonomy:** We are happy that the MoEF has clearly defined in this note that the NEAMA be an authority under the Environment Protection Act, 1986 and oversee the implementation and monitoring of two notifications issued under this Act. It has also been clarified that it is the MoEF which will finally issue environment and CRZ clearances. Some part of the financial support may also come through the Central Government, presumably the MoEF itself, as was the case with the National Environment Appellate Authority and is with the National Biodiversity Authority (NBA). We therefore fail to understand in what other way the authority will be autonomous and independent other than the fact that it will be constituted as a separate authority continued to be connected to the MoEF for its mandate, reporting and finances. We understand that the NEAMA will essentially be a relocation of the Impact Assessment Division of the MoEF and the Expert Appraisal Committees (EACs) into what is being termed as a body with scientific rigour. It will not take away the possibilities of similar instances of appointments and choice of experts as has happened in the existing system. Therefore, the proposed NEAMA is not an answer to the issue of conflict of interest.

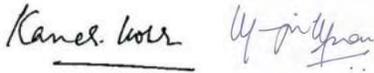


5. **Issues of Capacity and Tasks for the NEAMA:** The MoEF seeks to amalgamate the roles of the environment and CRZ tasks of the MoEF carried out by the regional offices, monitoring tasks of the MoEF regional office as well mapping and management functions coastal zone management authorities into one authority called the NEAMA. The reasons explained in the NEAMA note are due to increased pressure on these authorities, along with other functions the authorities are unable to respond to the plethora of responsibilities. While acknowledging that MoEF seeks to vest this responsibility into one full time body dealing with multiple functions of appraising projects for clearances, monitoring their compliance, advising the central government on environmental policies as well as supervise and coordinating with SEIAAs and SCZMAs. Additional tasks are also to prepare coastal zone management plans, carry out investigations and research as well as facilitating the creation of national databases of environmental information and dissemination. The tasks of three functional set ups spread across different regions of the country are now being collapsed into one authority. With no clarity on the number of full time members, number of regional offices of the NEAMA and also other issues related to staffing, MoEF's note prematurely assumes that the institutional structure envisaged will indeed been able put aside the woes of capacity shortfall which are being faced a vast network of full time officials and part time experts. It does not give any clarity on how the NEAMA can deal with the clearance numbers which continue to be to the tune of 80100 a month, monitoring of projects which is done every 34 years or the larger threats to coastal habitats and livelihoods; all of which MoEF, EACs and SCZMAs are to do as of today.

We once again bring to the attention of the MoEF, that the range of problems of the environment clearance regime are symptomatic of the regulatory framework and will not be resolved only through creation of new institutions. It will face the same hiccups, similar road blocks and inherit the legacy of the faulty regulatory framework that has been in existence till date. If environment protection and upholding peoples' livelihoods is truly the agenda of this reform process, then it cannot be done in exclusion of a regulatory revamp, suggestions for which have been brought to the notice of the MoEF several times before.

We do hope that you will initiate this much needed process as early as possible. We await your actions in this direction.

Thanking you, with regards



Kanchi Kohli and Manju Menon  
CC: Sunita Singh, Director (P&L),  
Ministry of Environment and Forests (sunitasinghgoyal@gmail.com)



Proceedings: International Conference on Poverty Reduction and Forests, Bangkok, September 2007

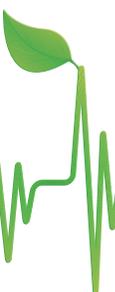
Commonly perceived as rights of local forest dwellers over forest products and forest land, forest rights have been a major area of concern as well as debate in India. In colonial and independent India, although a large tract of land would be recorded as “unclassified” forest in Government records, ownership was unclear, and because most of these forests were home to a large number of tribals, the land was acquired by the Forest Department without settling their rights over them. After Independence, supported by improper survey and settlement, large tracts of land were declared as “reserve forests,” meaning no rights either existed there or would exist later and all who either resided or claimed rights would be termed as encroachers.

A famous Bollywood song goes *Jungle mein more nacha kisne dekha*. In English this translates into “Who has seen the peacock dancing inside the forest?” Beginning with a line from a film song might seem to be a rather frivolous way to deal with a serious and important subject like tribal forest rights. But read between the lines and two very crucial aspects about forest management in India emerge. First, very few people know about what exactly is happening inside the forest. Secondly, it reinforces a nationally shared notion that no-one other than forest authorities has anything to do with forests. Expanded further, it also means that forest officials are only entitled to see the peacock dancing or hear a tiger growling.

Although somewhat of an exaggeration, the song offers much to reflect on about the age-old perception people have about forest management in India. Such notions and perceptions about the authoritative forest bureaucracy become believable when incidents occur like a tribal being beaten to death by two Jharkhand foresters merely on suspicion that the man might have taken a log from the forest to construct his half-collapsed house. Justice in this case was instant—a life for a log—and that too on mere suspicion.

A glimpse into the colonial and postcolonial history of India would clearly reveal that forest as a natural resource was never meant to be used for the local forest dwellers. It was to be used as a means to perpetuate their subjugation instead. Forestry in colonial India was all about commercial exploitation and revenue and thus recognized no rights and concessions for forest dwellers, who were mostly tribals. There was no legislative framework to make forests available for meeting local livelihood needs and the colonial powers made no effort to hide their intention, i.e. forestry for commerce, especially timber. Forestry science was introduced by western colonial forces as a codified, printed, and formal curriculum to continue political domination that implied nonrecognition as well as opposition to the largely oral indigenous forest management traditions. This marked the beginning of a forest governance system that was alien, induced, and most importantly that excluded forest-dependent communities in the name of scientific forestry, public interest, national development, conservation, and industrial growth. The national governments in the postcolonial phase inherited the colonial world view that not only aimed at the use of developing country forests to boost western industrial development, but also belabored the nonexisting incompatibility between conservation and livelihoods.

The objective of this paper is to highlight a series of policy developments that influenced forest governance during pre- and postcolonial India. There is no denying that colonial forest administration was revenue-centric and exploitative, and thus recognized no rights and concessions for forest dwellers, especially tribals. To address the common domain, this paper also briefly traces the history of forest laws and policies in India (colonial and postcolonial) and their impacts on tribal people, with particular focus on the two recent landmark legislations, the Panchayat Extension to Scheduled Area Act (1996) and the Forest Rights Act (2006) promulgated to recognize rights over forests & forest lands.



## Forest Rights in British India

The British established a mode of forest governance that imposed restrictions on local forest-dwelling communities through a definition of forests as national property for colonial objectives, which tried to acquire control of forests for commerce and national development at the cost of local forest-based livelihoods. Although the Forest Administration in British India put stress on national development, the primary focus of forest governance was commerce with limitations on the rights and privileges of local communities. Such regulation of rights was reflected in the classification of forests during colonial times. As national property, forests were classified as conservation forests, commercial forests, minor forests, and pasture lands. The first two categories—as the names would suggest—were out of bounds for local forest-dependent communities. Minor forests were managed by Panchayats with a view to reducing the contact between subordinate forest officials and villagers. Pasture land, mostly grassland, was for grazing purposes.

During medieval India, forests were owned by local chiefs with access rights being awarded to local communities. Towards the beginning of the nineteenth century, the British wanted to undertake unhindered exploitation of timber, which required the Government to assert its ownership over forests and do away with the traditional systems of community forest management that existed in most parts of the country. This had nothing to do with conservation; it was a ploy to keep direct control over trees, timber, and forest routes. Teak was identified as a substitute for oak, already becoming depleted in England, to build ships for the Royal Navy and railway lines. Oak was used for shipbuilding in England. During the nineteenth century, oak supply for shipbuilding declined heavily forcing the colonial government to look for alternatives in its colonies in the east. Burmese and Indian teak trees were identified as good substitutes and the East India Company was thus mandated to make laws for their extraction accordingly. With this objective, the East India Company acquired royalty rights over teak in 1807.

**Table 1: Timeline of Control Established**

Year	Controls and Rights Acquired	Remarks / Fall Out
1807	East India Company acquired royalty over teak	No locals allowed timber for domestic use. This meant prohibition of unauthorized teak felling and the Conservator becoming the sanctioning authority for teak felling and selling, more of an assumed power than lawfully given.
1846	Sanctioning authority over teak extended to all forests and forest produce	Prohibition of local use rights was supplemented by unrestricted extraction of timber from all forests.
1860	Company's sovereignty extended to the total area of forest land	As an aftermath of the Sepoy Mutiny in 1857, during which time forests and forest-dwelling communities provided the rebels with safe hiding places, Company administration prohibited and withdrew all access rights and privileges to fuel, fodder, and other local uses.
1864	Formation of the Imperial Forest Department	In order to legitimize authority with legal and administrative backing, the Imperial Forest Department was created in 1864 to consolidate Government control over forests and forestry was made a scientific operation, making it inaccessible to forest dwellers.
1865 1878 1927	Series of Forest Acts promulgated	In order to legitimize Government control through scientific operations, a series of legal instruments were passed in the form of Forest Acts.



The Acts referred to in Table 1 empowered the Government to declare its intention to notify any area as a reserved or protected forest, following which a “Forest Settlement Officer” supposedly would enquire into claims of rights (to land, forest produce, pasture, etc.). The colonial forest administration camouflaged timber extraction as conservation (thus curtailing livelihood rights) through classification of forests and prohibition of customary use rights. There was no settlement of rights and no space for meeting local needs. On the contrary, valuable trees were reserved and elaborate provisions were made for punitive action in the event of violation. The 1927 Act remains India's central forest legislation and with minor modifications is still operational in independent India. According to the Act, the Government can constitute any forest land or wasteland which is the property of the Government or over which the Government has proprietary rights, as reserved forest, by issuing a notification to this effect. This Act enabled the colonial Government to declare more and more land as reserve forests, without ascertaining the rights of the tribals and other forest. Thus started deliberate Government intervention in forests and measures relating to scientific conservancy were promoted for legitimacy.

### Forest Rights in Independent India

With Independence, local forest-dependent people expected to get their rights back. But far from improving, the rights situation actually worsened. Although the policy-makers changed, the policies remained more or less the same. In 1948, during the process of accession of the Princely States after Independence, the consolidation of Government forests continued. The Government proclaimed the lands of ex-Princely States and zamindars (large landholders with some governmental responsibilities) as Reserve Forests but no effective steps for settlement of rights were taken. This inevitably sowed the seeds of the future forest land conflicts between the tribals, nontribals, and the Government.

Forest governance in postcolonial India can be separated into three phases (Table 2).

**Table 2: Phases of Forest Governance in Independent India**

Phase	Time Frame	Developments / Remarks
Phase 1	1947-1970	This was the phase of commercial exploitation of forests for industrial development as well as for creating farmland for the large peasantry class.
Phase 2	1970-1988	This lasted till the commencement of the 1988 National Forest Policy; it was a phase of conservation with increased Government control. During this phase, forest conservation was made a directive principle, a fundamental duty in the Constitution, and brought to the Concurrent List for greater control of the Government. It was also the time when powerful legislative instruments like the Wildlife Protection Act and the Forest Conservation Act were put in place. This phase, like the previous one, had no space for forest dwellers and tribals in the protection and management of local forests.
Phase 3	1988 onwards	The third phase began with the introduction of the National Forest Policy in 1988, which not only made forest a local resource but also made the participation of local forest-protecting communities mandatory in the regeneration of degraded forests.

### Conservation Continuity in Independent India

The development of legal instruments in the second phase was a response to forest and wildlife depletion in the first phase. These instruments were extremely conservationist in nature, did not differentiate between local and external use, stressed excessive Government control in the form of Eminent Domain, and restricted or did not recognize existing local use rights. The assumption was that forest had been destroyed by the forest dwellers/tribals and needed to be protected/conserved from them, although in reality mindless exploitation of the



forest and its wildlife were the handiwork of the rich and the influential. Although the Forest Conservation Act restricted forest diversion for nonforest use, by prescribing prior permission and a high conversion rate, it in effect made such diversion possible. However for the rich, forest land diversion was easier whereas the poor forest-dwelling tribals were termed as “encroachers” and a direction for their eviction was issued by the Ministry of Environment and Forests (MoEF) through the May 2002 circular. This incapacitation of forest-dwelling tribals was aggravated by the establishment of the Protected Area Network, which meant further inviolable areas with no or negligible rights over forests and forest land by the tribals; it enabled the State to evict local forest dwellers without settling their bona fide rights to residence. It is unfortunate that even the recent amendment to the Wildlife Protection Act of 2002 (WLPA) has made no reference to the Panchayat Extension to Scheduled Area (PESA) Act (PESA) and has withdrawn continuance of rights even after the final notification of a protected area. A constant and consistent process was initiated to make the conservation legislations like WLPA and the Forest Conservation Act (FCA) more powerful than right providing legislations like PESA, although the latter was an amendment to the Constitution.

One of the residual features of the colonial Government that survived even in the post Independence period was its obsession with technocratic expertise and utter mistrust and complete rejection of people's power and knowledge as important inputs for achieving national development goals. Development policy making in India unfortunately, positioned itself on the astounding premise that people did not know anything. The prevailing social and political culture, the legal rational bureaucracy, and—most dangerously—the nation as a whole were made to believe in and sustain such an exclusionary development design, skillfully promoted by Government institutions. Curiously, almost all enabling- and right-conferring provisions were in the form of policies that had no legal sanction while the restrictive ones were in the form of Acts, which had legal backing. Besides, regulatory authorities and right-guaranteeing institutions mostly focused on commercial exploitation and conservation whereas the rights of local forest-dependent communities still remained an area of utter indifference.

### Evolution and Implications of Pro-Tribal Forest Legislations in India

Since the primary intention of colonial laws was to take over lands and deny the rights of communities, the “settlement” process initiated during the late nineteenth and early twentieth centuries was hardly effective. Surveys were often incomplete or not done (82.9% of Madhya Pradesh's forest blocks have not been surveyed to date, while in Orissa more than 40% of State forests are “deemed” reserved forests where no settlement of rights took place). Where the claims process did occur, the rights of socially weaker communities—particularly tribals—were rarely recorded. The problem became worse particularly after Independence, when the lands declared “forests” by the Princely States, the *zamindars*, and the private owners were transferred to the Forest Department through blanket notifications. In short, what the Government records called “forests” often included large areas of land that were not and never were forest at all. Moreover, those areas that were in fact forest included the traditional homelands of communities. As such consolidation of Government forests did not settle existing claims on land; all people, mostly tribals, who lived in these forests, were subsequently declared “encroachers,” as they did not have recognized rights and claims to their ancestral homelands.

### Panchayats Extension to Schedule Areas Act, 1996

During the 1990s, the Eminent Domain of the Government was challenged by activists and human rights movements. Rights of the tribals over local resources were considered sacrosanct and nonnegotiable and a move was initiated to secure Constitutional recognition for these rights. The sustained campaign led first to the 73<sup>rd</sup> Amendment of the Constitution to give recognition to decentralized governance in rural areas and then the constitution of the Bhuria Committee to look at tribal rights over resources through extension of the provisions of this Amendment to the Schedule V areas. Based on the recommendations of the committee, Parliament passed a separate legislation in 1996 as an annexure to the 73<sup>rd</sup> Amendment specifying special provisions for *Panchayats*. A Panchayat is a village council, at the bottom of the three tiers of local self-government in India. in Schedule V areas. Known as the Panchayats Extension to Schedule Areas, Scheduled areas are tribal-dominated areas put in Schedule V of the Indian Constitution, (PESA), 1996, it decentralized existing approaches to forest governance by bringing the *Gram Sabha*. The Gram Sabha is a body consisting of persons registered in the electoral rolls of a village or a group of villages which elect a Panchayat. Each Gram Sabha shall be competent to safeguard and preserve the traditions and customs of the people, their cultural identity,



community resources, and the customary mode of dispute resolution, center stage and recognized the traditional rights of tribals over “community resources”—meaning land, water, and forests. PESA was important not just because it provided for a wide range of rights and privileges, but also because it provided a principle as well as a basis for future law making concerning the tribals. According to the Central Government law, the states promulgated their own laws supposedly giving rights to tribals over local resources.

It is almost a decade since PESA came into effect, but the obstacles in enforcing its provisions have remained largely unaddressed. Its avowed objective of power to the people has yet to take shape. The states are struggling to devise definitive procedures to define rights over forests and minor forest produce. Meanwhile, some states like Maharashtra, Gujarat, and Orissa, in an effort to perpetuate State control over forest resources, tried to dilute the provisions of PESA although they had no legal jurisdiction to do so (Saxena 2004). The Government of Orissa, for example, has circumscribed the provisions of PESA by adding a clause, “... consistent with the relevant laws in force,” while incorporating the constitutional provision concerning the competence of the *Gram Sabha* to manage community resources and resolve disputes according to the customs and traditions of the people. This clearly implied that tribals could have rights over forests and minor forest produce, only if existing laws allowed it. Instead of changing State laws inconsistent with PESA, the Government of Orissa changed the provisions of the Act, thus negating the rights conferred on the community by the Constitution. The original objective of the Central Act was that state governments should change their laws according to central legislation. But the Government of Orissa, on the contrary, tampered with the central legislation to suit its own ends.

The Central Act talked about providing ownership rights over minor forest produce to the *Gram Sabha*. The MoEF constituted an expert committee to define ownership, which recommended that “ownership means revenue from sale of usufructory rights, i.e. the right to net revenue after retaining the administrative expenses of the department, and not right to control.” The case of Andhra Pradesh is even more interesting. It gave ownership rights to the *Van Suraksha Samitis* (VSS, forest protection committees) with respect to all nonwood forest products (NWFPs) for which Girijan Cooperative Corporation (GCC) did not hold the monopoly rights. Similarly, there is no clarity on the issue of “community resource.” The states have their own interpretations and legislations. While Orissa and Andhra Pradesh are silent about what constitutes community resource, Madhya Pradesh has defined it as land, water, and forest. This implies that the powers given by PESA to exercise rights over community resources are almost nonexistent in many states.

Although the Central Act leaves no room for doubt that reserve forests should be considered community resources under the purview of PESA, the official assumption is that reserve forests are out of the PESA domain. For instance, the NTFP Policy of 2000 in Orissa restricts the *Panchayat's* control over minor forest produce in reserve forests. It says that the *Gram Panchayats* shall not have any control over minor forest produce collected from the reserve forests whereas the PESA, in its spirit, sought to extend ownership of forests to any forest located in the vicinity of the village that the people had been traditionally accessing. The policy-makers knew very well that it would be foolish to create such a distinction because it was almost impossible to differentiate between produce collected from reserve forests and that from others. Nevertheless, they went ahead with putting in place the proviso that reserve forests cannot come under the purview of PESA because the relevant laws laid down that no rights can exist in the reserve forest area (Table 3).



**Table 3: Acts Challenging the Eminent Domain of the State**

Panchayat Extension to Scheduled Area Act, 1996	The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006
<p>The 73rd amendment to the Constitution and the subsequent enactment of PESA intended to ground decentralization in India, through the transfer of power to the <i>Gram Sabha</i> or the village assembly. With PESA, an effort was made to vest legislative powers in the <i>Gram Sabha</i>, to manage community resources, and to resolve disputes according to the customs and traditions of the people.</p> <p>This significant legislation was expected to have far reaching consequences in the social, economic, and cultural life of tribal people in Scheduled Areas. All the scheduled states were given one year to amend their respective Panchayat Acts to conform to the letter and spirit of PESA. Unfortunately, a handful has even ventured into adhering to the PESA provisions as regards tribal law making.</p>	<p>The Act has defined forest land as land of any description falling within any forest area and includes most types of forests. The law provides for recognition and vesting of forest rights to Scheduled Tribes in occupation of forest land prior to 13 December 2005 and to other traditional forest dwellers who are in occupation of forest land for at least three generations, i.e. 75 years, up to a maximum of 4 hectares. These rights are heritable but not alienable or transferable. Forest rights include among other things, right to hold and live in the forest land under individual or common occupation for habitation, selfcultivation for livelihood, etc. Besides, the Act recognizes the rights over “community forest resource” that it defines as customary common forest land within the traditional or customary boundaries of the village including protected areas. Moreover, one of the most crucial aspects of the Forest Rights Act is the realization of forest rights within a protected area through declaration and demarcation of the “critical wildlife habitat” (CWLH).</p>

**The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006**

The Supreme Court of India in an important case held that the tribals have a definite right over the forests and any sort of forest diversion or eviction should have their informed consent. Following suit, in an affidavit to the Apex Court, in June 2004, the Government of India made a significant admission by holding that “historical injustice” had been done to the tribal forest dwellers of the country, which needed to be immediately addressed by recognizing their traditional rights over forests and forest land. What made this admission particularly crucial was its acceptance that colonial perspective on forest management had failed and alienated a large chunk of the forest dwellers, especially tribals from forests and forest-based livelihood options. Besides, it could not have come at a better time—just months after the eviction of about 168,000 families from over 150,000 hectares effected by the May 2002 Government order of eviction of forest encroachers. This led the Government of India to introduce the Scheduled Tribes (Recognition of Forest Rights) Bill, 2005 in Parliament on 13 December 2005. This legislation is now widely accepted and revered as a major step towards achieving social justice and a milestone in the tribal empowerment process (Table 3).

Pressure mounted on the Government by tribal bodies and supportive progressive forces to introduce structural changes in favor of the forest-dependent people resulting in constitution of the Joint Parliamentary Committee (JPC) to take a fresh look at the Bill and recommend measures to meet their demands. Considering the fact that tribals were served with eviction notices in May 2002 for being “encroachers” as they could not produce residential evidence in forests before 25 October 1980 according to the FCA 1980, the JPC recommended that the cut-off date for the settlement of rights be extended to 13 December 2005, the date on which the Bill was first tabled in Parliament. It further recommended inclusion of nonscheduled tribe “traditional forest dwellers” living in the forest for three generations within its ambit. The recommendations also included the identification of the “critical wildlife habitat” by an independent and participatory scientific process, and relocation of the residents, if necessary, through mutually acceptable terms.



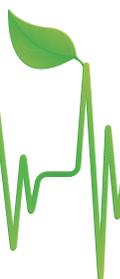
The JPC also recognized multiple land use for shifting cultivators and removed the land ceiling of 2.5 hectares for land rights. Besides, considering the heavy dependence of tribals and other forest dwellers on NWFPs, and the associated exploitation of these hapless people by intermediaries, it urged for ensuring a minimum support price for minor forest produce. Furthermore, the JPC made the *Gram Sabha* the final authority in the process of rights settlement. In matters relating to forest land diversion for nonforest use, consent of the *Gram Sabha* was made mandatory (Prasad 2007). Representation of the *panchayatiraj* institutions at all levels was also strongly recommended, the *Gram Sabha* being a core unit, in all matters relating to selection and identification in the rights settlement process. In recommending changes to the Bill, the JPC made PESA a reference point by bringing the *Gram Sabha* center stage.

Like most other progressive legislations, the JPC recommendations were hailed by everyone in the field as one of the most revolutionary contributions to the tribal law-making process in India, with the exception of the forest bureaucracy and the conservationists who regarded it as the “death knell” for forests in the country. But the Government probably had different motives and ideas. After these recommendations were introduced in the legislature and came out as law, the offspring had very little resemblance to its parentage. It raised serious doubts about its ability to undo the injustices it was supposed to address in the first place. The Bill which was hurriedly passed in December 2006 completely obliterated the preeminent position that was given to the *Gram Sabha*. PESA, which formed the very basis of the JPC recommendations, was ignored and quietly forgotten. The result was predominance of the limiting provisions over the enabling ones. The unhindered power and strength of the forest bureaucracy, conservationists, and the mining and industrial lobby were to a large extent reinstated and reinforced.

Unfortunately the preeminence given to the *Gram Sabha* in matters of forest governance by the JPC has been substantially reduced. It is now neither the final authority in settlement of rights nor is its consent mandatory in diversion of forest land for nonforest purposes. The authority has been transferred to the subdivisional committee. Representation of forestdwelling tribes in the subdivisional-level committee has been excluded from the Bill providing opportunity to the departmental officers to exercise their authority on the decisions. The *Gram Sabha* has no role when it comes to either demarcation of a protected area or in deciding the critical wildlife habitat. The Government reserves the right to decide the area, whether there would be eviction or not, and the *Gram Sabha* would only give its informed consent on the resettlement package. The *Gram Sabha* does not have the right to disagree. Besides, the role of the *Gram Sabha* for determining the rights has been limited only to initiating this process.

Even after several months of the Act coming into force, there is a misconception amongst many that the Government will give/distribute 4 hectares of forest land afresh to tribals for homestead and cultivation. This, they think, will destroy the forests as anybody can acquire 4 hectares of forest land and obtain the desired recognition. The truth, however, is that an individual claiming forest rights has to produce sufficient proof not only in terms of documents to support his/her claim but also needs an endorsement from the *Gram/Palli Sabha* about such claims. Thereafter the Forest Rights Committee will initiate the process of determination of such rights. This claim will then be verified first by the subdivisional-level committee and then the district-level committee and can either be settled or refused. The proviso about 4 hectares of forest land does not necessarily mean that all claimants will be provided with that amount of land. On the contrary, it should be interpreted to mean that no claimant will get more than 4 hectares. Land thus provided to the claimant will be under the joint ownership of husband and wife and the land *patta* will be prepared accordingly. In case of a widow claimant, land will be provided in her name with *patta*. *Patta* is private land of tribals who have a Government record of ownership.

With the promulgation of the Act, the age-old debate “tigers or tribals” has been revived once again. There is a fear that the Act will wipe out the remaining big cats in the country. Therefore, one of the most contentious issues influencing the realization of forest rights within a protected area has been the declaration and demarcation of the “critical wildlife habitat” (CWLH), a crucial aspect of the Forest Rights Act.



According to the provisions of the Act, under Section 4 of Chapter 3, “the forest rights recognized under the Act in critical wildlife habitats of national parks and sanctuaries may subsequently be modified and resettled, provided that no forest rights holders shall be resettled or have their rights in any manner affected for the purpose of creating inviolate areas for wildlife conservation.” This implies that the provision of forest land is recognized and is, therefore, possible even within a CWLH unless the Government and the experts feel that such rights might come in the way of making the area inviolate for wildlife conservation. Therefore, in the words of the Act, “relocation is possible only when it is established that coexistence is not possible and if the local communities give their informed consent.”

This has kept conservationists and wildlife activists busy in trying to keep the provisions of the Act outside the national parks and sanctuaries, fearing that the law would damage forest and wildlife. The MoEF suggested that the people’s rights in the national parks and sanctuaries should not be vested till 8% of the forest land—covering the 650 plus national parks and sanctuaries—was declared as CWLH. Therefore, the Act will be implemented in its true spirit only after all the protected areas have been formally demarcated and designated as CWLH.

The Act provided that the MoEF would deliver a set of guidelines for declaration of the CWLH within six months of the promulgation of the Act. But the guidelines were delayed as was the promulgation of the Act that was to happen through the framing of forest rights rules on 2 October 2007. The Forest Rights Rules, 2007 was finally notified on 1 January 2008, but much before the guidelines emerged, the State Forest Department was preparing action plans for prospective relocation from the protected areas. Such initiatives occurred in almost all states.

In this context, it is worthwhile to have a close look at the CWLH guidelines framed by the MoEF. The guidelines are only a reiteration of the MoEF’s stand on keeping people out of protected areas and nullifying the provisions of the law by diluting the preconditions for demarcation of the CWLH. They restrict local communities from consulting with the Gram Sabha, which again is not mandatory. Besides, the Government’s Expert Committee at the State level reserves the right to decide on the participation of a sociologist or a member of the Gram Sabha. It is interesting to note that people’s knowledge and information have been important sources of information during wildlife/tiger census. But the same knowledge is considered unscientific when it comes to demarcating CWLH.

The guidelines state that the resolution of the Gram Sabha would certify that in areas included within the proposed CWLH, the process of recognition and vesting of rights had been completed. This might turn out to be a contentious issue in the days to come as it is not very difficult for the Government to get such a resolution passed by the Gram Sabha through coercion. The Government machinery in Orissa is quite adept at getting the Gram Sabha to toe the official line as proved by land acquisition in mining operations.

Moreover, there is deliberate misunderstanding leading to improper interpretation of the Act when it is assumed that the relocation of villages would start immediately after the Forest Department prepares the proposal to identify the critical tiger habitat (CTH). Equivalent to CWLH under the Wildlife Protection Act 1972 (amended in 2002). In states like Kerala, Maharastra, Karnataka, and Uttar Pradesh, such CTH demarcation proposals have been prepared and an estimate of people likely to be relocated prepared. The Act declares that CTH has to be understood as a process and not just a plan. The proposal has to be submitted to the Central Government and then the demarcation process will start with the involvement of the Expert Committee and the Ministry of Tribal Affairs. However according to the Act, the Forest Department, while preparing the proposal, should only mention the area and not the number of people likely to be relocated as it is only proposing the area which might change and the committee might even think that no relocation is necessary for the purpose. Slightly before the Act became operational on 1 January 2008, around December 2007, in almost all tiger reserves, CTH had been demarcated and notified. In Section 4 (5) of Chapter 3, the Act clearly mentions that no forest-dwelling scheduled tribes (FDST) or traditional forest dwellers shall be evicted or removed from forest land under their occupation till the recognition and verification process is complete. But contrary to what has been provided in law, eviction decisions are invariably taken well before the final notification of the CWLH. A case in point is the Uttar Pradesh Government’s decision to create a special corridor in the Dudhwa National Park, Katamiaghat and Kishanpur sanctuaries, where 60% of the tigers found in the State live, for the free movement of tigers.



The Government has decided to evict villagers from these areas in installments. In the first phase, villages falling in the way of the special tiger corridor will be relocated. The State Government has issued eviction notices to 10 villages lying within these three forest areas. However, nothing has been mentioned about the provisions of resettlement as stated by the law: “the free, informed consent of the Gram Sabha in the areas concerned to the proposed resettlement and to the package has been obtained in writing.” It further says, “no resettlement shall take place until facilities and land allocation at the resettlement location are complete as per the promised package.”

One of the crucial threats to the proper implementation of the Act is the interpretational freedom of the Forest Department. Whether it is occupation on forest land or demarcation of CWLH or ownership over NWFPs, the Forest Department does what suits its interests best. One such example is ownership over NWFPs provided in PESA. Except for Orissa, no other state abides by this central provision. Therefore, realizing this interpretational freedom and the related problems, this Act once again defines and clarifies minor forest produce as all NWFPs of plant origin and bestows ownership rights on the *Gram Sabha*; but still in most states the Forest Department enjoys monopoly and does not allow tribals and other forest dwellers to sell NWFPs where the price is high. This implies the state governments reserve the right of not obeying the Central Act as well as even escaping unreprimed. Amidst all of its good work, the Ministry of Tribal Affairs (MoTA) should be careful about not allowing state bureaucracies to enjoy such extraconstitutional freedom.

### Controlling Through Definition and Classification

In the last couple of decades, debates around forest rights have focused basically on two areas: definition and classification of forests and the nature and extent of departmental control over different types of forests. Although classification is indicative of designated control, there are still some areas where community control is more than visible strictly from a conservation and sustainable dependence point of view. During British India, a good number of people resided on parcels of land where ownership was unclear. As discussed earlier, the situation was even worse after Independence due to inadequate and improper survey and settlement. The Government continued declaring reserve forests without settling the rights of the people who dwelt there. There are thousands of cases of local inhabitants claiming that they were in occupation of notified forest lands prior to initiation of forest settlements under the Indian Forest Act. There are various cases of *pattas/leases/grants* said to be issued under proper authority but which have now become contentious issues between different departments, particularly the Forest and the Revenue Departments. The problem is compounded by the fact that in many cases there is no clear demarcation of forest lands. In fact most of the disputes and claims relating to use and access to forests have lingered on and evaded resolution in the past because of the failure to demarcate precisely the extent of the forest.

Frequent changes in the definition and classification of forests have not helped in determining and settling forest rights. Different laws, policies, and orders defined and classified forests differently. Read between the lines—all the definitions and classifications have specific control regimes attached to them. For example, forest was first defined in the Indian Forest Act, 1865 as “land covered with trees, brushwood and jungle,” because its purpose was timber extraction. In 1996 the Supreme Court, as part of the interim judgement on the Godavarman case, defined forests as an extensive area covered by trees and bushes with no agriculture.

As recently as 2007, the MoEF has proposed a definition that says forest is “an area under Government control notified or recorded as forest under any Act, for conservation and management of ecological and biological resources.” If the proposed definition becomes operative, then it is expected to put private forest lands out of the purview of forest laws and may come in conflict with the 1996 verdict of the Supreme Court. Through this definition, an effort is being made to address the limitations on afforestation on forest land and also restrictions on cutting and transport of trees mandated by the Indian Forest Act, 1927 and the Forest Conservation Act, 1980. This definition is bound to have enormous implications for the corporate actors, especially those active in the plantation sector. With private forest lands taken out of the purview of forest laws, large tracts of revenue land would now have forest species on them, timber from which can be safely harvested without attracting any forest law. It is now becoming increasingly clear why the MoEF, in the recent past, has exhibited such missionary zeal in considering proposals to place large areas of forest land in the hands of industries for afforestation.



With this definition, diversion of a parcel of land legally defined as forest can be possible. What an irony! The MoEF, which so faithfully carried out the Supreme Court order as regards not giving land to the tribals and even termed them as “encroachers” in their own homes, instead is now ready—even eager—to take on the same mighty institution in favor of the corporate sector. The same MoEF never bothered when the Supreme Court banned collection of minor forest produce from within protected areas. It even went a step further and amended the Wildlife Protection Act according to the Supreme Court order. One more example of what money and influence can do in this country and what the voiceless and powerless are destined to endure!

### Global and External at the Cost of Local

A quick look into the current management approaches reveals some startling trends with regard to community rights over forest resources. On the one hand, the limitations of the so-called progressive legal framework are getting slowly exposed. On the other, there are equally disturbing developments like changing definition of forests, forest diversion becoming easier with the preeminent role of the mining lobby, in May 2007 a forest policy review process by the State identified that since Orissa is rich in minerals with 70% of the country’s coal production coming from the forest areas of Orissa, for harvesting minerals, forests have to be sacrificed, and compensatory afforestation undertaken. Large-scale plantation projects taken up to create carbon sinks in natural forests, overseas donor projects like the Orissa Forestry Sector Development Project (OFSDP) supported by the Japan Bank for International Cooperation (JBIC) and being implemented in Orissa, is one such example. Besides, public and private sector investment is also invited under the public–private partnership for plantations within natural forests. With no or negligible local access rights, gradual withdrawal of the State machinery from the forest-based livelihood sector, especially NWFPs, and the missionary zeal exhibited to renew the industrial–commercial approach to forest management further marginalizing local users and putting a major question mark on their continued dependence on forests.

As discussed in the previous sections, the colonial legislations had no pretensions whatsoever to protect and promote local access rights. Therefore, forest management was expected to adopt a welfare approach in independent India. But somehow, this did not occur. On the contrary, when it came to transferring rights to the local forest-dependent communities, laws, Acts, and Supreme Court orders were introduced to obstruct such transfer. Even when no such legal and judicial hurdles were there, bureaucratic apathy, inactivity, and reluctance combined to obstruct their effective implementation. Needless to say that in both the situations, the forest dwellers, mostly tribals, continued to remain at the receiving end. But the process of the marginalization of forest dwellers does not end with Acts and policies alone; Government-sponsored programs and projects faithfully reflect the dominant world view of creating more space for the private players, implying penury for the perennially marginalized “public,” i.e. the forest-dwelling tribals. In order to substantiate the current argument, it may be relevant to focus on some of these programs and approaches.

The strict conservation orientation of the plantation projects implemented to create carbon sinks, Global forest governance discourse has not only expanded the definition of forests, but also has caused a shift from its usual mercantile logic that puts a premium on timber—its quality and volume. Concerns about climate change, disruption of the global carbon cycle, carbon stocks, and emission and rates of sequestration have, besides adding a new dimension to forest management, also transformed forests from a local to a global resource. A new form of economic activity has spawned in the era of global warming, i.e. buying and selling of environmental services (read carbon trade). Carbon sinks are created through conserving existing forests and taking up tree-planting projects to remove greenhouse gases. In the protected forests, to a large extent, has limited local access rights. The only right that is recognized is the right over NWFPs. The approach of such projects is to remove potential threats of deforestation, and manage forest areas so as to minimize human impact. Interestingly, carbon payments would be supposedly used to develop local income sources, outside protected forests. In other words, it is an endeavor to shift the livelihood focus from forests to other nonfarm sources, and conserve forests exclusively for carbon sinks so as to create carbon credits for payments that states could use in infrastructure development.



Closely observed, these developments would reveal a very interesting, although disturbing, trend. Now, with the aforementioned developments taking place, the major land mass of the country is expected to come under the purview of plantation projects. On the one hand, the State Forest Departments will use bilateral donor funding for plantation in forest lands; on the other, the private sector, armed with a new definition of forest, will go in for large-scale plantation activities with deceptive use of jargon like “public–private partnership.” In the process, they will occupy and usurp a major portion of the revenue land, especially from the cultivable wasteland category. As discussed, the locals will have no access rights in the plantation forests not to mention any such rights in the private plantation areas. The states, as well as the corporate sector, are expected to earn a fortune in the process through selling of carbon credits as well as through timber trade.

If a major chunk of the revenue land of the said category is leased out to the corporate sector for taking up plantation projects, this is definitely going to have a serious repercussion on the process of land distribution to the landless under different Government schemes. Because of the huge revenue gain for the Government, revenue lands, which could have otherwise been settled in favor of the landless, will now go to the private sector. Besides, with large-scale industrialization, the Government also has to find land, especially of the nonforest category, for industries to take up Compensatory Afforestation, the local forest dwellers have neither any say in matters of forest diversion nor the compensation that is received under Net Present Value (NPV) for such diversion of forest land for nonforest purposes nor in its utilization. The irony is, the local communities protect the forest, somebody else cuts it, and somebody else receives the compensation. According to the MoEF order of April 2004, money received towards NPV shall be used for natural regeneration, forest management, protection infrastructure development, wildlife protection, and management. There is no mention of creating or compensating livelihoods for the local communities which the forest diversion has deprived them of. The fund distribution mechanism is based on the erroneous assumption that the losses due to forest diversion are more national than local. where locals will have no access rights. Besides, in matters of forest land being given to industries for compensatory afforestation, no rights assessment is done before such forest land is transferred. It is assumed that all rights are settled in a forest land area. There are instances in Keonjhar District in Orissa, India, where shifting cultivation areas have been given for compensatory afforestation. The forest-dependent communities are losers both ways. On the one hand, their livelihood options are closed within the protected forests; on the other, they have no entitlement over cultivable wasteland either. Such processes are expected to create a situation where the landless will remain so indefinitely.

As if all this was not enough, the hapless tribal now has to contend with the gradual closing of the NWFP option—his last remaining source for some cash income. Under the misleading pretext of falling international prices and procurement of certain commonly traded NWFPs, state governments are now increasingly trying to wriggle out of their responsibility to manage, monitor, and promote collection and trade of NWFPs. Rather than acknowledge the fact that the drop in procurement and prices of NWFPs is a result of their own policies and inaction and find ways to reverse the trend, they have chosen to place primary gatherers completely at the mercy of ruthless market forces. Their decision to curtail their involvement in the NWFP sector is based purely on calculations of profit and loss and is a complete abrogation of their welfare obligations.

PESA initiated and later the FRA clarified a clear ownership framework for NWFPs. With PESA the problem was separate from Orissa, no other state came out with a policy/circular giving ownership rights to the *Panchayat*. The earlier systems of long-term lease and state monopoly continued in most forested states in central India. This differing and at times contradictory operational framework created a set of problems relating to price, transport, transit, etc. The central PESA law enables ownership whereas there is no corresponding administrative procedure or set up to carry out central provisions. Therefore, there is a mix of control and a free market trade scenario existing in a huge contiguous forest area in central India that hamper trade and livelihoods. Besides, forest being a matter belonging to the concurrent list, the central laws should prevail over state laws and administration. This, however, continues postPESA and even with the promulgation of FRA being nine months old. Besides, it is still not very clear if legal interventions can actually be initiated in respective high courts if PESA and FRA provisions on deregulation are violated.



In the continued harangue over national objectives and global needs, the question of the livelihood security of the forest dwellers has been given quiet burial-as if they belong to another planet. As we have seen, forests in India have always been valued for revenue profit, conservation, and as a genetic reservoir. They have never really been perceived or managed as a livelihood recourse. The fact that sustainable development of forests is possible with the harmonious blending of local, national, and global needs has never been acknowledged in the country. In what can be called the mother of all ironies, the Government, through its policies and actions, first pushes the forest dwellers into utter penury and then starts poverty alleviation programs for them.

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### Introduction

Max Muller, the celebrated German Scholar once wrote 'if we were to look over the whole world to find out the country most richly endowed with all the wealth, power and beauty which nature can bestow - in some parts a veritable paradise on earth - I should point to India'. What he wrote of India, in fact, is truer for the Rural India which is a unique depository of all those beautiful things that God and human hands created for the posterity to draw inspiration for a better tomorrow. India is a country of villages. As per 2001 census, on the average 72.22% people lives in villages. In some states more than 85% people live in villages (Himachal Pradesh, 90.21%, Bihar, 89.53%, Sikkim, 88.9%, Assam, 87.28% and Orissa, 85.03%). The livelihood options and rural economy in Indian villages are largely bio-resource based, especially on agriculture, home garden, fishery, goatery, piggery, poultry, diary and artisan work based on bamboo, cane, wood and other bio-resources. In view of this, conservation of traditional ecological knowledge and management of bio-resource is most important.

This paper reviews the bio-resource and livelihood options in rural India. Since the management of bio-resources are linked with land, soil and water, these aspects are also reviewed in this paper. Recent thrust on industrialisation in resource rich states like Jharkhand, Orissa, Chhatisgarh, Rajasthan, Uttarakhand and some other states threaten the traditional livelihood options and therefore need implementation of EIA and EMP protocol very strictly and judiciously.

### Resource classification

Resources are basically of two kinds, (a) renewable, and (b) non-renewable. Some resources, such as plants (crops, forests, medicinal plants etc.) and animals (milk and meat producing) are renewed from time to time because they have a lifecycle, and a continuous harvest is possible provided these resources are well managed. These resources sustain life. Bio-resources become extinct if not managed properly. These resources require land, soil and water for their growth and continuance. (Dash and Dash, 2009)

### Land resources

India with a land area of 3,28,800 km<sup>2</sup> (about 2.4% of the world), supports 16% of the world's population. Land is now under great pressure due to the huge increase in population. There were about 238 million people in India in 1901 and have grown five times in 100 years (about 1200 million). With the present rate of population growth the per capita land resource in India may be reduced to <0.25 hectare in very near future. About 44% of our land is used for agriculture, 23 % is

### Abstract

India is a country of villages. As per 2001 census, on the average 72.22% people lives in villages. In some states more than 85% people live in villages (Himachal Pradesh, 90.21%, Bihar, 89.53%, Sikkim, 88.9%, Assam, 87.28% and Orissa, 85.03%). The livelihood options and rural economy in Indian villages are largely subsistence and bio-resource based. Live-stock products contributed 5.51 per cent of the total national gross domestic product in 1999-2000 and contributed about 25 % of the total agriculture sector in 2000-2001. In view of this, management of bio-resource for sustainable use is most important. Developmental efforts should be directed to help the poor to acquire durable productive assets. The government organizations and corporate houses should play enabling role in realising this goal. Recent thrust on industrialisation in resource- rich states like Jharkhand, Orissa, Chhatisgarh, Bihar, Rajasthan and some other states threaten the traditional livelihood options and create disturbance on resettlement and rehabilitation issues and put enormous stress on rural ecosystems, especially on water and land resources. Therefore the need for the implementation of Environmental Impact Assessment and Environmental Management Programmes- protocol very strictly and judiciously is need of the time

### Key Words

Bio-resources  
livelihood options  
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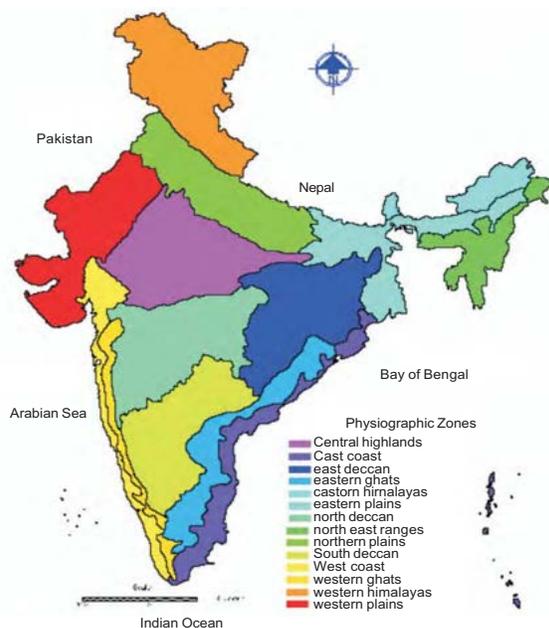
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covered with forests, and 4% is used for pasture and grazing fields, 8% for housing, agro forestry, industrial areas, and roads and so on. 14% of land is barren and about 7% is used for miscellaneous purposes. The rapid increase of urbanization and migration of population from rural area to towns and cities has led to conversion of agricultural land for housing, construction of office buildings, industries, and so forth. The rational use of land resources is possible only by adopting an integrated land-use policy through scientific survey of all land resource taking the village as a unit and apportioning land for both short and long-term requirements for agriculture, forestry, grazing, water bodies and fisheries, human settlements, roads, industries, and so on. The state governments play important role. There should be legislative control of land use. The fourteen physiographic zones of India are listed in Fig. 1 and below:

1. Western Himalayas (WH), 2. Eastern Himalayas (EH), 3. North East (NE), 4. Northern Plains (NP), 5. Eastern Plains (EP), 6. Western Plains, 7. Central Highlands (CH), 8. North Deccan (ND), 9. South Deccan (SD), 11. Western Ghats (WG), 12. Eastern Ghats (EG), 13. West Coast (WC), 14. East Coast (EC). These physiogeographical zones provide the livelihood support to large majority of the population. All the Bio-resources are located in these zones. However each zone is unique with regard to bio-resource and availability of water and other resources.



**Figure 1: The physiographic zones of India (State of Forest Report, 2005)**

**Forest resources**

The forest cover is important bio-resource for the people, especially for the village people and ecosystem people. Forest cover includes all lands which have a tree canopy density of 10 percent and above with area 1 ha or more. The minimum mapped area of 1 ha of the forest cover corresponds to the cartographic limit (a polygon of the size 2 mm x 2 mm) on a map at 1:50,000 scale. This definition is based on the scale of interpretation (1:50,000), the optimum size of cluster of pixels, resolution of digital satellite data used for the mapping (pixel size 23.5m x 23.5m) and the technique employed for image interpretation (State Forest Report, 2005-Government of India). The forest cover mapping presented in the 'State Forest Report' does not make any distinction between the origin of tree crops (natural or man-made) or tree species. Also, it does not recognize the type of land ownership or land use and legal status of land under the forest cover. Thus, all species of trees (including bamboos, fruits, coconut, palms, etc.) and all types of lands (forest, private, community or institutional) satisfying the criteria of

canopy density of more than 10 percent have been delineated as forest cover while interpreting the satellite data. The basis of classifying forest cover, the ministry of Environment and Forests follow the principle given in Table 1.

**Table 1: The Basis of Classification of Forest Cover**

Very Dense	
Forest	All lands having tree cover with canopy density >70%
Moderately Dense Forest	All lands having tree cover with canopy density between 40% and 70%
Open Forest	All lands having tree cover with canopy density between 10% and 40%
Scrub	All lands with mainly small and stunted trees with canopy density <10%
Non Forest	Any area not included in the above classes

**Forest Cover: 2005 Assessment**

The total forest cover of the country as per 2005 assessment is 677,088 km<sup>2</sup> and this constitutes 20.60 percent of the geographic area of the country. Of this, 54,569 km<sup>2</sup> (1.66 %) is very dense forest, 332,647 km<sup>2</sup> (10.12 %) is moderately dense forest, while 289,872 km<sup>2</sup> (8.82 %) is open forest cover. The scrub accounts for 38,475 km<sup>2</sup> (1.17 %). While computing the percentage of forest cover of the country, the total geographical area of 3,287,263 km<sup>2</sup> is taken. A closer analysis of this reveals that a sizeable part of the country's area lies in high altitude mountainous region under permanent snow/glaciers, steep slopes and rocks which are not available for tree planting due to climatic and physical reasons. As per a recent study of FSI, about 1, 83,135 km<sup>2</sup> areas in the States of Arunachal Pradesh, Himachal Pradesh, Jammu Kashmir, Sikkim and Uttarakhand have been found above 4,000 m altitude where climatic and edaphic conditions limit tree growth. If this part of the geographical area of the country is excluded for the purpose of forest cover analysis, the forest covers of the country in terms of percentage to the geographical area is much less. Forest cover in hills is essential to maintain

**Table 2: Energy Sources for Rural India**

Source	% of the total energy consumed
Renewable	
Wood	68.5
Animal dung	08.3
Others	03.4
Non-renewable	
Oil products	16.9
Coal	02.3



**Table 3: Production and productivity of some crops in India (source - Prasad, 2009)**

Crop	Year 1997-1968 Area Million ha	(Year of green revolution Production million tons)	Yield ton/ha	2005-2006 Area	% increase over Production	1967-68 Yield
Wheat	15 (26.4)	16.5 (69.3)	1.1 (2.6)	76.7	144	110
Rice	36.4 (43.7)	37.6 (91.8)	1.0 (husked clean rice)	20.0	166	136
Maize	5.6 (7.6)	6.3 (14.7)	1.1 (1.9)	35.7	133	73
Pulses	(22.4)	12.1 (13.4)	0.5 (0.6)	-	11	20
Total Food grains	121.4 (129.0)	95.0 (208.3)	0.8 (1.6)	-0.01	100	119
Major Nine Oilseeds	15.7 (27.9)	8.3 (28.0)	0.5 (1.0)	77.7	237	100

ecological balance and environmental stability as it prevents soil erosion and land degradation. The State/UT wise forest cover in the country shows that Madhya Pradesh with 76,013 km<sup>2</sup> has the largest area under forest cover, followed by Arunachal Pradesh (67,777 km<sup>2</sup>), Chhattisgarh (55,863 km<sup>2</sup>), Orissa (48,374 km<sup>2</sup>) and Maharashtra (47,476 km<sup>2</sup>). Considering the proportion of geographic area under forest cover, Mizoram has the maximum percentage of 88.63%. The recent forest policy of Indian Government envisages 33% of land under forest cover. This will also increase the sink area for green house gases and will create avenues for other benefits. Massive effort is required to achieve this and to increase the cover from present about 20.60% to 33%.

#### Tree cover

The total tree cover of the country has been estimated to be

91,663 km<sup>2</sup>, which constitutes 2.79 percent of the country's geographic area. The estimates of tree cover for each physiographic zone is given in the map. It is observed that the tree cover is the maximum in East Deccan (11,293 km<sup>2</sup>), followed by Northern Plains (10,747 km<sup>2</sup>) and West Coast (8,307 km<sup>2</sup>). West Coast has maximum percentage of tree cover (6.85%) with respect to geographical area followed by Western Ghats (5.37%) and East Coast (4.84%). Eastern Himalayas has the lowest tree cover of 255 km<sup>2</sup>, although the area is full of forests. There is need of increasing the tree cover in Himalayas, especially in Eastern Himalayas and in the urban centres of the country.

**Table 4: Fish production in India (tons per annum)**

Year	Fish Production (t)	Capture (t)	Aquaculture (t)
1997	5 485 270	3 620 948	1 864 322
1998	5 381 977	3 473 492	1 908 485
1999	5 686 963	3 552 149	2 134 814
2000	5 668 631	3 726 427	1 942 204
2001	5 936 931	3 817 092	2 119 839
2002	5 932 542	3 745 353	2 187 189
2003	6 033 870	3 720 899	2 312 971
2004	6 190 314	3 391 010	2 799 304
2005	6 658 010	3 691 364	2 966 646
2006	7 014 143	3 844 838	3 169 305
2007	7 308 233	3 953 476	3 354 757

(Source FAO, 2009)

#### Soil resources

Soil supports the life system and is formed through the combined action of parent rock material, climate, weathering process, vegetation and the decomposition process. Soil formation is an extremely slow process, taking thousands of years. It is important in that soil stores water and nutrients for biota including plants. This resource is now threatened because of large scale deforestation and erosion of the topsoil by wind action, floods and water flow. Soil erosion is a big problem in most of the states, especially in Himalayan region.

**Table 5: Livelihood support in Orissan villages (Dash, 2007, 2009)**

Social category	Bioresource Used	Issues
Landless and Wage earner: predominately SC and STs, financial weaker section (OBCs etc)	Forest, and forest products, Domesticated goat, poultry, Rivers, Nallas for fish and depend on upper-class/government/Private project work for wages	Food security, lack of provision for health issues, largely depend upon community common-property bioresource
Marginal and small farmers(Financially weaker section)(usually with < 1acre of land)	Can not survive on land alone, non-monsoon time-depend on common-property bioresource, domesticated goat, cow and poultry	Unable to harness benefits because of small holdings, and lack of adequate water resource/irrigation and above cited issues
Ecosystem Dependent people (Forest dependent communities, Fishing communities)(Tribals, Fishermen)	Fully bioresources based livelihood, Home garden, Animal rearing etc.	Seasonal unemployment, Exposure to risks, Income variable, Accident/health risk- can not afford insurance
Displaced people due to industrialisation	Bioresource, Employment, Entrepreneurship etc	Loss of land and livelihood, unable to adjust to new livelihood options, and new homes etc.
Widows, Destitute, Persons with disability, Disaster affected Artisans Miscellaneous (small %)	Bioresource(Community common-property based), Domestic help, Bioresource (Bamboo, Cane, Wood etc) Employment, Small Business,	Unable to cope with problems, Food security, Health security, Identity crisis Finance, Marketing etc Health issues and other problems



**Table 6: Environmental Liability of Livelihood options in villages**

Environmental Stress	Criteria	Remark	Pollution
Low	◆ Bio-resource based livelihood,	◆ Materials are biodegradable,(small tea stalls,tailoring,etc),	◆ Foul smell,
	◆ Non-biodegradable substances are small	◆ Cooking by biomass based fuels in quantity and reusable.	◆ Air pollution from biomass-cooking
Medium	◆ Bio-degradable substances with high organic and salt loading are produced,	◆ Fish drying activity, Bakery and Pitha making,	◆ Foul smell,
	◆ Non-biodegradable and non-hazardous substances are produced in small quantity and recycling is possible to a large extent, fossil fuels in small quantity are used.	◆ BOD of the effluent not exceeding litre, Workers involved in Agricultural 100mg/ activities using tractors, diesel irrigation pumps seasonally,	◆ Air pollution by exhaust gases and suspended particulate matter,
High	◆ Non-biodegradable, hazardous and toxic substances that create severe and adverse environmental impacts,	◆ Stone crushers etc	◆ Health risks
	◆ Natural resources are used in significant quantities which are not sustainable,	◆ Chemical fertilizer and pesticides used in agricultural field,	◆ Workers exposed to severe pollution,
	◆ Fossil fuel is routinely used	◆ Large brick kilns,	
		◆ Bio-resource based furniture making, Furnace and boilers using coal	◆ Depletion of resource due to unsustainable practices

**Water resources**

Of the total water resource of the earth, 97.3% is salt water and the rest fresh water. The fresh water 2.7% amounts to about 1.4 billion km<sup>3</sup> of water. Of this, about 77.2% is permanently frozen, 22.4% occurs as ground water and soil moisture, 0.35% is found in lakes and wetlands, and 0.01% in rivers and streams (World Resources, Basic Books, New York 1986). The total volume of ground water found in underground reservoirs, called aquifers, is estimated to be 42.3 x 1010 m<sup>3</sup>. Agriculture uses the maximum amount of water in the world and puts lot of pressure on ground water. Excessive use of ground water depletes aquifers, lowers the water table and may lead to salinisation, water logging and alkalinisation of soils. It has been estimated (Dash, 2006) that the fresh water needs (drinking and food) of a person are about 2.7L per day (1,000L or 1m<sup>3</sup> per year). India receives about 3 trillion m<sup>3</sup> of water from rainfall, which amounts to about 105 to 117 cm annually. This is a huge water resource and the largest in the world. But almost 90% of this precipitation falls between mid-June and October. Fourteen major river systems, such as the Ganges, Narmada, Brahmaputra, Mahanadi, Cauvery, Krishna and Godavari account for 85% of surface flow and share 83% of the drainage basin. They serve 80% of the total population. There are about 100 medium and minor rivers. The storage capacity is 3.65 million m<sup>3</sup>. Of the total annual precipitation, India utilizes only 10%, which may increase to about 26% by 2025. We need to apply improved technology to increase water harvesting and storage capacity and ground water utilization. Of the total water used in India, 92% is for irrigation and 8% for industrial and domestic use (Sharma, 1987).

The Central Ground Water Board has estimated that the available ground water in India is 210 billion m<sup>3</sup> and the annual utilization potential is about 42.3 million hectare, only one-fourth of which is used at present. However, the ground water availability is not adequate in provinces like Tamil Nadu and Andhra Pradesh and excessive ground water use (unsustainable use) for agriculture in Punjab, Haryana, Delhi and Rajasthan has depleted ground water resource. More than 26 cubic miles of ground water vanished from aquifers in these states due to excessive agriculture use and may bring collapse in agriculture production unless remedial measures taken on priority basis (NASA satellite data-Yahoo internet news dated 14 August 2009). Adequate ground water recharge and shifting to non water intensive crops are important to address the problem. Due to large scale deforestation and monsoon failure, there is a regular occurrence of drought in Kalahandi district and some other districts of Orissa, in Jharkhand, Bihar, Karnataka, Rajasthan, and Maharashtra.

The supply of drinking water in Indian villages is not adequate, especially in summer. There is no organized water supply in most of the villages and even in some small towns. Although there is good precipitation in India, sufficient care is to be taken to manage this water efficiently.

The wetland, coastal and marine ecosystems are highly productive and thousands of coastal villages depend on the ecosystems for their livelihood.

The coastal areas, apart from being environmentally sensitive and highly productive, are extremely attractive for human population and, therefore, for economic development.

Sixty percent of the world's population lives within 60 km of the coastlines, and this figure is forecasted to rise to 75% within the next three decades. The average width of the coastal zone on the terrestrial side is considered to be 60 km worldwide. Few thousand coastal villages exist in east coast and west coast of India. The livelihood options of these villages are predominantly marine and brackish water fishery.

It is essential to manage coastal zone, balancing and integrating demands of various sectors at the same time facilitate much needed awareness about its values and functions and promote its wise use by the local communities who depend on it for their livelihood

A variety of landform features are observed in this part such as spits, bars, lagoon, lakes, creeks, swamps, beaches, tidal flats including the classical mangrove swamps.

The coastal processes are complex and the coastal forms are very dynamic as changes happen regularly. India has about 7500 km of coast line and a number of coastal wetlands adorn the coastal zone of the country.

Mangroves forests are one of the most productive wetlands and bio-resource on earth and provide livelihood to thousands of village people.

In West Bengal, Orissa and Adaman-Nicobar Islands mangrove forest and swamps are found. The mangrove forests are under threat due alteration of fresh water flow and from the anthropogenic pressure. Their protection and conservation are the need of the time (Dash and Kar, 1990; Dash, 2006) Sea grasses constitute of about 60 species of bio- resource of underwater marine ecosystem. Fourteen species of



sea grasses belonging to seven genera are so far recorded in India, out of which three genera encompassing six species are recorded from Chilika lagoon (Pattnaik, 2006). Sea grass ecosystems provide habitats for a wide variety of organisms, especially fish, and shrimps and birds. Sea grasses are very sensitive to some human impacts and are important indicators of the health of the marine environment. Sea grasses with high protein content have commercial value. Many coastal village people depend on them for livelihood.

### Bio-resources

These resources are forests, crops, other plants, wildlife, domestic animals, and aquatic plants and animals, and their products yielding food, energy, biogas, and so on.

### Biomass

These are, however, renewable sources of energy. Fuel wood demand in India was about 300 million tons in 2005 AD. Natural forests provide 75-100 million tons and the rest of the demand is met with fuel wood plantations, which require lot of effort and sound management strategy.

Biogas: India has >391 million livestock, 185 million cattle, 61 million buffaloes, 45 million sheep, 97 million goats, 1 million horses, 1 million camels, and 1 million other livestock. These animals produce a huge quantity of dung, which can be utilized for biogas production. Water hyacinth, Hydrilla, duck weeds and algae can act as supplements for production of biogas. Besides cooking, biogas can be utilized to produce steam, which can be used to run machines and turbines for generating electricity. Left-over slurry can be utilized as manure.

Sharma (1987) mentions that some 1,000 to 1,500 million tons of wet animal dung is available per year in India and at a 66% collection rate, 22,425 million/m<sup>3</sup> of biogas can be produced. The slurry can produce 206 million tons of organic manure per year, equivalent to 1.4 million tons of nitrogen, 1.3 million tons of phosphate and 0.9 million tons of potash as fertilizers.

At present the amount of dung production is much more. There are about 0.61 million biogas plants in India now. Biogas generation, utilization and management require top priority to address the energy requirement problem in rural India and if implemented in large scale will help forest conservation.

Biomass Energy: Some conventional energy resource, such as wood- biomass fuels are also renewable. The principal energy sources for rural India are given in Table 2.

The firewood demand in India was about 300-350 million tons in 2,005. Biomass such as firewood, agricultural residue, bagasse, crop stalks, coconut shells, waste from agro based industries, and animal dung can be used to produce power. Direct burning of these wastes is inefficient and leads to pollution. If these wastes are combusted in a gasifier at low oxygen and high temperature, can be converted into a gaseous fuel called producer gas. This gas, although has a lower calorific value compared to natural gas or liquefied petroleum gas, can be burned with high efficiency and without emitting smoke. India generates > 600 million tons of agricultural residues per year. These wastes can generate 79000 MW of power if all of this waste is gasified (SPAN, 2006). It is feasible to set up a biomass based power plants of 10 to 20 MW in every village block, consisting 100 villages.

### Forests as Bio-resource

These are natural ecosystems dominated by trees. About a third of the world's land surface is covered by forests, of which tropical forests constitute about 50%. Forest ecosystems are great resources, since they provide habitat for wild life, fuel wood, fodder, fiber, fruit, herbal medicines, timber, and several raw materials, to rural people in India and these are primarily used in bamboo and wood-based cottage industries, including paper and pulp industries. A climax forest may account for 400 ton of dry matter per hectare. The large animal biomass may account for about 1,000 kg per hectare.

### Dependence of the rural society on forests

Forests provide timber, firewood, nuts, fruits, and seeds, medicinal plants etc. to the villages in India. Forests shape natural environment of villages by providing ecosystem services like prevention of soil erosion, flood, etc and influencing such factors as temperature, humidity and precipitation and as a sink for green house gases and some pollutants. Forests provide suitable habitats for a number of plant and animal species. They help in maintaining a broad genetic base from which future strains and varieties could be developed.

Nearly 23% of the total land area of India (328.8 million hectare) is occupied by forests, amounting to about 74.8 million hectares. However, analysis of satellite photographs indicates that the forest cover may now only be 14% (11% closed forests and 3% degraded woods).

It has been estimated that since independence, India has lost about 45 million hectares of good forests, of which only 6 million hectares have been replaced (Sharma, 1987). The principal factors for deforestation are an increase in human population and livestock and consequent increased demand for timber, fuel wood, and grazing. Urbanization and industrialization are important factors causing the destruction of forests. Other important causes are the construction of roads and mining activities. The construction of hill roads, particularly in the Himalayan region, has destroyed many forestlands. One estimate shows that some 683,672 hectares of land were under mining activity in 1973. Mining activities are still continuing in many states in full swing – the bauxite, coal, iron ore, chromites, lime stone, dolomite-mining in Orissa, Jharkhand, Chhatisgarh, Rajasthan and some other states is a case in point.

Wood consumption worldwide amounts to >3.2 billion m<sup>3</sup>. Of this total some 46 and 54% respectively are consumed by industry and as firewood in developing countries. The corresponding figures for developed countries are 84 and 16%, and most of the wood being consumed as firewood. In India, fuel wood production was 213 million m<sup>3</sup> in 1983, about 23% higher than the figure for 1973. (FAO year book of forest products, Rome, 1985). Paper industries consume a huge amount of bamboo, which is now in short supply in peninsular India. Paper mills now depend upon supply from North-east, especially Arunachal Pradesh (Sharma, 1987).

The Himalayan mountain areas amount to 12,49,000 km<sup>2</sup> which form about 38.4% of India's land resource. Deforestation is now a major problem in the Himalayan regions. It has caused soil erosion and other damages. Besides, a number of wood-based industries have come up in this region as raw materials are easily available. The growth of industries has also caused air and water pollution. No detailed survey on the rich wealth (fauna, flora, minerals, water resource, etc.) of Himalayan ecosystems has been made. Recently WWF(2009) have reported 350 new species of biota from eastern Himalayas. Village ecosystems in general and mountain village systems in particular are under severe stress. Fast depletion of forests including mangroves by illegal felling, practice



of Podu in many areas without taking remedial measures create stress among village people, especially in tribals.

Social forestry involves plantations on government, private and village panchayat land, roadsides, canal-banks, along railway lines, land not suitable for agriculture and so on. The aim is to grow fast growing trees, which are commercially valuable. These trees are meant to raise firewood for people, pulpwood for the paper industry, and fodder for cattle and act as windbreaks or shelterbelts. Social forestry also involves the participation of people on a large scale, so that natural forests are not destroyed. It helps create plant resource genetic banks, nurseries, recreation gardens, and so on. Although a few years ago monoculture (culture of one species of trees) was practiced for social forestry, polyculture (growing more than one tree species in the same land) is now considered better and practiced. Polyculture is based on indigenous or exotic species of plants which can provide not only timber but also much required fodder and fix nitrogen to increase soil fertility. The following species of plants are now widely used for social forestry: *Acacia*, Lukens, (Subabul), *Prosopis* (Jand), Sesames (Agastha), *Casuarina*, *Tectona* (Teak), *Dalbergia* (Shisham), *Moringa* (Shajan), and *Azadirachta indica* (Neem) in rural India. Eucalyptus plantation was once considered a panacea for our economic ills. It is a quick growing tree which is used in the paper pulp industry. But it is not very afforestation suitable as firewood or timber, nor can it be used as fodder or for consumption of fruit. The eucalyptus has lost the popularity it once had.

Social forestry also aims to provide a good income to the farmer. Therefore plants which grow faster and reach a marketable size in 3-8 years should be chosen. A modified version of social forestry is called agro forestry. Woody perennials are grown on the same land management units as annual agricultural crops and farm animals. These are grown either simultaneously or sequentially and the purpose is to maximize output on a sustained basis. Community forestry/ village forestry/gramya jungle is practiced around villages and panchayats. The three terms, social forestry, agro forestry and community forestry have much in common and are considered more or less the same thing. The social forestry programme has made the people conscious of the importance of afforestation and is gaining in popularity. Compensatory afforestation is stipulated by the Indian Government, while approving proposals for dereservation or diversion of forest uses. Compensatory afforestation is insisted over equivalent area of non-forest land. The purpose is to compensate the loss of forest cover due to its diversion so that the net area under forest cover remains the same. If non-forest lands are not available or is available in less extent to the forest area being diverted, compensatory afforestation may be carried over degraded forests twice in extent to the forest area being diverted or to the difference between forest land being diverted and available non-forest land, as the case may be. The nonavailability of non-forest land for compensatory afforestation is however, accepted by the Central Government only on the certificate from the Chief Secretary to the State/Union-Territory Government to that effect. However the compensatory afforestation has not been practiced vigorously and requires effective management strategy to support rural economy and livelihood options.

### Agriculture

Agriculture is the main source of livelihood in villages. Agriculture employs 73% of the main work force in the country, although contribution of agriculture to NSDP has declined from 67 per cent (1951) to 30 per cent (2002). Small farmers and marginal farmers (owner of <1 acre of land) constitute about 84% of the total operational holdings with 50% of the agriculture land. Table 3 provides data on the agricultural production and productivity in the country (Prasad, 2009).

In the last 5-6 years in most food grain crops the production has reached a plateau and in some there is decline (Prasad, 2009). The rice productivity is less than 2 tons per hectare in most of the states. The productivity in Punjab, Andhra Pradesh, Haryana, West Bengal and Tamilnadu is higher than the national average of 2.07 ton per ha. The population growth in the country is >1.3% and hence the production and productivity of food grains are to be enhanced. Prasad (2009) suggests many useful methods and the fact is that India needs another green revolution to cope with the demand of growing population.

### Animal resources

India's fish production data is given in Table 4. The total production was about 7.31 million tons in 2007, out of the total fish production, aquaculture amounted to about 3.355 million tons and the capture fishery (both marine and fresh water) amounted to 3.95 million tons. The per capita fish protein consumption is not much and there is good scope to increase the aquaculture facility and capture fishery considering 7500 km of coastline and a huge continental shelf.

Productivity. The animals are important for providing organic manure for agriculture, dung-fuel for rural homes, and byproducts like bone meal etc as manures etc.

]However with reduction in grazing land and monetary constrains for stall feeding by the small and marginal land owners, government subsidy and Fish, prawn, and turtle form part of the livelihood support in Indian villages. Some of the ST and SC people also consume frogs, molluscs etc. The area under ponds, tanks, beels and fresh water lakes etc amounts to 3.42 million hectare. There is need of renovating village ponds for water harvesting and fish culture. The length of rivers and canals is 171334 km. The cleaning of rivers and canals for fish culture will boost the village economy.

The animal resources are utilized for different purposes and can be grouped under (i) milk group comprising cow, buffalo, goat and some minor contribution from camel and sheep, (ii) draught group comprising bullock, buffalo, horses, ponies, mules, camels etc, (iii) meat supplier group comprising buffaloes, cattle, sheep, goat, pig, rabbit etc, (iv) wool group comprising largely sheep, (v) egg group comprising fowls, and ducks. Marginal and small land owners are the owners of 71% of cattle, 83% of buffaloes, 88% of small ruminants, 70% of pigs and 74% of poultry (government of India-publication, 2005). In view of this the village livelihood sustainability is dependent on animal resources. As per the statistics, India produced about 89.35 million tonnes of milk (96% from buffaloes and cows, and 4% from goat), about 39092 million numbers of egg (20012-2002) and 4.91 million tonnes of meat including poultry meat (2001-2002) and the estimated annual growth is 5%. The live-stock products contributed 5.51% to the gross domestic product of the country in 1999- 2000. The live-stock contributes about 25% of the agro-sector of the country in terms of money. This is the important sector for scientific research to increase the milk, egg and meat production. There is good scope to enhance this production and other welfare measures are required. Genetic selection of animal breeds, feed and nutrition aspects, health and disease aspects and opening of veterinary dispensaries and hospitals in villages are the priority areas. India is very rich in domestic animal resources and their management is the most important aspects for sustainable rural economy.

### Rural Livelihood options

The rural livelihood options in India have centered around on agriculture, collecting fire wood, sal (*Shorea robusta*) or broad leaves (*Tectona grandis*) for



making plates, kendu leaf for making cigarettes (bidi), Sal and Neem seeds for oil extraction, from nearby forests/Gramya jungle, fishing in ponds and rivers, and in sea in coastal villages, vegetables from home garden, meat, egg, and milk from domestic animals and (cattle, buffalo, goat and sheep), poultry etc from bioresource based cottage industries (bamboo, cane and wood for basket and furniture making) and small entrepreneurship (tea stalls, hotels, bakery and preparation of pitha, kiosks, cycle-motor cycle repair, tailoring, small laundry) etc.

The environmental liability of these livelihood options is either low or medium, but never assessed or looked into. My association in some World Bank funded projects, (Government of Orissa Project, 2007) field work for EIA report preparation for some industries in Angul and Denkanal districts, some coastal districts and in some districts of western part of Orissa is summarized below.

The non-farm activities center on goatery, poultry, dry fish trading, diary, rearing of wild boars, and piggery, and the forest based activities are leaf plate making, basket making, kendu leaf collection, firewood collection etc.

### Environmental Sustainable Indicators

The forest provides firewood, house building material, fodder, fruits, medicinal plants and other utility materials to the villages with some control by village Panchayat.

The runoff water from the slopes of the mountain forest/Gramya jungle is stored in the water harvesting village ponds. These ponds provide surface water for the use of the villages throughout the year as some ponds do not dry up fully in summer. In view of this the village forest forms the life line for the villagers. A garland drain connecting to water harvesting ponds is usually constructed. The villagers depend upon the buffaloes and cows for milk, goat and sheep, poultry for meat and eggs and use the bullocks and buffaloes in the crop field for ploughing. The goat rearing is a profitable business for many village households.

The village forest and grasslands are also used extensively for grazing of domestic animals of the villages. In the changed situation of industrialization, the reduction/complete loss of grazing lands, villagers have problems of providing grazing land and unable to afford stall feeding. Domestic animals provide livelihood support to the people. However, employment opportunities for villagers in the changed scenario may increase their income, which will help to partially stall feed the animals.

Cropping pattern: Paddy, pulses and vegetables are the main crops. Pulses are grown followed by paddy. Brinjal, tomato, leafy vegetables, ladies finger, and vegetable banana are widely grown. Mango, Banana & Gauva are the major fruit plants grown by the villagers. The home gardens are also productive resources and are to be managed well.

The core poverty group is the landless wage earners, marginal and small farmers, (less than 1 acre land holding), ecosystem people (Dasmann, 1988; Gadgil and Heda, 2009) (forest dependent and other bioresource dependent- largely SC, ST, and some OBC). Poverty is chronic as income is erratic (Table 3). The livelihood pattern in villages vary according to cast, ethnicity and financial condition of the families. Since the livelihood pattern is largely bioresource based, government schemes should protect these resources and funding should be done to enhance bioresource productivity and management. The income from these occupations is subsistence level and do not meet the family expenditure. In view of this migration to urban centres in the state or to distant places in search of work to augment family income happens.

### Environmental Aspects

Most of these livelihood options cited above have some environmental liability for people and these are never addressed in Indian situations. Table 4 gives an account of such environmental liability. In coastal belt industrial pollution has affected growth of coconut, Bamboo, Kaju production largely due to SO<sub>2</sub> pollution.

### Environmental Impact Assessment (EIA)

Since 1994 EIA study has become mandatory for all new projects or expansion or modernization of existing projects which have substantial stake on environment. As per 14 September 2006 notification of Ministry of Environment and Forests of Government of India, the generic structure of environmental impact assessment document and check list of environmental impacts have been stipulated. The purpose is to assess the expected impacts and to address them through an environmental management plan if the developmental project is allowed to operate. The check list includes land environment, water environment, vegetation, fauna, air environment, aesthetics, and socio-economic aspects, building materials, energy conservation and environmental management plan. The check list is a reflection of livelihood options prevailing in India. However there is a big gap between the EIA stipulations and implementation. The sustainability concerns of Indian villages have not been adequately addressed. The interest of multinational companies and big industrial houses of the country have received more attention than the natural resource management or furtherance of traditional livelihood options conserving the 'traditional ecological knowledge' available in village systems. Ramakrishnan (2009) points out emphatically that 'very traditional societies living close to nature and natural resources around them may have to have traditional ecological knowledge being brought in to a much larger degree so as to avoid social disruptions setting in, compared to the more modern societies who may need traditional ecological knowledge only to be brought in so as to create buffering mechanisms within the socio-ecological system and thus cope up with the ill-effects arising from excessive use of energy intensive technologies.' I have had the opportunity of getting involved in some World Bank funded projects and projects of big industrial houses to understand socio-ecological systems in some villages of Orissa. My understanding is that sustainable development in Indian villages centres on creating facilities to enhance the existing livelihood options, adopting effective community participatory approaches, and sustainable management of bio-resources. This does not prevent opening of new avenues which will have minimum environmental impacts and can be addressed by application of science and technology and will create livelihood options of youth. The judicious implementation of EIA provisions is need of the time to address environmental uncertainties and to conserve bioresource based traditional ecological knowledge and rural livelihood options.



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Section 3

## **International Case Studies**



## 1.0 Introduction

### 1.1 Part I – Constitutional Framework

#### 1.1.1 Nature of Federal Government

Not unlike India, the South African Constitution divides powers between the legislature, executive and the judiciary. Parliament in South Africa is a bi-cameral legislature consisting of the National Assembly that is a popularly elected body and the National Council of Provinces constituted by representatives of all the nine Provinces of South Africa and other specially appointed persons. The national executive in South Africa is headed by the President who is elected by and from amongst the members of the National Assembly. It further consists of a Cabinet of Ministers each heading a Ministry. Similarly, at the provincial level, there is a legislature consisting of elected persons with an executive headed by a Premier and assisted by an Executive Council.

As part of its federal structure, there are three levels of governance:

- ♦ National government;
- ♦ Provincial governments; and
- ♦ Local governments.

Areas are identified within which the Provinces may legislate and areas where Parliament and the Provincial Legislatures have concurrent powers to legislate (referred to as functional areas of provincial and/or national competence). As compared to India though, the South African structure of governance tilts more towards centralization. This is reflected in the following:

- ♦ The areas within which the Provinces in South Africa enjoy exclusive legislative power<sup>1</sup> are not as extensive as the subjects in respect of which the States in India exercise such power.<sup>2</sup> Similar to the power of the Indian Parliament and State Legislatures to enact laws on matters falling under the Concurrent List,<sup>3</sup> the Provincial Legislatures in South Africa have the right to legislate on certain other matters qua which Parliament is also entitled to legislate.<sup>4</sup> In the event of conflict between the provincial enactment and the national law, subject to certain conditions,<sup>5</sup> it is the national law which prevails;
- ♦ Parliament in South Africa may exercise legislative power in respect of matters exclusively within the domain of the Provincial Legislatures for reasons such as maintenance of economic unity, essential national standards, establishment of minimum standards for rendering of services etc.<sup>6</sup> These circumstances are far wider than the grounds under the Indian Constitution enabling Parliament to legislate on matters falling under the State List.<sup>7</sup>



### 1.1.2 Federalism and Legislative Competence to Enact Mining Related Laws

Under the South African Constitution, the subject matter of minerals and energy resources does not fall within either the functional areas of concurrent national and provincial competence or of exclusive provincial competence. As such, the regulation and development of minerals in South Africa is a functional area of exclusive national competence.

Under the Indian Constitution, regulation of mines and mineral development is a subject in the Union List to the extent that such regulation and development under the control of the Union is declared by Parliament by law to be expedient in public interest.<sup>8</sup> Any regulation of mines and development of minerals that falls outside the scope of such law passed by Parliament falls within the domain of the State Legislatures.<sup>9</sup> The existing Mines and Minerals (Development and Regulation) Act, 1957 contains the requisite declaration and thus denudes the State Legislatures of the jurisdiction to enact any laws on the regulation and development of mines and minerals that is covered within this central statute.<sup>10</sup> In effect therefore, in both South Africa and India, the field of mines and mineral development is primarily governed by Parliamentary legislation.

### 1.1.3 Federal Structure and Implementation of Mining Laws

The 1957 Act contains very bare and basic provisions and the bulk of the detailing and implementation is to be determined by delegated legislation. With respect to minor minerals, the State Governments have the right to frame rules for implementation of the 1957 Act.<sup>11</sup>

Even with respect to major minerals, while the Central Government is authorized to formulate rules,<sup>12</sup> most functions have been delegated to the State Governments in the discharge of which the State Governments enjoy considerable autonomy, subject to requiring approval of the Central Government for grant and renewal of mineral rights in respect of specified minerals (under the new proposed Act, the list of minerals requiring Central Government approval is sought to be reduced).<sup>13</sup>

On the other hand, in South Africa, for implementation of the provisions under the Mineral and Petroleum Resources Development Act, 2002 (“MPRDA”) the Minister of Energy (“Minister”) is required to divide the Republic of South Africa into regions. The MPRDA does not stipulate that such regions would be synonymous with the provinces in South Africa.<sup>14</sup> Most functions under the statute are discharged by the Minister. Regional functions are entrusted to a Regional Manager, who is an officer of the Department which assists the Ministry at the national level. Thus, the regional functions are performed by officers of the national government and not by the provincial governments.<sup>15</sup>

## 2.0 Part II – Mineral Rights

### 2.1 Vesting of Mineral Rights

The State is the custodian of all mineral and petroleum resources in South Africa.<sup>16</sup> The State is empowered to grant, refuse, manage etc. any reconnaissance permission, prospecting right, permission to remove, mining right, mining permit, retention permit etc. (together “mineral rights”) and determine any levy payable for utilization of any mineral rights.

It is interesting in this regard to contrast the law in South Africa with the law in India. Under the 1957 Act as well as the proposed MMDRA, minerals can vest either in the State or in private persons. If minerals vest exclusively in persons other than the State, then mineral rights may be obtained only by entering into an agreement with such private persons, which cannot be in contravention of the provisions of the statute. Royalty for such minerals would be payable to the private person.<sup>17</sup> Ordinarily, the owner of land would be the owner of all the minerals beneath the surface in the absence of a reservation of the minerals in favour of the State. The terms of the grant or other document establishing title of such person having interest in the land would be looked at for the purpose of determining if such reservation exists.<sup>18</sup>



By contrast, the position in South Africa is as follows:

- ♦ Ownership and other questions relating to title of the land do not impede the grant of mineral rights;
- ♦ Applicants for and holders of mineral rights need to deal with the State only, and grant of mineral rights is not dependent upon volition of a third person;
- ♦ There is no legal requirement for acquisition of land by the State in order to grant mineral rights in respect of minerals under such land;
- ♦ Despite ownership of land, exploitation of minerals discovered beneath or on such land may only be done upon being permitted under and in accordance with the MPRDA.

## 2.2 Right of Access

As far as surface rights of the owner and lawful occupier of the land are concerned, the MPRDA provides for a redressal mechanism in case of obstruction by such owner or occupier in allowing the rights holder to enter upon the land and carry out operations in accordance with the terms of the mineral rights. The rights holder is required to notify the Regional Manager who is to take measures stipulated under the MPRDA including initiation of a mechanism for determination of compensation payable to the owner or occupier, if applicable. The Regional Manager is also empowered, after considering the issues raised by the rights holder, the owner or occupier of land and recommendations of the Regional Mining Development and Environmental Committee, to recommend expropriation of land to the Minister.<sup>19</sup>

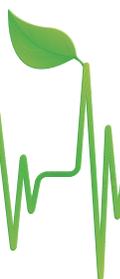
The proposed MMDRA in India recognizes the right of a holder of mineral rights to enter the lands over which such mineral rights are granted for the purpose of conducting the operations to which the mineral rights relate.<sup>20</sup> The holder of mineral rights is however required to pay compensation to the owner of surface, usufruct and traditional rights as a condition attached to the mineral rights.<sup>21</sup>

## 2.3 Factors Governing Grant of Mineral Rights

In South Africa, while the Minister has discretion to grant any mineral rights, the parameters governing exercise of such discretion have been spelt out. These parameters relate to assessment of the financial resources and technical capability of the applicant, satisfaction that the activity would not result in unacceptable environmental degradation, advancement of the objects of the MPRDA pertaining to promotion of interests of the historically disadvantaged persons, discouragement of monopoly etc.<sup>22</sup>

Neither the 1957 Act read with the Mineral Concession Rules nor the proposed Act (except for grant of mineral rights pursuant to competitive bidding)<sup>23</sup> stipulate such factors that need to be taken into consideration while dealing with an application for grant or renewal of reconnaissance permission or prospecting rights. The Mineral Concession Rules merely provide that the applicant should not have defaulted in payment of dues under any other mineral right granted to it, or in payment of income taxes.<sup>24</sup>

However, there are more comprehensive requirements that affect grant of a mining lease. Under the proposed Act in India, the criteria for assessment of competitive bids for a mining lease are required to be taken into consideration for any grant of a mining lease.<sup>25</sup> Further, before execution of the lease deed and commencement of operations, the applicant is required to prepare a mining plan, which should incorporate detailed information and proposals touching upon various aspects of the mining activity including rehabilitation, environment etc. Without approval of such mining plan, the lease deed is not executed and mining operations cannot commence.<sup>26</sup>



## 2.4 Compliance and Monitoring

The performance of a rights holder in the course of prospecting / mining operations is circumscribed by a prospecting or mining work programme prepared by the rights holder and approved by the Minister. The rights holder, in addition to complying with the applicable statutes and statutory approvals or authorizations obtained, is required to adhere to such work programme.<sup>27</sup> Being a statutory condition, contravention of such provision attracts the consequence of suspension or cancellation of the concerned mineral rights.<sup>28</sup>

The MPRDA contemplates maintenance of records of reconnaissance, prospecting and mining operations, connected expenditure and data and submission of progress reports and data at prescribed intervals.<sup>29</sup> The Minister is also empowered to direct an applicant, a rights holder as well as the land owner or lawful occupier of the land to submit such information as may be necessary to achieve the objects of the MPRDA.<sup>30</sup> The MPRDA further confers upon the Minister and other officers, the power to enter upon any prospecting area or mining area, inspect records and ascertain compliance with the provisions of the MPRDA.<sup>31</sup>

## 3.0 Part III – Black Economic Empowerment

Black Economic Empowerment (“BEE”) refers to the vision of the Republic of South Africa to secure equality in a meaningful manner. The principle behind BEE is to achieve equality guaranteed by the Constitution by socially and economically empowering the historically disadvantaged South Africans.

### 3.1 Broad Legal Framework

BEE has found its place in all legislative activity, with legislations regulating various sectors incorporating the objectives of BEE. In addition to this, the South African Government has also, since 1994, enacted legislation with the specific purpose of addressing economic inequalities and in order to enable BEE measures to be undertaken.

Amongst the earliest of such legislation was the National Small Business Act, 1996, which was enacted to promote setting up of small, medium and micro-enterprises encouraging the growth of black-owned and black-controlled enterprises in South Africa. In 1998, the Employment Equity Act was enacted, rendering illegal all unfair discrimination and requiring enterprises to take affirmative action to increase the representation of designated groups. The Competition Act of 1998 also recognises the objectives of BEE and provides for exemptions to otherwise anti-competitive practices that promote the ability of black owned or controlled enterprises to compete. With a view to reform procurement by the public sector in line with its policy objectives, the Preferential Procurement Policy Framework Act, 2000 was passed. This Act focuses on empowerment by introducing preference towards historically disadvantaged persons in State procurement policies. It provides for a system of preference points in the evaluation of tenders such that weighting is given to tenders on the basis of specific goals achieved by such tenders. Financial impetus has also given by the Government for achievement of the goals of BEE.<sup>32</sup>

Thereafter, the Broad Based Black Economic Empowerment Act, 2003 (“BEE Act”) was enacted widening the perspective of BEE and in order to provide for a clearer and more focused approach. The BEE Act defines the principles of broad based black economic empowerment and purports to achieve holistic empowerment of black people, broadly by way of the following:

- ♦ Skill development that would make black people a valuable human resource;
- ♦ Promoting investment that results in and provides an incentive for participation by black people in economic activities;
- ♦ Increasing opportunities for black communities to own and manage enterprises as well as transforming the racial composition of the ownership and management structures in existing and new enterprises.<sup>33</sup>



The BEE Act operates as soft legislation that purports to inform the policy of the Government. It outlines broad targets to be achieved by the Government and industry in general and provides an enabling framework for initiation of BEE measures.

Under the BEE Act, power is delegated to the Minister of Trade and Industry (“Minister of Trade”) to issue “codes of good practice”. These codes of good practice are meant to establish parameters, which guide: (i) BEE strategy formulated by the Minister of Trade to operate at a general level; and (b) policies and dealings of different organs of the state and public entities.<sup>34</sup>

The BEE strategy referred to above is to be formulated by the Minister of Trade defining the approach by state institutions, communities and other stakeholders towards BEE, providing plans for financing BEE and establishing a system for public entities and enterprises to prepare broad-based BEE plans.<sup>35</sup> From a sector-specific perspective, the BEE Act also contemplates promotion of transformation charters for any particular sector if the Minister of Trade is satisfied that the charter has been developed by major stakeholders and advances the objectives of the Act.<sup>36</sup>

The BEE Act further provides for setting up of a Black Economic Empowerment Advisory Council (“Council”), which functions as an advisory body to the government on measures relating to BEE.<sup>37</sup>

### 3.2 Implementation of BEE

BEE is a goal that is an integral part of all economic activity and legislation in South Africa. It is sought to be implemented in a holistic fashion, taking into consideration industry-specific concerns and by means of persuasion rather than by taking the form of an onerous obligation.

With a view to introduce a more focused approach towards achieving BEE, the Department of Trade and Industry has formulated a Strategy for Broad Based Black Economic Empowerment (“Strategy Document”)<sup>38</sup>. This Strategy Document contemplated the introduction of the BEE Act and other regulatory means to achieve the BEE objectives. The Strategy Document is a pre-cursor to regulation of BEE and provides a useful insight into the nature of BEE measures and a broad overview of the manner in which BEE would be implemented in South Africa.

### 3.3 Strategy for Broad Based Black Economic Empowerment

An important feature of this Strategy Document is that it seeks to define BEE.<sup>39</sup> It sets out the policy objectives and key principles of BEE. The policy objectives essentially aim at greater participation of the black community in terms of ownership and control of enterprises, employment at senior management level positions, ownership of assets and income levels. The principles of BEE are founded on the premise that economic growth is to be achieved by policies that are inclusive in nature and shared growth alone would lead to stability.<sup>40</sup>

The need for private participation in BEE is recognized and sought to be achieved through drawing up of sector-specific charters formulated by the stakeholders of the sector in collaboration with the Government outlining the measures to achieve BEE. Such charters are intended to be self-regulatory in nature.<sup>41</sup>

The Strategy Document also envisions financing to facilitate participation by the black community by way of grants, lending, venture capital etc. It also briefly outlines the role of the Industrial Development Corporation of South Africa (“IDC”) in financing such participation and the strategies to be adopted by it.<sup>42</sup>



### 3.4 Codes of Good Practice Under BEE Act

As contemplated under the BEE Act, the Minister of Trade and Industry issued codes of good practice on 9<sup>th</sup> February, 2007 (“Codes”).<sup>43</sup> The Codes provide for scorecards measuring performance of enterprises in terms of BEE. There are seven major measurable elements to assess performance in relation to BEE, viz., ownership, management control, employment equity, skills development, preferential procurement, enterprise development and socio-economic development.

Performance in respect of each of the above elements is to be measured against the indicators prescribed under the Codes in accordance with the aforementioned principles. The Codes also prescribe the weightage to be provided to each of such indicators. While the score arrived at in accordance with the Codes is relevant for the purpose of measuring performance in terms of BEE, the Codes also stipulate targets for compliance in respect of each of the indicators concerned.

In the context of ownership, it is relevant to mention that the Codes prescribe a target ownership of 25% + 1 vote and 25% economic interest by black people.

The entities that are measurable in terms of the Codes are specified public entities, enterprises that have dealings with such public entities and other enterprises that have dealings with such enterprises. The Codes allow certain concessions in measurement of the scores in respect of start-up enterprises, entities with a low capital etc.

The Codes also contain recommendations for drawing up of transformation charters and BEE performance scorecards by different sectors. They provide for permissible deviations from the weightage, compliance targets and indicators of measurements in certain respects.

### 3.5 Mining and BEE

Underlying the MPRDA are the objectives of equitable distribution of wealth in the mining industry and increased participation by historically disadvantaged South Africans (“HDSA”) in the mining industry.<sup>44</sup>

The MPRDA gives effect to such objects in different ways. It empowers the Minister of Mining to take measures relating to facilitation of assistance to HDSA in the conduct of prospecting and mining operations.<sup>45</sup> The MPRDA requires that these objects be accommodated in decisions relating to grant of mineral rights taken by the Minister of Mining under the MPRDA.<sup>46</sup> In addition to this, the Minister of Mining is entitled to expropriate land for the purpose of giving effect to such objects.<sup>47</sup>

Each holder of a mining right is required to submit an annual report detailing its compliance with the objects of the MPRDA in relation to inclusion of HDSA and promotion of employment, social and economic welfare of all South Africans.<sup>48</sup>

### 3.6 Broad Based Socio-Economic Empowerment Charter for the South African Mining Industry (“Mining Charter”)

The implementation of BEE measures on a sector-specific basis is mostly effected through formulation of charters for each sector, which regulate the practices of such sector. Even prior to the enactment of the BEE Act, charters were prevalent for different industries, including the mining industry, which regulated the practices of such industry in general.

The MPRDA provides for formulation of a broad-based socio economic empowerment Charter setting out the framework, targets and timetable for entry into and active participation by HDSA in the mining industry. The Charter is required to provide for the methodologies to be adopted for achievement of the objects of the MPRDA relating to BEE and socio-economic development.<sup>49</sup>



The original Mining Charter was passed in 2002 even before the BEE was enacted. This charter put forth broad principles for the transformation of the mining industry keeping in view the need for black economic empowerment. The prominent principles enunciated are popularly known as the seven pillars of transformation, and are as follows:

- ◆ Ownership of equity in the mining companies by HDSA;
- ◆ Preferential procurement from blacks or entities owned by the blacks;
- ◆ Human Resource development;
- ◆ Employment equity increasing the representation of blacks in different levels of management;
- ◆ Improved standards of housing and living conditions;
- ◆ Increase of local beneficiation;
- ◆ Mine Community and rural development.

Major stakeholders of the mining industry being the Department of Mineral Resources, the National union of Mineworkers, Chamber of Mines of South Africa, the South African Mineral Development Association, Solidarity and UASA – the Union, passed a declaration on 30<sup>th</sup> of June, 2010 outlining the principles for transformation of the mining industry.

Upon an assessment of the implementation of the objectives, the Government decided to amend the original Mining Charter to streamline and expedite attainment of the objectives. The amendment to the Mining Charter in September, 2010 reflects these principles and outlines targets for facilitation of sustainable transformation, growth and development of the mining industry. It aims at redressing the discrimination against historically disadvantaged South Africans by enabling their meaningful participation in enterprise and development of skills.<sup>50</sup>

An important feature of the revised Mining Charter is that it provides that non-compliance with the provisions thereof would render the mining company to be in breach of the MPRDA. Thus, contravention of the Mining Charter may result in the cancellation of mineral rights.<sup>51</sup>

The Mining Charter identifies the components of meaningful economic participation by HDSA as follows:<sup>52</sup>

- ◆ Transactions with such objective should be concluded with clearly identifiable beneficiaries from the HDSA community;
- ◆ Stakeholders will engage the financing entities to structure financing that enables participation by the HDSA such that a percentage of the cash flow is used to service the funding and the rest flows to the beneficiaries;
- ◆ The HDSA should have full shareholder rights such as being entitled to participation in annual general meetings and exercising of voting rights;

The Mining Charter contains a scorecard providing for measurement of performance of mining enterprises in respect of the elements set out in the scorecard. The scorecard describes the nature of performance required in respect of each element, the manner in which such performance shall be measured, the weightage of each such element in determining the final score and the compliance targets.



The following targets have been set under the Mining Charter:

- ♦ It records the commitment of the stakeholders in the mining industry to achieve a minimum target of 26% ownership to enable meaningful participation by historically disadvantaged South Africans by 2014.<sup>53</sup>
- ♦ Mining industry should procure a minimum of 40% of capital goods from BEE entities by 2014 and ensure that multinational suppliers of capital goods contribute at least 0.5% of annual income generated from mining companies towards development of local communities from 2010.<sup>54</sup>
- ♦ Mining industry should procure 70% of services and 50% of consumer goods from BEE entities by 2014.<sup>55</sup>
- ♦ Mining companies must achieve a minimum of 40% representation of historically disadvantaged South Africans at various levels of management by 2014.<sup>56</sup>
- ♦ Mining industry must invest in skill development activities of the historically disadvantaged South Africans.<sup>57</sup>

Further, each mining company is required to report the level of compliance with the Mining Charter.

### 3.7 Mining Code

As contemplated under the MPRDA, the Minister of Mining also issued the Codes of Good Practice for the South African Minerals Industry on April 29, 2009 ("Mining Code").<sup>58</sup> The Mining Code describes itself as a statement of present policy, the applicability and enforcement of which *"cannot be divorced from the Mining Charter and the key legislation in relation to the measurement of the socio-economic transformation in the mining industry"*.<sup>59</sup>

The Mining Code primarily sets out the principles of measurement of the elements of performance by mining enterprises. It also stipulates targets that need to be achieved in respect of each such element and timeframe for achievement.<sup>60</sup> It further discourages practices involving token participation of black people and where economic benefits are diverted to other people.<sup>61</sup>

The statement of policy in the Mining Code broadly reflects the principles and targets adopted under the Mining Charter. While the Mining Charter envisages the nature of measures to be undertaken to achieve the objectives in respect of each pillar or element, the Mining Code lays down the qualifications that would make such measures relevant for the purpose of assessing performance of the enterprise. There is undoubtedly some degree of overlap between the two.

Under the Mining Code, the ownership element is measured in terms of voting rights, economic interest and Net Value, which is defined as the value of the equity instruments held by HDSA after deduction of the value of the debts incurred for acquisition of such instruments. The Mining Code provides that ownership fulfillment occurs only on the release of HDSA participants from all third party rights created by virtue of financing of the acquisition.<sup>62</sup>

The Mining Code is sought to be made binding upon the mining enterprises by providing that non-compliance with the Mining Code would amount to breach of the MPRDA and render the enterprise liable to cancellation or suspension of the mineral rights as prescribed thereunder.<sup>63</sup>

In this context it is relevant to mention the provisions of the proposed Indian Act that seek to impose an obligation upon holders of mining leases to allot free shares equal to twenty-six per cent through the promoter's quota in case the holder of lease is a company, or, an annuity equal to twenty-six per cent of the profit (after deduction of tax paid) in case holder of lease is a person, on account of annual compensation, to persons holding occupation or usufruct or traditional rights over the surface of the land. This obligation is in addition to such annual compensation payable to such persons as arrived at by mutual agreement, failing which as prescribed by the State Government. This is also in addition to providing employment or other assistance in accordance with the



Rehabilitation and Resettlement Policies of the State Governments.<sup>64</sup>

The beneficiaries of such equity/profit-share are to be identified by the State Government through the Gram Sabha, District Council or the Panchayat. The holder of a mining lease is required to institute a mechanism in consultation with the Gram Sabha, District Council or Panchayat and ensure that the benefits reach such families. There is also a requirement that the affected family should not be reduced to below poverty line category and should have an income level that is at least equal to the income earned prior to start of the mining operation.<sup>65</sup>

### 3.8 Future Challenges for BEE

While the concept of BEE is looked upon as an important step, the policies adopted by the Government in this regard especially with respect to ownership by blacks have invited criticism along the following lines:

- ♦ The concept of black empowerment lacks extensive support from education and health care;
- ♦ The Government policy envisages allocation of private resources for delivering a public good being skill development, which is essentially a state function;
- ♦ Skill development in any event seems to occupy a secondary position while ownership and management have occupied the primary position;
- ♦ In many instances, micro enterprises are exempt from the requirements of ownership, while inclusion of blacks at a micro level should have been the first step;
- ♦ It has created a section of blacks who, having the right connections have managed to become rich, while the other blacks have not been empowered;
- ♦ The Government should be concentrating on more growth oriented policy rather than a policy of redistribution.
- ♦ The goal of ownership and participation in management by a BEE partner has not been realized. The BEE partner is usually not in a position to acquire ownership on account of lack of funds. Though funding is made available through entities such as IDC, the requirement of servicing the loan often means that the BEE partner does not enjoy any tangible financial benefit in terms of dividends etc. for years together.
- ♦ The opportunities sought to be provided in terms of ownership and participation in management require resources and a skill set which the BEE partner often does not possess.
- ♦ The policy has created a new black elite
- ♦ Though the policy is aimed at empowerment, to be successful in its current form, it requires the BEE partner to already be empowered, thus becoming self-defeating.

In addition to the issues arising out of the policy itself, one of the key hurdles in achievement of the objectives of BEE appears to be obtaining and providing security for financing black participation in ownership of enterprises. Again, in some instances, for availing government tenders and contracts, white-owned companies have used black-owned companies as a front entity, thus perverting the purpose of the policy.



### 3.9 Other Measures of Socio-Economic Development

#### 3.9.1 Community Rights

Under the MPRDA, if a community wishes to secure a preferential right over others to prospect or mine in respect of any mineral or land, which is registered or to be registered in the name of such community, then an application needs to be made to the Minister of Energy. The Minister of Energy is then required to grant such preferential right if:

- ♦ Such right would contribute towards development and social upliftment of the community;
- ♦ The community submits a development plan indicating the manner of exercise of such right;
- ♦ The envisaged benefits will accrue to the community.

Such preferential right can only be granted in respect of areas where prospecting rights, mining rights, mining permits or retention permits have not already been granted.<sup>66</sup>

Under the proposed Indian legislation, the State Government may, in case of grant of mineral concessions in a scheduled area under the Fifth Schedule of the Constitution and in a tribal area under the Sixth Schedule of the Constitution, give preference in grant of mineral concessions to a co-operative of the Scheduled Tribes.<sup>67</sup>

#### 3.9.2 Social and Labour Plans

An application for a mining right has to be accompanied by a social and labour plan.<sup>68</sup> The contents of the social and labour plan as prescribed under the Mineral and Petroleum Development Regulations, 2004 (“MPRDA Regulations”) include a human resources development programme, a local economic development programme, processes pertaining to management of downscaling and retrenchment and financial provisions for implementation of the plans.<sup>69</sup> Compliance with the approved social and labour plan is an obligation of the mining rights holder under the MPRDA.<sup>70</sup> The social and labour plan furthers the objects of the MPRDA relating to promotion of employment, social welfare and socio-economic development. It is also in furtherance of the principles forming part of the Mining Charter relating to human resource development.<sup>71</sup>

### 4.0 Part IV – Environmental Management and Sustainable Development

Environmental management and sustainable development are prominent goals under the South African mining legislation.<sup>72</sup> The general law in this regard is contained in the National Environmental Management Act, 1998 (“NEMA”). NEMA acts as a framework that integrates environmental management into all developmental activities. It defines on a generic basis, the principles in consonance with which, all actions affecting the environment should be taken; the nature and extent of liability and modes of redress.

The MPRDA expressly requires that the principles set out in NEMA are followed in respect of all prospecting and mining operations and in the interpretation, administration and implementation of the environmental requirements of the MPRDA.<sup>73</sup> In 2008, the MPRDA and NEMA were amended primarily to align the MPRDA with the provisions of NEMA, and to make the Minister of Mining the responsible authority for implementing matters pertaining to the environment in respect of mining related activities.<sup>74</sup> In line with such principles, the MPRDA regulates mining and related activities from the perspective of environmental management and sustainable development at different levels.

#### 4.1 Implementation of Environmental Management Principles

##### 4.1.1 Environmental Authorisation

The MPRDA prohibits any person from prospecting, mining or conducting any reconnaissance operations or technical co-operation operations without an environmental authorization.<sup>75</sup> Application for an environmental



authorization has to be made simultaneously with the application for a prospecting right, mining right or a mining permit.<sup>76</sup> The Minister of Mining is allowed to issue such mineral right only once the environmental authorization is issued.<sup>77</sup> In addition to issuance of an environmental authorization, the Minister of Mining may grant a prospecting right or a mining right, only upon being satisfied that such operations will not result in unacceptable environmental pollution, ecological degradation or damage to the environment.<sup>78</sup>

Under the MPRDA, the Minister of Mining is the responsible authority for implementing environmental provisions in terms of NEMA and is the authority empowered to issue the environmental authorization in terms of NEMA.<sup>79</sup> The relevant factors to be considered by the Minister of Mining in grant of environmental authorization are the potential impact upon the environment, measures to prevent and mitigate such harm, ability of the applicant to take the necessary measures, available information, recommendations of State level departments etc.<sup>80</sup>

#### 4.1.2 Environmental Impact Assessment (EIA)

NEMA empowers the Minister of Environmental Affairs and Tourism (“Minister of Environment”) to identify the activities, geographical areas, nature of assessment to be conducted, reporting requirements and the procedure for investigation, assessment etc. The procedures must comply with the requirements stipulated under NEMA. Broadly speaking, NEMA requires that an exercise of assessment of environmental impact should entail compilation of information, investigation of potential consequences, determination of mitigation measures and involvement of public participation.<sup>81</sup>

The detailed processes and procedure to be followed are prescribed under the Environmental Impact Assessment Regulations, 2006 (“EIA Regulations”). The EIA Regulations have segregated the processes of EIA into basic assessment and scoping based upon the kind of activity in respect of which environmental authorization is sought. Mining, prospecting and reconnaissance operations have been listed amongst activities that require basic assessment.<sup>82</sup>

A snapshot of the procedure to be followed to procure an environmental authorization for mining, prospecting and reconnaissance operations, is as follows:

- ♦ Prior to making the application for environmental authorization, a public participation process is to be conducted, a register of affected and interested parties is to be maintained, their objections and representations to be considered and a basic assessment report<sup>83</sup> prepared based on a basic assessment of the potential consequences, mitigation of such impacts and other significant issues, in respect of which the interested and affected persons are required to comment.<sup>84</sup>
- ♦ Thereafter, the application for environmental authorization is required to be submitted along with the report so prepared and the Minister of Mining is entitled to seek additional information, if required. A basic assessment report may be rejected if the requirements of public participation are not fulfilled. The Minister of Mining may however suggest that scoping should be applied to such application.<sup>85</sup>
- ♦ Regardless of whether the Minister of Mining suggests that scoping is required, an environmental management programme needs to be submitted in respect of mining, prospecting and reconnaissance operations, in terms of NEMA. The contents of the environmental management programme are similar to those of the environmental management plan stipulated under the EIA Regulations.<sup>86</sup> Under the EIA Regulations, an environmental management plan is required to be submitted for scoping type of assessment of impact. The environmental management plan is to be prepared by an expert, and should contain extensive information on the environmental management, mitigation measures rehabilitation of the environment to be applied at different stages of the activity and measures for monitoring compliance with such plan.<sup>87</sup>



- ◆ Upon being satisfied with the basic assessment report and the environmental management programme, the Minister of mining may grant the environmental authorization.
- ◆ Thus, the distinction between the two methods of assessment provided under the EIA Regulations appears to have been blurred with respect to mining, prospecting and reconnaissance operations. Like in the case of scoping type of assessment, a detailed EIA needs to be conducted in a specialized manner examining and reporting the potential impacts and mitigation measures in respect of the environment.<sup>88</sup>
- ◆ The EIA Regulations specify time limits for consideration of applications and issuance of environmental authorizations by the Minister of Mining.<sup>89</sup>

#### 4.1.3 Remedial Measures

Environmental law in South Africa imposes a duty upon the entity responsible for causing environmental degradation to remedy the effects or mitigate the impact.<sup>90</sup>

Under the MPRDA, where prospecting, mining operations etc. cause ecological degradation, pollution or environmental damage, the Minister of Mining is entitled to direct the holder of a mineral right to undertake measures to remedy the same. Such measures could include investigation and assessment of the damage, cessation or control of the activity, education of employees of the risk of such activity, eliminating the source of pollution and/or remedying the effects.<sup>91</sup>

#### 4.1.4 Financial Provision and Liability

As security for discharge of such liability as may arise, an applicant is required to make the prescribed financial provision for rehabilitation, management and closure. The Minister of Mining is entitled to utilize such financial provision towards discharge of liability of the rights holder. The rights holder is required to suitably replenish the financial provision according to his liability.<sup>92</sup>

The rights holder is responsible for any environmental liability and is required to maintain the prescribed financial provision until issuance of a closure certificate by the Minister of Mining in accordance with the MPRDA. In order to obtain a closure certificate, a rights holder is required to apply for the same upon completion, relinquishment, and abandonment etc. of the operations. Closure certificate may only be issued upon the relevant government authorities being satisfied that the matters pertaining to effects upon the environment have been addressed. Also, such portion of the financial provision as may be necessary for residual or latent environmental impact may be retained beyond issuance of mine closure certificate.<sup>93</sup>

#### 4.1.5 Vigilance and Public Interest Litigation

NEMA guarantees access to information pertaining to implementation of laws affecting the environment and threats thereto, subject to some restrictions. An interesting feature is that NEMA protects whistleblowers not only from civil or criminal action, but also from any disciplinary proceedings if the information is disclosed to the specified bodies, on grounds that the disclosure was necessary to avert an imminent and serious threat to the environment.<sup>94</sup>

NEMA expressly confers locus standi upon all persons acting either in their own interest, on behalf of or in the interest of other persons, public interest, or for the protection of the environment to seek appropriate relief in case of any breach of the provisions of, or principles recognized in NEMA or any other statute relating to the protection of the environment. Further, NEMA also provides for the right of private prosecution for breach of any duty under statute, regulations, licenses or authorizations issued relating to the protection of the environment.<sup>95</sup>



Thus, in respect of matters relating to the environment, a rights holder is exposed to civil actions and prosecution on a wide scale, not restricted to actions taken by the Government.

#### **4.1.6 Other Enforcement Measures**

NEMA provides for an innovative measure to realize the principles of environmental management embodied therein. It provides for entering into environmental management cooperation agreements between any person and the Minister of Environment or other specified authorities. Such agreements could stipulate undertakings upon such person(s) to improve upon the environmental standards prescribed by law, targets for such undertakings and monitoring of compliance including penalties for the same.<sup>96</sup>

### **4.2 Coordinated Approach**

#### **4.2.1 Issuance of Environmental Authorisation**

With a view to harmonise procedures for obtaining environmental approvals and mineral rights, the MPRDA and NEMA have been amended to confer the Minister of Mining with the power to issue an environmental authorization.<sup>97</sup>

The process of issuance of the environmental authorization however requires the Minister of Mining to consult with and consider recommendations of the Regional Mining Development and Environmental Committee and State departments to address any regional issues.<sup>98</sup> Further, the Minister of Mining may also require that the environmental management programme is adjusted in the manner required by the Minister of Environment.

#### **4.2.2 Planning and Management**

NEMA provides a framework for consultation between various organs of the government in matters relating to environmental planning and management.

It requires all national departments dealing with matters relating to the environment to submit environmental implementation plans and environmental management plans. These plans are required to set out details of activities that may harm the environment and measures proposed to mitigate the effects of such activities.<sup>99</sup>

Such plans are required to be submitted to the Committee for Environmental Coordination set up under NEMA. This Committee scrutinizes the plans so submitted from the perspective of observing compliance with the provisions contained in Section 2 of NEMA and harmonizing the plans and procedures for a particular province. The Committee may give recommendations for amendment of the said plans, which need to be implemented by the relevant department.<sup>100</sup>

Compliance with the environmental implementation and management plans is monitored by the Director General of Environmental Affairs and Tourism.<sup>101</sup>

### **4.3 Sustainable Development**

#### **4.3.1 Environmental Management in a Sustainable Development Framework**

The overarching principles governing all actions by the State, guidelines and administration under NEMA embodied in Section 2 thereof, highlight the importance of sustainable development in environmental management.<sup>102</sup> As stated above, these principles are also expressly incorporated in the MPRDA.



The key elements of sustainable development are identified as follows:<sup>103</sup>

- ♦ Environmental degradation should be avoided and resources should be exploited in a responsible and equitable manner;
- ♦ There should be equitable access to resources of the environment and environmental impacts should not be distributed in a discriminatory manner;
- ♦ Development must be socially, environmentally and economically sustainable;
- ♦ Rights of workers to refuse work that is prejudicial to health and safety should be protected;
- ♦ Intergovernmental coordination and harmonization of policies and actions relating to the environment should be achieved;
- ♦ Participation of all interested and affected parties in environmental governance must be promoted;
- ♦ Cost of remedying and preventing environmental degradation and adverse effects to health must be paid by persons harming the environment.

The proposed Act in India contemplates framing of a National Sustainable Development Framework and State Sustainable Development Frameworks to facilitate the scientific development and exploration of mineral resources and protection of the environment from harm caused by prospecting and mining related operations.<sup>104</sup> Further, the Central Government is empowered to issue directions to the State Governments and other authorities, and the State Governments in turn may issue directions to persons in-charge of a mine, in the interest of sustainable development.<sup>105</sup> This enabling provision is likely to form the basis of practices of sustainable mining.

#### 4.3.2 Inclusion of Stakeholders

Consultation with stakeholders at various levels and addressing their concerns is an important feature under the MPRDA.

One aspect of such consultation is in relation to issuance of environmental authorization. Issuance of environmental authorization requires compliance with an elaborate mechanism for public participation.<sup>106</sup> An applicant for an environmental authorization is required to issue notice to all potentially affected and interested parties including owners and occupiers of lands where the activity is proposed to be conducted and adjacent lands that may be affected and also issue advertisements. Such notice or advertisement must provide sufficient details of the activity and procedures for EIA and invite representations.<sup>107</sup>

A register is required to be maintained of all interested and affected parties who have submitted comments. Such persons who have been registered may send comments to the relevant authority in respect of any materials submitted by the applicant.<sup>108</sup>

Additionally, the general framework of the MPRDA requires consideration of the concerns of groups affected by mining activities in decision-making. This is borne out by the following:

- ♦ The Regional Manager under the MPRDA is required to solicit comments from interested and affected persons upon accepting an application for prospecting and/or mining. If an objection is raised, the Regional Manager has to refer such objection to the Regional Mining Development and Environmental Committee to consider such objections and advise the Minister.<sup>109</sup>



- ♦ In addition to the above, upon acceptance of an application for prospecting rights or mining rights, the applicant is required to consult with the land owner or lawful occupier and other affected party and submit the result of such consultation.<sup>110</sup>

#### 4.3.3 Optimal Utilization

One of the objectives of the MPRDA is to promote development of mineral resources and downstream industries in South Africa.<sup>111</sup> In this respect, the MPRDA contains several directory and mandatory provisions.

The Minister of Mining is required to be satisfied that the mineral can be mined optimally in accordance with the work programme as a condition for granting a mining right.<sup>112</sup>

The MPRDA discourages hoarding of permits without conducting any prospecting or mining activities. Consistent with this outlook, the MPRDA provides that the rights holder must commence prospecting activities within 120 days and mining operations within one year from the date that the respective rights become effective and requires the holder of such rights to continuously and actively conduct prospecting or mining operations in accordance with the work programme.<sup>113</sup>

In this respect, the proposed Bill requires that the holder of a mining lease should commence mining operations within two years of date of execution of the lease.<sup>114</sup>

The MPRDA provides for a retention permit, which suspends the expiry of a prospecting right. Such retention permit is issued for a maximum period of 3 years (which may be renewed once for not more than two years) only if the existence of a mineral reserve which has mining potential is established but the market conditions make such mining uneconomical.<sup>115</sup>

While the Indian legislation does not contemplate issuance of a permit akin to the retention permit, with respect to a mining lease, it contains provisions preventing lapse of such lease for non-commencement or discontinuance of operations for reasons beyond the control of the holder of the mining lease.<sup>116</sup>

The MPRDA also makes provision for issuance of a two-year mining permit in respect of minerals which may be optimally mined within a period of two years. This again prevents hoarding of mineral rights over a particular area for a period longer than required for mining of a particular mineral.<sup>117</sup>

The Minerals and Mining Development Board (“Board”) established under the MPRDA is empowered to recommend corrective measures if the minerals are not being mined optimally after taking into consideration the financial and technical resources of the holder of the mining right. Failure to take the recommended corrective measures may result in suspension or cancellation of the license.<sup>118</sup>

#### 4.3.4 Health and Safety

The MPRDA requires as a condition for grant of prospecting right, mining right or mining permit, that the applicant should have the ability to comply with the relevant provisions of the Mine Health and Safety Act, 1996 (“Health and Safety Act”).<sup>119</sup>

A mine closure certificate may only be issued if the provisions relating to health and safety have been duly complied with.<sup>120</sup>

The Health and Safety Act in South Africa regulates the standards and procedures to be followed in mines to ensure the health and safety of workers and other persons in respect of mining operations. It makes the owner of the mine responsible to ensure that the mine is equipped and operated in a safe and healthy manner.<sup>121</sup> The Health and Safety Act also requires the appointment of a manager to carry out functions relating to implementing health and safety measures in the mine.<sup>122</sup> The said Act broadly provides for the requirement of maintaining health and safety equipment, response to emergencies, surveillance and reporting mechanisms and other



matters relating to employees' health and safety. It also contains provisions for establishment of health and safety committees at mines and election of health and safety representatives in furtherance of effective implementation of the provisions of the Health and Safety Act.<sup>123</sup>

A notable aspect of the Health and Safety Act is that it recognises the right of a worker to leave a working place where there are circumstances that appear to pose a serious danger to the health and safety of the employee.<sup>124</sup>

A governing principle under NEMA is the right of workers to refuse work that is harmful to human health and to be informed of dangers.<sup>125</sup> The provisions of NEMA give effect to this object. There is specific protection from all civil and criminal liability, as well as from any disciplinary action or prejudice against a person who refuses to perform some work that may be environmentally hazardous.<sup>126</sup>

The Mining Charter records undertakings in relation to improvement of health and safety performance by:<sup>127</sup>

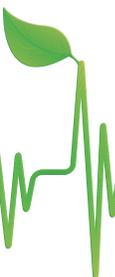
- ♦ Implementing management systems focused on continuous improvement of aspects of operations affecting health and safety of employees and communities;
- ♦ Providing employees with health and safety training;
- ♦ Implementation of regular health surveillance and risk-based monitoring of employees

## Notes

1. Section 104(1)(b) read with Section 44(1)(a)(ii) of the Constitution of South Africa provides that the Provinces enjoy the exclusive right to legislate on matters contained in Schedule 5.
2. The State List forming part of Schedule VII to the Constitution of India is a list of 66 subjects over which the States have the exclusive right to legislate.
3. Schedule VII contains a concurrent list of matters in respect of which both Parliament and the State Legislatures may legislate.
4. Section 104(1)(b) read with Section 44(1)(a)(ii) of the Constitution of South Africa. Schedule 4 to the Constitution of South Africa enumerates the matters in respect of which both Parliament as well as the provincial legislatures may legislate.
5. Section 146 of the Constitution of South Africa sets out the principles governing conflicts between the national legislation and provincial legislations in matters falling under Schedule 4 as follows:
  - “(2) National legislation that applies uniformly with regard to the country as a whole prevails over provincial legislation if any of the following conditions is met:
    - (a) The national legislation deals with a matter that cannot be regulated effectively by legislation enacted by the respective provinces individually.
    - (b) The national legislation deals with a matter that, to be dealt with effectively, requires uniformity across the nation, and the national legislation provides that uniformity by establishing -
      - (i) norms and standards;
      - (ii) frameworks; or
      - (iii) national policies.
    - (c) The national legislation is necessary for -
      - (i) the maintenance of national security;
      - (ii) the maintenance of economic unity;
      - (iii) the protection of the common market in respect of the mobility of goods, services, capital and labour;
      - (iv) the promotion of economic activities across provincial boundaries;
      - (v) the promotion of equal opportunity or equal access to government services; or
      - (vi) the protection of the environment.



- (3) National legislation prevails over provincial legislation if the national legislation is aimed at preventing unreasonable action by a province that -
- (a) is prejudicial to the economic, health or security interests of another province or the country as a whole; or
  - (b) impedes the implementation of national economic policy.
6. Section 44(2) of the Constitution of South Africa provides that Parliament may intervene by passing legislation in
- “functional areas listed in Schedule 5 when it is necessary –
- (a) to maintain national security;
  - (b) to maintain economic unity;
  - (c) to maintain essential national standards;
  - (d) to establish minimum standards required for the rendering of services; or
  - (e) to prevent unreasonable action taken by a province which is prejudicial to the interests of another province or to the country as a whole.
- Such legislation is required to be passed in the manner in which any legislation affecting provinces is required to be passed by Parliament.
7. Under Article 249 of the Indian Constitution, in order for Parliament to legislate on a matter in the State List, the Council of States has to declare by a resolution by at least two-thirds majority that it is expedient in national interest that Parliament should make laws on such subject contained in the State List. Such resolution is in force only for a period of one year, but may be extended by a resolution passed in a similar manner for a further period of one year.
8. Entry 54 of the Union List, Schedule VII of the Constitution of India
9. Entry 23 of the State List, Schedule VII of the Constitution of India
10. In *State of Orissa v. Tulloch & Co.* AIR 1964 SC 1284, the Supreme Court followed *Hinger Rampur Coal Co. Ltd. v. State of Orissa*, AIR 1961 SC 459 in interpreting the declaration made by Parliament in the 1957 Act and held that to the extent that regulation of mines and mineral development was covered under the Central Act, the States would not have the jurisdiction to enact any legislation in such respect.
11. Section 15 of the 1957 Act empowers the State Governments to make rules regulating grant of mineral rights for minor minerals. Section 108(2) of the proposed MMDRA Bill similarly empowers the State Governments to make rules governing grant of mineral rights, conditions of a mining lease and other matters relating to minor minerals.
12. The Central Government has promulgated the Mineral Concession Rules, 1960 (“Mineral Concession Rules”) prescribing essentially the procedure for regulating the grant, refusal, renewal, determination and conditions of mineral rights.
13. For a draft of the proposed Mines and Minerals (Development and Regulation) Act, as of 3.6.2010, see: <http://mines.gov.in/index.aspx?level=1&lid=80>
14. Section 7 of the MPRDA
15. Each Minister forming part of the Cabinet in South Africa is assigned a portfolio. The Minister is assisted by a Deputy Minister, a small team of advisors and a Department headed by a Director General. Section 9 of the MPRDA defines the Regional Manager as an officer designated by the Director General of the Ministry of Energy as such, who must perform the functions relating to the region for which he has been so designated. For a general overview of the structure of government in South Africa, please see <http://www.pmg.org.za/node/17040>
16. Section 2 of the MPRDA provides as one of its objects to:
- “(a) recognize the internationally accepted right of the State to exercise sovereignty over all the mineral and petroleum resources within the Republic;
- (b) give effect to the principle of the State’s custodianship of the nation’s mineral and petroleum resources;
- ...”
- Section 3 of the MPRDA declares as follows:
- “3. (1) Mineral and petroleum resources are the common heritage of all the people of South Africa and the State is the custodian thereof for the benefit of all South Africans.
- 2) As the custodian of the nation’s mineral and petroleum resources, the State, acting through the Minister, may -
- (a) grant, issue, refuse, control, administer and manage any reconnaissance permission, prospecting right, permission to remove, mining right, mining permit, retention permit, technical cooperation permit, reconnaissance permit, exploration right and production right; and
  - (b) in consultation with the Minister of Finance, determine and levy, any fee or consideration payable in terms of any relevant Act of Parliament.
17. Chapter V of the Mineral Concession Rules lays down the procedure for obtaining prospecting licenses and mining leases in respect of lands in which the minerals vest in a person other than the Government. Sections 34 – 36 of the proposed Bill contain provisions for mineral rights in respect of lands where the minerals vest partly or wholly in a person other than the Government which are similar to the Mineral Concession Rules.
18. In *Raja Anand Brahma Shah v. State of U.P.*, AIR 1967 SC 1081 the Supreme Court dealt with a case of acquisition of land by the Government and an issue arose as to whether the owner of the land was entitled to compensation for minerals underneath the said land. It was disputed that the owner of the land was not entitled to the minerals beneath the surface. The Supreme Court observed as follows:
- “13. In our opinion, a reading of the two Sanads supports the case of the appellant that there is no reservation of mineral rights in favour of the Government. The expression used in the Sanad of 1803 A. D. is “You ought to consider him the Raja of immovable Jagir and of Mahal and everything appertaining thereto belongs to him”. In effect, the grant to the Raja in the two Sanads is a grant of the lands comprised in the Mahal of Agori and everything appertaining thereto and as a matter of construction the grant must be taken to be not only of the land but also of everything beneath or within the land. Prima facie the owner of a surface of the land is entitled ex jure to everything beneath the land and in the absence of any reservation in the grant minerals necessarily pass with the rights to the surface (Halsbury’s Laws of England, 3rd Edn., Vol. 26. p. 325). In other words, a transfer of the right to the surface conveys right to the minerals underneath unless there is an express or implied reservation in the grant. A contract, therefore, to sell or grant a lease of land will generally include mines, quarries and minerals beneath or within it: *Mitchell v. Mosley*, 1914-1 Ch 438 (450). It is manifest that when the Sanad was executed in favour of the Raja the Government made over the land with all its capabilities to the Raja and merely imposed on him a fixed sum of revenue in lieu of all the rights the Government had as a proprietor of the soil. When neither of the parties knew undiscovered minerals underneath the land and the idea of reservation never entered their minds it cannot be held that there was any implied reservation in the grant. Nor can afterwards a distinction be drawn between the various rights that may exist on the land for the purpose of qualifying the original grant and importing into it what neither party could have imagined.



It was argued on behalf of the respondents that the assessment was made on the agricultural income, but this circumstance cannot derogate from the rights conveyed to the Raja in the two Sanads because no restriction was placed on the use of the land and the use by the Raja was not limited to agriculture.”

19. Section 54 of the MPRDA provides for such redressal mechanism. The Regional Manager upon receiving intimation from the right holder, is required to call upon the owner or occupier and inform him of the mineral right held by the right holder, the provisions under the MPRDA that the owner or occupier may be in contravention of, and the steps that may be taken against the owner or occupier if he should persist in such contravention. However, after considering such representations, if the Regional Manager is of the opinion that the owner or occupier has suffered or is likely to suffer damage then he may request the parties to agree upon compensation. If no such agreement is reached between the parties then the compensation shall be as determined by arbitration. The Regional Manager may suggest expropriation if he concludes that further negotiation shall detrimentally affect the achievement of the objects under the MPRDA.
20. Section 15 of the proposed Bill recognizes this right providing however that the right holder shall not be entitled to enter any building or enclosed court or garden attached to a dwelling house without previously giving notice to such occupier.
21. Section 21(1)(k) of the proposed Bill requires the holder of a prospecting license to pay such compensation to the person holding occupation rights as may be notified. Section 24(1)(m) stipulates a similar condition in respect of the holder of a mining lease. Section 42(2) governs the payment of such compensation. Section 21(2) separately provides that a prospecting license may contain other terms as to compensation for damage caused to the land.
22. The provisions in the MPRDA relating to grant of mineral rights provide that the Minister must grant a mineral right if satisfied with the conditions provided in the respective provisions. Section 14 sets out the conditions for grant of reconnaissance permission; Section 17 for prospecting rights and Section 23 for grant of mining rights
23. Section 13 of the proposed Bill sets out the criteria for assessment of bids by the State Government invited for grant of prospecting licenses, large area prospecting licenses and mining leases in accordance with the said provision.
24. Rules 4, 9 and 22 of the Mineral Concession Rules stipulate that the applicant should submit a valid clearance certificate or an affidavit in respect of due payment of all mining dues along with the application.
25. Section 25(3) of the proposed Bill extends the application of the criteria stipulated under Section 13(4) of the Bill to all applications for mining leases.
26. Section 26 of the proposed Bill provides for the requirement of preparation and approval of a mining plan without which mining activities cannot be conducted. Rules 22(4) and (4A) of the Mineral Concession Rules contemplate the preparation and approval of a mining plan prior to execution of the lease deed and Rule 22(5) elaborates upon the contents of the mining plan.
27. Section 19(2)(c), (d) and (e) and Section 25(2)(c), (d) and (e) respectively provide for the obligations of a prospecting right holder and mining right holder to perform prospecting and mining operations in accordance with the prospecting and mining work programme respectively.
28. Section 47(1) provides that the Minister has the right to cancel or suspend any reconnaissance permission, prospecting right, mining right, mining permit or retention permit if the holder inter alia conducts such operations in contravention of the MPRDA, breaches a material term of the mineral right, violates the environmental authorization.
29. Section 21 of the MPRDA provides for maintenance of records and submission of reports to the Regional Manager in respect of prospecting operations. Section 28 requires the mining right holder to maintain appropriate records of mining activities and financial records and to submit to the Director General, monthly returns, annual financial reports and requires annual reporting of compliance with the obligations of the right holder in respect of historically disadvantaged persons.
30. Section 29 of the MPRDA provides for such right.
31. Sections 91, 92 and 93 of the MPRDA contain detailed powers of inspection, seizure etc.
32. South Africa's Economic Transformation: A strategy for Broad-Based Black Economic Empowerment, Chapter 2 available at <http://www.dti.gov.za/bee/complete.pdf>
33. The components of broad based black economic empowerment are set out in the BEE Act. The definition of “broad-based black economic empowerment” in the BEE Act is as follows:

“... the economic empowerment of all black people including women, workers, youth, people with disabilities and people living in rural areas through diverse but integrated socio-economic strategies that include but are not limited to-

  - (a) increasing the number of black people that manage, own and control enterprises and productive assets;
  - (b) facilitating ownership and management of enterprises and productive assets by communities, workers, co-operatives and other collective enterprises;
  - (c) human resource and skills development;
  - (d) achieving equitable representation in all occupational categories and levels in the workforce;
  - (e) preferential procurement; and
  - (f) investment in enterprises that are owned or managed by black people.”

Further, Section 2 of the BEE Act lays down its objectives that define the approach and manner in which black economic empowerment is sought to be achieved. It provides as follows:

- “2. The objectives of this Act are to facilitate broad-based black economic empowerment by –
  - (a) promoting economic transformation in order to enable meaningful participation of black people in the economy;
  - (b) achieving a substantial change in the racial composition of ownership and management structures and in the skilled occupations of existing and new enterprises;
  - (c) increasing the extent to which communities, workers, cooperatives and other collective enterprises own and manage existing and new enterprises and increasing their access to economic activities, infrastructure and skills training;
  - (d) increasing the extent to which black women own and manage existing new enterprises, and increasing their access to economic activities, infrastructure and skills training;
  - (e) promoting investment programmes that lead to broad-based and meaningful participation in the economy in order to achieve sustainable development and general prosperity;
  - (f) empowering rural and local communities by enabling access to economic activities, land, infrastructure, ownership and skills; and
  - (g) promoting access to finance for black empowerment.



34. To further elaborate on the nature of codes of good practice, Section 9 of the BEE Act may be referred to. Sub-section (1) provides that the codes of good practice may include the following:

- (a) the further interpretation and definition of broad-based black economic empowerment and the interpretation and definition of different categories of black empowerment entities;
- (b) qualification criteria for preferential purposes for procurement and other economic activities;
- (c) indicators to measure broad-based black economic empowerment;
- (d) the weighting to be attached to broad-based black economic empowerment;
- (e) guidelines for stakeholders in the relevant sectors of the economy to draw up transformation charters for their sector; and
- (f) any other matter necessary to achieve the objectives of this Act."

From the proposed contents of codes of good practice, it emerges that a code of good practice would aid in identifying the specific targets of BEE according to which, actions would need to be taken.

Section 10 of the BEE Act provides that every organ of the state and public entity must take into account

"...the relevant code of good practice issued in terms of this Act in -

- (a) determining the qualification criteria for issuing of licenses, concessions or other authorization in terms of any law;
- (b) developing and implementing a preferential procurement policy;
- (c) determining qualification criteria for the sale of state-owned enterprises; and
- (d) developing criteria for entering into partnerships with the private sector."

It further provides that a strategy issued by the Minister of Trade as required under the BEE Act is also required to take into account the code of good practice.

35. Section 11 of the BEE Act lays down the broad constituents of such strategy to be issued by the Minister of Trade.

36. Section 12 of the BEE Act provides for promotion of sector-specific transformation charters that further the achievement of BEE in each sector.

37. Section 5 of the BEE Act lays down the major functions of the Council as follows:

"5. The Council must –

- (a) advise the Government on black economic empowerment;
- (b) review progress in achieving black economic empowerment;
- (c) advise on draft codes of good practice which the Minister intends publishing for comment in terms of Section 9(5);
- (d) advise on the development, amendment or replacement of the strategy referred to in Section 11;
- (e) if requested to do so, advise on draft transformation charters; and
- (f) facilitate partnerships between organs of state and the private sector that will advance the objectives of this Act."

38. Available at <http://www.dti.gov.za/bee/complete.pdf>

39. Purporting to strike a balance between a very wide and a narrow definition of BEE, the Strategy Document (in Para 3.2.2) states that the government defined BEE as "an integrated and coherent socio economic process that directly contributes to the economic transformation of South Africa and brings about significant increases in the numbers of black people that manage, own and control the country's economy, as well as significant decreases in income inequalities".

The Strategy Document further provides that the BEE process shall include "human resource development, employment equity, enterprise development, preferential procurement, as well as investment, ownership and control of enterprises and economic assets".

40. Paras 3.3 and 3.4 of the Strategy Document elaborate on the policy objectives and key principles of BEE.

41. Para 3.5 of the Strategy Document discusses in some detail, the nature of regulatory measures to be taken to achieve BEE. A scorecard measuring performance of enterprises against BEE parameters is contemplated, which would be used as a reference point in decision making. The Strategy Document also contemplates some direct measures by which black people could be enabled to own assets by way of stake sale of government enterprises etc. These principles have now been incorporated into the BEE Act and the code of good practice issued by the Minister of Trade and Industry.

42. Paras 3.6 and 3.7 of the Strategy Document discuss the macroeconomic factors that need to be considered in formulating any strategy for financing of BEE initiatives. They also set out the modes of financing contemplated and the functions of IDC.

43. The Codes of Good Practice are available at <http://www.dti.gov.za/bee/beemaincodes.htm>

44. The definition of historically disadvantaged South Africans in Section 1 of the MPRDA is wide and refers to the following:

- (a) any person, category of persons or community, disadvantaged by unfair discrimination before the Constitution took effect;
- (b) any association, a majority of whose members are persons contemplated in paragraph (a);
- (c) any juristic person other than an association, in which persons contemplated in paragraph (a) own and control a majority of the issued capital or members' interest and are able to control a majority of the members' votes"

Section 2 of the MPRDA sets out the objects thereof and includes the following from the perspective of social justice and BEE:

- (c) promote equitable access to the nation's mineral and petroleum resources to all the people of South Africa;
- (d) substantially and meaningfully expand opportunities for historically disadvantaged persons, including women, to enter the mineral and petroleum industries and to benefit from the exploitation of the nation's mineral and petroleum resources
- (f) promote employment and advance the social and economic welfare of all South Africans;
- (l) ensure that holders of mining and production rights contribute towards the socio-economic development of the areas in which they are operating"



45. Section 12 of the MPRDA provides that the Minister of Mining may facilitate assistance to HDSA in conduct of prospecting and mining operations taking into consideration, the financial resources of the applicant and the objects of the MPRDA.
46. Under Section 17(4), the Minister of Mining is empowered to request an applicant for a prospecting right to give effect to the objects of the MPRDA under Section 2(d) thereof, which pertains to expanding opportunities for HDSA. In respect of a mining right, Section 23(1) stipulates as a condition for an applicant to be entitled to a mining right, that the grant of a mining right should further the objects of the MPRDA under Section 2(d) and (f) thereof.
47. The MPRDA confers a general power upon the Minister of Mining under Section 55 thereof, to expropriate land for the purpose of achievement of the objects under Sections 2(d), (e), (f), (g) and (h) thereof, which includes objects pertaining to expansion of opportunities to HDSA and equitable distribution of resources. Further, in a case of conflict between a right holder and the owner or occupier of the land, the MPRDA under Section 54, provides for resolution of the conflict by negotiation and arbitration. Under sub-section (5), if the Regional Manager is of the opinion that further negotiation could be detrimental to the objects of the MPRDA under Sections 2(d) and (f), then the Regional Manager may recommend expropriation of the land to the Minister of Mining.
48. Section 25(2) of the MPRDA requires such an annual report as a part of the obligations of the mining right holder.
49. Section 100(2) of the MPRDA provides for formulation of the Mining Charter
50. Preamble of the Mining Charter sets these goals
51. Paragraph 3 of the Mining Charter read with Section 47 of the MPRDA would lead to such consequence
52. Definition of Broad Based Socio-Economic Empowerment
53. Paragraph 2.1 of the Mining Charter sets this target
54. Paragraph 2.2 of the Mining Charter sets this target
55. Paragraph 2.2 of the Mining Charter sets this target
56. Paragraph 2.4 of the Mining Charter sets this target
57. Paragraph 2.5 of the Mining Charter sets this target
58. The Codes of Good Practice for the South African Minerals Industry is available at <http://www.pmg.org.za/files/docs/090329goodpractice.pdf>
59. Para 1 of the Mining Code - Introduction and Scope
60. Para 2 of the Mining Code sets out the principles for measurement of each of the elements. It deals with the nature of participation contemplated for the purpose of achievement of the target set out in respect of each element; for instance it emphasizes on participation by local communities, women, youth etc. The objectives and principles broadly reflect the Mining Charter.
61. Para 4 of the Mining Code deals with the different fronting practices adopted that render the BEE measures illusory in nature.
62. Para 2.1.1(b) read with Para 2.1.3.6 of the Mining Code
63. Para 4.1.5 of the Mining Code provides that non-compliance with the Mining Code would amount to breach of the MPRDA and attract the consequences under Section 47 of the MPRDA. Section 47 of the MPRDA provides for suspension and cancellation of mineral rights for contravention of various provisions of the MPRDA.
64. Section 42(2) of the proposed Bill imposes this liability. Sub-section (3) of this Section clarifies that this is in addition to any other compensation payable under the Act.
65. Explanation to Section 42(2) describes this mechanism
66. Under Section 104 of the MPRDA, these are some of the relevant factors to be considered by the Minister of Mining for grant of such preferential rights. Compliance with other conditions applicable for grant of prospecting or mining right is necessary.
67. Section 6(7) of the proposed Bill makes provision for giving such preference.
68. Section 23(1)(e) of the MPRDA provides for the requirement of submitting a social and labour plan.
69. Regulation 46 of the MPRDA Regulations lays down the contents of a social and labour plan
70. Section 25(2)(f) of the MPRDA casts this obligation upon a mining right holder.
71. Paragraph 2.5 of the Mining Charter
72. One of the objects of the MPRDA stated in Section 2(i) is to "give effect to Section 24 of the Constitution by ensuring that the nation's mineral and petroleum resources are developed in an orderly and ecologically sustainable manner while promoting justifiable social and economic development"
73. Section 37(1) of the MPRDA incorporates the principles set out in Section 2 of NEMA, which provision outlines the basic tenets of NEMA.
74. Preamble of the Mineral and Petroleum Resources Development Amendment Act, 2008 available at [http://cer.org.za/wp-content/uploads/2010/10/MPRDA-amendment-act\\_49\\_of\\_08.pdf](http://cer.org.za/wp-content/uploads/2010/10/MPRDA-amendment-act_49_of_08.pdf) read with the Preamble of the National Environmental Management Amendment Act, 2008 available at <http://www.info.gov.za/view/DownloadFileAction?id=94444>
75. Section 5A of the MPRDA contains this prohibition. Section 24F(1) of NEMA also provides that no activity for which an environmental authorization is required shall be commenced without obtaining such environmental authorization.
76. Section 16(1)(a) of the MPRDA provides for making application for an environmental authorization along with application for a prospecting right, Section 22(1)(a) contains similar requirements for an application for a mining right and Section 27(2), in case of a mining permit.
77. Under Section 17(1)(c) of the MPRDA stipulates issuance of an environmental authorization as one of the requirements for a person to be eligible for a prospecting right. Similar requirement is stipulated under Section 23(1)(d) in relation to issuance of a mining right and under Section 27(6)(b) in relation to issuance of a mining permit.
78. This requirement of satisfaction is provided under Section 17(1)(c) of the MPRDA for issuance of prospecting right and Section 23(1)(d), for issuance of a mining right.
79. Section 38A of the MPRDA read with Section 24(1) of NEMA confers the Minister of Mining with the powers to issue the environmental authorization as required.
80. Section 24O of NEMA casts an obligation upon the Minister of Mining to take all such factors into consideration in this regard.



81. Section 24 of NEMA sets out in detail, the requirements that any prescribed procedure for assessment of environmental impact should fulfill. It outlines the aspects that the regulations prescribed for environmental impact assessment should cover.
82. Under Regulation 21 of the EIA Regulations, activities notified under Government Notice No. R. 386 of 2006 (available at [http://www.capegateway.gov.za/other/2010/2/listing\\_notice\\_1\(gn\\_no.\\_r\\_386\).pdf](http://www.capegateway.gov.za/other/2010/2/listing_notice_1(gn_no._r_386).pdf)) are subject to basic assessment and those notified under Government Notice R. No. 387 of 2006 (available at [http://www.capegateway.gov.za/other/2009/12/listing\\_notice\\_2\(gn\\_no.\\_r\\_387\).pdf](http://www.capegateway.gov.za/other/2009/12/listing_notice_2(gn_no._r_387).pdf)) are subject to scoping assessment. Mining, prospecting and reconnaissance have been notified under Government Notice No. R. 386 thus being subject to basic assessment in order to obtain environmental authorization.
83. Regulation 23 of the EIA Regulations provide that the basic assessment report should contain the following:
- details of the activity;
  - details of the property on which it is conducted;
  - description of the environment likely to be affected;
  - description of the relevant legislation;
  - details of the public participation process conducted;
  - outline of the advantages and disadvantages of the said activity,
  - impacts upon the environment;
  - proposed environmental management and mitigation measures.
84. Regulation 22 of the EIA Regulations contains this requirement
85. Regulations 24 and 25 of the EIA Regulations contain details as to the submission and consideration of applications. Regulation 25(2)(d) enables the Minister to require scoping if necessary.
86. This condition is imposed under Section 24N of NEMA
87. Regulation 34 of the EIA Regulations set out the contents of an environmental management plan.
88. Regulations 30 – 32 of the EIA Regulations detail the requirements of scoping and environmental impact assessment.
89. Regulation 25(1) read with Regulation 26 provides for a 30-day time period for consideration of applications subject to basic assessment and granting environmental authorization or seeking additional information or rejecting an application. In respect of detailed EIA, the Minister of Mining is required to accept or reject the EIA report within 60 days of submission and issue or reject the environmental authorization within 45 days of acceptance of the report.
90. Section 2(p) of NEMA provides statutory recognition to the 'polluter pays' principle. It provides that "the costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects must be paid for by those responsible for harming the environment".
- Section 28 of NEMA imposes a duty upon every person causing significant pollution or degradation of the environment to take reasonable measures to prevent such pollution or degradation, or minimise and rectify such pollution or degradation of the environment, where it cannot be prevented.
91. Section 45(1) of the MPRDA read with Section 28 of NEMA enables the Minister of Mining to issue such directions and describes the nature of measures to be taken.
92. Section 24P of NEMA contains details of financial provision for environmental damage
93. Section 43 of the MPRDA read with Sections 24P and 24R provide for maintenance of financial provision and mine closure.
- The above provisions also require the right holder to plan for, manage and implement prescribed procedures and requirements for mine closure.
94. Section 31 of NEMA grants access to information, specifies the grounds on which such information may be refused and the protection for whistleblowers.
95. Sections 32 and 33 of NEMA provide for enlarged locus standi and private prosecutions for breach of duties relating to protection of the environment.
96. Section 35 of NEMA provides for such agreements. These agreements may only be entered into between persons and the relevant organ of the state having jurisdiction over the activity to which such agreement related.
97. Section 38A of the MPRDA read with Section 24(1) of NEMA confers the Minister of Mining with the powers to issue the environmental authorization as required.
98. Section 24N(4) of NEMA read with sub-sections (2) to (5) of Section 24(O) of NEMA provide a mechanism for time-bound consultation with the State Departments and the Regional Mining Development and Environmental Committee. Comments may be sought from such State departments. Any objections raised in respect of any environmental management programme or an environmental authorization may be referred to the Committee mentioned, which is required to give recommendations to the Minister of Mining.
99. Section 11 of NEMA requires the preparation of environmental implementation and management plans by the national departments. Sections 13 and 14 set out the contents of such environmental implementation and management plans.
100. Section 15 of NEMA provides for submission of such plans to the Committee set up under NEMA. This provision also contains mechanism for resolution of any conflict arising between the relevant department and the Committee.
101. Section 16 of NEMA provides for such monitoring. The organs of the state entrusted with responsibilities under the environmental implementation and management plans are required to report annually in respect of the status of implementation of the plans and follow the directions issued by the Director General.
102. Section 2 of NEMA provides that the principles set out therein shall serve as a general framework for all environmental implementation and management plans, as guidelines for exercise of functions by organs of the state and shall guide the interpretation and administration of NEMA.
103. These principles are elaborated in Section 2 of NEMA.
104. Section 45 of the proposed Bill provides for development of such frameworks. They should enable formulation of project level practices for sustainable mining touching upon aspects such as minimal adverse impact on local communities, waste management, rehabilitation, consultative mechanisms etc.
105. Sections 45(6) and 46(1) of the proposed Bill provide for issuance of such directions.
106. Regulations 22(a) and 28(a) of the EIA Regulations provide for the requirement of conducting the public participation as provided under the EIA Regulations.



107. Regulation 56 of the EIA Regulations sets out the mechanism for public participation.
108. Regulation 57 of the EIA Regulations provides for maintenance of registers and the right of stakeholders to make comments to the concerned authorities.
109. Section 10 of the MPRDA contains this provision, which applies to all applications for mineral rights in general.
110. Section 16(4)(b) provides for this requirement of consultation upon acceptance of an application for a prospecting right; Section 22(4)(b) in case of application for a mining right and Section 27(5)(a) in case of a mining permit.
111. Section 2(e) of the MPRDA provides that one of the objects of the Act is to "promote economic growth and mineral and petroleum resources development in the Republic, particularly development of downstream industries through provision of feedstock, and development of mining and petroleum inputs industries".
112. Section 23(1)(a) of the MPRDA includes this as one of the factors for grant of a mining right.
113. Section 19(2)(b) of the MPRDA requires a prospecting right holder to commence prospecting activity within 120 days from the date on which it becomes effective. Section 25(2)(b) of the MPRDA prescribes a one year time limit within which to commence mining operations.
114. Section 24(1)(g) of the proposed Bill contains this condition.
115. Sections 31 to 34 of the MPRDA govern applications for, grant, duration, renewal and conditions of a retention permit.
116. Section 29(1) of the proposed Bill provides that the mining lease shall lapse if mining operations are not commenced within two years of execution of the lease or such operations are discontinued for more than two years. Section 29(2) of the proposed Bill provides that where a lessee is unable to so commence or continue mining operations for reasons beyond the control of the lessee, then he may seek extension of the period. Section 29(3) contains provision of revival of a lapsed lease for genuine and sufficient reasons not more than twice during the lease period.
117. Section 27 of the MPRDA contains the procedure for making applications, issuance and renewal of a mining permit.
118. Section 51 of the MPRDA provides for making of such recommendations together with consequences of failure to comply with the same.
119. Section 17(1)(d) of the MPRDA provides for this requirement in relation to prospecting rights, Section 23(1)(f) in respect of mining rights and Section 27(6)(c), in relation to a mining permit.
120. Section 43(5) of the MPRDA provides that no mine closure certificate may be issued without the Chief Inspector confirms inter alia, that the provisions in relation to health and safety have been complied with.
121. Sections 2 to 4 of the Health and Safety Act make the owner of the mine responsible for matters relating to the health and safety thereof.
122. Chapter II of the Health and Safety Act sets out the responsibilities of the manager of a mine in detail.
123. Chapter III of the Health and Safety Act stipulates the establishment of the Health and Safety Committees, election of the health and safety representatives and their powers and duties under the Act.
124. Section 23 of the Health and Safety Act provides for such right and also requires the manager of the mine to formulate procedures for giving enabling the employee to exercise such right along with procedures for resolving conflicts arising in such respect, alternative employment etc.
125. Section 2(4)(j) of NEMA spells out this object.
126. Section 29 provides for such protection if the person in good faith and reasonably believed that the performance of such work would result in an imminent and serious threat to the environment.
127. Paragraph 2.8 of the Mining Charter



- ✦ *In both South Africa and India, the field of mines and mineral development is primarily governed by Parliamentary legislation.*
- ✦ *The MPRDA of South Africa provides for a redressal mechanism in case of obstruction by such owner/occupier of land. Proposed MMDRA in India recognizes the right of access of holder of mineral but is required to pay compensation to the owner of surface, usufruct and traditional rights.*
- ✦ *In SA, mineral rights are granted after assessment of the financial resources and technical capability of the applicant, compliance to environmental and social development policies.*
- ✦ *MPRDA contemplates maintenance of records of reconnaissance, prospecting and mining operations, connected expenditure and data and submission of progress reports and data at prescribed intervals.*
- ✦ *Black Economic Empowerment BEE is a goal that is an integral part of all economic activity and legislation in South Africa. Holder of a mining right is required to submit an annual report detailing its promotion of employment, social and economic welfare of all South Africans.*
- ✦ *Under the MPRDA, the Minister of Mining is the responsible authority for implementing environmental provisions and is the authority empowered to issue the environmental authorization. Sustainable development and environmental conservation are the overarching principles.*
- ✦ *The proposed Act in India contemplates framing of a National Sustainable Development Framework and State Sustainable Development Frameworks.*





### 1.0 Introduction

The current paper was prepared pursuant to a visit to Canada in 2010 for an intensive study of the mining industry in Canada and the legal and regulatory framework it operates under.

The objective of the visit was to understand the Canadian mining legislations, regulations, processes and policies, particularly with a view to see how balance is struck between development of the mineral sector and social & environmental mandates and concerns. The Canadian perspective was considered necessary and crucial because of the following aspects:

- a) Canada has a split between federal and provincial government, each with their own defined sets of powers
- b) Canada has one of the largest mining industries in the world and mining is one of the country's largest industries
- c) Canada has one of the largest natural resource reserves and has ensured large scale development of its mineral industry
- d) The reserves in Canada are largely situated in areas inhabited by aboriginal or native communities like the Inuits and the First Nations, which have historical claims on land. Therefore issues of conflict arise while dealing with the rights and interests of these communities who hold harvesting as an Aboriginal right and thus protect it zealously.

A number of issues and topics emerged from the discussions in Canada during this visit which are presented in this paper and based upon these certain key learnings were derived, which are critical for the holistic development on any regulatory framework in mining, anywhere in the world. In the context of India, these assume greater importance since the Government is on the brink of coming forward with a fresh legislation partly subsuming the earlier enactments and partly adding on new aspects more relevant to our times.

### 2.0 Key Topics:

- I. Federal & Provincial Legislative Structure of Canada:** Canada is a federal state and legislative power is shared between the Centre (federal government) and the State (provincial government). Legislating on the issue of environment suffers from an overlap between the federal and the provincial governments, and therefore the source of many difficulties in allocation of power.
- II. The Issue of Indigenous Communities:** Canada has a number of indigenous communities which form a small part of the population but still populate most of the mineral rich areas. The main three communities are as follows: The Inuits – these are what were called the Eskimos and inhabit the northern regions; the First Nations – these are what are the aboriginal communities or the “Red Indians” as the colonizers called them – there are various groups amongst these; the Métis – these are communities formed due to inter-breeding between the original natives and early colonizers. The communities claim land rights through historical treaties or through modern land claims.



- III. **Allotment of Mines and Licensing:** The allotment of mines is done by the Province, since the rights over the mineral substance belong to the Province. The mine allotment is not through the process of auction but through a licence. The process involves, staking, prospecting and then mining.
- IV. **The Duty to Consult and Public Hearing:** There is a duty to consult the affected communities, which is borne out from legislation and court made law. The primary duty is with the Crown (Provincial and Federal) and not with the private sector which extends only till administrative issues and only when requested by the Crown. Even where not legally laid down, the Crown has to consult. The extent of consultation is proportionate to the impact the project is supposed to cause. After consultation, there is a duty to “accommodate” either through IBAs (discussed below) or through mitigation measures.
- V. **The Impact Benefit Agreements:** These Impact Benefit Agreements are entered into by proponents of a mine and the local communities. These are sometimes mandated by law or otherwise are customarily entered into as part of policy of obtaining “social licence”. The issues which have to be dealt with within the IBA are based upon negotiation. However, while some Treaties list out issues which should be taken into account, the basic minimal requirements have to be met.
- VI. **Environmental Assessment:** The Canadian Environmental Assessment Act offers a self assessment mechanism by the Federal Authorities for proponents of mining activity. The Environmental Impact Study is invariably prepared by the proponent. The Act mandates review in five years. An environmental assessment is an assessment of the potential adverse environmental effects of a project, identification of measures to eliminate or mitigate those effects and also the assessment of the Provincial laws. An environmental assessment must be conducted for any project, as defined under the Canadian Environmental Assessment Act, if the project “triggers” elements of a federal nature.

**Factors to be considered during Assessment:**

- (I) Environmental effects (does not include direct socio-economic effects, but only those that are caused by a biophysical effect. Direct socio-economic effects may be covered in provincial assessments). This includes both the impact of project on environment and the impact of environment on the project (like climate change).
- (ii) Cumulative effects
- (iii) Significance
- (iv) Mitigation [gross impact - mitigation = residual impact]
- (v) Public comments
- (vi) Other matters

Depository and Records: A Registry is created for deposit of records and access to the public. There is also an internet site on which a notice of commencement is published within 14 days of the start of the environmental assessment giving the description of the project. Notices requiring public input are also published and the final decision of the environmental assessment (which should be at the minimum 15 days after notice of commencement). The project files are publicly accessible to provide an opportunity for consultation and comment.



### Agency Responsibilities:

The prime responsibility shall be as follows:-

- a. Administer
- b. Advise
- c. Coordinate
- d. Harmonize
- e. Administrative support, and
- f. Training

**Note:** There is no policing by the Environmental Agency. This is done by the Federal Authority which is responsible for that component.

The environmental agency has proposed an Initiative for (a) bringing consistency to Federal Systems, (b) Risk Management and (c) Manage Multifarious Processes for Proponents.

**VII. Monitoring and Compliance:** Monitoring of both exploration and extraction (in Quebec, for example) is ensured by means of reports by the proponent to the Minister each year, which would include a preliminary report for the year as well as forecasting of the following year, showing expenses made and anticipated for exploration, capital expenditures and sums allocated for repairs, nature and cost of restoration work proposed and done. All other Provinces too have similar procedures for monitoring and compliance by the proponent.

**VIII. Sustainable Development Initiatives:** This initiative has been taken in Quebec and gives an insight as to how sustainable development principles can be adopted across all arms of the Government. An Office of Sustainable Development has been created under the mandate of the Sustainable Development Act of Government of Quebec. The SD Act establishes a new management framework in Quebec for all ministries, agencies and enterprises of the Government of Quebec. The Act sets out 16 principles for sustainable development which ought to be taken into account by all Government Ministries and Agencies in their actions. Municipalities, school boards and health and social services are invited to frame their actions also in line with these principles. The heads of the 16 principles are as follows:-

1. Health and Quality of Life.
2. Social Equity and Solidarity.
3. Environmental Protection.
4. Economic Efficiency.
5. Participation and Commitment.
6. Access to Knowledge.
7. Subsidiary
8. Inter-Governmental Partnership and Cooperation.
9. Prevention.
10. Precaution.
11. Protection of Cultural Heritage.
12. Bio-diversity Preservation.
13. Respect for Eco-System Support Capacity.
14. Responsible production and Consumption.
15. Polluter Pays.
16. Internalization of Costs.



The strategy 2008-2013 has adopted 9 strategic directions for the Departments and Agencies:

- (i) Inform, make aware, educate, innovate.
- (ii) Reduce and manage risks to improve health, safety and the environment.
- (iii) Produce and consume responsibly.
- (iv) Increase economic efficiency.
- (v) Address demographic changes.
- (vi) Practice integrated, sustainable land use and development.
- (vii) Preserve and share the collective heritage.
- (viii) Promote social involvement.
- (ix) Prevent and reduce social and economic inequality.

**IX. Inter-Governmental and Inter-Departmental Harmonization:** In order to mitigate the overlaps in the assessment process, and action by various departments both of the Federal Government and that of the Provincial Government, there is a concept of Cooperation Agreements which ensure that such overlaps are minimized and the process smoothed.

**X. Financial guarantees and restoration:** Before submission of a mining plan, the proponent needs to give a plan for restoration and rehabilitation. This is to be carried out in accordance with the approved plan. Plan must include a description of the process proposed, phases, estimate of costs, details of guarantees which are to be presented. The financial guarantee is a key component of the rehabilitation plan.

**XI. Valuation of Mines:** The Canadian Institute of Mines (CIM) has developed standards for resource and reserves valuation which was created as a consequence of Instrument 43-101 (which is a national instrument used by Stock Exchanges for disclosure, standards of resource and reserves in the mining industry). Guidelines for such validation are evolving constantly and CIM guides these changes. As part of these emerging guidelines, there is now a need for considering environmental issues as an essential parameter.

**XII. CSR initiatives of the industry:** The Canadian Mining Industry has a number of Industry bodies which are the voice of the industry and have between themselves initiated a number of CSR initiatives. The industry bodies play an active role in the opinion formulation, lobbying with the government and introducing CSR guidelines for adoption by the members of such bodies

**XIII. Abandoned Mines:** The National Orphaned and Abandoned Mines Initiative (NOAMI) was launched by the Government of Canada in association with the industry in order to address issues of abandoned mines

**XIV. Taxation on Mining:** All provinces and territories having significant mining activities impose mining taxes and/or mining royalties and/or mineral land taxes on mining operations within their jurisdictions. This is a third level of taxation, separate and distinct from federal and provincial/territorial income taxes. These mining levies are intended to compensate the province or territory for the extraction of non-renewable resources owned by it

**XV. Green Mining Initiative:** The Green Mining Initiative, announced in May 2009, is a proactive effort by Natural Resources Canada to reduce Canada's mining footprint by addressing issues such as water quality, waste management and site rehabilitation.



The four pillars of Green Mining are:

- ♦ Footprint reduction;
- ♦ Innovation in waste management;
- ♦ Mine closure and rehabilitation; and,
- ♦ Ecosystem risk management.

The Green Mining Initiative will enhance the industry's competitiveness by helping to establish leadership in environmental performance and social responsibility. This initiative will also promote the use of science and technology to:

- ♦ Reduce the environmental burden of mining for the benefit of future generations;
- ♦ Promote a strong, socially responsible economic performance that will help the mining sector support sustainable communities;
- ♦ Support effective policy and regulation;
- ♦ Develop knowledge and processes, as well as design equipment aimed at stimulating Canadian innovation expertise and export; and
- ♦ Promote environmental protection and sustainable resource development in Canada and abroad

**XVI. Nature of Mines and Mining Activity:** Mines are categorized into various types. It is important to assess the impact of mining from the perspective of the natural resource it is expected to mine, the extent of the mining, the amounts extracted and the effect it is expected to have on the environment

**XVII. Environmental Effects, Biodiversity and Natural Capital:** Laws have been framed for preservation of the Environment and for preservation of Bio- Diversity by various provinces and the federal government. Also there have been attempts to value "Natural Capital" i.e. not only measure its benefits to the general economy but assess the integrity and value of the ecosystem, using "natural capital accounting".

**XVIII. Role of NGOs in Mining:** There are various NGOs functioning in Canada to overlook the mining sector, its activities and its effect on the environment. The NGOs play a major role in policy formulation and opinion making in matters relating to the mining industry. The major NGOs functioning are MiningWatch dedicated especially to mining issues and NorthWatch which is basically an NGO for keeping a look out on energy use, generation and conservation

**XIX. Women in Mining:** "Women in Resource Development" (WRDC) is an initiative which was established to foster an environment that will increase the participation of women in the trade and technologies sectors in Newfoundland and Labrador. It aims to achieve this through elimination of barriers that exclude or discourage women from seeking employment in these sectors. It works on increased access for training, educating general public and development of policies to promote the involvement of women.

### 3.0 Key Learnings

- I. One-Window approach and Harmonization:** In Canada, as in India, there are various offices a proponent needs to get clearances from for a mining lease, which is essentially because of different issues being dealt with by the Centre and the State due to their division of powers and various departments of the Government getting involved due to different aspects being involved in a mining project viz. forests, environment, wildlife, social development, land acquisition etc.



There have been various attempts in Canada to smoothen processes by entering into Cooperation Agreements between the federal government and the provincial governments which may not be legally binding and do not dilute the exercise of powers under respective legislations by either government but set up a guidance template to enable joint reviews or to decide who may be the lead party for a review involving both federal and provincial aspects. The federal government has also established Major Project Management Offices for large projects which would facilitate multi-departmental clearances. By using powers under the Canadian Environment Assessment Act, the federal government has issued regulations and amends it from time to time, to include or exclude activities which do or do not require a federal assessment. This ensures greater clarity for a proponent of a project. Under a Cabinet Directive, the office of a Federal Coordinator has also been created to ensure effective coordination between federal departments while dealing with an environmental assessment.

What transpires from the Canadian experience is that even though legislative history creates hurdles in one department process, the possibility of having a one-window approach, which would coordinate clearances from and the efforts of various departments in relation to a mining project, would be an ideal worth pursuing. Also would make monitoring and compliance a simpler and more effective process.

- II. Duty to Consult and Accommodate:** In Canada the duty of the government to “consult and accommodate” the project affected aboriginal communities, comes from the rights delineated under the Constitution and Court made law mandating so. Although the federal government has issued interim guidelines to the federal authorities laying down their understanding of what is the scope and content of the duty and instructions to officials as to how to go about it, they propose issuing a federal policy on how to best comply with the duty to “consult and accommodate”. The guidelines are a dynamic document and are expected to evolve with the development of consultation case law and the lessons learnt from the experience on the ground.

What transpires from the Canadian experience is that the duty to consult be made mandatory, the scope and the content of the duty to consult i.e. when, who and how to consult (depending in turn on the strength of the potential right asserted by the community and the seriousness of the potential adverse effect of the contemplated activity) should be further mandated by law or by clear policy guidelines, which ought to be implemented in letter and spirit by the government. The process of how to get organized for consultations and what is needed to ensure that meaningful consultation is carried out, should be clearly delineated so as to give clarity to all stakeholders. An awareness of the duty and a consideration of when and how it might apply and how it corresponds with existing departmental or agency consultation policies must become part of the government's daily business including such activities as operational decisions, policy development, negotiations and legislative processes. Also, importantly, there should a mandate on the local community to participate in the consultation process and consequences of non-participation spelt out.

- III. Agreement with Communities:** While the Canadian Government has a duty to consult under law, the mining proponent has the obligation, under a Treaty wherever required, to negotiate and execute an Impact Benefit Agreement (IBA) with the affected communities. This arises from either Treaty mandates or through government mandate under the duty to accommodate. This process is critical since while on one hand it clearly states the anticipated negative impacts of the project to the community and therefore ensures clarity, it also lays down a plan for compensation and development benefits to the community.

The key learning is that instead of leaving the process of negotiation open-ended, it would be well worth mandating the elements which would be necessary to be dealt with while negotiating an IBA or while laying down a rehabilitation & re-settlement plan by the mining proponent. This may include aspects like cash outlay, employment quotas, technical and professional jobs, education and training, local supply chain, monitoring environmental impact, alternative dispute resolution mechanism. The crystallization of a binding agreement ensures that all aspects are dealt with at the inception stage, ensuring clarity both for the proponent and the community and resolving any dispute or disagreement at that stage only.



Also important are including legal enforceability provisions through dispute resolution provisions, thereby giving the community recourse to law and proper procedure for redressal of their grievance.

- IV. Restoration and Financial Guarantees:** The Canadian Government has sought to implement the concept of Environmental Bonding by taking financial guarantees for ensuring that restoration and rehabilitation is done after the closure of the mine. The proponent has to make sure that the Restoration and Rehabilitation is mostly a progressive procedure that is done while a project is still in operation and not necessarily after the mine has been closed. This could take any form – cash, credit, escrow or enforceable security. This ensures both an in-principle commitment of the proponent and a duty of the government to ensure that rehabilitation is carried out even though the proponent may fail to do so.

The financial guarantee can take any form and must be part of the restoration plan proposed by the proponent at the time of obtaining clearances and the mining licence. What is most important is that this plan and this guarantee has to be necessarily dynamic, since the large time lapse between commencement of a project and its actual completion and closure, may either make the restoration plan or the guarantee complete irrelevant and disproportionate to the harm caused or on the other hand unnecessarily onerous on the proponent, if the damage caused is lesser than contemplated. Therefore it should change keeping in mind (a) the progress of the rehabilitation work compared to the schedule; (b) the amount of rehabilitation work completed when the mine is shut down; and (c) whether or not the proponent intends to use more economical rehabilitation methods.

- V. Royalty, Taxes and Development:** Canada has a three-level taxation structure on mining. There is income tax and capital tax on the mining company by the federal and provincial government and then the mining tax (which the Canadian equivalent of royalty) by the provincial government on the unrefined product. However since mining is a highly cyclical and capital-intensive industry, with a long lead time between initial investment and commercial production, the federal and provincial income tax systems, as well as provincial mining taxes, provide a generous treatment of exploration and other intangible expenses, loss carry over rules, resource allocation, and allow mining companies to recover most of their initial capital investment before paying a significant amount of taxes. The mining tax is principally based on mineral wealth at the “mine mouth” i.e. the value of the unrefined product less the cost of processing it.

As regards social development, it is the mining company's obligation to ensure rehabilitation and resettlement of the affected community through IBAs. The Government does its bit through the tax it collects. In principle, therefore, the Canadian experience also reiterates that the core resettlement initiatives have to be made by the mining company (with the monitoring and supervision of the government and legal enforceability of agreements through the courts) while the generic development process is the duty of the government.

- VI. Compliance Management:** The number of clearances required, the numerous conditions imposed on a mining project and the potentially huge affect it can have on social and environmental aspects, necessitates a strict compliance management process. In Canada, though there was a high awareness of compliance requirements and reporting, of making documents and consultation process and results public, there was no single compliance management system setup by Government for ensuring monitoring of mining companies. Transparency in compliance and monitoring would ensure that the public opinion regarding a mine is channelized and properly assessed rather than have communities resort to public nuisance and disruption mechanisms, for either lack of proper knowledge or unnecessary apprehension. It was largely acknowledged that a net-based compliance management software system would be conducive to this process.

- VII. Sustainability, Adaptation and Mitigation:** Although sustainable development has been defined as “*development that meets the needs of the present without compromising the ability of future generations to meet their own needs.*”



*Sustainable development is based on a long-term approach which takes into account the inextricable nature of the environmental, social and economic dimensions of development activities”, by the Quebec Sustainable Development Act, it is well acknowledged that any extractive process leads to an irreversible depletion of resources and hence the concept of “sustainability” is really a process of “adaptation and mitigation”. The focus has to be on reducing and minimizing the impact by creating innovative methods, using the best technology and also traditional community knowledge. The Quebec Sustainable Development initiative which has a legislative mandate and spans across all government departments is laudatory and ensures that the principle of sustainability weaves into every policy, every regulation and every operation by any department. It ensures continued implementation of sustainable development policies and therefore gradual accumulation of benefits.*

- VIII. Public Hearing and Transparency:** Quebec, for example, uses a system of a Public Hearing Office as well as a Registry of documents during the process of assessment of a mining project, to encourage and ensure public participation before the assessment is completed and a licence is given. This kind of a process ensures that all public opinion is channelized and is collected and addressed prior to the start of the project. Also making records of continued monitoring and compliance public, while the project is on, would also ensure complete transparency. Though this might delay processes for mining companies and may be a disincentive to investors, but it facilitates meeting the social and environmental objectives better and also the mining company gets the benefit of complete clearance before the project rather than deal with protests after.

The key is to devise a composite, robust process, with specific timelines, which would ensure that the public consultation process is completed and addressed within a definite framework, rather than be left to scattered public interest litigation before various Courts.

- IX. Role of Industry Bodies:** Canada, being one of the largest mineral producers and the natural resources industry being one of the largest, has robust industry bodies who have taken substantial initiatives to ensuring that the mining companies interests are heard and more importantly have devised tools and guidelines for CSR initiatives. Such initiatives ensure standard CSR guidelines, reporting on compliance, measurements of performance and evolution of such processes. Development of appropriate standards which would be able to grade the mining companies for their CSR activities seem to be way ahead. This could be in collaboration with international standards bodies like the ISO and with the local mining institutes and companies. Creating branded standards, grades and a certification basis, would help the mining industry work towards and vie for a better reputation than struggling forever to establish their CSR credentials. The CSR initiatives have also ensured that Canadian companies which have off shore projects in other countries also comply with such guidelines, irrespective of the local laws and regulations. This ensures a growth of the country's mineral sector and mining companies.

- X. Mandatory Review of Legislation:** Section 72 of the Canadian Environment Assessment Act mandates that *“Five years after the coming into force of this section, a comprehensive review of the provisions and operation of this Act shall be undertaken by the Minister. The Minister shall, within one year after a review is undertaken or within such further time as the House of Commons may authorize, submit a report on the review to Parliament including a statement of any changes the Minister recommends”*.

This process of mandatory review inbuilt within legislation has been considered extremely useful especially in the growing minerals sector and particularly when technologies are rapidly evolving becoming more environment friendly as well as ensuring better implementation of mitigation measures. Therefore, in principle, any mechanism which ensures a mandatory review would ensure adaptability and evolution. The downside is, of course, that any irrational change would impact the planning of a mining company, which necessarily has a long cycle of capital investment and return. However, if a review is mandated with the right intention and adequate checks and balance, it would serve the larger purpose of proper evolution of legislation, ensuring better compliance and more benefits to the communities and the environment.



*Canada has one of the largest mining industries in the world. The mineral reserves are largely situated in areas inhabited by aboriginal or native communities which have historical claims on land.*

*Impact Benefit Agreements are entered into by proponents of a mine and the local communities.*

*That there is no policing by the Environmental Agency. This is done by the Federal Authority which is responsible for that component.*

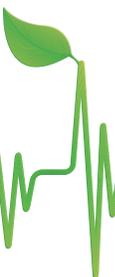
*An Office of Sustainable Development has been created under the mandate of the Sustainable Development Act of Government of Quebec.*

*The financial guarantee is a key component of the rehabilitation plan.*

*There have been attempts to value "Natural Capital" i.e. not only measure its benefits to the general economy but assess the integrity and value of the ecosystem, using "natural capital accounting".*

*Some key learning from Canada:*

- ✦ Having a one-window approach, which would coordinate clearances from and the efforts of various departments in relation to a mining project.*
- ✦ The key is to devise a composite, robust process, with specific timelines, which would ensure that the public consultation process is completed and addressed within a definite framework, rather than be left to scattered public interest litigation before various Courts.*
- ✦ The financial guarantee must be part of the restoration plan proposed by the proponent*
- ✦ The core resettlement initiatives have to be made by the mining company (with the government supervision while the generic development process is the duty of the government.*



EMP	Environmental Management Planning	FAC	Forest Advisory Committee
EIA	Environmental Impact Assessment	CRZ	Costal Regulation Zone
BIA	Biodiversity Impact Assessment	NBA	National Biodiversity Authority
SIA	Social Impact Assessment	SBB	State Biodiveristy Board
ICMM	International Council on Mining and Metals	BMC	Biodiversity Management Committes
IBM	Indian Bureau of Mines	CBD	Convention on Biological Diversity
MOEF	Ministry of Environment and Forests	NBSAP	National Biodiversity Strategy and Action Plan
NSDP	Net State Domestic Product	PA	Protected Areas
IUCN	International Union for Conservation of Nature	MoEF	Minister for Enviorment and Forest
CBD	Convention on Biological Diversity	EMP	Enviorment Management Plan
WPA	Wildlife Protection Act	IBA	Important Bird Area
MMRD	Mines and Minerals (Development and Regulation) Act, 1957	MCRP	Mine Closure and Reclamation Plan
BEE	Black Economic Empowerment	BAP	Biodiversity Action Plan
IBA	Impact Benefit Agreements	IUFRO	International Union of Forest Research Organisation
CSR	Corporate Social Responsibility	PPA	Power Purchase Agreement
SDF	Sustainable Development Framework	ESAs	Ecosensitive Areas
NASSC	National Academy of Science Study Committee	SMCRA	Surface Mining Control Reclamation Act
DGMS	Director General of Mines Safety	LUDM	Landuse Decision Matrix
AOC	Approximate Original Contour	UNEP	United Nations Environment Programme
SOM	Soil Organic Matter	PPTEP	Production Public Company Limited
NCZMA	National Coastal Zone Management Authority	SEIAAs	State Environment Assessment Authorities
TAC	Thematic Appraisal Committes		



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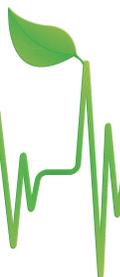
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**Dr. Raj Shekhar Singh** is working as Scientist and Asst. Director, Central Institute of Mining and Fuel Research, Barwa Road, Dhanbad. He has more than twenty years of research experience in the field of Restoration Ecology and Biodiversity Conservation. He has more than 150 research papers in the field of ecology and nine edited proceedings to his credit. He has three patents and one copy right. He is the fellow, reviewer and life member of several International Societies. He is the recipient of several awards and is the editor of several international journals.

*Central Mining Research Institute, Barwa Road, Dhanbad – 826 001*

**Dr. Nimisha Tripathi** is working as Women Scientist and Principal Investigator at Central Institute of Mining and Fuel Research under Department of Science and Technology, Govt. of India. She has seven years of research experience in the field of Restoration Ecology and Conservation Biology. She has more than 30 research papers in national and international journal s of repute and one copy right. She is the recipient of women scientist award from Ministry of Science and Technology, Govt. of India and Endeavor Research Award for Post Doctoral Fellowship from Australian Government.

*Central Mining Research Institute, Barwa Road, Dhanbad – 826 001*

**Dr. Aparna Watve** heads BIOME which provides consultancy for biodiversity research. She is an ecologist and has worked on specialized rocky habitats diversity in India.

*Biome, 34/6, Gulawani Maharaj Rd. Pune 411004.*



### TATA Institute of Social Science(TISS)



- ♦ Tata Institute of Social Sciences (TISS) is a social sciences institute based in Deonar, Mumbai, India.
- ♦ TISS was established in 1936, as the Sir Dorabji Tata Graduate School of Social Work, the first school of social work in India.
- ♦ In 1944 the school was renamed to its current name. It was recognized as a Deemed University in 1964.
- ♦ Most of the programmes offered by TISS are postgraduate (PG) programmes. TISS offers programmes in Master of Health Administration, Master of Public Health, Master of Hospital Administration, and about ten other M.A. programmes.

TISS, Main Campus  
Deonar Bus Depot, V.N.  
Purav Marg,  
P.O. Box 8313,  
Deonar,  
Mumbai 400 088.

Tel: +91-22-25525000  
(Board Number)

Website: <http://tiss.edu/>

### International Union for Conservation of Nature



- ♦ The International Union for Conservation of Nature and Natural Resources (IUCN) is an international organization dedicated to finding "pragmatic solutions to our most pressing environment and development challenges.
- ♦ The IUCN supports scientific research, manages field projects all over the world and brings governments, non-government organizations, United Nations agencies, companies and local communities together to develop and implement policy, ws and best practice

IUCN India,  
20 Anand Lok, 2nd  
Floor, New Delhi -  
110049  
India

Tel: +91-99-4605 2583

Website: [www.iucn.org/](http://www.iucn.org/)



## Development Alternatives



- ♦ The Development Alternatives Group is a premier research organization, with a deep understanding of the rural market and a strong presence in the Indian heartland. Its existence has been a credible and visible one – nationally and internationally in addressing poverty challenges in a climate sensitive environment.

Development Alternative, HQ  
B-32, TARA Crescent,  
Qutub Institutional Area  
New Delhi - 110 016,  
India

Tel: 91 (11) 26134103

Website:  
[www.devalt.org](http://www.devalt.org)

- ♦ The organization works to create a world where every citizen can live a secure, healthy and fulfilling life, in harmony with nature.

- ♦ SPWD focused on identification of needs of the local communities on one hand, documentation of technologies in the field and development of appropriate institutional mechanisms to deal with the concrete issues emerging on the ground.

SPWD, Head Quarters,  
14-A, Vishnu Digamber  
Marg, Rouse Avenue  
Lane, New Delhi -  
110002

Ph: +91 11 23236440

Website:  
[www.spwd.org/](http://www.spwd.org/)

- ♦ The diversity of initiatives spawned has led SPWD to develop its understanding on issues relating to ecology and livelihoods on the one hand and a concrete study of governance structures appropriate for multi layered, multi nested natural resources on the other

- ♦ The Council deals with the solution based forestry research in tune with the emerging issues in the sector, including global concerns such as climate change, conservation of biological diversity, combating desertification and sustainable management and development of resources.

ICFRE,  
P O IPE,  
Kaulagarh Road,  
Dehradun- 248195,  
Uttarakhand, India

Tel: +91 135 2751826

Website: [www.icfre.org](http://www.icfre.org)

## Society for Promotion of Wasteland Development



## Indian Council of Forest Research and Education



## Obituary

### Dr. Ram Dayal Munda



1939 – 2011

It is with great sadness that we announce the peaceful passing of Dr. Ram Dayal Munda, on 30<sup>th</sup> September 2011, a former Vice-Chancellor of Ranchi University and member of the Upper House of Indian Parliament.

Dr. Ram Dayal Munda, has participated in a National level consultation of Biodiversity Conference 'Optimizing Biodiversity & Social Security in Indian Mining Areas – An earthy vision' held at Tezpur, Assam on 3<sup>rd</sup> December, 2010.

Balipara Tract & Frontier Foundation team greatly appreciates his valuable contribution towards making a Biodiversity Conference a true success.

May his Soul Rest in Peace.

#### **A Brief Profile of Dr. Munda follows:-**

He obtained Ph.D. from the University of Chicago for specializing on Indic group (Santali, Mundari and others) of the Austro-Asiatic Languages and was subsequently appointed in the faculty of Department of South Asian Studies.

Later, he was offered a position to start a Department of Tribal and Regional Languages. He was appointed as Vice-Chancellor of Ranchi University in 1985.

Dr. Munda retired from active teaching in 1999 but his involvement with the cultural mobilization of the people continued which also included his active policy making at the UN Working Group on Indigenous People at Geneva and the UN Forum of Indigenous Issues in New York, in the capacity of a senior official of the ICITP, an all India tribal led and managed movement.

Dr. Munda authored several books and was a consultant and participant in important issues of the Adivasi people of the country. He represented his country in the Festival of India in the USSR, and other cultural events in China, Japan and the South East, besides participating at the World Social Forum conferences in India.

Dr. Munda was honoured by the Sangeet Natak Akademi (for the year 2007) in recognition of his contributions. President of India, Pratibha Patil, had nominated him to the Rajya Sabha, based on recommendations made by the Union cabinet.

