
(2017) 03 UK CK 0005
In the Uttarakhand High Court
Case No : Writ Petition (Pil) No. 16 of 2016

Naveen Chandra Pant

APPELLANT

Vs

State of Uttarakhand

RESPONDENT

Date of Decision : 28-03-2017

Acts Referred:

Forest (Conservation) Act, 1980 — Section 2

Mines And Minerals (Development And Regulation) Act, 1957 — Section 10A, Section 2

Citation : (2017) 03 UK CK 0005

Hon'ble Judges : Rajiv Sharma and Sudhanshu Dhulia, JJ.

Bench : Division Bench

Advocate : Mr. Lalit Sharma, Standing Counsel, for the Union of India; Mr. Manoj Tiwari, Senior Advocate assisted by Mr. Alok Mahara, Advocate present, for the Respondent Nos. 8 to 10; Mr. Prabhakar Joshi, Advocate present, for the Petitioners; Mr. P.C. Bisht, Standing Counsel present, for the State of Uttarakhand/Respondent Nos. 1 to 6

Final Decision : Disposed Off

Judgement

Rajiv Sharma, J. - With the consent of parties, Union of India through Secretary, Ministry of Environment, Forest & Climate Change, is added as respondent no.11. Petitioners are the residents of village Ganwa Sirmoli, District Bageshwar. The present petition has been filed pro bono publico by the petitioners highlighting the degradation caused to the environment by private respondent Nos. 8 to 10 who are allegedly carrying illegal mining activities in village Panchayat Ganwa Sirmoli, Tehsil Kanda, District Bageshwar.

2. The sum and substance of the averments made in the petition is that private respondent Nos. 8 to 10 have damaged the roads by carrying out the illegal mining by using explosive and deploying heavy machinery.

3. According to the averments made in the writ petition, respondent Nos. 8 to 10 have carried out illegal mining activities in the forest areas. The mining activities have caused threat to schools and residential houses. The mining activities have

been carried out within the radius of 20 meters from the residential houses. There are about 150 families residing in the village. Electric Poles have also been damaged. The waste material is being dumped by the private respondents into the river 'Gadhera'. The residents of the area have made several representations highlighting the illegal mining activities carried out by the respondents before the State authorities, but in vain.

4. This Court, vide order dated 08.03.2016, directed respondents to file counter affidavit. Learned Additional Chief Standing Counsel, appearing on behalf of State, has submitted on the basis of instructions received that few mining leases have been granted. It has also been stated that illegal mining has been carried out by the persons, who have been given mining lease. Thereafter, on 17.11.2016, this Court ordered the respondent Nos.5 & 6 to take prompt and effective steps as per law to stop illegal mining. In sequel of this, an order was passed on 06.01.2017 by this Court directing respondent no.5/District Magistrate, Bageshwar to file an affidavit explaining as to what action has been taken pursuant to order passed by this Court on 17.11.2016.

5. Thereafter, on 18.11.2016, the District Magistrate, concerned directed the Sub Divisional Magistrate, Kanda to carry out physical spot inspection and submit latest inspection report. Notices were served on the private respondents. Sub Divisional Magistrate, Kanda inspected the site on 19.11.2016 and submitted the report on the same day wherein it has been stated that Shri Mahesh Chandra Pant had carried out the mining activity near 10 meters of the residential houses of Shri Bhuwan Chandra, Shri Khyali Dutt and Shri Manoj Pant. The water sources and paths of the village were blocked. There are certain soil erosions in the field of Bhuwan Chandra and Manoj Pant. As far as lease holder, namely, Shri Fateh Singh Parihar is concerned, it was noticed that there was certain damage caused to the land of the State Government, however, damage has not been caused to the trees. Sub Divisional Magistrate, Kanda submitted a report with regard to Shri Ummed Singh Kalakoti that the muck of the mining was disposed of in a natural water source and no demarcation was carried out on the spot. Since the report dated 19.11.2016 was incomplete, therefore, again vide order dated 23.11.2016, the Sub Divisional Magistrate, Kanda, Geologist and Deputy Director, Mining were directed to carry out the joint inspection and submit a report with more details. The joint inspection report was submitted on 26.11.2016, wherein, it has come on record that the lease holder Shri Fateh Singh had disposed of muck in field No.264M, 287M, 542M, 545M and 646M, which is liable to be removed from the said fields. There was likelihood of flooding of the nearby Ambedkar School. JCB machines were deployed causing disturbance to natural water resources. There was no plantation to prevent the soil erosion. The illegal mining which was carried out was stopped.

6. In respect of Shri Ummed Singh, the footpath was not constructed and no demarcation was carried out. In respect of Shri Mahesh Chandra, soil erosion was noticed near the house of Harish Pant and Maya Pant w/o Manoj Pant at the

distance of 10 meters. It was also noticed that mining activities have damaged the minor irrigation canal including footpath. It was a considerable case of illegal mining for which fine was imposed. After receipt of report dated 26.11.2016, notices were issued to the lease holders on 29.11.2016 directing as to why appropriate proceedings be not initiated against them. The replies were submitted by the private respondents on 02.12.2016, 03.12.2016 and 05.12.2016.

7. District Magistrate concerned called further specific report from Sub Divisional Magistrate concerned. According to the communication received from S.D.M. concerned dated 21.12.2016, the anomalies were removed.

8. Respondent No.8/Mr. Mahesh Chandra Pant is one of the Director of the Company i.e. M/s. Sirmoli Mines Pvt. Ltd. The mining lease was sanctioned by State Government to M/s. Sirmoli Mines Pvt. Ltd. on 20.08.2011 for 4.588 hectares when the father of respondent No.8 namely Mr. Ramesh Chandra Pant was alive. After the death of Mr. Ramesh Chandra Pant, the lease was transferred in the name of his son Mr. Mahesh Chandra Pant/respondent No.8 on 23.11.2015. The supplementary mining lease was entered into between M/s. Sirmoli Mines Pvt. Ltd. and Government of Uttarakhand on 09.11.2015. Since, the lease was granted in a favour of M/s. Sirmoli Mines Pvt. Ltd. which is a company duly registered under the Companies Act, 1956, but the same could not be transferred in the name of individual.

9. The mining lease was sanctioned by the State of Uttarakhand to Respondent No.9/Mr. Umed Singh Dalakoti on 27.05.2015 for 4.795 hectare. The mining lease was entered into between respondent No.9 and Government of Uttarakhand on 19.11.2015. The mining lease was given to respondent No.9 after the cut off date i.e. on 12.01.2015.

10. The mining lease was sanctioned by the State of Uttarakhand to Respondent No.10/Mr. Fateh Singh Parihar on 07.09.2011. The mining lease deed was entered into between respondent No.10 and Government of Uttarkhand on 05.05.2015. The sanction was granted before the cut off date i.e. 12.01.2015. The State Government has not taken into consideration its own policy whereby after the cut off date i.e. 12.01.2015, no lease was granted but mining rights were auctioned.

11. In the reply, it has been stated that private respondents have not used explosives for mining purpose. They are also contributing welfare services in various communities in the area. There is no damage to environment and ecology due to mining activities. No electricity pole was damaged due to mining. The damage caused to rainfall was immediately repaired. There is no threat to the building of school due to mining activities. Natural resources of water were intact.

12. Section 10A of the Mines and Minerals (Development and Regulation) Act, 1957 (hereinafter referred to as "The Act, 1957) defines Rights of existing

concessionholders and applicants wherein it is provided under sub section (1) of the Section 10A of the Act, 1957 that the all the application received prior to the date of commencement of the Mines and Minerals (Development and Regulation) Amendment Act, 2015, shall become ineligible. As per sub section (2) of 10A of the Act, 1957, without prejudice to subsection (1), the following shall remain eligible on and from the date of commencement of the Mines and Minerals (Development and Regulation) Amendment Act, 2015. Subsection 2(b) & (c) of the 10A of the Act, 1957 is as under :-

(b) where before the commencement of the Mines and Minerals (Development and Regulation) Amendment Act, 2015, a reconnaissance permit or prospecting licence has been granted in respect of any land for any mineral, the permit holder or the licensee shall have a right for obtaining a prospecting licence followed by a mining lease, or a mining lease, as the case may be, in respect of that land, if the State Government is satisfied that the permit holder or the licensee, as the case may be -

(i) has undertaken reconnaissance operations or prospecting operations, as the case may be, to establish the existence of mineral contents in such land in accordance with such parameters as may be prescribed by the Central Government;

(ii) has not committed any breach of the terms and conditions of the reconnaissance permit or the prospecting licence;

(iii) has not become ineligible under the provisions of this Act; and

(iv) has not failed to apply for grant of prospecting licence or mining lease, as the case may be, within a period of three months after the expiry of reconnaissance permit or prospecting licence, as the case may be, or within such further period not exceeding six months as may be extended by the State Government;

(c) where the Central Government has communicated previous approval as required under sub-section (1) of section 5 for grant of a mining lease, or if a letter of intent (by whatever name called) has been issued by the State Government to grant a mining lease, before the commencement of the Mines and Minerals (Development and Regulation) Amendment Act, 2015, the mining lease shall be granted subject to fulfillment of the conditions of the previous approval or of the letter of intent within a period of two years from the date of commencement of the said Act:

Provided that in respect of any mineral specified in the First Schedule, no prospecting licence or mining lease shall be granted under clause (b) of this sub-section except with the previous approval of the Central Government.

13. Respondent Nos. 8 to 10 have carried out the mining illegally. They have used heavy machinery and explosives causing gross damage to the environment and ecology. The mining activities carried out by them caused threat to school

building. Rampant mining activities in close proximity has also damaged the residential buildings and waste material has damaged the adjoining water sources.

14. District Magistrate, Bageshwar directed S.D.M. of the area to visit the spot. S.D.M., Kanda inspected the spot on 19.11.2016 and has noticed that illegal mining was carried out by respondent Nos. 8 to 10. District Magistrate, Bageshwar again ordered on 23.11.2016 the Sub Divisional Magistrate, Kanda alongwith Geologist and Deputy Director, Mining to carry out the joint inspection and submit a report. The joint inspection report was submitted on 26.11.2016 with the following observations :-

"(1) The lease holder namely, Sri Fate Singh had disposed of the much in Khet No.264 M, 287M, 542M, 545M and 646M and which is liable to be removed from the said field, inasmuch as, if same is not removed, there is likelihood of flood in the nearby Ambedkar school. It is also necessary to mention here that in the report there were JCB machines operated in Khet No.924 in which the natural water resource has also been disturbed and further, there was no appropriate plantation for the prevention of soil erosion, it has also been mentioned in the report itself that in western direction of the leased area, illegal mining has been carried out, which has now been plugged.

(2) The report further submitted with respect to Sri Umed Singh that in order to reach the mining pit, the footpath has not been constructed and demarcation pillars were not found.

(3) The report further submitted with respect to Sri Mahesh Chandra reveals that there were certain soil erosion near the residential house of Harish Pant and Maya Pant W/o Sri Manoj Pant and there is a distance of near about 10 meter of the said houses, however, the said houses are not actually used for residence."

15. Thus, it is conclusively proved that environment and ecology has been damaged by the mining activities and rivers have also been polluted by the respondent Nos.8 to 10.

16. Respondent Nos.8 to 10 are carrying out illegal mining. They are required to follow the law while carrying out mining activities. District Magistrate, concerned has also noticed that illegal mining activities have been carried out and notices were sent to the private respondents.

17. The Court has also noticed that no suitable action has been taken against the private respondents. There is no tangible material placed on record to show as to what action has been taken against these respondents. The Shivalik region of the Himalayas is further getting fragile by mining activities. Mining activities are required to be regulated by the State to ensure that no illegal mining is carried out. It is also arbitrary on the part of the State to permit mining in the fragile areas. The mining activities are required to be carried out as per law. Petitioners have also stated in the petition that mining is being carried out in the forest area

as well. They further avered that no mining activities should be permitted in the State of Uttarakhand till the report is obtained from experts committee regarding the effect of mining in the State of Uttarakhand.

18. The people of Kumaun used to mine iron and copper for domestic consumption since ancient times, until availability in the market of relatively cheaper exported metals rendered indigenous production an uneconomic proposition. There is a record of allotment of land to Vishnu Upadhyay for copper mining in Athigaon area by King Prithvi Chand (of Chand dynasty).

19. Grouping of Mineral Resources can be classified in the following categories :-
(i) minerals which occur in great abundance and the commercial exploitation of which would be highly profitable. In this category are included magnesite, talc-steatite, limestones, dolomites and building and roofing material; (ii) Minerals, the deposits of which are too small to be commercially profitable, but which are of great strategic and industrial value. In this class come ores of uranium, copper, lead, pyrite, and also the deposits of phosphorite, gypsum and graphite; (iii) In the third category, those minerals can be included, which are known but no serious attempts have been made to search for their larger deposits, i.e. Garnet, Kyanite, Barite, Asbestos and Glass-sand. Discontinuation chains of lentiform deposits of coarsely crystalline magnesite extend for approximately 150 km. from the Kali valley northwest to the Mandakini valley. Talc and steatite occur in two ways, as veins and lentils and pockets within magnesite and in the bedded form. Among notable deposits are those of Jakhera, Harap, Maulagar, Biskhal and Surag in the Lahor valley, NNE of Baijnath, Agar-Girichhina E of Someshwar. Phosphorite and phosphatic deposits occur in two different stratigraphic units of two different geographic areas. The first formation is the Precambrian Gangolihat Dolomite (Deoban) of the Pithoragarh area. The second stratigraphic formation which includes phosphorite is the lower Permian jogria member of the Tal Formation in the Mussoorie Hills near Dehradun. Copper minerals occur mainly in three lithostratigraphic units; in the dolomites, magnesite and talc schist. These are found at east of Kanalichhina in the Dundu valley. Uranium mineralization has been noticed along the line of old copper workings in the fault-and shear-zones in the Chamethi-Pokhri-Tungi belt in the District Chamoli. Limestone and marble constitute the third import group of mineral material of Kumaun. These are found in District Pithoragarh and in the Ramganga valley. Dolomites are found in Gangolihat and Upper Krol formations. Graphite is found in Kalmatiya, Sirar, Petsal and Banini Devi. The Gypsum is found in the middle and upper Krol Dolomite near Khurpatal and Dhapila (Nihal valley) in Nainital.

20. An Article written by learned author- Mr. Pyar Singh, published by Wadia Institute of Himalayan Geology, under captioned "Alpine Treeline Rise, Climate Change Response and its effect on Sustainable Development in High Mountains in the Northwestern Indian Himalaya", the following pertinent observations qua the effects of degradation in environment and ecology on Alpine tree and climate

change have been made:-

"Intensive investigation revealed that spatial position of alpine treeline in Dokriani glacier valley was at the altitude of 3880 m in the year 1962 and migrated higher to the 3960 m asl up to the year 2009 along Singh/OIDA International Journal of Sustainable Development 05: 04 (2012) 33 with the current aerial distance of 1.7 Km and altitude difference of 40 m to the glacier snout. While in Chorabari glacier valley treeline was reported at the altitude of 2920 m in the year 1962 and it moved uphill to the altitude of 3400 m up to the year 2009 along with the aerial distance of 3.7 Km and altitude difference 466 m to the glacier snout (table 1). The alpine treeline dynamics towards the higher altitude @10.21m/year in Chorabari and @1.70m/year in Dokriani glacier valleys with in the period of 47 years is mainly attributed to the CC and anthropogenic impact on the ecosystem features. The relative difference of 08.51m to the rate of treeline rise in both valleys of similar climatic domain is strongly indicative of dominance of site specific conditions and associated local factors. Another study based on remote sensing data, also reported nearly similar treeline dynamics variability, i.e., from 10 m to 11.9 m/year in different parts of same climatic regime of himalayan region for the period of 1970 to 2006. And in majority of areas treeline elevation was reported between 3000-4000 m but in some cases treeline was found below than 3000 m and above than 4000 m asl [9]. The current findings based on field as well as remote sensing study are suggestive that concept of existence of regional treeline need to be revised with respect to area specific attributes in himalayan region [10]. Studies confirmed that treeline dynamics is not uniform in all regions and it is hardly governed by global climate system and looks to be a product of prevailing micro-climatic scenario [11], [12], [13]. Since temperature is considered as a principal treeline driver worldwide and hence it can be concluded that "uniform global warming impact" is barely discernible in the region under study. The site specific and interlinked factors such as altitude, topography, geology, snow and water precipitation, photoperiod, light intensity, airsoil temperature and moisture regime, soil content, wind velocity and aspect of the slope, forest fire and anthropogenic activities, etc., are considered possible determinants and important players in the treeline uphill dynamics. The influence of location specific treeline drivers appears to be dominant over the global drivers in the Himalayan region like some of the other mountain regions of the world [14].

Forest

Forest is a one of the integral parts of alpine as well as downstream ecosystem in IGB and in addition to the food, shelter, fuel wood, fodder and other major/minor forest products essentially required for sustainable development, it also provide various ecosystem services for the sustenance of basin population. In addition to climate change impacts specifically discussed so far with reference to treeline dynamics, various others possible implications are evident and discussed herewith. Present investigation in Dokriani and Chorabari Glaciers Valley suggest

that alpine ecosystem is witnessing by change in plant species composition, productivity and biodiversity which is also being reported in other major ecosystems of the World [29]. The various seasonal phenomenon of the forest species such as leaf sprouting, leaf fall, flowering, fruiting, etc., have been reported to advance by 1-3 weeks in some of the central Himalayan species viz *Quercus leucotrichophora*, *Q. floribunda*, *Rhododendron arboreum*, *Pinus roxburghii* [30]. Even in alpine tree species i.e. *Betula utilis*, the marked difference has been observed by the author in leaf development with in Gangotri Glacier Valley at the altitudinal difference of 250 m asl in the year 2011. At the elevation of 3600 m asl near Chirbas, tree was reported with full of leaves (Figure 4) and at the elevation of 3850 near Bhojbas, same species was reported leafless at same time frame i.e. May 23, 2011 (Figure 5). While in the year 1985 both the localities were reported to display same climatic effect i.e. leafless trees. This change is attributed to the shifting of snowline towards higher altitude and vacating a relatively suitable area for tree growth in erstwhile snow covered area. The upward shifting of snowline is generating moisture stress for alpine vegetation, especially to herbaceous species and affecting their productivity. In central Himalayan region, the encroachment of less useful tree species i.e. *Pinus lonifolia* into the domain of much useful species i.e. *Quercus leucotrichophora* is also linked to the moisture stress. The fast invasion of exotic species such as *Lantana camara*, *Eupatorium* spp. and *Parthenium* spp. in the Himalayan region is also assigned to the change in floristic composition and looks to be related to CC impact [31]. The forest fire is one of the natural and man made calamity which destroy the forest, wild life resource and local ecosystem up to worst extant. Rapidly increasing fire affected area in Himalayan region is a matter of serious concern and seems to be associated with climate change, especially of moisture stress. In one of the Himalayan states i.e. Uttrakhand, the fire affected area in the year 2001 was only 825 hectares and it increased to 3652 hectare in the year 2006 and in recent year i.e. 2010 it reached to the 4115 hectares [32]. It may be predicted that some of the Himalayan forest species may adopt themselves according to the climate change scenario. Because under dry condition, the seed maturation and seed germination period coincides with monsoon rainfall in few dominant tree species such as in Sal (*Shorea robusta*), Moru (*Quercus floribunda*) and Kharsu (*Q. semecarpifolia*), while in wet conditions, these species show vivipary. The water stress may advance 36 Singh/OIDA International Journal of Sustainable Development 05: 04 (2012) seed maturation, which might result in the breakdown of synchrony between monsoon rains and seed germination [33].

Agriculture, Water and population

Agriculture is a main source of subsistence to the IGB population with net cropped area 114 million hectares. And poverty is substantially higher in rural areas where agriculture is the main source of livelihood. High rate of population growth remain a cause for concern in terms of water and food security, poverty alleviation and resource conservation. IGB is likely to have some of the highest

growth of population in South Asia in the first half of this century. Especially India's population is increasing, but projected to be stabilized around 1,583 million in the middle of this century. By this time (2050), about half of the India's population shall be living in cities. Table 2 shows that, due to high population growth, more than 61% of the rural population and 56% of the urban population of India will live in IGB by 2050 [34]. Table 3 shows that in Ganga Basin, 90% of the annual water is still being used for agriculture followed by 7.8 per cent for domestic use in IGB. In Indus, the share of agriculture in total use is as high as 96%. However, the major drivers of increasing water demand in the future will be from the domestic and industrial sectors [1].

Although glaciers are the birth place to all Himalayan perennial rivers but main portion of their water discharge in downstream basin areas is contributed by rain water rather than snow/glacier melt water. The glacial melt water component has been estimated 44.8% for Indus, 9.1% for Ganges, 12.3% for Brahmaputra, 8.8% for Salween, 18.5% for Yangtze, 1.3% for Yellow and 40.2% for the Tarim River [35], [36], [37]. The examined sources and availability of water for irrigation are evident that majority of Himalayan region is rain fed and water received from the monsoon still is principal driver for sustainable productivity in IGB. The basin is mainly fed by the Asian Monsoon and winter Westerlies but continuous weakness, delaying trend and erratic behavior of the these sources of precipitation is predicted to generate resource crunch, productivity loss, socio-economic constraints and various environmental stresses and ultimately hamper the sustainable development in the region [26], [38], [39]. The considerable decline in productivity in various crops and fruits due to CC especially of change in weather pattern and cycle has been reported in various parts of India in the IGB [40], [41], [42], [43], [44]. Author has observed decline in productivity of traditional crops due to delayed and erratic monsoon in Ganga River catchment and some times well grown crops and fruits are destroyed due to excessive rains during the harvesting period. And consequently productivity of both dry-land and wet-land crops and fruits such as Wheat (*Triticum* spp.), Rice (*Oryza* spp.), Sorgham (Juar), Ragi (*Eleusine* spp.), Bajra (*Pennisetum* spp.), Maize (*Zea mays*), Black Gram (*Phaseolus mungo*), Pea (*Pisum sativum*), Lentil (*Lens culinaris*), Soya bean (*Glycine max*), Potato (*Solanum tuberosum*), Mango (*Mangifera indica*), Orange(*Citrus reticulata*), Sugarcane (*Saccharum officinarum*) etc, have been severely affected by CC.

Glaciers

Glaciers are the unique frozen water resource in alpine region of IGB and behave as a climate marker. Most of the perennial rivers in Himalayan Ecosystem originate from these glaciers and feed most of the populated regions including northern part of India. But due to CC impact their conventional enrichment system has been deteriorated. Glaciers are getting less snow precipitation and some time precipitation followed by rain fall do not allow them to hold snowice mass. The disbalance between the snow precipitation received and snow-ice melt

is results into negative mass balance every year and consequently most of the Himalayan glacier are in the phase of recession. The Himalayan region represents one of the most dynamic and complex mountain systems of the World and is extremely vulnerable to CC [45]. Due to the harsh climatic condition and difficult terrain, studies on Himalayan Glaciers have been scanty and limited to a few glaciers only. In fact decrease in snow-ice cover during the last century, across the globe, especially in mountain glaciers is seen as impact of CC [46]. Studies carried out on some of the important Himalayan glaciers revealed that due to different climatic setting, site specific geomorphic conditions and study time frame, their recession rate is variable.

The recession rate of Gangotri glacier has been estimated about 28.33 m per year between the years 1990 and 1996 [47], while between the years 2005 - 2007, it was receded by nearly 11.80 m per year [23],[48]. In Siachen and Pindari glaciers recession was at the rates of 31.5 m and 23.5 m per year [49], in Milam Glacier it was 9.1 m per year between 1901 and 1997 [50], in Dokriani Bamak Glacier, recession was recorded 16.6 m per year from the years 2001-2007 [15], in Gara, Gor Garang, Shaune Garang, Nagpo Tokpo Glaciers of Satluj River Basin it was reported between 4.22 - 6.8m per year [49]. The variable recession rate behavior of glaciers is also confirmed in the most detailed satellite imagery based study ever done in the Himalayas. Study revealed that 75% of these glaciers have shown annual retreat rate at an average of 3.75 m, 8 % have shown an advance and rest of 17 % have exhibited stable position [51]. The overall prevailing scenario of glacial regime is suggestive that water reservoir in Singh/OIDA International Journal of Sustainable Development 05: 04 (2012) 37 the form of Himalayan Snow-glacier is depleting with non-renewable phase which is bound to create water and geo-hydrological crises to hamper various activities related to the sustainable development.

The global warming is also attributed to the glacier recession and treeline dynamics in some of the studies [18], [42], [45],[46], [51], [52], [53]. However, recent studies conducted in the western Indian Himalaya and other parts suggests that global warming impact is hardly evidenced in instrumental records as well as in natural archives. The general slowdown in the rate of glacial retreat has been reported during late nineties and in the decade of year 2000 in the Himalayan region [24], [49]. Study based on observational records and tree rings suggest a pre-monsoon temperature cooling during the later part of the 20th century [21]. Dokriani glacier area has also not witnessed any air temperature rise trend in instrumental records and followed by slight decrease in snout recession in comparison of preceding years [15]. The presumed rapid melting of snow-glaciers due to warming need to be reflected through increasing annual glacial water discharge but in Gangotri glacier more or less a decreasing trend has been reported during 2000-2006 melt season [54]. Glacier fed rivers such as Beas, Chenab, Ravi and Satluj also have not witnessed increasing trend of overall water discharge [22]. It appears that ever weakening monsoon for long period has created poor snow precipitation system and negative mass balance

which consequently has resulted into overall recession in most of the glaciers. Recent study also established weakened summer monsoon circulation in general, during the period of years 1951-2004 [26].

21. In the book "Facing the Hazards : Earthquakes and Landslides" written by renowned author Mr. K.S. Valdiya, he has mentioned that of the people killed due to natural hazards, more than 80% belonged to the poorest sections of the society. The man himself is responsible for producing conditions that cause natural hazards to happen through his mindless deeds and selfish activities, for example, by indiscriminately cutting unstable slopes for roads, buildings heavy structures, extraction of minerals and rocks, and by removing the protective cover of plants from the slopes. The loss of human life due to earthquakes in the Indian subcontinent is as under :-

Year

Locality

Death Toll

1819 (16th June)

Kachchh (Gujarat)

15,000

1855

Badgam (Kashmir)

3,000

1897 (12th June)

Shillong (Meghalaya)

1,600

1905 (4th April)

Kangra (Himachal Pradesh)

19,500

1934 (15th January)

Northern Bihar

10,500

1935

Quetta (Pakistan)

30,000

1950 (15th August)

Northeastern Arunachal Pradesh)

>1,500

1988 (21st August)

Udaypur (Nepal)

1,000

1991 (20th October)

Uttarkashi (Uttarakhand)

>1,500

1993 (30th September)

Latur (Maharashtra)

>9,000

2001 (26th January)

Bhuj (Gujarat)

>20,000

22. This Court can take a judicial notice of the fact that the size of agriculture land in State of Uttarakhand has shrunk. The production of food grains has comedown. One of the plausible reasons for this shrinking of agriculture land is possibly the increase in rising construction activities and mining activities on agriculture land.

23. Their Lordships of Hon"ble Supreme Court in (1985) 2 SCC 431 have also stopped the mining activities in Dehradun-Mussoorie area. For mining of Lime Stone quarries in Dehradun-Mussoorie area, various committees were appointed.

24. Their Lordships of Hon"ble Supreme Court in AIR 1981 SC (1) 711 in the case of State of Tamil Nadu v. M/s. Hind Stone etc. have held that Rivers, Forests, Minerals and such other resources constitute a nation's wealth. These resources are not be frittered away and exhausted by any one generation. Their Lordships have held as under :-

6. Rivers, Forests, Minerals and such other resources constitute a nation's natural wealth. These resources are not to be frittered away and exhausted by any one generation. Every generation owes a duty to all succeeding generations to develop and conserve the natural resources of the nation in the best possible way. It is in the interest of mankind. It is in the interest of the nation. It is recognised by Parliament. Parliament has declared that it is expedient in the public interest that the Union should take under its control the regulation of

mines and the development of minerals. It has enacted the Mines and Minerals (Regulation and Development) Act, 1957. We have already referred to its salient provisions. Section 18, we have noticed, casts a special duty on the Central Government to take necessary steps for the conservation and development of minerals in India. Section 17 authorises the Central Government itself to undertake prospecting or mining operations in any area not already held under any prospecting licence or mining lease. Section 4-A empowers the State Government on the request of the Central Government, in the case of minerals other than minor minerals, to prematurely terminate existing mining leases and grant fresh leases in favour of a Government company or corporation owned or controlled by government, if it is expedient in the interest of regulation of mines and mineral development to do so. In the case of minor minerals, the State Government is similarly empowered, after consultation with the Central Government. The public interest which induced Parliament to make the declaration contained in Section 2 of the Mines and Minerals (Regulation and Development) Act, 1957, has naturally to be the paramount consideration in all matters concerning the regulation of mines and the development of minerals. Parliament's policy is clearly discernible from the provisions of the Act. It is the conservation and the prudent and discriminating exploitation of minerals, with a view to secure maximum benefit to the community. There are clear signposts to lead and guide the subordinate legislating authority in the matter of the making of rules. Viewed in the light shed by the other provisions of the Act, particularly Sections 4-A, 17 and 18, it cannot be said that the rule-making authority under Section 15 has exceeded its powers in banning leases for quarrying black granite in favour of private parties and in stipulating that the State Government themselves may engage in quarrying black granite or grant leases for quarrying black granite in favour of any corporation wholly owned by the State Government. To view such a rule made by the subordinate legislating body as a rule made to benefit itself merely because the State Government happens to be the subordinate legislating body, is, but, to take too narrow a view of the functions of that body. The reasons that prompted the State Government to make Rule 8-C were explained at great length in the common counter-affidavit filed on behalf of the State Government before the High Court. We find no good reason for not accepting the statements made in the counter-affidavit. It was said there:"

25. Their Lordships of Hon"ble Supreme Court in 1986 (Supp) SCC 517 in the case of Rural Litigation and Entitlement Kendra and others v. State of Uttar Pradesh and others in a case related to the State of Uttarakhand, stated as follows :-

"17. The limestone quarries in this area are estimated to satisfy roughly three per cent of the country's demand for such raw material and we were told during the hearing that the Tata Iron and Steel Company is the largest consumer of this limestone for manufacture of a special kind of steel. At the present rate of mining, the deposits are likely to last some 50 years. It is for the Government

and the Nation - and not for the Court - to decide whether the deposits should be exploited at the cost of ecology and environmental considerations or the industrial requirement should be otherwise satisfied. It may be perhaps possible to exercise greater control and vigil over the operation and strike a balance between preservation and utilisation that would indeed be a matter for an expert body to examine and on the basis of appropriate advice, government should take a policy decision and firmly implement the same.

18. Governments - both at the Centre and in the State - must realize and remain cognizant of the fact that the stake involved in the matter is large and far-reaching. The evil consequences would last long. Once that unwanted situation sets in, amends or repairs would not be possible. The greenery of India, as some doubt, may perish and the Thar desert may expand its limits.

19. Consciousness for environmental protection is of recent origin. The United Nations Conference on World Environment held in Stockholm in June 1972 and the follow-up action thereafter is spreading the awareness. Over thousands of years men had been successfully exploiting the ecological system for his sustenance but with the growth of population the demand for land has increased and forest growth has been and is being cut down and man has started encroaching upon Nature and its assets. Scientific developments have made it possible and convenient for man to approach the places which were hitherto beyond his ken. The consequences of such interference with ecology and environment have now come to be realised. It is necessary that the Himalayas and the forest growth on the mountain range should be left uninterfered with so that there may be sufficient quantity of rain. The top soil may be preserved without being eroded and the natural setting of the area may remain intact. We had commended earlier to the State of Uttar Pradesh as also to the Union of India that afforestation activity may be carried out in the whole valley and the hills. We have been told that such activity has been undertaken. We are not oblivious of the fact that natural resources has got to be tapped for the purposes of social development but one cannot forget at the same time that tapping of resources have to be done with requisite attention and care so that ecology and environment may not be affected in any serious way; there may not be any depletion of water resources and long-term planning must be undertaken to keep up the national wealth. It has always to be remembered that these are permanent assets of mankind and are not intended to be exhausted in one generation."

26. Their Lordships of Hon"ble Supreme Court in (1987) 1 SCC 213 in the case of Ambica Quarry Works v. State of Gujarat and others have held that the primary purpose of the Act, which must subserve the interpretation in order to implement the Act, is to prevent further deforestation and ecological imbalances. Their Lordship have held as under:-

"15. The rules dealt with a situation prior to the coming into operation of 1980 Act. The "1980 Act" was an Act in recognition of the awareness that deforestation

and ecological imbalances as a result of deforestation have become social menaces and further deforestation and ecological imbalances should be prevented. That was the primary purpose writ large in the Act of 1980. Therefore the concept that power coupled with the duty enjoined upon the respondents to renew the lease stands eroded by the mandate of the legislation as manifest in 1980 Act in the facts and circumstances of these cases. The primary duty was to the community and that duty took precedence, in our opinion, in these cases. The obligation to the society must predominate over the obligation to the individuals."

27. Their Lordships of Hon^{ble} Supreme Court in 1993 Supp (3) SCC 115 in the case of Tarun Bharat Sangh, Alwar v. Union of India and others have held that for grant of leases within the protected forest clearance from Central Government under Rule 4(6) of the Rajasthan Minor Mineral Concession Rules and approval of Central Government under Section 2 of Forest (Conservation) Act, 1980 are conditions precedent. Their Lordship have held as under:-

"15. At the outset, we may be permitted to clarify an aspect. This is not a case where we are called upon to shut down an activity being carried on lawfully, in the name of higher considerations of ecology and environment. This is a simple case where we are called upon to ensure observance of enacted laws made by the State to protect the environment and ecology of the area. In such a case, we need not be oppressed by considerations of balancing the interests of economy and ecology. That has already been done by the Legislature and Parliament. The grievance of the petitioner is against the executive. Charged with the delegation of implementing the laws of the land, the executive is yet failing to do its duty by law and by people, when faced with the might of money; respect for law is dissolving into respect for Mammon, says the petitioner. Let us therefore first find out which laws are violated, if any, and then decide, what are the proper directions to make.

(A) Section 2 of the Forest (Conservation) Act read with Section 29 of the Rajasthan Forest Act and Rule 4(6) of the Rajasthan Minor Mineral Concessions Rule:

18. Once an area is declared as a protected forest, it comes within the purview of the Forest (Conservation) Act, 1980. It becomes a forest land within the meaning of Section 2. The effect of this position is that no non-forest activity can be carried on in the said area except with the prior approval of the Central Government. Even the State Government cannot carry on any such non-forest activity in the said area without such prior approval. That the mining activity amounts to non-forest purpose is beyond dispute. Thus, the grant of mining leases/licences and their renewal by the State Government, without obtaining the prior approval of the Central Government, in respect of the mines situated within the protected forest, after January 1, 1975 is contrary to law. All the mines listed in Appendix `A" to the committee"s report do fall within the areas declared as protected forest while the mines listed in Appendix `B" fall partly

within and partly outside such areas. According to Rule 4(6) of the Rajasthan Minor Mineral Concession Rules, 1986 too, no mining lease could have been granted or renewed within the forest "without clearance from the Central Government in accordance with the Forest (Conservation) Act, 1980 and the rules made thereunder". Admittedly, no such prior approval or clearance of Central Government was obtained. The Chairman of the committee, Shri Justice M.L. Jain has recommended that 215 mines mentioned in Appendix 'A' to his report, which are situated wholly within the protected forest should be closed forthwith. There can hardly be any valid objection in law to the said recommendation. Similarly, with respect to 47 mines mentioned in Appendix 'B' to the report, the learned Chairman has recommended that they should be closed forthwith insofar as they fall within the protected forest. To this recommendation also, there can be no valid objection in law."

28. Their Lordships of Hon"ble Supreme Court in (1996) 5 SCC 647 in the case of Vellore Citizens' Welfare Forum v. Union of India and others have held that while the industries are vital for country's development, but having regard to pollution caused by them, principle of Sustainable Development has to be adopted as a balancing concept. Their Lordship have held as under:-

"9. It is no doubt correct that the leather industry in India has become a major foreign exchange earner and at present Tamil Nadu is the leading exporter of finished leather accounting for approximately 80 per cent of the country's export. Though the leather industry is of vital importance to the country as it generates foreign exchange and provides employment avenues it has no right to destroy the ecology, degrade the environment and pose as a healthhazard. It cannot be permitted to expand or even to continue with the present production unless it tackles by itself the problem of pollution created by the said industry.

10. The traditional concept that development and ecology are opposed to each other is no longer acceptable. "Sustainable Development" is the answer. In the international sphere, "Sustainable Development" as a concept came to be known for the first time in the Stockholm Declaration of 1972. Thereafter, in 1987 the concept was given a definite shape by the World Commission on Environment and Development in its report called "Our Common Future". The Commission was chaired by the then Prime Minister of Norway, Ms G.H. Brundtland and as such the report is popularly known as "Brundtland Report". In 1991 the World Conservation Union, United Nations Environment Programme and Worldwide Fund for Nature, jointly came out with a document called "Caring for the Earth" which is a strategy for sustainable living. Finally, came the Earth Summit held in June 1992 at Rio which saw the largest gathering of world leaders ever in the history - deliberating and chalking out a blueprint for the survival of the planet. Among the tangible achievements of the Rio Conference was the signing of two conventions, one on biological diversity and another on climate change. These conventions were signed by 153 nations. The delegates also approved by consensus three nonbinding documents namely, a Statement on Forestry

Principles, a declaration of principles on environmental policy and development initiatives and Agenda 21, a programme of action into the next century in areas like poverty, population and pollution. During the two decades from Stockholm to Rio "Sustainable Development" has come to be accepted as a viable concept to eradicate poverty and improve the quality of human life while living within the carrying capacity of the supporting ecosystems. "Sustainable Development" as defined by the Brundtland Report means "Development that meets the needs of the present without compromising the ability of the future generations to meet their own needs". We have no hesitation in holding that "Sustainable Development" as a balancing concept between ecology and development has been accepted as a part of the customary international law though its salient features have yet to be finalised by the international law jurists.

11. Some of the salient principles of "Sustainable Development", as culled out from Brundtland Report and other international documents, are Inter-Generational Equity, Use and Conservation of Natural Resources, Environmental Protection, the Precautionary Principle, Polluter Pays Principle, Obligation to Assist and Cooperate, Eradication of Poverty and Financial Assistance to the developing countries. We are, however, of the view that "The Precautionary Principle" and "The Polluter Pays Principle" are essential features of "Sustainable Development". The "Precautionary Principle" - in the context of the municipal law - means:

(i) Environmental measures - by the State Government and the statutory authorities - must anticipate, prevent and attack the causes of environmental degradation.

(ii) Where there are threats of serious and irreversible damage, lack of scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

(iii) The "onus of proof" is on the actor or the developer/industrialist to show that his action is environmentally benign.

12. "The Polluter Pays Principle" has been held to be a sound principle by this Court in *Indian Council for Enviro-Legal Action v. Union of India*. The Court observed: (SCC p. 246, para 65)

".. we are of the opinion that any principle evolved in this behalf should be simple, practical and suited to the conditions obtaining in this country."

The Court ruled that: (SCC p. 246, para 65)

".. once the activity carried on is hazardous or inherently dangerous, the person carrying on such activity is liable to make good the loss caused to any other person by his activity irrespective of the fact whether he took reasonable care while carrying on his activity. The rule is premised upon the very nature of the activity carried on".

Consequently the polluting industries are "absolutely liable to compensate for the harm caused by them to villagers in the affected area, to the soil and to the underground water and hence, they are bound to take all necessary measures to remove sludge and other pollutants lying in the affected areas". The "Polluter Pays Principle" as interpreted by this Court means that the absolute liability for harm to the environment extends not only to compensate the victims of pollution but also the cost of restoring the environmental degradation. Remediation of the damaged environment is part of the process of "Sustainable Development" and as such the polluter is liable to pay the cost to the individual sufferers as well as the cost of reversing the damaged ecology.

13. The Precautionary Principle and the Polluter Pays Principle have been accepted as part of the law of the land. Article 21 of the Constitution of India guarantees protection of life and personal liberty. Articles 47, 48-A and 51- A(g) of the Constitution are as under:

"47. Duty of the State to raise the level of nutrition and the standard of living and to improve public health.-The State shall regard the raising of the level of nutrition and the standard of living of its people and the improvement of public health as among its primary duties and, in particular, the State shall endeavour to bring about prohibition of the consumption except for medicinal purposes of intoxicating drinks and of drugs which are injurious to health.

48-A. Protection and improvement of environment and safeguarding of forests and wildlife.-The State shall endeavour to protect and improve the environment and to safeguard the forests and wildlife of the country.

51-A. (g) to protect and improve the natural environment including forests, lakes, rivers and wildlife, and to have compassion for living creatures."

Apart from the constitutional mandate to protect and improve the environment there are plenty of post-independence legislations on the subject but more relevant enactments for our purpose are: the Water (Prevention and Control of Pollution) Act, 1974 (the Water Act), the Air (Prevention and Control of Pollution) Act, 1981 (the Air Act) and the Environment (Protection) Act, 1986 (the Environment Act). The Water Act provides for the constitution of the Central Pollution Control Board by the Central Government and the constitution of the State Pollution Control Boards by various State Governments in the country. The Boards function under the control of the Governments concerned. The Water Act prohibits the use of streams and wells for disposal of polluting matters. It also provides for restrictions on outlets and discharge of effluents without obtaining consent from the Board. Prosecution and penalties have been provided which include sentence of imprisonment. The Air Act provides that the Central Pollution Control Board and the State Pollution Control Boards constituted under the Water Act shall also perform the powers and functions under the Air Act. The main function of the Boards, under the Air Act, is to improve the quality of the air and to prevent, control and abate air pollution in the country. We shall deal with the

Environment Act in the latter part of this judgment.

14. In view of the above-mentioned constitutional and statutory provisions we have no hesitation in holding that the Precautionary Principle and the Polluter Pays Principle are part of the environmental law of the country.

16. The constitutional and statutory provisions protect a person's right to fresh air, clean water and pollution-free environment, but the source of the right is the inalienable common law right of clean environment. It would be useful to quote a paragraph from Blackstone's commentaries on the Laws of England (Commentaries on the Laws of England of Sir William Blackstone) Vol. III, fourth edition published in 1876. Chapter XIII, "Of Nuisance" depicts the law on the subject in the following words:

"Also, if a person keeps his hogs, or other noisome animals, or allows filth to accumulate on his premises, so near the house of another, that the stench incommodes him and makes the air unwholesome, this is an injurious nuisance, as it tends to deprive him of the use and benefit of his house. A like injury is, if one's neighbour sets up and exercises any offensive trade; as a tanner's, a tallowchandler's, or the like; for though these are lawful and necessary trades, yet they should be exercised in remote places; for the rule is, `sic utere tuo, ut alienum non leadas'; this therefore is an actionable nuisance. And on a similar principle a constant ringing of bells in one's immediate neighbourhood may be a nuisance.

With regard to other corporeal hereditaments; it is a nuisance to stop or divert water that used to run to another's meadow or mill; to corrupt or poison a watercourse, by erecting a dye-house or a lime-pit, for the use of trade, in the upper part of the stream; to pollute a pond, from which another is entitled to water his cattle; to obstruct a drain; or in short to do any act in common property, that in its consequences must necessarily tend to the prejudice of one's neighbour. So closely does the law of England enforce that excellent rule of gospel-morality, of `doing to others, as we would they should do unto ourselves'."

17. Our legal system having been founded on the British common law the right of a person to a pollution-free environment is a part of the basic jurisprudence of the land.

20. It is thus obvious that the Environment Act contains useful provisions for controlling pollution. The main purpose of the Act is to create an authority or authorities under Section 3(3) of the Act with adequate powers to control pollution and protect the environment. It is a pity that till date no authority has been constituted by the Central Government. The work which is required to be done by an authority in terms of Section 3(3) read with other provisions of the Act is being done by this Court and the other courts in the country. It is high time that the Central Government realises its responsibility and statutory duty to protect the degrading environment in the country. If the conditions in the five

districts of Tamil Nadu, where tanneries are operating, are permitted to continue then in the near future all rivers/canals shall be polluted, underground waters contaminated, agricultural lands turned barren and the residents of the area exposed to serious diseases. It is, therefore, necessary for this Court to direct the Central Government to take immediate action under the provisions of the Environment Act.

21. There are more than 900 tanneries operating in the five districts of Tamil Nadu. Some of them may, by now, have installed the necessary pollution control measures; they have been polluting the environment for over a decade and in some cases even for a longer period. This Court has in various orders indicated that these tanneries are liable to pay pollution fine. The polluters must compensate the affected persons and also pay the cost of restoring the damaged ecology.

24. The Board has the power under the Environment Act and the Rules to lay down standards for emissions or discharge of environmental pollutants. Rule 3(2) of the Rules even permits the Board to specify more stringent standards from those provided under the Rules. The NEERI having justified the standards stipulated by the Board, we direct that these standards are to be maintained by the tanneries and other industries in the State of Tamil Nadu."

29. Their Lordships of Hon"ble Supreme Court in (1996) 6 SCC 442 in the case of Divisional Forest Officer and others v. S. Nageswaramma have held that in view of total prohibition under Section 2 of the Forest (Conservation) Act, 1980 respondents had no right to continue operation in the area. Their Lordship have held as under:-

"5. It is contended by Shri Subba Rao, the learned counsel for the respondent, that what the respondent has been denied is not making any fresh extraction of the mines (sic minerals) in the forest area but only the removing of the stacked minerals from the surface of the earth, that too, with the permission granted by the authorities; the direction issued by the High Court in the impugned order, therefore, is correct in law. We find no force in the contention. The learned Judges have proceeded on the premise that the respondent is entitled to extract and remove minerals, said to be stacked on the ground that the lease is a valid lease; otherwise he does not get any right. The premise on which the Division Bench has proceeded is obviously illegal. Section 2 of the Act prohibits mining operations if the mines are situated within the forest area. It is a total prohibition, unless the State Government grants mining lease with the prior concurrence of the Central Government. Admittedly, the prior concurrence of the Central Government had not been obtained. Shri Subba Rao sought to place before us the guidelines issued by the Department of Environment and Forest, Government of India in relaxation of Rules/guidelines under Forest (Conservation) Act, 1980. Therein, the question is of the clearance of the projects by the State Government without obtaining the prior concurrence of the Department of Environment and Forest. In that behalf, it was mentioned that the

renewal of the mining leases, if they are within a particular radius was directed to be done without any fresh breaking up of fresh area and felling of the trees but subject to reforestation. In this case that situation does not arise. This is a case of grant of renewal in a routine way. Under these circumstances, the direction issued by the Division Bench of the High Court is clearly illegal."

30. Their Lordships of Hon''ble Supreme Court in AIR 2001 SC 184 in the case of Goa Foundation, Goa v. Diksha Holdings Pvt. Ltd. And others have held that no activities which would ultimately lead to unscientific and unsustainable development and ecological destruction should at all be allowed and the Courts must scrupulously try to protect the ecology and environment. Their Lordships have held as under :-

"6. Before we examine the materials on record to test the correctness of the rival submissions, we think it appropriate to notice one or two decisions, indicating the approach of a court in such matters concerning environment and development. The Calcutta High Court in the case of People United for Better Living in Calcutta-Public v. State of W.B. had the occasion to deal with a similar problem in relation to the wetland and the learned Single Judge (U.C. Banerjee, J., as he then was) came to the conclusion: (AIR Headnote)

"There is no manner of doubt that the issue of environmental degradation cannot but be termed to be a social problem and considering the growing awareness and considering the impact of this problem on the society in regard thereto law courts should also rise up to the occasion to deal with the situation as it demands in the present day context: Law courts have a social duty since it is a part of the society and as such, must always function having due regard to the present day problems which the society faces. It is now a well-settled principle of law that socio-economic condition of the country cannot be ignored by a court of law. It is now a wellsettled principle of law that while dealing with the matter, the social problems shall have to be dealt with in the way and in the manner it calls for, since benefit to the society ought to be the prime consideration of the law courts and ecological imbalance being a social problem ought to be decided by a court of law so that the society may thrive and prosper without any affection."

The learned Judge had indicated in the said judgment that there should be a proper balance between the protection of environment and the development process: the society shall have to prosper, but not at the cost of the environment and in the similar vein, the environment shall have to be protected but not at the cost of the development of the society - there shall have to be both development and proper environment and as such, a balance has to be found out and administrative actions ought to proceed in accordance therewith and not dehors the same. In the case of Indian Council for Enviro-Legal Action v. Union of India this Court had the occasion to deal with the question of protection of 6000 km long coastline of India and the Court emphasised that it would be the duty and responsibility of the Coastal States and Union Territories in which the stretches exist, to see that the notifications issued under the provisions of the Environment

(Protection) Rules as well as the notifications issued, declaring the coastal stretches as Coastal Regulation Zone should be properly and duly implemented and the various restrictions on the setting up and expansion of industries, operation or process etc. in the Regulation Zone should be strictly enforced. The Court had indicated that with a view to protect the ecological balance in the coastal areas, notifications having been issued by the Central Government, there ought not to be any violation and the prohibited activities should not be allowed to come up within the area declared as CRZ Notification. The Court also emphasised that no activities which would ultimately lead to unscientific and unsustainable development and ecological destruction should at all be allowed and the courts must scrupulously try to protect the ecology and environment and should shoulder greater responsibility of which the court can have closer awareness and easy monitoring.

17. While it is true that nature will not tolerate after a certain degree of its destruction and it will have its toll definitely, though, may not be felt in praesenti and the present day society has a responsibility towards the posterity so as to allow normal breathing and living in cleaner environment but that does not by itself mean and imply stoppage of all projects. In my judgment in regard to East Calcutta Wetlands (People United for Better Living in Calcutta-Public v. State of W.B.) I did speak of a balance between development and ecology and since my learned brother Pattanaik, J. has already dealt with the issue, I refrain myself from dealing with the matter in extenso in that regard excepting however, recording my concurrence therewith and state that harmonisation of the two namely, the issue of ecology and development project cannot but be termed to be the order of the day and the need of the hour."

31. Their Lordships of Hon''ble Supreme Court in (2002) 10 SCC 606 in the case of T.N. Godavarman Thirumalpad v. Union of India and others have held that convenience and benefit to a larger section of people has to be given primacy over hardship to a comparatively smaller section. Their Lordships have also held that the duty is cast upon the State Government under Article 21 of the Constitution of India to protect the environment and the two salutary principles which govern the law of environment are : (i) the principles of sustainable development, and (ii) the precautionary principle. as under :-

"14. "Environment" is a difficult word to define. Its normal meaning relates to the surroundings, but obviously that is a concept which is relatable to whatever object it is which is surrounded. Einstein had once observed, "The environment is everything that isn't me." About one-and-a-half century ago, in 1854, as the famous story goes, the wise Indian Chief of Seattle replied to the offer of the Great White Chief in Washington to buy their land. The reply is profound. It is beautiful. It is timeless. It contains the wisdom of the ages. It is the first ever and the most understanding statement on environment. The whole of it is worth quoting as any extract from it is to destroy its beauty:

"How can you buy or sell the sky, the warmth of the land? The idea is strange to

us.

If we do not own the freshness of the air and the sparkle of the water, how can you buy them?

Every part of the earth is sacred to my people. Every shining pine needle, every sandy shore, every mist in the dark woods, every clearing and humming insect is holy in the memory and experience of my people. The sap which courses through the trees carries the memories of the red man.

`the white man's dead forget the country of their birth when they go to walk among the stars. Our dead never forget this beautiful earth, for it is the mother of the red man. We are part of the earth and it is part of us. The perfumed flowers are our sisters; the horse, the great eagle, these are our brothers. The rocky crests, the juices in the meadows, the body heat of the pony, and man - all belong to the same family".

So, when the Great Chief in Washington sends word and he wishes to buy our land, he asks much of us. The Great Chief sends word he will reserve us a place so that we can live comfortably to ourselves. He will be our father and we will be his children. So we will consider your offer to buy our land. But it will not be easy. For this land is sacred to us.

This shining water moves in the streams and rivers is not just water but the blood of our ancestors. If we sell you land, you must remember that it is sacred, and you must teach your children that it is sacred and that each ghostly reflection in the clear water of the lakes tells of events and memories in the life of my people. The water's murmur is the voice of my father's father.

The rivers are our brothers, they quench our thirst. The rivers carry our canoes, and feed our children. If we sell you our land you must remember, and teach your children, that the rivers are our brothers, and yours and you must henceforth give the kindness you would give any brother.

We know that the white man does not understand our ways. One portion of land is the same to him as the next, for he is a stranger who comes in the night and takes from the land whatever he needs. The earth is not his brother but his enemy and when he has conquered it, he moves on. He leaves his father's graves behind, and he does not care.

He kidnaps the earth from his children. His father's grave and his children's birthright are forgotten. He treats his mother, the earth, and his brother, the sky, as things to be bought, plundered, sold like sheep or bright beads. His appetite will devour the earth and leave behind only a desert.

I do not know. Our ways are different from your ways. The sight of your cities pains the eyes of the red man. But perhaps it is because the red man is a savage and does not understand.

There is no quiet place in the white man's cities. No place to hear the unfurling

of leaves in spring or the rustle of an insect's wings. But perhaps it is because I am a savage and do not understand. The clatter only seems to insult the ears. And what is there in life if a man cannot hear the lonely cry of the whippoorwill or the arguments of the frogs around a pond at night? I am a red man and do not understand. The Indian prefers the soft sound of the wind darting over the face of a pond, and the smell of the wind itself, cleansed by a midday rain, or scented with the pine.

The air is precious to the red man, for all things share the same breath - the beast, the tree, the man, they all share the same breath. The white man does not seem to notice the air he breathes. Like a man lying for many days, he is numb to the stench. But if we sell you our land, you must remember that the air is precious to us, that the air shares its spirit with all the life it supports. The wind that gave our grandfather his first breath also receives the last sign. And if we sell you our land, you must keep it apart and sacred as a place where even the white man can go to taste the wind that is sweetened by the meadow's flowers.

So we will consider your offer to buy our land. If we decide to accept, I will make one condition. The white man must treat the beasts of this land as his brothers.

I am a savage and I do not understand any other way. I have seen a thousand rotting buffaloes on the prairie, left by the white man who shot them from a passing train. I am a savage and I do not understand how the smoking iron horse can be more important than the buffalo that we kill only to stay alive.

What is man without the beasts? If all the beasts were gone, man would die from a great loneliness of spirit. For whatever happens to the beasts soon happens to man. All things are connected.

You must teach your children that the ground beneath their feet is the ashes of our grandfathers, so that they will respect the land. Tell your children that the earth is rich with the lives of our kin. Teach your children what we have taught our children, that the earth is our mother. Whatever befalls the earth befalls the sons of the earth. If man spits upon the ground, they spit upon themselves.

This we know: the earth does not belong to man, man belongs to the earth. This we know: all things are connected like the blood which unites one family. All things are connected.

Whatever befalls the earth befalls the sons of the earth. Man did not weave the web of life; he is merely a strand in it. Whatever he does to the web he does to himself.

Even the white man, whose God walks and talks with him as friend to friend cannot be exempt from the common destiny. We may be brothers after all. We shall see. One thing we know, which the white man may one day discover - our God is the same God. You may think now that you own him as you wish to own our land; but you cannot. He is the God of man, and his compassion is equal for

the red man and the white. This earth is precious to him, and to harm the earth is to heap contempt on the creator. The white too shall pass perhaps sooner than all other tribes. Contaminate your bed and you will one night suffocate in your own waste.

But in your perishing you will shine brightly, fired by the strength of the God who brought you this land and for some special purpose gave you dominion over this land and over the red man. That destiny is a mystery to us, for we do not understand when the wild buffaloes are slaughtered, the wild horses are tamed, the secret corners of the forest heavy with scent of many men and the view of the ripe hills blotted by talking wires. Where is the thicket? Gone. Where is the eagle? Gone. The end of living and the beginning of survival."

15. It would be hard to find such down-to-earth description of nature. "Nature hates monopolies and knows no exception. It has always some levelling agency that puts the overbearing, the strong, the rich, the fortunate substantially on the same ground with all others" said Zarathustra. Environment is a polycentric and multifaceted problem affecting the human existence. The Stockholm Declaration of the United Nations on Human Environment, 1972, reads its Principle No. 3, *inter alia*, thus:

"Man has the fundamental right to freedom, equality, and adequate conditions of life, in an environment of equality that permits a life of dignity and well-being and bears a solemn responsibility to protect and improve the environment for present and future generations."

16. The Declaration, "therefore, says that" in the developing countries, most of the environmental problems are caused by underdevelopment. The Declaration suggests safe actions with prudent care for ecological balance. It is necessary to avoid massive and irreversible harm to the earthly environment and strife for achieving for present generation and the posterity a better life in an environment more in keeping with the needs and hopes. In this context immediately comes to mind the words of Pythagoras who said:

"For so long as man continues to be the ruthless destroyer of lower living beings, he will never know health or peace. For so long as men massacre animals, they will kill each other. Indeed, they who sow the seeds of murder and pain cannot reap joy and love."

19. Environmental law is an instrument to protect and improve the environment and to control or prevent any act or omission polluting or likely to pollute the environment. In view of the enormous challenges thrown by the industrial revolution, the legislatures throughout the world are busy in this exercise. Many have enacted laws long back and they are busy in remodelling the environmental law. The others have moved their law-making machineries in this direction except the underdeveloped States who have yet to come in this wavelength. India was one of those few countries which paid attention right from the ancient times down to the present age and till date, the tailoring of the existing law to

suit the changing conditions is going on. The problem of law-making and amending is a difficult task in this area. There are a variety of colours of this problem. For example, the industrial revolution and the evolution of certain cultural and moral values of humanity and the rural and urban area developments in agricultural technology, waste, barren or industrial belts; developed, developing and underdeveloped parts of the lands; the rich and poor Indians; the population explosion and the industrial implosion; the people's increasing awareness and the decreasing State exchequer; the promises in the political manifestos and the State's development action. In this whole gamut of problems the Tiwari Committee came out with the data that we have in India "nearly five hundred environmental laws" and the Committee pointed out that no systematic study had been undertaken to evaluate those legislative developments. Some legal controls and techniques have been adopted by the legislatures in the field of Indian environmental laws. Different legislative controls right from the ancient times, down to the modern period make interesting reading. Attention has to be paid to identify the areas of great concern to the legislature; the techniques adopted to solve those problems; the pollutants which require continuous exercises; the role of the legislature and people's participation outside. These are some of many areas which attract the attention in the study of history of the Indian environmental law.

20. Since time immemorial, natural objects like rivers enjoyed a high position in the life of the society. They were considered as goddesses having not only purifying capacity but also self-purifying ability. Fouling of the water of a river was considered a sin and it attracted punishments of different grades which included penance, outcasting, fine etc. The earth or soil also equally had the same importance, and the ancient literature provided the means to purify the polluted soil. The above are some of the many illustrations to support the view that environmental pollution was controlled rigidly in the ancient times. It was not an affair limited to an individual or individuals but the society as a whole accepted its duty to protect the environment. The "dharma" of environment was to sustain and ensure progress and welfare of all. The inner urge of the individuals to follow the set norms of the society, motivated them to allow the natural objects to remain in the natural state. Apart from this motivation, there was the fear of punishment. There were efforts not just to punish the culprit but to balance the ecosystems. The noteworthy development in this period was that each individual knew his duty to protect the environment and he tried to act accordingly. Those aspects have been highlighted by a learned author C.M. Jariwala in his article "Changing Dimensions of the Indian Environmental Law" in the book Law and Environment by P. Leelakrishnan.

23. Apart from the direct cost to business of complying with stricter regulatory controls, the potential liabilities for non-compliance are also increasing. These liabilities fall into five general categories:

(a) Criminal liabilities

The number of criminal offences for noncompliance with environmental legislation is immense, and in recent years the regulation agencies have shown an increased willingness to resort to prosecution. Private prosecution is also a possibility. Fines will be the normal penalty, though in a number of cases sentences of imprisonment have been imposed (there is normally a potential personal liability for directors and senior managers). Maximum fine levels have risen in recent years, as have actual levels of fines imposed.

(b) Administrative sanctions

In most regulatory systems there is a range of options available to the regulator, including variation, suspension or revocation of a licence. Since these steps may lead to the closure of a plant, they are obviously of great importance.

(c) Clean-up costs

In most environmental legislation there is a power to clean up after a pollution incident and receive the cost from the polluter or (in some cases) the occupier.

(d) Civil liability

There is growing interest in the toxic torts, although many of the actions have in fact been around for a long time. Many environmental actions rest upon strict liability. Although liability may often be difficult to establish, the size of claims may be very high indeed.

(e) Adverse publicity

In practice the publicity attracted as a result of infringements of the law may be as costly as any direct costs.

24. The tide of judicial considerations in environmental litigation in India symbolizes the anxiety of courts in finding out appropriate remedies for environmental maladies. At global level, the right to live is now recognized as a fundamental right to an environment adequate for health and well-being of human beings. [See World Commission on Environment and Development - Our Common Future (1987).] To commemorate the tenth anniversary of the Stockholm Conference, the world community of States assembled in Nairobi (May 10-18, 1982) to review the action taken on to implement the Stockholm Declaration. It expressed serious concern about the state of environment worldwide and recognized the urgent need of intensifying the effort at the global, regional and national levels to protect and improve it.

25. Progress and pollution go together. As this Court observed in *M.C. Mehta v. Union of India* when science and technology are increasingly employed in producing goods and services calculated to improve the quality of life, there is a certain element of hazard or risk inherent in the very use of science and technology and it is not possible to totally eliminate such hazard or risk altogether. We can only hope to reduce the element of hazard or risk to the community by taking all necessary steps for locating such industries in a manner

which would pose least risk of danger to the community and maximizing safety requirements. As observed in the United Nations Conference held at Stockholm in June 1972, economic and social development was essential for ensuring a favourable living and working environment for man and for creating conditions on earth that were necessary for the improvement of the quality of life.

26. The tragedy of the predicament of the civilized man is that

"Every source from which man has increased his power on earth has been used to diminish the prospects of his successors. All his progress is being made at the expense of damage to the environment which he cannot repair and cannot foresee."

There is increase in awareness of the compelling need to restore the serious ecological imbalances introduced by the depredations inflicted on nature by man. The state to which the ecological imbalance and the consequent environmental damage have reached is so alarming that unless immediate, determined and effective steps were taken, the damage might become irreversible. In his foreword to International Wildlife Law, M.R.M. Prince Philip, the Duke of Edinburgh said:

"Many people seem to think that the conservation of nature is simply a matter of being kind to animals and enjoying walks in the countryside. Sadly, perhaps, it is a great deal more complicated than that... As usual with all legal systems, the crucial requirement is for the terms of the conversions to be widely accepted and rapidly implemented... Regretfully progress in this direction is proving disastrously slow." (See International Wildlife Law by Simon Lyster, Cambridge, Grotius Publications Ltd., 1985 Edn.)

29. To protect and improve the environment is a constitutional mandate. It is a commitment for a country wedded to the ideas of a welfare State. The world is under an impenetrable cloud. In view of enormous challenges thrown by the industrial revolution, the legislatures throughout the world are busy in their exercise to find out means to protect the world. Every individual in the society has a duty to protect nature. People worship the objects of nature. The trees, water, land and animals had gained important positions in the ancient times. As Manu VIII, p. 282 says, different punishments were prescribed for causing injuries to plants. Kautilya went a step further and fixed the punishment on the basis of importance of the part of the tree. (See Kautilya III, XIX, 197.)

30. As observed by this Court in Rural Litigation and Entitlement Kendra v. State of U.P. natural resources have got to be tapped for the purpose of social development but one cannot forget at the same time that tapping of resources has to be done with requisite attention and care so that ecology and environment may not be affected in any serious way; there may not be any depletion of water resources and longterm planning must be undertaken to keep up the national wealth. It has always to be remembered that these are permanent assets of mankind and are not intended to be exhausted in one generation.

31. Academy Law Review, at pp. 137-38 says that a recent survey reveals that every day millions of gallons of trade wastes and effluents are discharged into the rivers, streams, lakes and sea etc. Indiscriminate water pollution is a problem all over the world but is now acute in densely populated industrial cities. Our country is no exception to this. Air pollution has further added to the intensity and extent of the problem. Every year millions of tons of gaseous and particulate pollutants are injected into the atmosphere, both through natural processes and as a direct result of human activity. Scientists have pointed out that earth's atmosphere cannot absorb such unlimited amount of pollutant materials without undergoing changes which may be of an adverse nature with respect to human welfare. Man in order to survive in his planetary home will have to strike a harmonious balance with nature. There may be boundless progress scientifically which may ultimately lead to destruction of man's valued position in life. The Constitution has laid the foundation of Articles 48-A and 51-A for a jurisprudence of environmental protection. Today, the State and the citizen are under a fundamental obligation to protect and improve the environment, including forests, lakes, rivers, wildlife and to have compassion for living creatures.

32. A learned jurist has said, the Rig Veda praises the beauty of the dawn (usha) and worships nature in all its glory. And yet today a bath in the Yamuna and Ganga is a sin against bodily health, not a salvation for the soul - so polluted and noxious are these "holy" waters now.

"One hospital bed out of four in the world is occupied by a patient who is ill because of polluted water.. Provision of a safe and convenient water supply is the most important activity that could be undertaken to improve the health of people living in rural areas of the developing world." (WHO)

"Nature never did betray, the heart that loved her." (Wordsworth) The anxiety to save the environment manifested in the Constitution (Forty-second Amendment) Act, 1976 by the introduction of a specific provision for the first time to "protect and improve" the environment. Man is nature's best promise and worst enemy. If industry is necessity, pollution inevitable. Since progress and pollution go together, there can be no end of progress, and consequently, no escape from pollution. If industry is a necessary evil, pollution surest sufferance. Several enactments have been made to combat pollution. "Pollution" is a noun derived from the transitive verb "pollute" which means to make foul or unclean, dirty, to make impure or morally unclean. In Halsbury's Laws of England (4th Edn., Vol. 38, para 66) "pollution" means the direct or indirect discharge by man of substances or energy into the aquatic environment resulting in hazard to human health, harm to living resources and aquatic ecosystems, damage to amenities on interference with other legitimate uses of water.

35. It cannot be disputed that no development is possible without some adverse effect on the ecology and environment, and the projects of public utility cannot be abandoned and it is necessary to adjust the interest of the people as well as

the necessity to maintain the environment. A balance has to be struck between the two interests. Where the commercial venture or enterprise would bring in results which are far more useful for the people, difficulty of a small number of people has to be bypassed. The comparative hardships have to be balanced and the convenience and benefit to a larger section of the people has to get primacy over comparatively lesser hardship.

40. Sustainable development is essentially a policy and strategy for continued economic and social development without detriment to the environment and natural resources on the quality of which continued activity and further development depend. Therefore, while thinking of the developmental measures the needs of the present and the ability of the future to meet its own needs and requirements have to be kept in view. While thinking of the present, the future should not be forgotten. We owe a duty to future generations and for a bright today, a bleak tomorrow cannot be countenanced. We must learn from our experiences of the past to make both the present and the future brighter. We learn from our experiences, mistakes from the past, so that they can be rectified for a better present and the future. It cannot be lost sight of that while today is yesterday's tomorrow, it is tomorrow's yesterday.

43. Duty is cast upon the Government under Article 21 of the Constitution of India to protect the environment and the two salutary principles which govern the law of environment are: (i) the principles of sustainable development, and (ii) the precautionary principle. It needs to be highlighted that the Convention on Biological Diversity has been acceded to by our country and, therefore, it has to implement the same. As was observed by this Court in *Vishaka v. State of Rajasthan* in the absence of any inconsistency between the domestic law and the international conventions, the rule of judicial construction is that regard must be had to international conventions and norms even in construing the domestic law. It is, therefore, necessary for the Government to keep in view the international obligations while exercising discretionary powers under the Conservation Act unless there are compelling reasons to depart therefrom."

32. Their Lordships of Hon^{ble} Supreme Court in (2004) 12 SCC 118 in the case of *M.C. Mehta v. Union of India* and others have laid down the responsibilities, duties and accountability therefor of entrepreneurs setting up and running mining operations including scope of Articles 21, 48-A, 51-A(g), 47, 32 and 226 of Constitution of India. Their Lordships have further held that the natural sources of air, water and soil cannot be utilized, if the utilization results in irreversible damage to environment. Life, Public health and Ecology have priority over unemployment and loss of revenue. Their Lordship have also held that Mining Operation is hazardous in nature. impairs the ecology and people's right to natural resources. The entire process of setting up and functioning of a mining operation required utmost good faith and honesty on the part of the intending entrepreneur. The fullest disclosures including the potential for increased burdens on the environment consequent upon possible increase in the quantum and

degree of pollution, has to be made at the outset so that the public and all those concerned including the authorities may decide whether the permission can at all be granted for carrying on mining activity. Their Lordships have also held that diversion of forest land for any non-forest purpose should be subject to the most careful examinations by specialists from the standpoint of social and environmental costs and benefits. Their Lordships have held as under:-

"45. The natural sources of air, water and soil cannot be utilised if the utilisation results in irreversible damage to environment. There has been accelerated degradation of environment primarily on account of lack of effective enforcement of environmental laws and noncompliance of the statutory norms. This Court has repeatedly said that the right to live is a fundamental right under Article 21 of the Constitution and it includes the right to enjoyment of pollution-free water and air for full enjoyment of life. (See *Subhash Kumar v. State of Bihar*.)

46. Further, by the Forty-second Constitutional Amendment, Article 48-A was inserted in the Constitution in Part IV stipulating that the State shall endeavour to protect and improve the environment and to safeguard the forest and wildlife of the country. Article 51-A, inter alia, provides that it shall be the duty of every citizen of India to protect and improve the natural environment including forest, lakes, rivers and wildlife and to have compassion for living creatures. Article 47 which provides that it shall be the duty of the State to raise the level of nutrition and the standard of living and to improve public health is also relevant in this connection. The most vital necessities, namely, air, water and soil, having regard to right to life under Article 21 cannot be permitted to be misused and polluted so as to reduce the quality of life of others. Having regard to the right of the community at large it is permissible to encourage the participation of *amicus curiae*, the appointment of experts and the appointments of Monitory Committees. The approach of the Court has to be liberal towards ensuring social justice and protection of human rights. In *M.C. Mehta v. Union of India* this Court held that life, public health and ecology has priority over unemployment and loss of revenue. The definition of "sustainable development" which Brundtland gave more than 3 decades back still holds good. The phrase covers the development that meets the needs of the present without compromising the ability of the future generation to meet their own needs. In *Narmada Bachao Andolan v. Union of India* this Court observed that sustainable development means the type or extent of development that can take place and which can be sustained by nature/ecology with or without mitigation. In these matters, the required standard now is that the risk of harm to the environment or to human health is to be decided in public interest, according to a "reasonable person's" test. [See *Chairman Barton: The Status of the Precautionary Principle in Australia* (Vol. 22, 1998, *Harv. Env'tt. Law Review*, p. 509 at p. 549-A) as referred to in para 28 in *A.P. Pollution Control Board v. Prof. M.V. Nayudu*.]

47. The mining operation is hazardous in nature. It impairs ecology and people's right to natural resources. The entire process of setting up and functioning of

mining operation requires utmost good faith and honesty on the part of the intending entrepreneur. For carrying on any mining activity close to township which has tendency to degrade environment and is likely to affect air, water and soil and impair the quality of life of inhabitants of the area, there would be greater responsibility on the part of the entrepreneur. The fullest disclosures including the potential for increased burdens on the environment consequent upon possible increase in the quantum and degree of pollution, has to be made at the outset so that the public and all those concerned including authorities may decide whether the permission can at all be granted for carrying on mining activity. The regulatory authorities have to act with utmost care in ensuring compliance of safeguards, norms and standards to be observed by such entrepreneurs. When questioned, the regulatory authorities have to show that the said authorities acted in the manner enjoined upon them. Where the regulatory authorities, either connive or act negligently by not taking prompt action to prevent, avoid or control the damage to environment, natural resources and people's life, health and property, the principles of accountability for restoration and compensation have to be applied.

48. Development and the protection of environment are not enemies. If without degrading the environment or minimising adverse effects thereupon by applying stringent safeguards, it is possible to carry on development activity applying the principles of sustainable development, in that eventuality, development has to go on because one cannot lose sight of the need for development of industries, irrigation resources and power projects etc. including the need to improve employment opportunities and the generation of revenue. A balance has to be struck. We may note that to stall fast the depletion of forest, a series of orders have been passed by this Court in T.N. Godavarman case regulating the felling of trees in all the forests in the country. Principle 15 of the Rio Conference of 1992 relating to the applicability of precautionary principle, which stipulates that where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation, is also required to be kept in view. In such matters, many a times, the option to be adopted is not very easy or in a straitjacket. If an activity is allowed to go ahead, there may be irreparable damage to the environment and if it is stopped, there may be irreparable damage to economic interest. In case of doubt, however, protection of environment would have precedence over the economic interest. Precautionary principle requires anticipatory action to be taken to prevent harm. The harm can be prevented even on a reasonable suspicion. It is not always necessary that there should be direct evidence of harm to the environment.

55. In respect of mining in the forest area, we may also refer to the National Forest Policy, 1988 issued by the Ministry of Environment and Forests, Government of India which, inter alia, notices that over the years, forests in the country have suffered serious depletion. One of the reasons for it is inadequacy of protection measures and diversion of forest land to nonforest uses, without

ensuring compensatory afforestation and essential environmental safeguards; and the tendency to look upon forests as revenue-earning resource. The basic objectives of the policy, inter alia, are maintenance of environment stability through preservation and, where necessary, restoration of the ecological balance that has been adversely disturbed by serious depletion of the forests of the country and checking the soil erosion and water conservation and increasing substantially the forest/tree cover through massive afforestation and social forestry programmes. It provides that the national goal should be to have a minimum of 33rd of the total land area of the country under forest or tree cover. In the hills and in mountainous regions, the aim should be to maintain 33rds of the area under such cover in order to prevent erosion and land degradation and to ensure the stability of the fragile ecosystem. It also provides that a massive needbased and time-bound programme of afforestation and tree planting, with particular emphasis on fuel wood and fodder development, on all degraded and denuded lands in the country, whether forest or non-forest land, is a national imperative.

56. The question of permitting mining in the area where large scale of afforestation with foreign funding has taken place, is required to be examined keeping in view the national forest policy which also provides that forest land or land with tree cover should not be treated merely as a resource readily available to be utilised for various projects and programmes but as a national asset which requires to be properly safeguarded for providing sustained benefits to the entire community. Diversion of forest land for any non-forest purpose should be subject to the most careful examinations by specialists from the standpoint of social and environmental costs and benefits. Mining and industrial development should be consistent with the need for conservation of trees in forests. It provides that no mining should be granted to any party, private or public, without a proper mine management plan appraised from the environmental angle and enforced by adequate machinery.

57. Our attention was drawn by learned counsel appearing for leaseholders to the part of the national policy which provides that beneficiaries who are allowed mining and quarrying in forest land and in land covered by trees should be required to repair and revegetate the area in accordance with established forestry practices to submit that the policy itself contemplates mining operations in the forest area. For the present, we are not suggesting a complete ban on mining operations on forest land so long as it is possible to undertake the said operation on the sustainable development principle and after obtaining due approvals under various statutory provisions including Section 2 of the Forest (Conservation) Act, 1980. At the same time, we are unable to appreciate the commencement and continuation of mining over areas on which crores of foreign funds have been spent for afforestation and plantation. Further, it is also not possible to accept the contention urged on behalf of the leaseholders that only that part of such leased land where allegedly damage has been caused to plantation as a result of mining operations, be excluded from mining and not the

entire area of the lease. For example, if the mining area is 5 hectares and damage as a result of mining is to plantation in an area of 1 hectare, it is not practicable or reasonable to exclude only that 1 hectare and permit the mining operation on the rest of the mining area. Reference can also be usefully made to the part of the State Forest Report, 1999 issued by Forest Survey of India in relation to Haryana. It, inter alia, provides that large-scale plantations were carried out under the Aravalli Project since 1992. The document claims increase of the forest cover in the State as a result of plantation under the Aravalli Project. It, inter alia, mentions that forest cover increase in Gurgaon and Faridabad is mainly due to plantation raised under the Aravalli Project which was started in the early 1990s. In these matters, neither the State nor the leaseholders can be permitted to turn round and now take a stand that the areas covered under the Aravalli Project are not forest. The National Forestry Action Programme of December 2000 issued by the Ministry of Environment and Forests of the Government giving project profile also makes detailed reference to the institution building and integrated national resource development in the Aravalli region, Haryana under the project implementing agency of the Forest Department, Government of Haryana. The project profile, inter alia, states that central to such a policy is rehabilitation of common lands to meet the needs of the rural poor and to reduce soil and water erosion, and the proposed programme was envisaged to bring the benefit of integrated development of the Aravalli ecosystem to the whole community, particularly, to the poorer sections. The project, it is stated, has been implemented in Aravalli hills situated in the five districts of Haryana including Gurgaon. One of the expected outcomes of the project is the reduced soil erosion and improved water regime in the rehabilitated area which will drastically reduce the run-off leading to recharge of constantly depleting groundwater resources. It records that the Haryana Forest Department has implemented a project on the eco-restoration of common lands in the Aravalli hills, from June 1990 to October 1999. The project is being funded by the Delegation of European Communities. The total cost was 28.8 million ECU in which external assistance was to the extent of 23.2 million ECU.

78. The provisions of the Act provide for the conservation of forest and for matters connected therewith or ancillary or incidental thereto. Any forest land or portion thereof cannot be used for any non-forest purposes or assigned by way of leases or otherwise to any private person or to any authority, corporation, agency or any other organisation not owned, managed or controlled by the Government, except with the prior approval of the Central Government. Mining activity within forest area cannot be permitted in contravention of the provisions of the Act. The Act makes the contravention of any of the provisions of Section 2 as an offence punishable in the manner provided in the Act.

82. In the instant case, it is not necessary to decide the legal effect of issue of the notification under Sections 4 and/or 5 of the Act. Not only in their record has the area been shown as forest but affidavits have been filed in this Court stating the area to be "forest". In *T.N. Godavarman Thirumulkpad v. Union of India* this

Court held that the term "forest" is to be understood in the dictionary sense and also that any area regarded as a forest in government records, irrespective of ownership, would be a forest. The State of Haryana, besides having filed affidavits in the forest matters treating such areas as forest for the purposes of the FC Act has been seeking prior approval from the Central Government for diversion of such land for non-forestry purpose. Reference in this connection may also be made to the affidavit dated 8-12-1996 filed by Banarsi Das, Principal Chief Conservator of Forests, Chandigarh, Haryana in *Environmental Awareness Forum v. State of J&K*. Our attention has also been drawn to letter dated 26-11-2002 addressed by the Divisional Forest Officer, Faridabad to the Mining Officer, Faridabad forwarding to him a list of blocked forest areas of Faridabad district and requesting him to ensure that the said forest areas are not affected by any mining operations as also to a letter dated 17-9- 2001 sent by the Principal Chief Conservator of Forests, Haryana (Panchkula) to the Director of Environment, Haryana stating therein that no mining activity can be permitted in the area. On the facts and circumstances of the case, we cannot permit the State Government to take a complete somersault in these proceedings and contend that the earlier stand that the area is forest was under some erroneous impressions. In the present case, for the purposes of the FC Act, these areas shall be treated as forest and for use of it for non-forestry purpose, it would be necessary to comply with the provisions of the FC Act.

96.4. No mining activity can be carried out on area over which plantation has been undertaken under the Aravalli Project by utilisation of foreign funds."

33. Their Lordships of Hon"ble Supreme Court in (2008) 2 SCC 222 in the case of *T.N. Godavarman Thirumulpad v. Union of India and others* and in the matter of *Vedanta Alumina Ltd.* have held that adherence to the principle of sustainable development is now a constitutional requirement. How much damage to the environment and ecology has got to be decided on the facts of each case. The courts are required to balance development needs with the protection of the environment and ecology. It is the duty of the State under our Constitution to devise and implement a coherent and coordinated programme to meet its obligation of the sustainable development based on intergenerational equity. Their Lordship have held as under:-

"3. As a matter of preface, we may state that adherence to the principle of sustainable development is now a constitutional requirement. How much damage to the environment and ecology has got to be decided on the facts of each case. While applying the principle of sustainable development one must bear in mind that development which meets the needs of the present without compromising the ability of the future generations to meet their own needs is sustainable development. Therefore, courts are required to balance development needs with the protection of the environment and ecology. It is the duty of the State under our Constitution to devise and implement a coherent and coordinated programme to meet its obligation of sustainable development based on

intergenerational equity (see A.P. Pollution Control Board v. Prof. M.V. Nayudu). Mining is an important revenue-generating industry. However, we cannot allow our national assets to be placed into the hands of companies without a proper mechanism in place and without ascertaining the credibility of the user agency."

34. Their Lordships of Hon^{ble} Supreme Court in (2009) 6 SCC 142 in the case of M.C. Mehta v. Union of India and others have held that environment and ecology are national assets. They are subject to intergenerational equity. Time has now come to suspend all mining in the said area on sustainable development principle which is part of Articles 21, 48-A and 51-A(g) of the Constitution of India. Their Lordships have further held that mining within the principle of sustainable development comes within the concept of "balancing" whereas mining beyond the principle of sustainable development comes within the concept of "banning". Balancing of the mining activity with environment protection and banning such activity are two sides of the same principle of sustainable development. They are part of precautionary principle. Their Lordships have also explained the concept of Mining plan, Object, Nature, Essence and components. Their Lordships have held as under :-

"20. Mining plan is prepared with the object of providing a systematic working of mine after considering every aspect of the background information, plant, machinery, method of working, object of mining, mining operations and reclamation of mined-out areas. It is a mandatory document comprising information about leasehold area showing nature and extent of the mineral body, prospecting data, details of geology, including mineral reserves, method of mining, manual mining, mechanised mining, nature and extent of water bodies, forest areas, density of the trees, protective areas, environment impact assessment of mining activity on forests, land surface, details of ecological restoration of area, land reclamation, use of pollution control devices and plans for excavation from year to year for five years and such matters and measures as may be directed by the Central Government or the State Government (see Handbook of Environment & Forest Legislations, Guidelines and Procedures in India by Ravindra N. Saxena and Sangita Saxena at p. 1529). The concept of mining plan applies to cases of mining of major minerals.

(c) Environmental management plan

21. Rule 22(5) of the Mineral Concession Rules, 1960 provides for various components of a mining plan. Every mining plan has to indicate limits of reserves, density of trees, assessment of impact of mining activity on forests, land surface and scheme for restoration of the area by afforestation, land reclamation and such other measures as may be directed by the Central Government from time to time. The mining plan includes an environmental management plan which must indicate the area degraded due to quarrying, dumping, etc., a statement on environment impact assessment giving details of the impact of mining on environment over a period of next 5 years, details regarding abandoned quarries/pits, measures to control erosion of watercourses,

treatment and disposal of water from the mines and reclamation of mined-out areas (see Handbook of Environment & Forest Legislations, Guidelines and Procedures in India by Ravindra N. Saxena and Sangita Saxena at pp. 1544-46).

45. Environment and ecology are national assets. They are subject to intergenerational equity. Time has now come to suspend all mining in the above area on sustainable development principle which is part of Articles 21, 48-A and 51-A(g) of the Constitution of India. In fact, these articles have been extensively discussed in the judgment in M.C. Mehta case which keeps the option of imposing a ban in future open.

46. Mining within the principle of sustainable development comes within the concept of "balancing" whereas mining beyond the principle of sustainable development comes within the concept of "banning". It is a matter of degree. Balancing of the mining activity with environment protection and banning such activity are two sides of the same principle of sustainable development. They are parts of precautionary principle."

35. Their Lordships of Hon"ble Supreme Court in (2009) 9 SCC 737 in the case of Tirupur Dyeing Factory Owners Association v. Noyyal River Ayacutdars Protection Association and others have held that if in spite of stringent conditions, degradation of environment continues and reached stage of no return, Court may consider closure of industrial activities in areas where there is such a risk. The authorities have to take into consideration macro effect of wide-scale land and environmental degradation caused by absence of remedial measures. Their Lordships have held as under :-

"26. The concept of "sustainable development" has been explained that it covers the development that meets the needs of the person without compromising the ability of the future generation to meet their own needs. It means the development, that can take place and which can be sustained by nature/ecology with or without mitigation. Therefore, in such matters, the required standard is that the risk of harm to the environment or to human health is to be decided in public interest, according to a "reasonable person"s" test. The development of the industries, irrigation resources and power projects are necessary to improve employment opportunities and generation of revenue, therefore, cannot be ignored. In such eventuality, a balance has to be struck for the reason that if the activity is allowed to go on, there may be irreparable damage to the environment and there may be irreparable damage to the economic interest. A similar view has been reiterated by this Court in T.N. Godavarman Thirumulpad (104) v. Union of India and M.C. Mehta v. Union of India.

27. In case in spite of stringent conditions, degradation of environment continues and reaches a stage of no return, the Court may consider the closure of industrial activities in areas where there is such a risk. The authorities also have to take into consideration the macro effect of wide-scale land and environmental degradation caused by absence of remedial measures. The right to information

and community participation for protection of environment and human health is also a right which flows from Article 21 [vide *Bombay Dyeing & Mfg. Co. Ltd. (3) v. Bombay Environmental Action Group*, *T.N. Godavarman Thirumulpad v. Union of India*, *Research Foundation for Science Technology National Resource Policy v. Union of India*, *N.D. Jayal v. Union of India*, *M.C. Mehta v. Kamal Nath* and *Susetha v. State of T.N.*].

34. Undoubtedly, there has been unabated pollution by the members of the appellant Association. They cannot escape the responsibility to meet out the expenses of reversing the ecology. They are bound to meet the expenses of removing the sludge of the river and also for cleaning the dam. The principles of "polluter pays" and "precautionary principle" have to be read with the doctrine of "sustainable development". It becomes the responsibility of the members of the appellant Association that they have to carry out their industrial activities without polluting the water.

36. In order to regulate the mining activities in State of Uttarakhand, an emergent action is necessary to avert danger to the soil, the environment, the ecology, the natural resources, underground water, the forests, the flora and the fauna and the socio-economic conditions of the inhabitants of the Uttarakhand. There is apparent conflict between development and conservation. We have to maintain balance between the two principles on the basis of "sustainable development".

37. In the Book "Mining & Environment in India" edited by Shri S.C. Joshi & Shri G. Bhattacharya in article written by learned author Shri K.C. Sahu under captioned "Environmental Impact Assessment of Mineral Exploitation" has made following pertinent observations:-

"Limits of Mineral Exploitation

To support an ever increasing population and to maintain continuation of supply of raw materials to the industrialised society and to increase the quality of life, larger and larger quantity of earth resources have to be supplied. Indeed the quantity and variety of mineral resources used by a society is considered as an index of development and progress. Looking into the rate of consumption of raw materials by some of the industrialised rich nations, Romney (1965) called it "Mineral demand explosion", and the persistent effort of the underdeveloped or developing nations to rush in their foot-step, the Club of Rome (Medows et al, 1972) forecasted a raw material famine by the end of the century for many key minerals. However, exploration strategy, technological advances in the know-how for extraction and discovery of new and cheaper sources of energy for extraction of the desired stuffs have made it theoretically possible to utilize the lower than the lowest grade ores increasing the resources reserve severalfolds. Apparently the rate of precipitation of some of the sea-bed minerals like manganese nodules is considered to match the present consumption rate of the metal (Mero, 1967). Besides, synthetic substitutes and alternative materials always appear in the

market whenever the need arises. Collection of scraps and recycling of wastes have also made the non-replenishable resources virtually replenishable, except for those which are too difficult to collect or contain in the present level of entrapment in the utility cycle and leak out into the environment (Fig 2 after Brooks, 1976). "The sufficiency of physical resources in the earth's crust has become a matter of hot debate. Prophecy about the prospective exhaustion of the world's resources is rooted in the shifting stands of statistics on proved reserves" (U.S. National Commission on Material Policy, 1973) (Fig 3 after Govett et al, 1974 and Fig 4 after McKelvey, 1974). Therefore, the spectre of world mineral starvation, once the slogan of many futurologists no more threatens the technologists of the present generation whose contention is "if oil and coal are exhausted (imagine the amount of CO₂ that would be generated) man will turn for nuclear fission, then to fusion (irrespective of waste disposal problem?) and if natural resources are finished, there will be synthetics".

Resources are almost infinitely greater than assumed by the Serra Club who brought out the scarcity model in terms of data available during the period. The geologically available resource becomes economically exploitable reserve depending on market conditions and technology. The scare is false and technology has always been able to extend the horizon of the resources reserve. For example with improved beneficiation and processing technique copper ore of 0.5% grade is today considered economically mineable and with micro-biol heap leaching, mining of 0.1% grade ore is not far from sight. However looking into the average lead time in mineral exploitation which take more than a decade to translate a "strike" to production and the rate of increase in consumption, the proved reserves of most key minerals are likely to be exhausted and here lies the "mineral crisis" model proposed by the Doomsters in the Limits of Growth.

The "Limits of Growth" does not arise out of scarcity of resources, but out of scarcity of energy to convert the resources into products. The limits of energy again do not arise out of shortage of fossil or fissile fuels or in lack of technological know-how to harness "alternate", "clean" or "nonconventional" energy, but out of environmental impact in their use. For examples: the "greenhouse gas" problems in burning of fossil dangers associated in operating nuclear power plants, the wellknown problems of large dams generating hydel power, the possibility of large-scale surface water pollution in harnessing geothermal energy and last but not the least the possible impact on earth's rotation due to massive tapping of wind and tidal power have to be considered in the long run. In global mineral exploitation, a true environmentalist must think "globally while acting locally" (Clark and Holling, 1985). Besides we must remember that "to look is easy and to think is difficult" (Home 1978) but to act is dangerous.

Thus, while the capability of modern technology to provide the material hungry society a reasonable supply of mineral raw materials or substitutes for progress or what is known as improvement in quality of life is unquestionable, the impact

of the technological endeavour on the environment, society and earth as a whole bring about the "The Limits to growth" (Meadows et al, 1972).

38. In the same book, learned authors; Mr. S.C. Patnaik & Mr. S. Ray, in article "Mining and Environment" have stated as under :-

The mining operations like drilling, blasting, ore-crushing and other associated activities are carried out in underground and open-cast mines. Mining operations can damage the environment and ecology to an unacceptable degree, unless carefully planned and controlled. There is the need for specialist to assess the environmental & ecological impact of mining and for mining operations to be a balance between mining engineering and environmental requirements. The environmental assessment team should be set up in the initial stage in the planning process. Mining operators should always consider engaging the best possible environmental issues alongside the mining engineers. If it is not done, more time will be required to obtain an approval for mining projects or it may be refused altogether.

Different Types of Pollution In Mining Industry

In order to combat the pollution problems in the mining activities, extensive environmental control measures have been launched in some of the developed countries. Considering the mining industry in its entirety, the following environmental problems are classified:-

- i. Visual
- ii. Subsidence
- iii. Noise
- iv. Ground vibration from blasting
- v. Air blast
- vi. Air pollution
- vii. Water pollution
- viii. Nuisance due to transport
- ix. Ecological disturbance.

1. VISUAL IMPACT

i. Source

All the working mineral processes in mining create an unwanted visual impact. The visual impact on the mines workings are due to the following sources:

a) Surface excavations:

The magnitude to which surface excavations intrude into the landscape bears no

direct relationship to size. The nature of excavation, the surrounding landforms and the relationships between the two are the main factors. Fresh rock exposures created by surface mining are often highly visible. Serious visual impact is caused by the excavation intersecting the skyline. The resulting gap is almost invariably highly prominent.

b) Waste Disposal:

Dumping of solid wastes, impounding of slurries, etc. cause visual intrusion. A particular problem of mining non-ferrous metals like lead and zinc is the disposal of tailings. Some impoundments are initially constructed so as to serve the life of the mine, but it is more common for dam walls to be progressively raised over an extended time period. Such methods result in long term visual intrusion.

c) Fixed plant:

Non ferrous metal mine requires crushing, grinding, classifying and processing circuits. Underground mines have headframes, and haulage or winding equipment. These equipments are located for a wide area. Very frequently, the fixed surface plant gives rise to visual impacts.

d) Mobile plant:

Mobile equipment also give rise to visual intrusion. Occasional nuisance is created by vehicles working various locations.

e) Air and water pollutants:

In addition to their nuisance as physical and chemical pollutants, liquid effluents and aerial emissions also cause aesthetic nuisance.

ii. Measures for control

All the underground mines should be confined and located in sparsely populated remote regions away from highways and densely populated areas. Then there would be no pronounced impacts affecting the surrounding landscape. Preparation of a landscape plan before starting operations will help in minimising the visual impact.

2. SUBSIDENCE

i. Source

By underground mining operations, the material from the earth's hard rind is removed. This causes ground movement and consequential deformation of the surface depending upon the geometry of the mineral deposit, the method of mining and the nature of the mineral deposit and the overlying strata. Surface subsidence causes damages to man-made structures and it affects the ground-water regime, surface drainage pattern, highways, building and bridges. Sometimes the water and the gas mains may also get sheared or twisted.

ii. Measures for Control

To minimize the severity of deformation of the surface, modified mining methods should be adopted. Before designing new mining operations, the following points are to be taken into consideration:-

- a) The proposed site should be sufficiently away from areas of natural geological discontinuities (faults, thrusts, fractures etc.)
- b) The structures should be designed with factor of rigidity, flexibility, etc. with due consideration for the subsidence problems and geo-technical setting.
- (c) The mining should be planned to permit controlled subsidence with the entire overlying ground subsiding uniformly by using harmonic mining.
- (d) The mined areas should be filled with sand or suitable packing material. Cut and fill system of mining also helps to prevent subsidence.

3. NOISE

i. Source

The three major categories of noise source in mining operations are fixed plant, mobile plant used internally and external transport movements. Fixed plant machineries such as crushers, grinders, screens, conveyors, ventilation fans, etc. generate noise and vibrations. Similarly the mobile plant used on site associated with drilling, blasting, loading, haulage or service operations causes noise also. Thirdly, the external transport movements which are related to mining operations like supply to materials, the despatch of valuable product and waste by road, cause noise problems.

ii. Measures for Control

There are three basic control techniques available: to lessen the noise generated at source, to isolate the source or to increase the attenuation or absorption between the source and listener. Noise is best controlled at source by choosing machinery and equipment suitably by proper mounting of equipment and ventilation fans and by providing noise insulating enclosures or padding. Noise of aerodynamic origin may be reduced by the use of absorption type silencers. Reactance mufflers can be used where the noise is caused by repeated pluses by gas, as in the case of exhaust of diesel and compressed air powered machines. Absorption mufflers can be used where there is a continuous noise such as a blower or pump. Regular maintenance of machinery and equipment can also affect significant reductions in noise levels. Residential colonies should be located reasonably away (about 3 km) from the mining premises. Boundary walls (bafflewalls), waste banks and dense belt of trees should be erected to act as acoustic barriers. A 10 m wide belt of trees of different heights act as a noise absorbant.

4. GROUND VIBRATIONS FROM BLASTING

i. Source

In the blasting operations carried out in mines, the potential energy contained in the explosive is suddenly released, normally with the primary intention of fragmenting rock. A secondary and undesirable result of explosive detonation is that the surface of the ground in the vicinity of the blast undergoes displacement, the amplitude of which depends upon the distance from the blast, the energy released in explosion and the local geological conditions. Ground vibrations are caused by blasting operations, subsidence due to mining operations, deployment of mobile equipments, rock bursts and rock bumps. Blasting also generates air vibrations and in turn damages structurally unsound buildings. These vibrations cause annoyance also to human beings.

ii. Measures for Control

The following actions are necessary in controlling the nuisance due to blasting:-

- a) Careful supervision of drilling and blasting is to be carried out.
- b) Monitoring and checking of the vibration levels are to be done regularly at sensitive points.
- c) The vibrations from the test shots should be monitored to determine the site factors and the directional influence of local geology.
- d) The maximum instantaneous charge permissible should be calculated.
- e) Blasting patterns should be designed in such a way that these conform to the maximum instantaneous charge permissible.
- f) Inspection of building likely to be damaged by blasting is to be carried out by noting age, conditions, etc.

5. AIR BLAST

i. Source

The vibrations are caused in the air due to blasting operations and the same is multiplied through the atmosphere as sound waves. The main factors affecting air blast are:-

- a) The release to atmosphere of the gases from unconfined or partially confined blasts.
- b) The release of gases to atmosphere from an exposed detonating fuse.
- c) Ground vibrations resulting from blasting. Ground movement produces air vibrations.
- d) Sudden subsidence of large area.

ii. Measures for Control

- a) Over charging should be avoided by considering depth, load and spacing while calculating charge weight per hole.
- b) By the use of relays, the maximum instantaneous charge detonated should be limited.
- c) Adequate stemming is to be ensured.
- d) The detonating fuse should be possibly replaced by electric initiation.
- e) Low energy fuse should be used rather than high energy detonating fuse.
- f) The detonating fuse should be covered with atleast 15 cm of consolidated material preferably drilling dust and chippings.
- g) When unfavourable atmospheric conditions such as temperature inversions, adverse wind direction and low cloud ceiling prevail, the blasting should be avoided.

6. AIR POLLUTION Air pollution is defined as the presence in atmosphere of substance which adversely affect living organism or their habitats.

i. Source

Air pollution caused by mining and associated activities can be classified into:-

- a) Gaseous pollutants (sulphur dioxide, nitrogen oxides, carbon monoxide and hydrocarbons).
- b) Suspended particulate matter (silica, fluorides, asbestos and metallic mineral dust).

Air pollutants from mining come from two types of sources: Point and non-point source. Point source of air pollutants are from drilling, crushing and screening machinery, conveyors and transshipment points. The nonpoint source of air pollutants are from blasting (dust and combustion gases), haulage over internal and external roads, and general dust blow from working areas, dumps, stock piles, tailing dumps etc. From these, dust is the main pollutant.

ii. Measures for Control

The measures which can be taken to control the air pollution are:-

- a) Dust suppression and extraction system should be provided by providing blowers, cyclones and wet scrubbers at the ore handling plant i.e. crushing and grinding units.
- b) In case of open-cast mines, the haul roads are to be sprayed with water to suppress dust.
- c) Transportation of minerals from mines to plant is the main source of dust. To prevent dust from being air borne transport equipments like trucks, dumpers and railway wagons should be leak proof and properly covered. Alternatively suitable

chemicals or water may be sprayed on the top to prevent dust effect. In the recent times wholly sealed containers have been mooted for transporting metallic concentrates.

d) To reduce the dust nuisance, measures like adoption of hoods at transfer points, proper design of chutes, vulcanising of conveyor belt joints, under belt cleaning devices should be adopted.

e) Dense belt of trees should be planted on road sides. These trees would serve as dust arresters. Trees planted on one hectare can arrest about 50 tonnes of dust.

f) For controlling the dust on the tailing dumps revegetation or some other form of surface stabilization to growing grass or herbs is to be done.

7. WATER POLLUTION

i. Source

The sources of liquid effluents generated in mining operations are:-

a) Mine water pumped out during drainage operations.

b) Spent water from handling plants, dust extraction and dust suppression systems.

c) Effluents from beneficiation plants, leachates/wash offs from waste/tailing dumps.

ii. Measures for Control

a) All possible steps should be taken to prevent the discharge of toxic effluents into surface water bodies, ground water aquifers. All possible ways of reusing the waste water should be thought over.

b) Effluents generally should be treated to conform the standards laid down by the Central and State Boards for prevention and control of water pollution before discharge.

c) Wherever practicable, the mine water should be used for irrigation of the plantations raised to stabilize the mine waste dumps.

d) Acid mine drainage can be controlled by the following methods:

i. By prevention of the formation of acid mine drainage at source itself. The techniques include modified mining practices, sealing of abandoned mine entrances & drainage levels etc. Surface reclamation, water diversion, and control of ground water flow system by well fills to prevent the exposure of ground water to sulphides in a mine, coating sources with gels.

ii. To control the acid mine drainage techniques like deep well injection, subsurface dams and grout curtains should be adopted.

- iii. The acid mine drainage should be diluted to an acceptable effluent quality.
- iv. Standard waste water treatment methods should be incorporated for neutralisation and removal of solids. The techniques are lime treatment followed by oxidation process to convert ferrous to ferric iron, neutralisation with soda ash, caustic soda and anhydrous ammonia, reverse osmosis, ion exchange, electrodialysis, evaporation, ozone oxidation, desulfating, sulfide iron removal, microbiological iron removal.

8. NUISANCE DUE TO TRANSPORT

Mining operations require a two way flow of goods, material, and the products with the external community. The transport associated with this exchange inevitably represents an extension of mining activity into the external environment, and often directly confronts the general public with environmental problems. The seven most important types of mineral transport are by:-

a) road, b) rail, c) sea, d) inland waterways, e) aerial ropeway, f) conveyors, g) pipe lines.

i. Source

Pollution problems are associated with all these types of transport as described above to some extent or other. Road transport method normally occasions the greatest number and range of environmental complaints. The principal areas of concern are public safety and inconvenience, noise and vibration, air pollution and visual intrusion. The main environmental disadvantages of rail transport are noise, vibration and dust. The environmental problems connected with sea transport are at the loading and discharge points as similar to those of rail. Inland waterways transport also has the same type of environmental problems as described for sea transport. The pollution problems associated with the conveyors are dust and visual intrusion. In the same fashion for the aerial ropeways the problems are similar. Finally in the case of pipelines the only problem is the very slight possibilities of pollution from leaks.

ii. Measures for Control

a) Precautions for the transport of materials both as regards personal safety and minimisation of loss of values during operations can be handled routinely since the methodology and techniques exist. Modern practice tends towards the use of explosive slurries which are mixed with chemicals to render them harmless in transit. Some of the chemicals used in ore beneficiation are in some forms and usages dangerously toxic. The special precautions for transporting dangerous substances should be observed.

b) The concentrate after filtration being fairly dry can readily be dispersed by wind or spillage. When the concentrate has to be transported over long distances or shipped overseas, covered containers should be employed and precaution against spillage and wind blown dust should also be taken in unloading. Storage

areas also ought to be covered and protected from the wind to avoid dispersal of the concentrate over the surrounding neighbourhood. This is more necessary in the case of lead bearing concentrates.

c) In case of dust problems in the conveyors and aerial ropeways, this can be controlled by the use of water sprays, regular maintenance or by total enclosure. Visual intrusion problem connected with conveyors and aerial ropeways can be solved by careful selection of the route and minimising the height of structures.

9. ECOLOGICAL DISTURBANCE

In the overwhelming majority of cases, the reclamation for whatever purpose of abandoned mineral workings require the establishment and maintenance of vegetation on the disturbed land. No other medium can achieve rapid visual reintegration, surface stabilisation or reductions in air and water pollution nor offer a wide variety of land use possibilities which can be achieved at acceptable cost. The design of the mining programme materially causes revegetation problems. In natural circumstances, plants exist in a soil, formed by weathering and biological processes from a parent rock which may or may not underlie it. The precise type of soil, which forms, depends upon the complex interactions between the parent rock, the climate, and the type of plants and animals which first colonise it.

i. Sources

The problems which affect revegetation on mine waste are: a) Toxicity of metals and other contaminants, b) Water balances, c) Particle size of mine waste, d) Temperature, e) Wind turbulences, f) Compaction, g) Nutrient deficiencies, h) Surface instability due to wind or water erosion on slopes.

39. In the same book, learned authors; Mr. S.P. Baloni & Mr. Raj Tilak, in article "Mining and Ecological Impact on Himalaya" have held as under : -

Himalaya is sacred and important not merely for its aesthetic value but because it is the fount of life for the entire sub-continent. Instrumental in determining the climate of the region, it is a source of life-sustaining rivers and fertile alluvium besides being a treasure house of herbal and medicinal plants, minerals and a wealth of genetic plant and animal strains yet unknown to us.

Himalaya contains a large variety of minerals which are economically very viable. It contains minerals like limestone, magnesite, phosphorite, talc, gypsum, diaspore, graphites and barite. The metalliferous minerals are copper, lead and zinc.

Limestone of different grades is present in large quantities in many parts of the Himalaya. The lime deposits around Mussoorie and in between Dehra Dun and Mussoorie are of extraordinary pure material. It has been found acceptable to sugar industry. Uttar Pradesh State Mining Development Corporation has established a lime based chemical industry at Dehra Dun. Deposits of magnesite

occur extensively in the U.P. Himalaya. This is used in the manufacture of fire-bricks employed in the steel industry. Phosphorite deposits are found in U.P. Himalaya and Himachal Pradesh. The pyrite phosphate is available in Mussoorie hills. Talc, also called steatite or soapstone, is found in small pockets in the Garhwal and Kumaun Himalaya. Uranium deposits have been found in Ghansali area of Tehri- Garhwal. During the past half a century, these rich mineral resources of Himalaya have been exploited and besides, mining activity has been witnessed in Mussoorie hills. The general public and environmentalists have observed detrimental effect of mining and raised this issue with the highest authority in the Government and the judiciary. The Supreme Court of India has recently put a blanket ban on mining in Mussoorie hills. It is the endeavour of the authors to bring out the effects of mining on the environment of Himalaya in this paper.

Today, due to mining and deforestation, rivers cause devastating floods not only in the mountains but in the plains as well. Every year, hundreds of people are killed and a thousand more are rendered homeless. Thousands of tons of irreplaceable fertile topsoil is washed away, resulting in declining agricultural outputs, thereby adding further pressure on natural resources. Forest lands are deprived of soil holding vegetation. Hillsides are sinking and cracks have developed in the rocks. As such, the landslides have spoiled the character and beauty of the mountains.

Fragile Nature of Geological Structure of Himalaya

The Himalaya is one of the youngest mountain systems of the world; it is geologically unstable and made up mostly of stratified and sedimentary rock formation. The instability of the Himalayan regions is exemplified by the occurrence of earthquakes; several earthquakes in recent times have affected vast areas in the Himalaya. It is anticipated that such violent movements will continue in future. To-day the fragile structure of the Himalaya is being further undermined by the construction of huge dams, mining, use of high potency explosives and the tunneling of deep surge shafts which will eventually channel great volume of water. These activities have shaken the loose rocks of the mountains.

Due to quarrying limestones in the hills of Mussoorie, the environment of Doon Valley has become imbalanced. It has disturbed the stability of the fragile ecosystem. The extraction of the minerals initially disturbs the land-soil-vegetation system by removal of vegetation and top soil. This phenomenon is associated with mining. The high rainfall (specially in monsoons) worsens the land instability introduced by mining. The extraction of limestone creates a deteriorating ecological impact on land resources. The use of explosives to remove the rocks weakens the already fragile rock structure. Landslides due to mining have further increased the silting in the rivers and streams of the Doon Valley. Increased silting has also been observed in Bhagirathi river due to construction activity in connection with a Dam at Tehri.

Turbidity and Its Effect on Aquatic Environment

Turbidity or silting also adversely affects the fauna and flora of the streams and rivers. It also hinders in the process of photosynthesis among photoplanktons. The highest and lowest turbidity changes have been found to be associated with minima and maxima of phytoplanktons. In the Bhagirathi river, downstream from Tehri, due to excessive turbidity by the construction of dam, there has been a continuous decrease in the quantity of phytoplanktons, zooplanktons and fish communities. The turbidity decreases dissolved oxygen and increases carbon dioxide in the river water. Fishes are unable to detect their food in turbid waters. The feeding activity gets reduced, the gut is either empty or with only a small amount of food material. This could be due to the following reasons.

The increased turbidity affects the feeding of the fishes. In most of the fish, the stomachs were found to be empty and devoid of any food item. It appears that the turbidity of the water is correlated with the decreased feeding activity of the fishes. In turbid waters, on the other hand, the fishes are unable to detect the food with ease.

The water resources of the Doon Valley are slowly and gradually drying up due to quarrying of the limestone deposits of the Mussoorie hills. The water retention power of the hills is exorbitantly reduced due to loss of top soil and vegetation cover and as such, the rain water quickly flows down the hills. As a result, the aquifers are not annually charged and the natural springs slowly die out. The valley is served mainly by streams originating in the Mussoorie hills. Calcium carbonate from lime based industries and dust from cement factory has polluted the environment of Doon Valley and the entire valley is turned into a gas chamber. The cement dust, which is a mixture of calcium carbonate and silica, affects the animal and plant life of this area. The dust layer on the plants (specially on the leaves) hinders the process of photosynthesis, transpiration and exchange of gases. Due to the layer of dust, the leaves do not get sun light (radiant energy) properly and slowly and gradually the chlorophyll pigment of the mesophyll tissue of the leaves gets disintegrated and ultimately the leaves become pale and yellow. The trees are unable to synthesise their food and as a result, they perish. This magnitude of pollution is also affecting the famous Basmati rice crop of Dehra Dun. Quarrying for the limestone and phosphates have destroyed the green cover of the earth. The fertile top soil has been destroyed. It is estimated that one inch of natural soil formation takes place in 400- 1000 years. During the process of unscientific mining, this layer is destroyed within days. The mining is fast spreading over the Himalaya, unspectacularly but relentlessly. The beautiful Himalayan forested hills are becoming bare producing, ugly landscapes. The wildlife is getting exterminated. This ecological stress in the mountains has a destructive impact in the plains because of the fury of floods, the siltation of reservoirs and dams, the loss of agriculture leading to irrecoverable human and economic losses.

40. In the same book, learned authors; Mr. R.C. Upadhyaya & Mr. C.C. Pant, in

article "Mining Activities in parts of Eastern Kumaun Himalaya and their Environmental Impact" have stated as under :-

Kumaun is rich in its mineral wealth, specially in magnesite, talc, dolomite, limestone and gypsum etc. Being bestowed with important mineral deposits, Kumaun is no exception to the problems of environmental degradation caused by the mining operations. Extraction of minerals in this part is not a recent phenomenon. Evidences of old workings are seen at various places, which signify the smelting operations in the past. The slag material is seen scattered on the hill slopes at various localities. Significantly this region a very advance copper and iron industry in the past, over three hundred years old. With the advent of modern industrial advancement, the Himalaya, in general, were searched for various industrial raw materials. The actual scientific mining however, started recently. Recent surveys by various government organizations and universities have proved that these mineral deposits, if properly utilised and assessed, can bring about an economic revolution for the region. Although the variety of minerals is not very much, however the important occurrences/deposits of magnesite talc, limestone, dolomite, copper and lead are known (Fig 1). Significantly Kumaun has the richest magnesite deposits of the country, presently being mined at some place. Herbert (1842), Medlicot (1864), Auden (1935), Heim and Gansser (1939), Nautiyal (1942, 1953), Muktinath (1949), Muktinath and Wakhloo (1961), Misra and Valdiya (1961), Valdiya (1968, 1972), Safaya (1976) are pioneer workers, who described various mineral occurrences in Kumaun. Valdiya (1968) comprehensively described the various magnesite deposits of Kumaun stretching between the Kali river in the east and the Satluj river in the west.

The complex structural architecture of Kumaun Himalaya consists of all the four Himalayan physiographic-geologic subprovinces. On being traced northward, these are (1) The Outer Himalaya or Sub Himalaya (2) Lower or Lesser Himalaya (3) Higher or Great Himalaya and (4) Trans or Tethyan Himalaya. The geological details are beyond the scope of the present paper and for more information, the work of Heim and Gansser (1939), Gansser (1961) and Valdiya (1980) could be referred.

Mineral Resources: Present Status and Future Prospects

The chief mineral occurrences/deposits associated with these geotectonic units are described below in order of their abundance and distribution.

Limestone- The basal horizon of the Gangolihat dolomite is predominantly made up of limestone with thin bands of dolomitic limestone. In the Pithoragarh district three distinct belts of limestone are recognizable. The first, extending from Baste to Naulara (Ramganga valley) and further eastward is about 20 km long and 230 metres thick and consists of about 3.4 million tonnes of cement grade (CaO 74.2%, MgO 2.5 and insoluble residue 10-13%) limestone (Kumar et, al., 1970). Another band of cement grade limestone is recorded from Postala-Kulur Gad

area. This belt is about 6 km long and 25 metres thick with a total estimated reserves of 16 million tonnes. A very significant band has been recorded south of Gangolihat. This is about 13 km long and 50 to 200 metres thick, extending along Nargol Gad, Bagaur, Chaunala and Suitola. Chemically it consists of Ca 45-50%, Mg 0.75 to 1.80%, and SiO₂ 5 to 13.20, with an average of about 10.38%. About 60 million tonnes of limestone has been estimated and the U.P. State Cement Corporation has proposed to establish a cement plant near Chaunala. The Calc-tuffa of the Krol Formation of Nainital area is of cement grade. About 55,000 tonnes reserves of calc-tuffa (CaO 32-53%, MgO 2%, Al₂O₃ 3%, SiO₂ 1-10%) have been recognised from Chunakahan-Saulena-Adhaura area. Another marmorized limestone belt has been found north of Nainital, extending from Betalghat- Jaurasi to Nathuakhan. The average chemical composition of the limestone of the belt is CaO 46.06, Al₂O₃ 1.53, SiO₂ 14.63, Fe₂O₃ 1.211 and LOI 36.33 Kumaun has very rich limestone deposits. Detailed investigations are still to be carried out.

Dolomite- Dolomite is found in many parts of Kumaun. The Gangolihat Dolomite Formation of the eastern Kumaun Himalaya is predominantly made of dolomite. The deposits are vast and no systematic attempt has been made to calculate the reserves of dolomite deposits. The Krol Formation of Nainital area are predominantly made up of dolomite.

Dolomite is an important mineral used in refractory, and as flux material in steel, glass, paper and sugar industries.

Magnesite- The magnesite deposits of Kumaun are one of the biggest deposits in India. It is used in steel and cement industry for making refractory bricks. The coarsegrained Kumarun magnesite is found associated with the uppermost horizon of the carbonates of Gangolihat dolomite. The deposits stretch between the river Kali in the east and Alaknanda Valley in the west. (Valdiya, 1968).

North of Pithoragarh, an important deposit extending along Bisabajer, Chandak, Dharigaon, Baste has been located (Fig 1).

The average chemical composition of the deposit is MgO 42.3%, CaO 1.66%, SiO₂ 5.53% and R₂O₃ 3.41% (Valdiya, 1976). In the east, another significant belt is found along Rithait-Fadyali-Dhuraphat upto Jhirauli. (The Jhirauli deposit consists of about 3.3 million tonnes of magnesite, economically being mined by M/s. Almora Magnesite Ltd., since 1974. The average chemical composition of the deposit is MgO 42.05%, CaO 1.22%, SiO₂ 2.5% and R₂O₃ 3.10%. Another chain of magnesite is found extending from Panthsera, Gandoli, Dungari, Dewalthal, Bora-Agar and Rain-Agar in the east, and extends west ward from Bhurgaon-Dewaldhar towards Girichhina. The average composition of the deposit is MgO 43.39%, CaO 1.40%, SiO₂ 2.83% and R₂O₃ 1.71%. South of Main Central Thrust a chain of magnesite is also recorded extending from Paiya in the east and Tupar, Jakh and Jakheri in the west (Lahor Valley). The thickness of a few important magnesite deposits is given in Table 1.

Talc - It is found associated with the magnesite and dolomite. Preliminary surveys indicate occurrences of high grade talc in Almora, Pithoragarh and Chamoli district. The deposits of Jakhera, Lahor Valley, Agar- Girichhina, Khuna, Pachar, Pungar Valley, Pinya-Pauri, Ritha Raintoli, Dewalthal, Rain Agar have proved to be economically exploitable. An estimated reserve of about 2 million tonnes have been calculated in the deposits of Girichhina, Badolisera, Chimta and Kanda. The Pangar and Lahor Valleys, deposits are estimated to have 4.1 million of talc. In the Pithoragarh district near Malajhula, about 4 km long and 60 metres thick talc and has been located (Valdiya, 1976). There are many known occurrences of talc but detailed investigations are still to be carried out.

Environmental Impacts of Mining Activities

Being bestowed with important mineral deposits Kumaun is no exception to the environmental degradation caused by their unscientific exploitation. In the present investigation a few mines such as Chandak magnesite, Tarigaon magnesite, Jhirauli magnesite, Chharendev magnesite, Toli talc mine, and Dewalthal talc mines (Fig 1) and other small mines were investigated and the observations are described in the following pages.

Chandak Magnesite Mines (District Pithoragarh)

North of Pithoragarh, around Chandak many magnesite and talc occurrences have been reported in the recent years. The Chandak mines are located about 156 km from the railhead Tanakpur. Some of the magnesite deposits around Chandak are being economically exploited such as near Tarigaon, Dharigaon, Dhunga. The magnesite is associated with stromatolitic dolomites and dolomitic limestones in the uppermost horizon of the Gangolihat Dolomites (= Deoban). It occurs in lenticular forms and is coarse-grained greyish, whitish and light pink in colour. The mining activities in these mines were started in 1973, by two private concerns namely M/s Himalayan Magnesite Ltd. and Orissa Industries Ltd.

The average chemical composition of the magnesite is MgO 42.3%, CaO 1.66%, SiO₂ 5.53 and R₂O₃ 3.51% (Valdiya, 1976) thus making it suitable for refractory bricks. The area has a total estimated reserve of 3 million tonnes. The annual production, during 1985, for different mines was - Chandak (231850.598 mt), Dhunga (6250 mt) Dharigaon (3185 mt) and in Tarigaon magnesite for 1984 the production was 180139.66 mt.

The mining is done by the opencast methods and the extraction is carried by dynamite blasting and handtools. The magnesite is slid down the hillslopes to the dumpsites. In the process of excavation, benches and approach roads are made for an easy excavation of the material.

Environmental Problems

The indiscriminate and unscientific methods of mining in the geodynamically sensitive areas has caused serious environmental problems in this sector of Himalaya. The various aspects of environmental degradation, as observed during

field work are described in the following pages.

Deforestation- Prior to the mining activities the vegetal cover is removed from the mining sites, accelerating erosion and mass movement. The scree which is allowed to slide down the hill slopes near Dhunga (Plate 3), Tarigaon and Chandak is harming and hampering the growth of trees, shrubs and grasses. The recent growth of xerophytic plants around Chandak area indicate emergence of semidesertic to desertic climatic conditions in the area caused by unscrupulous felling of trees.

Mass-Movement and siltation - In the process of excavation a huge amount of debris is allowed to roll down the valley slopes, accelerating the erosion. The scree originating from Chandak mines is swept away by the Papdev stream. During the last 13 years, more than 4 metres thick sediment load has been deposited in the stream, resulting in the widening of channel, flooding of low lying cultivated fields and accelerating bank erosion (Plate 2). The flash floods have completely destroyed the boundary walls and fencing of the cultivated fields such as seen near Papdev village, northwest of Pithoragarh township and along Rai gadhera. The very poorly maintained approach roads too contribute a large amount of mass wasting and sinking of the ground. On an average, construction of one kilometer road in the hills requires removal of about 40,000 to 80,000 m³ of debris (Valdiya, 1985). As such the unmetalled approach roads connecting the mines to the main roads, such as Chandak- Dharigaon (3 km) Pithoragarh town-Tarigaon (1.9 km) Chandak to Dhunga (2.5 km), generate a large amount of loose debris. The loose material is allowed to roll down the slopes triggering off the landslides, increasing mass movement and reactivating the erosion processes. Most affected areas are the banks of Rai gadhera and western slope of Mostmanu. The abandoned mining sites in the area continue to present dangers because of unsealed shafts, sharp cliffs and unstable spoil piles etc. The villagers informed that many cattles die every year due to such mining menace.

Geohydrological impacts - The mining activities have largely affected the local surface drainage as well as the groundwater conditions in area. Few years back, before the mining operations started in the Dharigaon area, there used to be water mills along the Chhanna gadhera, but the excessive siltation and debris flows in the stream have completely changed the hydrological conditions and there is no water in the stream for running the mills (Plate 6). Moreover the excessive siltation has not only accelerated the erosion but has also destroyed the gradient required for running the mills, such as seen near Dharigaon. The blasting operations have affected the discharge of the springs, even some springs in Papdev, Chandak, Dharapani, Kimchaur, Bajethi, Kaphlani, Marhgaon, Mostmanu, Helpati, Dhari and Channa have dried up during last two decades.

Health Hazards - Large quantities of smoke and dust are produced during excavation, blasting and beneficiation processes. The inhalation of dusty air causes pneumoconosis and many lung diseases. Thin layers of silt could be seen upto many kilometers away from the excavation and beneficiation plant sites.

The silt and carbon emanating from the beneficiation plant ultimately settles on the leaves of the herbs, shrubs and plants causing severe physiological disorders due to blocking of stomata, affecting transpiration and photosynthesis processes. This causes molting and premature yellowing of leaves. The growth of pine trees near the Chandak and Tarigaon beneficiation plants has been affected, causing premature mortality of the leaves. The noxious gases produced during blasting and from dead burn magnesite (DBM) near Tarigaon and Chandak adds up to the problem of atmospheric pollution. The main pollutant gases being nitrous oxide, carbon mono-oxide and carbon dioxide. The area has also suffered to some extent due to the noise pollution.

Socio-economic impacts - The opening of the mining industries in this economically backward region of Himalaya has both positive and negative socio-economic implications. The mining activities have raised the income of local people and have to some extent also changed the social environment. The problem of rehabilitation, scarification of agricultural land due to mining and their socio economic impact must be studied in detail before the actual mining operations are taken up.

41. In the same book, learned author; Mr. G.S. Rajwar, in article "Limestone Quarrying -A hazard to Mussoorie Mountains and their Ecosystem" has opined as under :-

Mussoorie hills were developed as a base for trekkings and excursions by the parties from the plains of India and abroad about 50 years ago. The Mussoorie town situated at an altitude of 2000.5 m having a population of about 30,000 is no longer a queen of hills as these are badly scarred with irregular patches due to uncontrolled limestone quarrying and road construction to these quarries. This activity has posed a great threat to the ecosystem and stability of these mountains. The quarrying has resulted in the loss of top soil and vegetation cover thus increasing the soil erosion and landslides. The quarrying is being done in an unscientific manner and without any control measures for the protection of the ecosystem of these mountains. These hills need an immediate attention for the balance in the environment and the conservation of palnt, soil and water resources.

The vegetation of Mussoorie hills has been described by Osmaston (1927), Gupta (1928), Raizada (1959), Saxena and Srivastava (1973), Rajwar (1976) and Raizada and Saxena (1978). Some of the ecological problems of these hills have been studied by Rajwar (1981-82, 1982). The geological study of these quarries has been made by Negi (1982).

Mussoorie hills fall within the district Dehra Dun of Western Himalaya. During the fifth decade of the present century the quarrying was confined to a few places. Since the lime extracted in Mussoorie and Dehra Dun valley is the best in India, the demand for it grew fast and leases for quarrying were given by the Government. The protests of the local people were ignored while issuing and

renewing the leases. The quarrying in Mussoorie hills is carried out for the extraction of limestone, marble, dolomite, gypsum and a phosphate called Mussoorie phos. The quarrying in these hills is done by the private contractors and a Government of India Undertaking - Pyrites, Phosphates and Chemicals Limited. As a result of intensive quarrying, one views a shocking glimpse of the fading beauty of these mountains from Dehra Dun valley. Both the northern and the southern slopes have become badly scarred with wide, irregular patches making blots on these mountains. For the extraction of various minerals, the hills are quarried at random with the help of blasts using explosives. The quarries are situated at Hathipaon, Bhatta village, Durmala, below Mossey Fall, Near Kempty Falls, on the east and south of Jharipani, north of Rajpur and on all sides of Sahastradhara. There are about 60 temporary roads constructed for the carrier trucks from these quarries to the main roads.

Topography and Geology The topography of these mountains is hilly with deep gorges and gullies. The rivers are smaller and pass through the narrow ravines in north-south direction. Most of the quarries are situated on the southern slopes which consist of less thicker vegetation as compared to the northern ones.

The rocks of these mountains are divided into Tertiary and pre-Tertiary groups. The Main Boundary Thrust separates the pre-Tertiary from Tertiary formation. This thrust is disturbed by a series of faults. These faults and the Main Boundary Thrust make a disturbance zone. In this zone a part of quarrying has been taking place in the foothills area. The pre-Tertiary rocks constitute the Mussoorie hills whereas the Tertiary rock are confined to the Dehra Dun valley and Siwaliks. There are two belts in the Tertiary rocks - Mandali and Krol belts. The quarries occur in Krol belt. The Chandpur slate, consisting mainly of grey, green, purple, red and black coloured slates occupy the bottom of the rock formation. This slate is covered by pink, white and cream coloured quartzites in the sequence of rock geology. The Krol formation consist of limestone, dolomite and marble. The red shales comprise the lower units. The Krol formation is separated from the overlying Tal formation by a band of black coloured phosphorite. This rock part is quarried at Durmala to extract a rock phosphate called Mussoorie phos. The Tal formation consists of shales and quartzites.

Effects of quarrying on the ecosystem The Mussoorie hills are badly denuded by quarrying and the construction of temporary roads to these quarries affecting the ecosystem of these mountains adversely. The quarrying has resulted in the loss of vegetation and top soil, decreased the water table and accelerated the soil erosion and landslides. The explosions for the blasting of rocks have weakened the faults and rock formations as a result of which the slope failures occur and these increase the probability of landslides.

The quarrying activities are going on in an unscientific manner as the check dams have not been constructed below these quarries to prevent the soil erosion. The mineral belt is exposed by random quarrying which clears the vegetation and top soil of these mountains. The blasting has activated the faults

and the Main Boundary Thrust forming a disturbance zone in the middle area. This zone is prone to soil erosion and landslides due to slope failure. The hills are quarried indiscriminately without following any measures to prevent the ecological balance in the ecosystem. The quarry owners do not take any interest in maintaining a balance in the ecosystem.

In the upper areas such as at Hathipaon, Durmala and Kempty Falls there has been a continuous decrease in the water table. The water resources in these areas have decreased in the recent years. The quarrying activities near the Mussoorie town and surrounding villages have threatened their stability. The accelerated soil erosion and landslides have resulted in the silting up of rivers and agricultural fields. The amount of silt has been increasing in the rivers at Rajpur and Sahastradhara. The waterfalls on the north of Sahastradhara have dried up due to quarrying on all sides of this area. The agricultural fields on the east and north of Sahastradhara have been filled up with the silt during the rains. The erosion and silting up of rivers have also caused the water pollution and the floods in Dehra Dun valley since 1978. The residential houses and agricultural area near Bhatta village, mossey Fall and below Hathipaon have been threatened due to quarrying in their upper parts. There has been an increase in the dust count of the air at various quarrying places. The maximum dust count has been recorded at Jharipani (89.7 per cubic feet of air) and Sahastradhara (98.6 per cubic feet of air). The amount of dust deposition on the vegetation has also been found in an appropriate quantity to affect the physiology of plants near the quarries and temporary roads. The amount of dust on the leaves of different species has recorded as 20 to 90 cm in 24 hours. The dust particles block the stomata of these plants and ultimately kill them by affecting their physiology adversely. The maximum temperature of Mussoorie town has increased by 8 degrees in 1981 as against the maximum temperature in 1950 (25.80C).

The quarrying has caused a severe damage to the temperate and subtropical vegetation of the area. In the upper areas the forests of *Quercus incana*, *Q. dilatata*, *Rhododendron arboretum* and their undergrowth has been reduced at Hathipaon in particular. Other temperate forests near Bhatta village and Haripani have been affected adversely. The forests of *Olea glandulifera*, *Machilus odoratissima*, *Bauhinia retusa*, *Cornus oblonga*, *Pinus roxburghii*, *Engelhardtia colebrookiana*, *Acer oblongum*, *Phoebe lanceolata* and *Cestrum aurantiacum* have been cleared near Jharipani. The subtropical forests near Rajpur and Sahastradhara affected by quarrying include the forests of *Shorea robusta*, *Toona ciliate* and *Qugeinia oojenensis*. The vegetation loss has also resulted in the emergence and growth of xerophytes such as *Euphorbia royleana*, *Lantana camara* and *Tagetes minuta* in the lower areas.

The quarrying has endangered the stability of residential and agricultural area and the stability of these mountains. The main Dehra Dun-Mussoorie road may sink due to quarrying near Bhatta village. If the present system of quarrying continues, the consequences will cause more environmental pollution and

instability of the Mussoorie mountains.

Measures for Conservation

The Mussoorie mountains need an immediate attention for the maintenance of ecosystem and the conservation of soil and vegetation cover. The local people of Mussoorie and Surrounding villages have raised their voice for the protection of these hills under the banner of the Save Mussoorie Society, but at present the first need is to prevent the denuded hills from erosion and landslides.

The quarrying should not be allowed near the Mussoorie town and villages. The distance of quarries should be more than 8 km from the human settlements. The minimum distance between two quarries should be 4 km. The quarrying should not be allowed on the slopes where vegetation loss and soil erosion has taken place. The check dams should be made below the quarries. The blasted areas should be declared at the reserve areas by putting them under afforestation programmes for at least 10 years. In these plantation programmes first the trees suited to drier conditions should be planted for example *Toona Ciliata*, *Ougeinia oojenensis* and *Erythrina* sp. followed by the broad leaved other trees.

A 4-5 km wide zone on either side of the main Boundary Thrust should be declared as a zone of no blasting. This would help in minimizing the slope failures. The present open quarrying method should be switched over to tunneling or underground method to protect the top soil and vegetation cover. These conservation measures are essential to prevent the ecosystem damage and for the maintenance of stability and beauty of these Himalayan mountains.

42. In the same book, learned authors; Mr. R.C. Misra, Mr. R.C. Mehrotra & Mr. M.N. Joshi, in article "Perception of Environmental Hazards In Dehradun Valley Due to Exploitation of Natural Resources" have opined as under :-

The 'Dun', a characteristic geomorphological entity of Himalaya, is significant for its natural resources particularly the minerals, soil, forest and water. The exploitation programmes for these have, however, been observed to influence adversely the ecosystem of the region. The Dehradun Valley, is structurally a synclinal trough within the Siwalik system of rocks. The youngest formation in the region are the river terraces formed of the Dun gravels. The land is very fertile and is a bonanza of rich forest wealth. The occurrences of limestone, gypsum, phospherite marble barite, galena and building stones are noteworthy.

The study has revealed that unscrupulous exploitation of these resources has caused alarming environmental degradation. Therefore, the developmental plans of the region are required to be guided by environmental management and scientific planning. Hence, the results of the chemical, physical and data based investigation have been presented here. It is suggested that suitable measures be adopted before and during the exploitation programme.

Introduction

In the Himalayan region a series of narrow elongated longitudinal valleys characteristically designated as 'Duns' form important geomorphological features. They owe their origin primarily to the structural features rather than the erosional processes. The Dehradun, one such important valley is bounded by Lesser Himalaya in north and younger Siwalik mollasse in south and is limited by the rivers Ganga and Yamuna in east and west respectively. It lies between Long. 77035 to 78024 east and Lat. 29055 to 30030 north and covers an area of more than 2,000 sq km. The elevation ranges from 315 to 2,400 m, with gradient varying between 7 to 10 m/km. The annual rainfall is 2,145 mm and the maximum and minimum temperatures are 420 and 40C respectively (Sexena, Anantharaman & Pandey, 1979).

The Dehradun valley could boast of the most pleasant climate, prolific growth of forests, a natural shelter for the wild life and most fertile agricultural lands, besides promising mineral resources. All these gifts of the nature were to be utilized by the man for his own prosperity which he gallantly did, but, in his over enthusiasm to plunder the earth's assests, he had been recklessly overlooking the consequences. The complex environmental phenomenon can be defined by the mutual interaction between the lithosphere, hydrosphere, biosphere and the atmosphere 1. In so far as this interaction was controlled by the natural agencies, an adequate eco-balance was maintained but it started to deteriorate when the needy and greedy man came into picture 2. Lately the significance of the problem of the environmental hazards has been perceived. The object here is to exemplify this very perception of environmental degradation particularly in the Dehradun valley.

Geological and Geomorphological Model of the Valley

Geologically the Dehradun valley is a synclinal trough within the Siwalik formation. The limbs of the syncline consist of the Middle and Upper Siwalik rocks followed by the northerly dipping Pre-Tertiary formations of Lesser Himalaya in north. On all these older formations are deposited the Pliocene and Recent sediments, the Dun gravels. Towards north, unlike to the other part of Himalaya, the Siwaliks directly come in contact with the rocks of Krol nappe and thus the superposition of the krol thrust on the Main Boundary Fault is exhibited. Main Boundary Fault appears to be neotectonically active as revealed by changes in the river courses and movement of hills blocks, landslides etc.

The oldest lithounit of the Lesser Himalayan succession in the present area is the Precambrian Chandpur Formation overlain by the Precambrian to Lower Palaeozoic Nagthat, Blaini, Infra-Krol, Krol and Tal Formation successively which form the northerly dipping southern limb of Mussoorie syncline.

The geomorphic features of the valley are the ultimate net result of the geological structures, lithology, erosional and depositional processes, climate and drainage pattern. Geomorphologically also the valley can be divided into the northern lesser Himalayan zone, the southern Siwalik zone and the central valley

zone, the three more or less coinciding with the synclinal-anticlinal pattern of the valley. Anatharaman (1981) has given a detailed classification of the various geomorphic regions of the Dehradun valley. viz. (i). Lesser Himalayan Structural Hills, (ii). Piedmont colluvial tract, (iii). Dun gravels and (iv). Siwalik structural denudation hills.

The drainage pattern in the valley is also quite significant. There is main water divided trending more or less N-S and passing through the city of Dehra Dun and it separates the Ganga and Yamuna water systems. The rivers commonly exhibit intermittent drainage network.

Natural Resources and their Exploitation

The Chandpur phyllites, Nagthar quartzites, Blaini conglomerates and the Infra-Krol slates of the valley are broadly speaking barren as far as the mineral resources are concerned. However, some of the quartzite is locally used for building purposes but no economic significance can be given to it. On the contrary the Krol formation, particularly the massive as well as bedded limestone of the Upper Krol extensively exposed in the area formed the backbone of the mineral based industry in the Dehra Dun valley. Most of the limestone mined was till recent past being used for manufacture of lime but the cement grade and chemical grade varieties also occur and possibilities to establish suitable industries to use them could have been considered. A small-scale cement factory was already in operation in the region, but its closure has been ordered. There are a few workable pockets of gypsum within the Krols such as those near Sahastradhara, Chiphaldi etc. which are being currently mined by the private enterprises.

The Krol-Tal contact in the Mussoorie syncline is marked by the presence of 3 to 3.5 m, thick phosphorite belt which has been found to be a most suitable natural fertiliser particularly for acidic soils. The mining is being carried out at Maldeota and Durmala by the PPCL, a Government of India undertaking. The other prospective deposits are located at Paritibba, Chamasari, Chiphaldi and Bhusti, the exploitation of which may be taken up in due course of time.

The younger Siwalik rocks supply good building material. The Upper Siwalik sandstone in the valley is suitable to be mixed up with some of the Krol limestone for the manufacture of Portland Cement. The Dun gravels supply material to be used for building purposes.

Besides these, there are some minor occurrences of minerals like barite, galena, marble and lignite from various formations, the economic importance of which has not yet been established. Show the important mineral localities in the Dehradun valley and adjoining areas.

The forest of Dehradun valley occupy more than 60% area and is represented by different types of herbs, shrubs and trees. Babu (1977) has given an elaborate list of some of the noteworthy plants which proves that the Dehradun forest is

extremely rich for wood industries, fruit production and therapeutic applications besides the wild life protections. The species of deodar, sal, oak, walnut, semal, khair, gular, kans, munj, strawberry, kunj etc., are worth mentioning.

So far as the soil resources are concerned, the valley comprises both denudational and depositional soils. The Dun gravels form older and younger terraces of different rivers of both Ganga and Yamuna system. Sedimentological studies have shown that the older Pleistocene terraces are fluvioglacial whereas the younger Holocene terraces are fluvial (Prasad and Verma, 1974). The soil of the region has been proved to be very fertile for the cultivation of rice, sugarcane, fruits and vegetables.

Even in case of water resources the valley is quite prosperous. The annual rainfall is so high that the water poured in the valley has to follow various river channels to feed up the two major rivers Ganga and Yamuna. It is only the topography of the region which is responsible for the intermittence in the surface runoff. Ground water level is transected for the water to come out in the form of springs and seepages. Nossin (1971) points out that it is fortunate for the valley to have the Dun-Aquifer-zone which more or less coincides with the limits of Dun fan formation. Further, the Lesser Himalayan zone is characterised by the presence of extensive limestone formation of the Krols. This also gives rise to a number of spring zones in the valley which according to Saxena, Anantharaman and Pande (1979) can be classified in the following zones:

Candrabhaga-Rishikesh spring zone; Dunaquifer zone; Swarna-Ghuchupani-Bhogpur 104 Ogal spring zone; Aglar-Khattapani-Bidhalana spring zone, and Ghattudhar-Murray spring zone.

Thus it is obvious that as far as the natural resources are concerned the valley is highly prosperous to feed up the regional requirements of both the mountainous and plain habitations. However, as in other cases, in exploitation of these resources also, it is essential that a proper balance is maintained so that it does not hamper the natural environment. Ironically the various developmental programmes being carried out in the valley were not observing the environmental planning schemes till recent past. Although, now the situation is slightly changed due to the alert and conscious pursuance by various social, scientific and academic agencies as also due to strict steps taken by the government, there are still some voices of concern regarding the economic development of the valley and related social and socio-economical problems. So it is self evident that a perception of environmental degradation and the economical growth should be developed in a balanced manner.

Perception of Eco-Imbalance

Substantial contributions have been made by the geoscientists in perception studies as a part of hazard research which was initially confined to natural hazards. Poerter 1 has enlarged the scope of hazard perception research by introducing environmental hazards as a recognition of the human and social

contribution to the existence of hazards. Technological hazards also form a part of environmental hazards as the former is a concomitant of technological contributions to the creation of a desirable man - environment relationship. But mismanagement of technology has been greatly responsible to create technological hazards which, in many cases, become more damaging than the natural hazards. Burton and Kates (1978) stated that in resource management activities, inadequate knowledge of environment leads to extreme hazardous conditions. Mehrotra and Joshi 1, while reviewing the environmental degradation in Himalaya have also shown that the relatively young and tectonically weak mountain system is in itself prone to natural hazards which become more damaging by the addition of server technological hazards caused by the mineral exploitation activities. Subsequently Mehrotra and Bahukhandi (1982) have carried out detailed investigations of Eastern Himalayan sector and have substantially proved that there also the natural hazards have been accelerated due to technological applications.

From this point of view when one looks at Dehradun valley, he immediately discerns the grave situation of both natural and technological hazards in this region too. The slope failure and landsliding has been a common phenomenon in this region and the incompetent rocks like phyllites, slates and shales accompanied with highly jointed quartzites and sandstones were being most susceptible to large-scale erosion causing severe damages, (Sah, Pal & Mazari, 1982). Similarly the neotectonic activity bringing upheaval of the valley and changing the courses of the rivers and creating fluctuations in the rate of erosion were also bringing about additive effects. Besides, a major portion of the area is occupied by the limestones which being relatively susceptible to water action creates numerous cavities and caverns ultimately weakening the region. The Rajpur - Mussoorie tract Saura viilage Dwara village Ichari dam site are some of the important examples of such natural hazards.

Soil erosion is also enhanced by various natural activities such as the high rainfall, landslides, network of torrents and the sloppy terrains (Bharadwaj, 1982). Similarly the landsliding and slope failure cause natural deforestation also. Another intends to emphasise here that although hazards do occur naturally but the nature has got the tendency to compensate the loss and maintain the ecobalance by soil accumulation and afforestation.

On the contrary man creates technological hazards ignoring the compensation. The quarrying for limestone from the hills and along the northern border of the valley is a glaring example. Whosoever had visited the beautiful Sahastradhara tourist resort a few years back will be shocked to see the unscrupulous mining operations which have extensive wastelands and bare hills. The overburden was dumped in the Baldi river valley not only damaging the greenery but also causing water pollution. Apart from being a beauty spot the Sahastradhara spring water has been found similar in composition to that of Trinquelle (Germany) and the white sulphur spring (USA) which are used for the cure of skin diseases (Saxena,

Anantharaman and Pande, (1979). If such highly medicinal water instead of being used for the specific purpose gets polluted it's significance will be totally lost.

At Maldeota quarrying for phosphorite is going on. Although water pollution in the Bandal river is being induced by the steams flowing from the mine site but the PPCL seems to be cautious regarding the problem. They have built barrages to check the waste accumulation and are trying to some extent recultivation of forests. However, it is necessary to accelerate this process, as the measures being taken are quite insignificant comparing the loss. Huge boulders are being eroded blocking the valleys. At Durmala phosphorite quarry also, suitable precautionary measures are being applied and the removed overburden is begin accumulated in the dry valley gaps, thus strengthening the slopes.

At Bhatta, situated between Dehradun and Mussoorie, quarrying for marble on a largescale was being done by private enterprises. Bhatta marbles form the basement for a part of Dehradun-Mussoorie highway. Therefore, continuous mining operations proved a threat to it.

Not only the quarrying of limestones was creating technological hazards in the region but also the limestone processing plants were damaging the environment more severely. The lime kilns are located within the residential areas for example on Rajpur road and Sahastradhara road within Dehradun city. These kilns were continuously producing the toxic gases and smoke polluting the surroundings. Further, these kilns are situated along the bank of river Rispana and during rainy season pollute it's water as well.

Almost all the roads leading to various quarries and kilns are non-metalled, hence the vehicles continuously plying on the tract cause constant dust pollution. The private mine owners were not such particular in maintaining the vehicles and other instruments in perfect working conditions. Therefore, often they create a lot of noise pollution. It has shown that the noise pollution is also a severe damage to a healthy environment.

Cultivation, overgrazing and felling of trees has been important factors responsible for deforestation. Although 60% area of Dehradun valley is forest but only trees are left in parts and the herbs and shrubs have all been destroyed.

Precautionary and Remedial Measures

In so far as the protection of natural environment is the duty of the humanity, it should always be borne in mind that our own prosperity depends on developmental programmes. Because of the environmental degradation in the valley the executive and legal authorities of the country have taken very strict steps and presently most of the developmental activities are discontinued. This may turn out to be another extreme stage which may not be agreeable in due course of time. As already observed, a clear cut priority policy should be drawn to assess the real need of the nation and then to formulate the guidelines for the

exploitation of resources required for it. Sah et al (1982) again stress the significance of maintaining the eco-balance without jeopardizing the developmental programmes. To achieve this a few remedial measures are being proposed which are as follows:

Remedial Measures

- A programme like environmental awareness should be adopted and private mine owners should be trained.
- Strip mining should be stopped and regular mining opted.
- Mine waste should be suitably disposed off.
- Metalled roads should be constructed to approach the quarry sites, if, ropeways, conveyer belts facilities are not available.
- The lime kilns and crushers should preferably be shifted in places far off the towns, if possible, in forest areas where pollution may be minimised.
- Afforestation of mined areas should be taken up vigorously.
- Enforcement of mines legislation by Government of India.
- Reclamation of land and conservation of soil should be speeded up and the area should be terraced to avoid slope failures.
- Gully erosion should be checked by erecting the check dams and retaining walls etc.
- Grazing should be stopped in erosion prone areas.
- Toe walls along the foot of the slope should be erected to check further soil erosion and siltation of rivers.
- Permeable barriers should be made to make run off smooth and to retain the debris, siltation pits (catch-pits) should be constructed.

43. In the same book, learned author; Mr. Shekhar Pathak, in article "Mining In The Himalaya - Some Sociolegal and Environmental aspects" has observed as under :-

"The controversy over mining in the U.P. Himalaya turns on the complex issue of conflicting government policies and private interests. The government is pursuing two policies: one is to exploit mineral resources in the interest of industrial development, while the other is to restore the hill environment in the interest of both of the natural economy of the hills and the agricultural economy of North Indian plains. Both of these policies are supposed to be in the national interest but it is clear that unless mining of minerals in the hills is very carefully controlled, it will damage the very environment that is also sought to be preserved. The profit oriented interests of mining companies frequently leads them to ignore the controls imposed by the government and to ignore the disturbance to the lives of

the hill people in the vicinity of the mines..."

-Madhava Ashish: 19 May 1986: Kausani.

The contentment among petitioners, environmentalists and general public after the Supreme Court decision (12 March, 1985) that the mining in 54 limestone quarries of Mussoorie - Dehradun region be stopped, was quite obvious. Perhaps this was the first occasion when judiciary came forward to protect the decaying environment of the Himalaya.

A bench of three judges, including Justice P.N. Bhagwati has been set up as a committee under the rural development secretary D. Bandopadhyaya. The committee shall report whether mining could be permitted in any particular limestone quarry? If not why? This committee shall also look into the pattern, extent, rate and consequences of the violation of the Mining Act 1952, Mining Regulation of 1961 and other law, and prepare a comprehensive plan for regulated mining. Central and quarries should be given priorities in the matters of contract and employment respectively, when and wherever new mining sites are given on lease. In these areas, degraded by mining, immediate steps towards afforestation and soil conservation will have to be undertaken.

But despite this important decision, the past and present of mining in the hills remains a sordid saga. Similarly there does not emerge any hope about the rejuvenation of the badly polluted water and air and stability of the soil around the mines in the Mussoorie - Dehradun and Almora - Pithoragarh regions. While welcoming the decision, we must look into the history and the present reality of the mining in the hills of Uttarakhand.

One may ask - is not the destruction and defilement of environment something inherent in the developmental model, our politico - economic system has choose? Wanton felling of the trees, pillage of herbs and plants is going on. Big dams are being constructed against the geo-seismic structure of the region. Mining activities are going on in a callous and unscientific way. At this juncture, mass Supreme Court alone may not be efficacious. Moreover, it is not certain whether it will effect other areas similarly affected. It should also be remembered that the decision of Supreme Court is not a final one.

A Peep into the Past

The coming of East India Company to this region in 1815 was the beginning of the opening of the Himalaya. The colonial rulers cast longing eyes on the natural wealth of the Himalayan region and beyond. The search for resin, timber and minerals had begun before they actually reached here. The travelers and hunters who came here in that period did not forest to mention the forest and mineral wealth of the region, apart from the general wilderness of the Himalaya. Francis White (1837) was possibly the first traveler who mentioned about the vast reserves of limestone in the Mussoorie region. Those were the years when Mussoorie was in its infancy. In the lap of the hills over which the `queen of

mountains" settled down, the minerals remained unexploited for the next hundred years. The harmonious relationship between man and nature remained undisturbed and water resources from the nearby hills to Sahastradhara undefiled. The Britishers kept the region in good shape, particularly the hill stations - while they did not hesitate to overexploit other adjoining regions.

Sporadic mining started after 1940. The refugees coming here after partition accelerated the process. In a short time, 20 families having cordial relationship with both politics and administration monopolized mining in the region. In 1961, the State Government resolved to regulate mining under the Mineral Act of 1957 and allowed 19 sites on lease for a period of 20 years. This act of State Government confined the mining rights in the hands of 14 families. The refugees of yesteryears became neo rich. But the colonial outlook of the government persisted.

From Injury to Sickness

Now, Dehradun known for its litchi and basmati and Mussoorie for its wood and snows, began to grow and develop. For making luck from mining and forests, indiscriminate felling of the trees and overuse of dynamites for mining became a common feature. The population of Mussoorie was 500 in 1840, 5000 in 1881, and it swelled to 18,241 in 1981, while that of Dehradun went up from 2,126 in 1827, 20,683 in 1881 to 2,93,628 in 1981. The unregulated mining caused landslides, soil erosion and floods-a recurrent and dreadful phenomenon. But for a long time public opposition against the formidable contractor lobby was pail and unorganized. Even the decisions taken by the Chief Minister Sri. H.N. Bahuguna (1976) against renewal of leases could not be implemented because of the influence of the contractor lobby. Although now the public was not a mute spectator and the issue was raised by journalists and scientists but it was of no avail. The landslides and soil erosion in Mussoorie area made floods in Dehradun more gruesome. The volume of silt in Balmi and Rishi rivers became unprecedented and the water source of Sahastradhara, also known for its medicinal value, dried up. Since the cement and lime factories were gulping half of the city's drinking water, water crisis further worsened, irrigation system suffered, while dust pushed up air pollution from normal 100 to 368 microgram per cubic metre. The clouds of danger began to hover over the flora and fauna of the Mussoorie hills and the Doon valley.

While it was realized in the Geological Congress of 1982 and pollution was mounting in the Doon valley, but because of the electoral and political reasons, Dehradun, the most developed town and district of U.P., was declared industrially backward. Hazardous lime-cement, and chemical industries were set up instead of industries suitable for the region like electronics. In a short span, the number of crushers and kilns increased to 210. Mrs. Indira Gandhi was very much concerned after seeing the favourite resort of her father so degraded and destructed. She expressed concern in the Parliament on 28 July 1983. But general politics and opinion about this issue remained confused and even in the

much talked about Garhwal election, environment could not become an important issue. As public remained unorganized the contractors went on exploiting the minerals recklessly.

Finally, in 1983, 'Rural Litigation and Entitlement Centre', Dehradun moved the Supreme Court under PIL and filed a writ (No. 82K09/83). While on the one hand, the Supreme Court set up an enquiry committee and the Prime Minister expressed her concern in this regard, on the other hand, a few leaders of ruling party were hobnobbing with contractors. Thus, disregarding the master plan of Dehradun and against the views of the local Municipal Board two influential industrialists were permitted to set up cement and calcium-carbide plants at Dehradun- Mussoorie road (It may be mentioned here that the establishment of Union Carbide factory at Bhopal had a similar background). This made the air more polluted within no time and the dust of these plants started turning vast agricultural land into waste-land and affected the flora and fauna at Malasi Park. The news of the death of 8 men and dozens of animals also came into light. After the submission of the report of afore 113 mentioned committee, came the decision of the Supreme Court.

Decision: Important but not Sufficient

The decision of the Supreme Court is undoubtedly important but not sufficient. Therefore, there is hardly any room for complacency because, firstly: illicit mining is still going on in Mussoorie-Dehradun valley, secondly - it has come after the near depletion of the water resources and forests of the region. Moreover, legal mining is to go on in 8 mines. Thirdly the decision is not likely to make any direct and immediate impact on the mining activities in Almora-Pithoragarh regions and elsewhere in the Himalaya.

This decision was not enforceable to 8 mines lying outside the jurisdiction of Mussoorie Municipality, as the Mining Act 1982 is not enforceable in those areas - as if the environment of the rural and urban parts of Mussoorie-Dehradun were two different things and rural environment is of less importance.

In the eastern part of Uttarakhand, mining is going on for more than a decade. It was started in Pithoragarh and Almora respectively in 1973 and 1974. In Almora, Almora Magnesite-Jhiroli, in Pithoragarh, Magnesite and Minerals Co. Chandak, Himalayan Magnasite Ltd. Tarigaon and Devalthal Magnasite Ltd. Devalthal are the leading companies. Share-holders of Almora Magnasite are TATA, SAIL and U.P. Government, while mining at Pithoragarh is in the hands of industrialists like Khetan, and Jhunjhuwala and Bharat refractories is operating as a public sector undertaking at Devalthal. From Devalthal only raw magnesite is transported. Limestone mines of Chaunala (Gangolihat) region in Pithoragarh and Khairna and Chaunala (Gangolihat) region in Pithoragarh and Khairnain Nainital districts have been allowed to the private sector for use in cement industry. Construction of one such cement factory has already started in the picturesque town of Lohaghat. But is has presently been deferred due to public opposition.

Mining, silting and dynamiting is drying up the water resources of Jhiroli, Matela, Bilori, Chhana, Kafligari, Baskhola, Bunga, Hartola villages in Almora district; Chandak, Bhurmuni, Nakena, Chhana, Dharigaon, Bakarkatiya, Halpati, Tarigaon, Gadia, Chhera, Bajethi, Devalthal and surrounding areas in Pithoragarh. Forest cover is fastly vanishing and encroachment of silt in the human settlement and agricultural lands is alarmingly increasing. The water, air and soil around Jhiroli, Chandak and Tarigaon have been polluted by magnesite dust (magnesium oxide) and other poisonous gases. A cementlike layer in the field around the magnesite factories could easily be seen. Important flora and fauna, ranging from moss, lichen and bryophytes-to fish and butterflies, are slowly dying. The prosperous valleys of Kafligair, Gurang and Shore are beset with danger and likely to meet the fate of Mussoorie, if we do not take a lesson from the Mussoorie- Dehradun area. Experts believe that mining at Almora Magnesite alone is systematic and planned, although the real situation does not fully testify this fact.

Soapstone: The White Gold

Soapstone (talc) is yet another important mineral being recklessly exploited in the remote regions of Uttarakhand. Mining and environmental laws do not restrict this indiscriminate exploitation. For more than a decade, the mining of soapstone is being carried out in Garia-Gadera, Chaurathal, Basguna, Kheerakote Knada and Kiroli etc., in Almora Huna in Chamoli, villages of Goriganga valley- Sabli, Guriyali, Paturil Khatyad, Lavadhar, Jhoprayali - in Pithoragarh, villages of Hevalghati in Tehri and nahikala-Barkote etc. in Dehradun districts. The mineral is rapidly being exploited and exported to many parts of the world since its demand in the international market is very high. The mining of soapstone has enabled the criminals and exploiters to penetrate into the remote villages and combined with activities of the criminal contractors this has damaged the rural fabric in more than one way. Most of the mining operation are in rural areas, where the people are generally unaware of their rights and suffer from lack of their ability to protest effectively, when they are harmed by the decisions of the government and actions of the mining licencees. But it is also true that in some rural areas, such as Huna, Gariagadera, Kheerakote and, Hevalghati etc., mining has either been retarded or stopped due to local protests. Very recently, antimining agitation have come up in Chaurathal (Almora), Nahikalabarkote (Dehradun) and an anti-cement factory agitation in Lohaghat (Pithoragarh). But at other places, mining is still taking place drastically and unscientifically with the connivance of politicians and administrators, close to the contractor-capitalist lobby. Especially where the big industrialists have monopolized mining and allied industries, local protests and environmental consciousness, both are being suppressed.

The chief components of environment - air, water and soil - are being destroyed rapidly in the above mentioned mining regions. The local people, labourers and small contractors are simultaneously exploited. There are no specific mining or environmental laws. Even the general laws are not followed strictly. Open

blasting, providing mining contracts to the petty contractors to avoid labour problems, inadequate pollution control measures, provoking local anti-social elements to suppress the local protests, all these have become a very common practice. Neither any study of the effects and impacts of mining on agriculture, forests, water, air and impact of mining on agriculture, forests, water air and local social milieu has been made nor any attempt of rehabilitation of badly affected villages has ever been thought, though all the mining sites are either almost close to the densely populated areas or around very sensitive and landslide prone zones like Tawaghat, Tham, Loharkhet, Karmi, Baghar or Hevalghati etc. Under such an alarming situation, it should be accepted that mineral exploitation in Uttarakhand should now be restricted unless it is essential in the national interest. The fact that a quarry or mine could yield a lot of profit to an industrialist and employment to a few people does not in itself make a national need.

Uncertain Smile and Certain Slow Death

Even if we dare to overlook the long-term devastation effects of mining, we find that the immediate benefits are grasped by tiny influential fringe, while the local people are the losers. The people in politics and administration have stood firmly in favour of mining contractors and factory owners. For a short while, the local populace might hail such mining projects illusioned by the phenomenon that these would get employment at home. But in due course, the cracking houses, increasing infertility of land, hazardous water and air pollution, the confiscation of village land-holdings and forests, soon makes them realize that their earlier days were better. The subsequent ill effects of mining, for what they take part to earn their livelihood, gradually entrap them causing a slow death. Even the natural guarantee of pure air and water becomes the reality of remote past. As the people come to know about the real dimensions of these hazards it often becomes too late.

The Supreme Court decision has not inflicted any impact upon the cement and calciumcarbide factories which are devastating the local environment. In the above mines and factories, those who were killed or have been handicapped or burnt to death or have been victims of fatal diseases, such as tuberculosis etc., would never be taken into account. Nobody knows how far this decision would benefit those who have lost their cattle, agricultural fields and water resources. But with all these short comings, the decision may be considered a constructive beginning by those who are interested in the conservation of whatever has now been left safe, if at all they visualize the decision as the result of people's growing consciousness.

The decision, while on the one hand will accelerate the environmental consciousness, it will also have a retarding effect on mining or processing agencies. There are indications of such changes in contract and temporary labour system in Pithoragarh mines. The local populace is demanding the replacement of magnesite kilns. Almora magnesite has established a 20 member `Pollution

Control Group". But the remote soapstone mining occupations, however, are unaffected from this decision. It should also be mentioned here that in the VIIth plan Rs. 82.7 crore has been sanctioned for mining in Uttarakhand. It is notable that only 1,350 people are likely get employment from this investment.

Whole and the Parts

Actually, the unwilling construction of high dams, the over exploitation of forests and medicinal herbs, the popularity of alcohol in the remotest villages, the establishment of magnesite, lime, cement or paper mills/factories in the name of industrialization of backward hill regions, facilitating the big industrialists to exploit the natural wealth of the Himalaya, all are the different aspects of the same problem. Therefore, partial solutions cannot bring any real change in the system. The issue of mining is related with just one aspect of the environment while we have to care for all other aspects.

In our existing system, an equitable distribution of wealth and natural resources is not possible. Whenever acceleration in the exploitation of natural resources is needed, the capitalists and the political system works unitedly. The nature and the people both are affected simultaneously by this. We have to realise this interrelationship. Today the judiciary is in favour of the damaging environment and tomorrow it may give a verdict in favour of the mining operators.

The need of the hour therefore is to stir up the mass consciousness and to develop a people, science movement, which can clearly understand and analyse the interrelationship of natural, socio-economic and political environments. Only an awakened society can acquire the co-operation of judiciary, journalism and science to meet its aspirations.

44. In the same book, learned author; Mr. P.C. Chatterji, in article "Mine-Spoils And Their Rehabilitation" has held as under :-

Introduction

Economic development of any region largely depends upon the availability of resources and their exploitation to the optimum capacity which is of paramount importance. This also applies to the minerals and rocks. Minerals are required for the industrial use whereas rocks are required for the rural, urban and industrial developments. Such activities reduce or destruct the biological potential of the land which can ultimately lead to disturb the otherwise balanced ecosystem thereby creating "wasteland". Though the mining areas are not covered under the definition of wasteland, but such activities when carried out irrationally by the man for their own needs, develops focus of desertification during and after the mining activity (Man and Chatterji, 1978). The mining activity is increasing day by day e.g. in Rajasthan during the last decade the mining activity has spread over to double the area, and with this rate of increase in area likely to be effected by the year 2000 will about three folds (based on the growth rate between 1970 and 1976 (Saxena and Chatterji, 1985). As per the estimates of

the Department of Environment, Government of Rajasthan, the State has 37.8% area as wasteland as compared to country's average of 16.21%. Even in the higher rainfall areas of Udaipur and Bhilwara district the wasteland cover 38% and 40% areas respectively which is due to more mining activity.

Mining for mineral and lock is known from the ancient times. However, most of these activities were on small scale, sporadic and intermittent. The mining activity gained impetus during the world war II. At that time no regulations regarding the conservation, optimum development and utilization of deposits were introduced. Consequently the mining activity was mostly indiscriminate and unscientific commonly known as "Fox mining method". It is only after India attained Independence in 1947 that mining regulations and mineral conservation ordinance came into existence and improved the mining activity to some extent.

Land damaged by the mining and other allied activities must be reclaimed to the possible extent so that we do not handover a desertified and complete wasteland to the future generation. This would only be possible if the mine owners, who are accruing profits out of these activities, invest a percentage of profit to rehabilitate and restore the ecological balance or to make these land productive in other sense. Some large mine owners having mineral based industries have recently initiated to follow the conservation and rehabilitation plans but small mine owners which are in large number and scattered over whole of the country, do not follow any conservation norms. Moreover road material mining leaves behind numerous shallow pits of 1-2 metre depth and covers wider area poses a potential threat (Saxena and Chatterji, 1985). In arid and semi-arid areas, the ecosystem is so fragile that when disturbed; its restoration becomes a herculean task. Imbalanced conditions of such disturbed ecosystem are largely governed by the type of mining, scale of mining, resulting topography, physical and chemical nature of the mine waste and procedure of their disposal.

Discussions

Types of mining

Broadly the mining activity could be classified into three groups i.e. (i) alluvial, (ii) open cast and (iii) underground. These could be small manual operations or large scale semi or fully mechanised depending upon the extent of ore/mineral/rock deposits and its use.

Whatever may be the type or magnitude of mining operation it will have detrimental effect on the ecosystem by way of (i) removal of vegetation i.e. tree, shrub and grasses, (ii) if there is any surface overburden over the body it will have to be removed and dumped elsewhere, (iii) the entire mined out portion is never usable and a sizable percentage has to be scrapped and dumped on the surface near about the mining area and (iv) the low grade ore/mineral etc. which do not have immediate market value have to be also dumped separately.

Impact of mining

All of the above processes have the undermentioned adverse impact on the existing balance of ecosystem and causes land degradation (Saxena and Chatterji, 1986).

(1) Reduction of land: Due to mining operation undertaken on the fertile/productive land the areas available for cultivation, forestry and grassland are reduced. Even when the mining activity are on the rocky areas, these reduce the forest and pasture land. In both of the cases disposal of surface material, mine wasteland low grade product pose a still greater threat in reducing the productive land.

(2) Pollution hazards: Mining activity causes three types of pollution hazards.

(a) Air: The fine mineral/ore/rock particulates released during the process of blasting are released to the atmosphere. These in turn cause health hazards to the miners, animals and people inhabiting in the adjoining areas, retards and destroys the plant growth (Vyas et al, 1985) and when it ultimately settles down on land also adverse effects in several ways.

(b) Land surface: When the atmospheric particulates settles down on the land surface and also minewaste which spreads all over the mining area, changes the land capability class and the productivity of the land is reduced. Moreover these are being transported by the surface runoff during the rains and pollute the surface water resources like lakes, rivers etc.

(c) Underground: The toxic and harmful metal and mineral which gets dissolved in the rain water percolates down to the aquifer within the mining area and also in the adjoining areas thereby deteriorating the ground water quality which has again its adverse effects depending upon the use and may turn them into wastelands.

(3) Degradation of land capability class: The removal of productive top soil development of gullies and exposure of rock/hard pan on the surface, deposition of fine particulates from the air and contamination of the surface and ground water resources reduce the productivity of the land and thereby reduce the land capability class.

(4) Development of salinity: The fine particulates which get accumulated on the land surface gradually reduce the permeability of the top soil formation thereby the recharge to the aquifer is reduced and during rainy season the area gets water logged. This in turn releases the mineral/metal contents of the particulate and develops the salinity in the soil.

(5) Deterioration of hydrological conditions: Due to mining activity and disposal of minewaste, especially in case of surface mining, the surface drainages are disturbed and blocked. Due to which the surface storage in the adjoining areas, which receive water from these drainages, are affected. Also the blocking of the drainage channels and structurally weak joints reduce the recharge to the aquifer. As a result the yield from the wells and quality of ground water are

affected.

(6) Land subsidence: This takes place only in case of underground mining, specially on the sensation of mining activity i.e. when all of the underground support structum are withdrawn. Thereby causing a scar in the land surface small or big depending upon the magnitude of the underground excavated area.

(7) Development of pits: This is associated with the alluvial and open cast mining methods, size of which depends upon the magnitude of mining activity.

All of the above degradational processes either singularly or collectively causes to degrade the land and develop `wasteland'.

Allied activity

Most of the mining activities are associated with beneficiation or upgrading and processing activities. Because most of the mining products are not directly used, these have to be either upgraded, concentrated or processed for use by the industry or other. The beneficiation process is composed of crushing, sizing classification, washing and scrubbing, floatation and separation components. Likewise the processing is also composed of crushing, cutting, grinding and polishing and chemical processing components. It is not essential that all of the components are always associated with each beneficiation and processing activity.

Impact of Allied Activity

Both of the above processes affect the ecosystem in three ways i.e.

(1) Atmospheric This can be classified into two groups:

(a) Suspended particulates: These are emitted from the crushing, sizing and classification and cutting processes. These pollute the atmosphere and also degrade the land when it settles down on land and vegetation.

(b) Chemical fumes: These are emitted from the floatation, separation and chemical processing stages where chemical reactions are involved. These are detrimental for the health of the inhabitants and vegetation.

(2) Ground level: This effect is of three types i.e.

(a) Disposal waste products: Disposal of waste product needs extra productive land and changes the topography and drainage of the area.

(b) Contamination of water: The toxic minerals and metals spread over the area are transported by runoff water during rainy season and contaminate the surface water resources. These are also dissolved with the water and contaminate the ground water during the process of recharge. This contamination affects the use of water.

(c) Disposal of tailing: These need extra productive land for disposal. As these are rock crushed product ahs practically no binding material like clay and silt. As

a result are subjected to spreading and covering more area during strong wind regimes.

(3) Underground: The various atmospheric and ground level effects discussed above induces two type of subsurface effects i.e.

(a) The soil profile is adversely affected reducing the productivity of the soil and the toxic metals, are recycled in the vegetation.

(b) The ground water is contaminated which affects its use. Also the toxic metal contents are recycled when used for irrigation.

All of the above three factors affects the ecosystems in various ways i.e. either collectively or singularly. These effects are shown in Table 1.

All of the above degradational processes of the allied activities of the mining leads to make the land unproductive for future generation and create "wasteland".

45. In the same book, learned author; Mr. Y.M.L. Sharma, in article "Environmental Control in Mining" has stated as under :-

Mining and Environment

a) What is environment? Environment as one understands is the status of various factors which contribute towards healthy living, the nature of land, air noise, water and other factors. Irregular or improper handling of any one of these attributes upsets the equilibrium. Though these elements had been damages or disturbed over the years the cumulative effect of these has created a persectible change in the conditions around us, that the awareness has only been recent. There are many causes for disturbance of these natural factor and one significant cause of upsetting of environment has been the mining operations. Metals and minerals have been part of the human needs from times immemorial but the recent upsurge in population, industrialisation and the need for raw material have been the cause of increased exploitation of metals and minerals. Coal, lignite, iron, manganese, lead and zinc and copper and a host of such commodities are needed for a large number of uses in any developed and developing countries. There have been large scale exports and these to developed countries due to lack of technology in the processing as well as money to do so and sooner we become self sufficient in our requirements and export processed minerals and metals the stronger would our country be.

b) Metals and minerals are invariably or largely situated in forest areas of different densities, especially in areas very vulnerable to environmental degradation, like top of hills watersheds and valleys. This has led to conflicts. There has always been a controversy about location of mining or nay other projects in forest areas. There are reasons for this. The country's forest resources were very rich. After independence we have lost more than 4.3 million hectares of forests due to release for agricultural extension, development of

communications and power, submersion due to power and irrigation projects, development of command areas, release of forests for rehabilitation of repatriates from Ceylon, Tibetan people and East Pakistan displaced persons, indiscriminate exploitation of Zamindari areas before being handed over to Forest Department, mining etc.. It is not only mining that has destroyed the forest. It is the cumulative effect of all these which have been responsible for reduction of forest area. Though about 1/3 of land area has to be under forest, the area of forests is about 23% according to Forest Department while NRS agency shows it as hardly 12%. This is a very alarming situation as we need more forests to cater to the increasing needs of timber, fuel, usufructs and a host of materials required by the people, raw materials needed for industries, protection of watersheds and conserving the soil. It is in this context that the Government is now insisting towards more trees, and for restoration of mined out sites and for adopting measures against soil erosion, preventing floods and maintaining proper conditions to improve the health and quality of life of the people living around mined areas. It is thus a duty on the part of all of us to face the challenge and avoid conflicts.

A balanced outlook is thus needed. We need forests and trees etc. We also need metals and minerals for a developing country. We need to prevent degradation of environment. We need to generate employment oriented projects. This being so, it is essential that environmental improvement works are taken up and implemented with the same zeal and enthusiasm as production of metals and minerals. It has now become incumbent on the part of mining organisations to submit environmental management plans simultaneously with the detailed project has to clear the project before final clearance. It would be worthwhile to work out the percentage of expenditure that is being spent on environmental safeguards and restoration of mined land to as near its original form. The figures would be shocking. It thus calls for an immediate reorientation of thinking in these matters.

Impact of mining

Mining results in despoliation of land, creates ugly scars and leaves the area with large lakes, hillocks rendering the area useless for any other purpose.

a) Loss of forests: Mining directly affects forests when located in a wooded area. There is loss of timber and fuel resources, usufructs, minor forest produce and loss of habitat for wild life. The vegetation has to be cleared and this results in irregular exploitation of forest contrary to accepted principles of removal of wood equivalent in volume to that of increment put on by forests in a year. The destruction of forests is more evident in an area when open cast mining is resorted to. In the case of underground mines land subsidence when it occurs becomes significant but it is equally serious. Mining also results in loss of genetic resources.

b) Loss of agricultural lands: Mining invariably, if forests are absent, affects

agricultural lands. It may be rainfed, or irrigated or garden lands or orchards which are valuables grown over the years out of soil and soiling their hands. Their acquisition is resented as such cannot be built over a short period however high the compensation may be. It is a highly sensitive issue.

c) Loss of home - rehabilitation: Mining results in the displacement of people and their vacating the villages and homes where they have lived over the year, as well as their lands. This is the most sensitive aspect of the project - any project. They resent, and if there is a strong political backing, the project may not come through. If the area lies in a tribal belt and the tribal people resent, there is difficulty in the projects going through. Should the project be approved the selection of an alternative area to rehabilitate the displaced people is a vexed problem. Proximity to different facilities, water supply, sanitation, proper housing, medical facilities, providing other infrastructural facilities, roads etc., are important considerations in choosing the sites for rehabilitation. Of course if the site is in forests, there is the problem of getting clearance. Best is to avoid locating forest lands for this and other infrastructural facilities. Either rehabilitation colonies are built or compensation with a site given to the families. The payment of compensation is beset with difficulties as the youth are likely to misuse the funds for various purposes. This is a matter of policy of the organisation. Secondly, the displaced people invariably request employment of atleast one member of the family in the mining project which I hear now, is discouraged due to surplus labour in the coal sector. In the matter of rehabilitation, data has to be collected carefully and when one goes to do that, villagers drive out the staff since they are against the project coming up. A considerable P. R. work is also needed and a proper planning is necessary. People locally living and even State Governments resent to such projects which supply coal to thermal stations in other States, and supply of power to other States at their cost.

d) Air pollution: Mining results in serious disturbance of soil involving digging, transport and dumping. This leads to considerable dust generation at all levels inspite of the provisions of safeguards. When mines are situated on hill tops and the speed of the wind is high, the dust generated in the mines is carried far and wide affecting the atmosphere and the life of the local workers and people living around the mine. Inhalation of the fine dust results in development of pulmonary diseases and the control of dust has to be minimised to a great extent if it is not possible to totally control it.

e) Noise pollution: Noise above a particular level is detrimental to human health. A lot of noise is caused by heavy machinery operating in the mine, transport carriers like dumpers, trucks and blasting operations. Noise levels have to be reduced which should be compatible to the human system. There are several measures adopted for reduction of noise and an all out effort should be made to reduce noise level.

f) Water pollution: Mining sometimes destroys water sources. The soil is

disturbed. In hilly terrain, the loosened soil is not only washed downhill choking water courses or habitations, and silting of tanks, reservoirs etc., the wash off soil also results in the raising of river beds and consequent flooding of agricultural garden lands and villages. If it is heavy rainfall zone, may also wash down the fines into streams and rivers. The water thus gets contaminated. Acid mine water is also injurious to the health of local people. Aquifers exist in some areas and pose a problem in drawing out the mines when they are open cast and below the surface of the ground. Such surplus water should be used for forestry, agriculture, rural and urban water supply. Fresh water should not be wasted, as water is not a cheap commodity today.

g) Unplanned development: The development of jhuggies/slums around mining complexes is another impact. Insanitary conditions prevail when ill planned and unauthorise structures come up. Hawkers, traders, their attendant paraphernalia like cattle and goats also come in. Problems of grazing arise for original and migratory cattle and goat population, leading to destruction of vegetation and affecting afforestation schemes taken up. This leads to costly methods like barbed wire fencing, rubble walls around planted areas.

h) Transmission of power: The establishment of a mine involves great power requirement conveyed through long high tension lines. These power lines riddle the country-side and mining complexes and sometimes involve clearance of forests and trees which produces a dreary atmosphere.

i) Blasting: Quarrying locally and in nearby forest areas, or excavation of tailing dams causes serious disturbance of soil, loss of vegetation and affect wild life if the forest area is nearby. They also affect nearby habitations. They affect free movement of wild life and are detrimental to sancturies and game preserves if they are close as wild life migrates away. They may also affect the endangered species.

j) Infrastructural facilities: The construction of roads, establishment, of colonies, processing plants, crushers, tailing dams cause destruction of vegetation, loosen the soil especially in hill regions leading to soil erosion, requiring costly operations like stabilisation of slopes and other works.

k) On quality of life: The establishment of mining industry results in changes in life style of the people, especially tribals and this results in hitherto peaceful inhabitants resorting to fast life especially youth affecting their health. Benefits, no doubt, are there like all round development of the economy of the area, opening of communications, health centres and better medical facilities etc.

"Annexure 1"

Role of Forest in Maintenance of Ecology and Environment

Ecology has been receiving increased attention in recent years. The place of man in nature, his influence on the environment and the influence of the total environment on man are objects of increasing study and thought. Forests

intercept incoming and outgoing radiation, precipitation, and winds and have thus a marked effect on the microclimate. They filter dust from the air and absorb it. It is known that a stand of one hectare of spruce collects about 32 tonnes of dust from the air, one of pine 36.4 tonnes and a like one of beech (a broad leaved tree) 68 tonnes till the needles and leave can hold no more dust. The dust carrying winds invade the forest and deposit the dust on the leaves, branches and stems. By the mechanical obstacles the wind also loses much energy. Its velocity is reduced resulting in an increased dust precipitation. During the rains the dust is washed to the ground, where, due to moisture, it loses its flying capacity and is thus bound. This can be termed as "active filtering". Dense forest stands which the wind cannot penetrate have a positive effect on the purification of the air. The wind's ascent in front and the descent behind the obstacle, create air currents, jams and vortices causing increased dust sedimentation. This is called "passive protection". The forest serves also in removing dust source. Best results have been obtained by extensive afforestation on the dumps of the lignite districts of the Rhine land in Germany. The air cleaning capacity of the forest has indirect positive effects in so far as the condensation nuclei, necessary for fog formation, are absorbed from the air. Thus the frequency and density of fog formation is reduced. This has a direct bearing on the occurrence of fog on the ore body in Kudremukh during December and January. Dust particles absorb sunlight and reduce ultra-violet radiation.

A special property of the forest is that the leaves and needles can absorb upto 50% of the collected radio iodine. The forest protects man against radio active radiation as it screens fields and pastures against radio active dust, saving man from incorporation radio activity contaminated nutrition.

For mental recreation the forest is ideal. In the quiet of the forest the hunted man finds peace. Freed from the anonymity of the mass he finds himself again. There nature is observed in its various aspects. He often gets to inner contemplation. The continuously changing views divert him from the sorrows of daily life.

Forests intercept incoming and outgoing radiation, precipitation and wind and have a marked effect on the microclimate. They affect soils by their effect on microclimate moisture regime, amount and kind of soil organic matter supplied, animal and plant life in the soil layers and depth of rooting. Soils under tropical forests have thin organic layers resulting in a rapid decomposition of organic matter and recirculation of nutrients. Forest soils in comparison with grasslands soils, have greater porosity and tend to encourage infiltration and absorption of water and to increase underground supplies. Forests reduce extremes of soil temperature partly by canopy action and partly by the action of the forest floor.

It is reported that in the taiga zone, run off coefficients (percentage of precipitation measure as stream flow) on loamy podzol soils decreased with increasing forestation from 0.42 for non-forested catchments. Considerable work has been done in S. Urals Kirghizia, forest-steppe belt etc. in USSR which

indicates that the run off of water is checked effectively by afforestation. Forests have a marked effect in altering the manner in which water is delivered from catchments, most especially in tempering flood flows.

In the Federal Republic of Germany, 2 million tonnes of solids are expelled annually from smoke stacks. Forest trees filter the air and collect the dust to the tune of some 32 to 80 tonnes per hectare. Later this dust is washed to the ground by rains. Filtering of dust by trees removes water condensation nuclei and reduces fog which often contains concentrations of health damaging nuclei and reduces fog which often contains concentrations of health damaging gases. Dust in the air reduces ultraviolet radiation diminishing the formation of Vitamin D and the germicidal and healing effect of sunlight. A negative psychic effect may result from dust. Forests control erosion as the soil is protected from rain drop splash and surface run off become minimum. Forest soils, well stocked with deep rooted trees, have a storage capacity estimated to be 50,000 to 2000,000 m³ of water per km².

The essential point in environmental administration is that costs cannot be reckoned merely on one economic basis. It must include the external costs such as damages caused to the environment and to other species in the ecology and should take into account aesthetic wants derived from conserving the environment. The idea underlying Japanese laws related to pollution is that the polluter should pay the costs for environmental protection of polluter Pay principle (PPP). This covers restoration of normal environment (installation of green buffer zones, dredging of rivers, lakes, harbours etc.,) where pollution causing substances are deposited. This is in addition to various other laws.

Noise raises blood pressure, pulse rate and affects frame of mind resulting in depression and dulling of the spirits. Excessive fatigue, emaciation and headaches result from noise. Children are especially sensitive to noise, which affects hearing. Noise can be other noise. Measured in decibels (db) or in DIN phon respectively. When a sound absorbing capacity of the forest depends on its structure. The denser the undergrowth and the ground vegetation the more pronounced the vertical closure of forest stand, the higher is its sound absorbing capacity equal frequencies provided. A park of 50 m wide can reduce traffic noise by 20 to 30 decibels. The forest also provides indirect protection against noise.

Against this context, KIOCL has planned a programme of forestry to maintain the environment, prevent soil wash and pollution and silting of the rivers. The problems of environmental disruption the KIOCL is faced with and measures the Company proposes to undertake are those of a pioneer in this field.

The people of Kumaun used to mine iron and copper for domestic consumption since ancient times, until availability in the market of relatively cheaper exported metals rendered indigenous production an uneconomic proposition. There is a record of allotment of land to Vishnu Upadhyay for copper mining in Athigaon area by King Prithvi Chand (of Chand dynasty). Grouping of Mineral Resources

can be classified in the following categories :- (i) minerals which occur in great abundance and the commercial exploitation of which would be highly profitable. In this category are included magnesite, talc-steatite, limestones, dolomites and building and roofing material; (ii) Minerals, the deposits of which are too small to be commercially profitable, but which are of great strategic and industrial value. In this class come ores of uranium, copper, lead, pyrite, and also the deposits of phosphorite, gypsum and graphite; (iii) In the third category, those minerals can be included, which are known but no serious attempts have been made to search for their larger deposits, i.e. Garnet, Kyanite, Barite, Asbestos and Glass-sand. Discontinuation chains of lentiform deposits of coarsely crystalline magnesite extend for approximately 150 km. from the Kali valley northwest to the Mandakini valley. Talc and steatite occur in two ways, as veins and lentils and pockets within magnesite and in the bedded form. Some of larger deposits are of economic value and are being exploited profitably. Among notable deposits are those of Jakhera, Harap, Maulagar, Biskhal and Surag in the Lahor valley, NNE of Baijnath, Agar- Girichhina E of Someshwar. Phosphorite and phosphatic deposits occur in two different stratigraphic units of two different geographic areas. The first formation is the Precambrian Gangolihat Dolomite (Deoban) of the Pithoragarh area. The second stratigraphic formation which includes phosphorite is the lower Permian jogria member of the Tal Formation in the Mussoorie Hills near Dehradun. Copper minerals occur mainly in three lithostratigraphic units; in the dolomites, magnesite and talc schist. These are found at east of Kanalichhina in the Dundu valley. Uranium mineralization has been noticed along the line of old copper workings in the fault-and shear-zones in the Chamethi-Pokhri-Tungi belt in the District Chamoli. Limestone and marble constitute the third import group of mineral material of Kumaun. These are found in District Pithoragarh and in the Ramganga valley. Dolomites are found in Gangolihat and Upper Krol formations. Graphite is found in Kalmatiya, Sirar, Petsal and Banini Devi. The Gypsum is found in the middle and upper Krol Dolomite near Khurpatal and Dhapila (Nihal valley) in Nainital. The mining activities carried in the fragile of Himalaya and plains of Uttarakhand have led to ecological disturbance. It has led to air pollution, water pollution, shrinking of agriculture land and displacement of persons from the villages. The forest wealth has already been destroyed. The rivers, canals, streams have been polluted in an unscientific manner. The mining activities have also affected the public health. The flora and the fauna is also adversely affected. There is a large scale of erosion of land. The green cover is reduced. The dust layer on the plants hinders the process of photosynthesis, transpiration and exchange of gases. Due to the layer of dust, the leaves do not get sun light (radiant energy) properly. Trees are unable to synthesise their food and as a result, they perish. The water retention power of the hills is exorbitantly reduced due to loss of top soil and vegetation cover.

46. The preamble and principles formulated by United Nations Conference on Environment and Development states that the forestry issues and opportunities should be examined in a holistic and balanced manner within the overall context

of environment and development, taking into consideration the multiple functions and uses of forests, including traditional uses, and the likely economic and social stress when these uses are constrained or restricted. All types of forests embody complex and unique ecological processes which are the basis for their present and potential capacity to provide resources to satisfy human needs as well as environmental values. Forests are essential to economic development and the maintenance of all forms of life. Forest resources and forest lands should be sustainably managed to meet the social, economic, ecological, cultural and spiritual human needs of present and future generations. These needs are for forest products and services, such as wood and wood products, water, food, fodder, medicine, fuel, shelter, employment, recreation, habitats for wildlife, landscape diversity, carbon sinks and reservoirs, and for other forest products. Appropriate measures should be taken to protect forests against harmful effects of pollution, including airborne pollution, fires, pests and diseases, in order to maintain their full multiple value. The provision of timely, reliable and accurate information on forests and forest ecosystems is essential for public understanding and informed decision-making and should be ensured. Governments should promote and provide opportunities for the participation of interested parties, including local communities and forest dwellers and women, in the development, implementation and planning of national forest policies. National policies and strategies should provide a framework for increased efforts, including the development and strengthening of institutions.

47. The vital role of all types of forests in maintaining the ecological processes and balance at the local, national, regional and global levels should be recognized. National forest policies should recognize and duly support the identity, culture and the rights of indigenous people, their communities and other communities and forest dwellers. The full participation of women in all aspects of the management, conservation and sustainable development of forests should be actively promoted. The forests play an important role in meeting energy requirements through the provision of a renewable source of bio-energy. The role of planted forests and permanent agricultural crops as sustainable and environmentally sound should be recognized, enhanced and promoted. Their contribution to the maintenance of ecological processes, to offsetting pressure on primary/old-growth forest and to providing regional employment and development with the adequate involvement of local inhabitants should be recognized and enhanced. Natural forests also constitute a source of goods and services, and their conservation, sustainable management and use should be promoted. Efforts should be made for increasing the forest productivity.

48. National policies and/or legislation aimed at management, conservation and sustainable development of forests should include the protection of ecologically viable representative or unique examples of forests, including primary/old-growth forests, cultural, spiritual, historical, religious and other unique and valued forests of national importance. National policies should ensure that environmental impact assessments should be carried out where actions are likely

to have significant adverse impacts on important forest resources. National policy should be formulated with respect to all types of forests taking into account of the pressures and demands imposed on forest ecosystems.

49. Lord Gautam Budha and Lord Mahavira also sat under the trees for enlightenment. The trees in India are worshipped as incarnations of the goddess: Bamani Rupeshwari, Vandurga. The goddess of the forest, Aranyi, has inspired a whole body of texts, known as 'Aranyi Sanskriti'. It means, "the Civilisation of Forest".

50. The term of ecology, eco-system, environment, environment engineering including environment ecology have been explained in "MacGraw-Hill Encyclopedia of Science & Technology, read as under :-

Ecology

The subdiscipline of biology that concentrates on the relationships between organisms and their environments; it is also called environmental biology. Ecology is concerned with patterns of distribution (where organism occur) and with patterns of abundance (how many organisms occur) in space and time. It seeks to explain the factors that determine the range of environments that organisms occupy and that determine how abundant organisms are within those ranges. It also emphasizes functional interactions between cooccurring organisms. In addition to its character as a unique component of the biological sciences, ecology is both a synthetic and an integrative science since it often draws upon information and concepts in other sciences, ranging from physiology to meteorology, to explain the complex organization of nature.

Environment is all of those factors external to an organism that affect its survival growth, development, and reproduction. It can be subdivided into physical, or abiotic, factors, and biological, or biotic, factors. The physical components of the environment include the organisms. A somewhat more general term is habitat, which refers in a general way to where an organism occurs and the environmental factors present there.

Applied Ecology

Applied ecology is that branch of ecology dealing with practical problems of immediate social importance. Ecology is often confused in the minds of laypersons with the environmental movement, a social interest group concerned with environmental degradation and problems of resource supply to human societies. Applied ecology makes a fundamental contribution to those social and political concerns by identifying environmental problems, gaging their significance, and suggesting potential solutions. Among the environmental issues to which ecology had made an important contribution have been problems of population growth and resource supply, acid rain, eutrophication, consequences of pollution, biological control of crop pests, range management, forestry, and the ecological consequences of nuclear war. From T.R. Mathus's essay on human

population growth to recent scientific evaluations of nuclear war, ecology has always been concerned with problems that are important to the affairs of humans.

Ecosystem ecology

Ecological systems, or ecosystems, are complexes of plants, animals, microorganisms, and humans, together with their environment. Environment includes all those factors, physical, chemical, biological, sociocultural, which affect the ecosystem. The complex of life and environment exists as an interacting system and is unique for each part of the Earth. The unique geological features, soils, climate, and availability of plants, animals, and microorganisms create a variety of different types of ecosystems, such as forests, fields, lakes, rivers, and oceans. Each ecological system may be composed of hundreds to thousands of biological species which interact with each other through the transfer of energy, chemical materials, and information. The interconnecting networks which characterize ecosystems are often called food webs (Fig. 1). It is obvious from this structural feature of interaction that a disturbance to one population within an ecosystem could potentially affect many other populations. From another point of view, ecosystems are composed of chemical elements, arranged in a variety of organic complexes. There is a continual process of loss and uptake of chemicals to and from the environment as populations are born, grow and die, and are decomposed. Ecosystems operate on energy derived from photosynthesis (called primary production) and from other energy exchanges. The functional attributes of ecosystems, such as productivity, energy flow, and cycling of chemical elements, depend upon the biological species in the ecosystem and the limiting conditions of the environment. See BIOLOGICAL PRODUCTIVITY; ECOLOGICAL ENERGETICS; FOOD WEB.

Ecological systems develop in accord with the regional environment. Although these systems have evolved to resist the normal expected perturbations encountered in the environment, unusual disturbances and catastrophic events can upset and even destroy the system. In this case, recovery can occur after the disturbance stops. Recovery is termed ecological succession since it comprises a sequence of communities which succeed each other until a dynamic steady state is reestablished. See ECOLOGICAL SUCCESSION.

Populations in these ecosystems fill a variety of structural and functional roles within the system. Often, groups of populations coevolve, so that they form a more or less isolated subunit. For examples, the pollinators of a plant species, and their predators and parasites, form such a guild. Populations continually adapt and develop through natural selection, expanding to the limit of their resources. Population growth is, therefore, due to an increase in resources or a relaxation of limiting factors. See ECOSYSTEM; POPULATION ECOLOGY.

Atmospheric problems

The atmosphere is one of the most important components of the environment to

consider from the viewpoint of applied ecology since it connects all portions of the Earth into one ecosystem. The atmosphere is composed of a variety of gases, of which oxygen and nitrogen make up the largest percentage. It is not uniform in its depth or its composition, but is divided into several layers or zones which differ in density and composition. Although most interaction with humans occurs in the zone nearest Earth, the most distant parts of the atmosphere are also important since they affect the heat balance of the Earth and the quality of radiant energy striking the surface. Disturbances to these portions of the atmosphere could affect the entire biosphere. See ATMOSPHERE.

The composition of the atmosphere varies according to location. The qualities of minor gases such as carbon dioxide, the amounts of various metallic elements, and the quantity of water vapor and dust all may differ, depending on the relative distance from land or sea. But, in addition, the atmospheric composition may change in time. For example, over the history of the planet, the percentage composition of oxygen has changed from a very oxygen-poor environment by volume. See ATMOSPHERE, EVOLUTION OF; ATMOSPHERIC CHEMISTRY.

Human activities may introduce a variety of pollutants into the atmosphere. The principal pollutants are carbon dioxide, sulfur compounds, hydrocarbons, nitrogen oxides, solid particles (particulates), and heat. The amounts of pollutants that are produced may be quite large, especially in local areas, and have increased in amount as industrialization has become more widespread. Industrial and domestic activities have also been estimated to put 2.18×10^8 tons (1.96×10^8 metric tons) of sulfur into the atmosphere per year. In most cases, these pollutants have increased during the recent past, and in many areas have become a serious problem. See AIR POLLUTION.

Atmospheric problems can have a variety of impacts on humans. Numerous observers have attributed climatic change to atmospheric alteration, since any change in the gaseous envelope of the Earth could alter the heat balance and the climate. The Earth's climate is not constant, and it is difficult to establish an exact correlation between pollution and variation in temperature or solar radiation at the Earth's surface. The pollutants most likely to have an effect on climate are carbon dioxide and solid particles. Pollution may also affect the chemical balance of regions of the Earth. These effects may be extremely complicated. For example, it has been reported that sulfur oxides produced in the industrial districts of northern Europe have moved north in the atmosphere over Scandinavia. The sulfur oxides react with water to form sulfuric acid, which rains out in precipitation. The acid rain changes the acidity of the soil in this region and may depress the activity of blue-green algae, with fix nitrogen from the atmosphere. Acid rain appears to cause reduction in the growth of trees. Other pollutants may act in a similar complicated fashion through the network of interactions in the Earth ecosystem. See ACID RAIN.

Finally, atmospheric pollution has direct effects on plants and animals and human activities. Pollutants, like other materials, can act as limiting influences on the

growth, reproduction, and survival of plants and animals. A variety of plants, such as lichens and mosses, that are extremely sensitive to pollution can be used to indicate the degree of atmospheric deterioration. In some severe cases, all vegetation and animal life may be destroyed in the vicinity of the polluting industry. Gases and solids are taken into the lungs of humans, and cause disease or discomfort. In cities, such pollutants as asbestos and lead are exceedingly dangerous to the population. And finally, the impact of pollutants on buildings, clothes, artwork, and machines is costly.

Control of atmospheric pollution requires interception of pollutants at the point of discharge. Industrial control can be achieved by the use of special filters, precipitators and other devices. Control of pollution for automobiles also may involve special equipment, as well as redesign of engines and fuel. Reduction in dust and similar general sources of air pollution may demand a change in the operation producing the problem.

Water problems

The aquatic environment is of equal importance to applied ecology since most of the Earth's surface is covered by the oceans, and the land is connected to the oceans by streams and rivers. Thus, like the atmosphere, the waters are a connection between distant parts of the biosphere and can carry a disturbance from its origin to another region.

Ecosystem

A functional system that includes an ecological community of organisms together with the physical environment, interacting as a unit. Ecosystems are characterized by flow of energy through food webs, production and degradation of organic matter, and transformation and cycling of nutrient elements. This production of organic molecules serves as the energy base for all biological activity within ecosystems. The consumption of plants by herbivores (organisms that consume living plants or algae) and detritivores (organisms that consume dead organic matter) serves to transfer energy stored in photosynthetically produced organic molecules to other organisms. Coupled to the production of organic matter and flow of energy is the cycling of elements. See ECOLOGICAL COMMUNITIES; ENVIRONMENT.

Environment

The sum of all external factors, both biotic (living) and abiotic (nonliving), to which an organism is exposed. Biotic factors include influences by members of the same and other species on the development and survival of the individual. Primary abiotic factors are light, temperature, water, atmospheric gases, and ionizing radiation, influencing the form and function of the individual.

For each environment factor, an organism has a tolerance range, in which it is able to survive. The intercept of these ranges constitutes the ecological niche of the organism. Different individuals or species have different tolerance ranges for

particular environmental factors - this variation represents the adaptation of the organism to its environment. The ability of an organism to modify its tolerance of certain environmental factors in response to a change in them represents the plasticity of that organism. Alterations in environmental tolerance are termed acclimation. Exposure to environmental conditions at the limit of an individual's tolerance range represents environment stress. See ADAPTATION (BIOLOGY); ECOLOGY; PHYSIOLOGICAL ECOLOGY (ANIMAL); PHYSIOLOGICAL ECOLOGY (PLANT).

Environment engineering

The division of engineering concerned with the environment and management of natural resources. The environmental engineer places special attention on the biological, chemical, and physical reactions in the air, land, and water environments and on improved technology for integrated management systems, including reuse, recycling, and recovery measures.

Scope

Environmental engineering began with the need for acceptable drinking water and for management of liquid and solid wastes. In fact, the terms public health and sanitary were used to identify the engineers seeking solutions for eliminating waterborne disease in the 1800s. Later, urbanization and industrialization contributed significantly to the formation of unsanitary conditions in many areas. Abatement of air and land contamination became new challenges for the environmental engineer, followed by toxicwaste and hazardous-waste concerns. The environmental engineer is also instrumental in the mitigation and protection of wildlife habitat, preservation of species, and the overall well-being of ecosystems.

During project development, environmental engineers conduct a life-cycle analysis (cost-effectiveness analysis) of project alternatives that consider the capital and the operation and maintenance costs over the life of the project. The National Environmental Policy Act and other legislation, regulations, and policies contain provisions to expand the alternative analysis to reduce ecological, health, and safety risks during project development. This process embraces the concepts often called green engineering.

Green engineering is the early application of environmentally favorable engineering project concepts in the design and development of processes, products, and facilities. Embracing the basic concepts of pollution prevention and waste minimization, green engineering considers innovative and alternative technologies. The project should be feasible and economical, while minimizing the generation of air, water, and solid-waste pollution at the source, as well as the risk to public health and the environment.

The U.S. Environmental Protection Agency has a Design for the Environment (DfE) program that includes a life-cycle assessment. This process provides a tool

to examine the environmental impacts of products over their entire life cycle from materials acquisition to manufacturing, use, and disposition. Design for the Environment provides decisionmakers with information, tools, and incentives to make informed decisions that integrate risk, performance, and cost issues. The life-cycle analysis evaluates impacts on human health, atmospheric resources/air quality, water quality, ecological health, and natural resource consumption.

Education of professionals. Traditionally, environmental engineers drew their basic education and training from civil engineering programs. In order to broaden their perspective and capabilities, contemporary environmental engineers undertake course work and postgraduate training in a number of professional areas, including biology, epidemiology, chemical engineering, chemistry, and hydrology. Since environmental engineers deal with sensitive public issues, training in public education, risk assessment, public policy, and social sciences is desirable.

After satisfying experience and testing requirements, the environmental engineer obtains professional engineering registration. Professional associations of interest to the environmental engineer include the American Academy of Environmental Engineers, the Air and Waste management Association, the American Water Works Association, the Water Environment Federation, and the solid Waste Association of North America.

Professional activities. Principal areas of employment for practicing environmental engineers include consulting, industry, and government. Other environmental engineers are academic or research faculty, or they direct the development and production of pollution-control equipment.

Consulting environmental engineers apply their knowledge and experience under contract to public and private clients. Their services may range from studies to preliminary design, final design, construction management, and operation and maintenance services. Specific areas of service studies and assessments, assistance in obtaining permits, and expert witness testimony.

Within the industrial sector, there is considerable demand for environmental professionals to achieve and maintain compliance with environmental statutes and regulations. Increasing public sensitivity to the environment and demand for a clean environment have expanded industry's need for environmental engineering technology.

Environmental engineers in public service provide technical expertise in all levels of government. Though most publicized for their role in the development of regulations and in enforcement, they also are involved in numerous research and development programs and technology transfer activities.

The principal environmental engineering specialties are airquality control, water supply, wastewater disposal, storm water management, solid-waste management, and hazardous-waste management. Other specialties include

industrial hygiene, noise control, oceanography, and radiology.

Air-quality control

The term air pollution is used to describe the presence in the atmosphere of one or more contaminants in quantities, and with characteristics, that will be injurious to, or unreasonably interfere with, public health and welfare or other natural environmental processes. The extent of air pollution problems ranges from relatively small areas, such as an industrial park impacted by one or more emission sources, to urban areas impacted by a number of contaminant sources.

Contaminants are categorized as particulate matter and gases and their associated forms, including dust, smoke, fumes, mist, and vapor. The primary gaseous air contaminants are carbon monoxide, hydrocarbons, nitrogen oxides, and sulfur oxides.

Meteorological and topographical factors contribute to the creation and continuation of air pollution under specific site conditions. Temperature inversions prevent upward diffusion, and very low wind speeds allow emissions to remain near their source. Some terrains cause emissions to follow specific patterns from one area to another.

Generally, sources of air contaminants may be classified as stationary, mobile, or fugitive. Respectively, they are attributed to point sources such as industrial stack emissions, transportation activities such as automobile emissions, and uncontrolled (fugitive) sources such as windblown dusts from stockpiles.

The environmental engineer is instrumental in developing particulate and gas controls for all sources of air contaminants. Source control is the first abatement method considered. Controls for particulates include settling chambers, inertial separators, wet scrubbers, and fabric filters. Gas controls include absorption, absorption, condensation, flaring, and incineration. Other areas of practice address acid rain issues, fugitive emissions, odor control, indoor air quality, and noise abatement.

Indoor air quality is of increasing concern for health officials and the public. Industrial hygienists and various engineering disciplines are instrumental in identifying and controlling indoor air pollution. Environmental engineering principle can be used in technical assessments for identifying air pollutants and selecting source controls.

Indoor air quality control measures are very source-specific. The basic abatement strategies are source control, ventilation improvements, and air cleaners. Typically, source control is the most cost-effective abatement measure. See AIR POLLUTION; AIR POLLUTION, INDOOR.

Environmental geology

The branch of geology that deals with the ways in which geology affects people. Examples of the effect of geology on human civilizations include (1) the ways

that fertile soils develop from rocks and how these soils can become polluted by human activities; (2) how rocks and soils move down-slope to destroy roads, houses, and other human construction; (3) sources of surface and subsurface water supplies and how they become polluted; (4) why floods occur where they do and how human activities affect floods; (5) locations of earthquakes and volcanic eruptions and the dangers they pose; (6) location of mineral resource such as copper, oil and gas, and uranium, and how mining these resources can pollute the environment; (7) how human activities can pollute the atmosphere and cause global warming, sea-level rise, and ozone depletion.

Soil

Most environmental concerns center on three materials essential to human life: soil, water, and air. Soils develop from chemical reactions between rocks, water, and atmospheric gases such as oxygen and carbon dioxide. The most abundant solid product of these reactions is a variety of clay minerals, which are major contributors to agricultural fertility. Ions on clay surfaces and decaying organic matter are the sources of nutrient elements for growing plants. Clay minerals are also responsible for destructive events, such as when they absorb water and cause soil to swell, resulting in foundation cracking and other structural problems in buildings. Changes in clay minerals as they lie in the soil are also the cause of many types of landslides. See CLAY MINERALS; SOIL.

The major environmental problems affecting soil are erosion and pollution. Almost half of American farmland is losing fertile topsoil faster than it can be formed. Most of the erosion results from poor farming practices and overzealous logging. Which deplete the soil of plants and root systems that hold the soil in place. Most soil pollution is caused by synthetic chemical pesticides which not only kill the pests but also are absorbed by plants, which are then eaten by people and other animals. See EROSION; SOIL CONSERVATION.

Water

The amount of water on the Earth's surface is constant and more than enough to supply human needs. Water problems are generally concerned with local supply and its pollution. Serious water shortages in the United States occur in many western states because of increasing populations, as in Phoenix, Las Vegas, and Los Angeles.

In areas where surface water supplies are inadequate, fresh water can commonly be obtained from underground sources. The water occurs in the open spaces between the grains in sedimentary rocks and has accumulated in the rocks over many thousands of years. When this water is withdrawn faster than it is naturally replenished by rain-and snowfall, the underground supply can become seriously depleted, as is occurring today in many western cities. Such depletion is also a serious problem in the heavily irrigated agricultural areas of the central United States, because most irrigation water is drawn from subsurface supplies. Removal of subsurface water can also result in ground subsidence, a serious

problem in central California, Houston, and New Orleans. See GROUND-WATER HYDROLOGY.

Pollution. Most water pollution problems in the United States are caused by synthetic organic compounds and heavy elements released in wastewater discharges, many by the military as well as by chemical plants. Oil refineries are also major polluters. Other sources of pollution include leaking sanitary landfills, pesticides in runoff from farms, and mixtures of sulfuric acid and cyanide from mining operations. See HAZARDOUS WASTE; WATER POLLUTION.

Hazardous waste water can be disposed of by underground injection, incineration, evaporation from open pits, or export to other areas. The most common domestic method is underground injection, but because the underground geology is inadequately known, liquid hazardous waste injected deep underground has seeped into underground water supplies in about half the states. About 20% of hazardous waste is incinerated, but the Environmental Protection Agency (EPA) estimates that 60% could be disposed of by this safer method. Incineration is more expensive than subsurface disposal, however. Disposal by evaporation from surface impoundments is very unsafe and has caused ground-water contamination in about three-quarters of the 50 states.

Floods. Floods are the most commonly experienced natural calamities and are the cause of about 60% of declared disasters. Flooding may be caused by hurricanes from the ocean or excessive water from landward areas. Hurricanes cannot be controlled, and the value of property destroyed by them has increased considerably over time because of people's desire to live near the seashore. Loss of life has decreased, however, because of improved forecasting and early warning. Flooding resulting from excessive rain on the land surface has been exacerbated by the human desire to live near river channels, to pave land surfaces and increase the rate of runoff, and to denude hill slopes by excessive logging. Without vegetation and porous soil, the rate of runoff of rainwater is increased and river channels cannot hold all the water they receive. The massive flooding in central China in 1998 was attributed to the stripping of vegetation over large areas.

Atmosphere

Concerns about air quality revolve around increases in the amount of carbon dioxide, decreases in the amount of ozone 10-20 mi above the surface, and pollution of the air that sustains life in the lower atmosphere. Increasing carbon dioxide levels result largely from the burning of coal and oil, the main sources of energy in industrial societies. The amount of carbon dioxide in the air has increased by nearly 30% during the past 150 years. Carbon dioxide absorbs radiation from the Earth's surface and has caused a measurable increase in global temperatures (greenhouse effect); this global warming may in turn result in rising sea levels (from melting glaciers), endangering coastal communities over the long term. See GREENHOUSE EFFECT.

The concentration of ozone in the stratosphere absorbs most of the Sun's ultraviolet (UV) radiation, thus protecting people from excessive skin cancers, damaged immune system, and other maladies. The thickness of the ozone layer has decreased significantly during the past 50 years because of the release to the atmosphere of chlorofluorocarbons (CFCs) which now nearly stopped worldwide, but the ozone layer will not restore itself completely for about another 50 years.

Noxious gases and particulates in the air result largely from combustion of coal and oil in automobiles and factories. It is the cause of many lung problems and premature deaths in industrial countries. See AIR POLLUTION.

Applied ecology is that branch of ecology dealing with practical problems of immediate social importance. Ecology is often confused in the minds of laypersons with the environmental movement, a social interest group concerned with environmental degradation and problems of resource supply to human societies. Applied ecology makes a fundamental contribution to those social and political concerns by identifying environmental problems, gaging their significance, and suggesting potential solutions. Among the environmental issues to which ecology had made an important contribution have been problems of population growth and resource supply, acid rain, eutrophication, consequences of pollution, biological control of crop pests, range management, forestry, and the ecological consequences of nuclear war. From T.R. Mathus's essay on human population growth to recent scientific evaluations of nuclear war, ecology has always been concerned with problems that are important to the affairs of humans.

51. Their Lordships of Hon. Apex Court have repeatedly held that mining operation is hazardous in nature. It impairs the ecology and people's right to natural resources. The entire process of setting up and functioning of a mining operation requires utmost good faith and honesty on the part of the intending entrepreneur. A balance has to be struck.

52. The mining activities have largely affected the local surface drainage as well as the groundwater conditions in area. It has come on record that private respondents have started mining activities in the Forest areas. The ground water condition has been disturbed. The entire area is geodynamically sensitive and ecologically fragile. The mountain environment is entirely different from other environments. The State should adopt positive environmental economics. State should also promote the positive environmental values by education, debates etc. The essential objectives of all provisions relating to waste disposal must be protection of human health and the environment against harmful effects caused by the collection, transport, treatment, storage and tipping of waste. The human health and environment is harmed by the illegal unscientific mining. The Dust, Chemicals spills, harmful fumes, heavy metals and radiation etc. can poison workers and cause life-long health problems. The heavy lifting can lead to injuries to the arms, legs and back. The use of jackhammers or other vibrating

machinery etc. can cause damage to nerves and blood circulation. The loud, constant noise from mining activities may cause hearing problems. Vision can also be affected. In case the mining operation is carrying out in hot conditions, it can cause weakness. The dust may cause damage to lungs and develop other health diseases like as heart disease, lung cancer, pneumonia and asthma. Workers should be provided materials to protect from breathing dust. State Government should ensure that in the mining operation, necessary protection to the workers from the dust be provided. The mining operations contaminate the water, surface water and ground water for centuries together. The mining operation must ensure that there is no leakage into the ground water by way of spilling. First Aid must be made available to the people. It is the duty of the State to teach and trained the workers about the mining dangers. The focus should be on sustainable mining instead of haphazard mining. The mining activity has a strong impact on environment in the exploration, construction and exploitation steps. Mining as noticed leads to erosion. The erosion of land should be controlled at the early stages since it results in land sliding. The erosion may result in loading of sediments to nearby water bodies. The mining impacts on air quality. The mining also impacts flora and fauna. The survival of wildlife species can depend on soil conditions, local climate, altitude and other features of the local habitat. Direct and indirect damage to wildlife is caused by mining. Similarly, human life is also affected since streams, lakes and rivers are contaminated. Unscientific and irregular mining has also impacts public health.

53. "In the north, there stands Himalaya the kind of the mountains, having a divine soul. It exists like a measuring rod of earth, having reached the eastern and western seas. - Kalidas (Kumara-sambhava)."

54. The Nobel Prize laureate and poet, Rabindranath Tagore, in his book Tapovan, has explained the importance of nature as under :-

"Indian civilisation has been distinctive in locating its source of regeneration, material and intellectual, in the forest, not the city. India's best ideas have come when human beings were in communion with trees. Indian thinkers were surrounded by and linked to the life of the forest, and the intimate relationship between human life and living nature became the source of their knowledge."

55. In one of the articles contained in "The Secret Abode of Fireflies, Loving and Losing Spaces of Nature in the City", the importance of trees is explained in article "Foresters without Diplomas" written by Sri Wangari Muta Maathai (Kenyan Environmentalist and Nobel Peace Winner-2004) as under :-

"We could see Mount Kenya from my house, and I grew up hearing that God lives in Mount Kenya and all good things come from there. The clouds, the rains, the rivers in which I played with frogs" egg and tadpoles; they all start from there. And they said that sometimes Ngai likes to take a walk in the mountains and the forests. If anyone used their machetes to cut down trees, it was said that the trees would bleed. You were only allowed to collect dry, fallen wood for fuel these

forests full of fig trees.

`For my people, the fig tree is sacred and when we were growing up it was everywhere. I would go collect firewood for our mother; she warned me, "Do not collect firewood from a fig tree. That is a tree of God. We don't cut it. We don't burn it. We don't use it for beauty. It must stand there." When we offer sacrifice, we do it under a fig tree, `she shares, urging on a greater awareness of how an awesome symmetry binds people to their land and to each other, her thoughts seamlessly flowing in and out of each other and her eyes, brilliant points, charging the mellow lighting and cream sophistication of the room. `I am spiritually nurtured by the fact that what I am doing is in accordance with a spiritual constitution, a rhythm. For me, in the work that I do, it is a spiritual fulfillment, rather than a religious or dogmatic conviction. I was raised by people who were not detached from the land. We didn't have anything written, all our scriptures were oral, and they are embedded in me, although I went through Christian teaching and became a Catholic. But I do find that even in other scriptures, you come across a Garden of Eden or some engagement with nature. And there is much more to forests than trees; trees are only what we see, and there is so much we still don't understand," she stresses.

Wangari continues with glorious concentration, `One of the ways through which communities conserve their biodiversity and their resources is through culture, and I want to emphasize that for me culture is very important, very enriching, because culture influences who we are. Festivals, rituals and ceremonies are all a part of our culture as well, and can you imagine how much we conserved because we incorporated nature into our festivals, into our religions, into our dances, into our songs, into our symbols, into our stories? And they define who we are. When they are destroyed, our environment too is destroyed. Any very often when we forget who we are, we lose all our wonderful associations, our values that we've brought from the past generations. Once this gets translated into resources, it is converted into money. but in life everything is not money" her voices rises, indignant, exasperated.

`To a very large extent, I think, globalization is a threat to the environment in countries that are not developed industrially, in countries that are poor, because these countries are looking towards globalization as an answer, and believe that corporations will get them out of poverty. Very often, these corporations simply do business, take their profits and go- leaving their problems behind. I want to say to them that unless we can appreciate that the planet is very small, that part of the problem is that you think you are doing something to a distant person, a different part of the world. But it will eventually come back to you. We must expand our concept of home, to make sure we see beyond our individual countries. The very first astronauts told us that they were overwhelmed by the fact that they could not see boundaries, and they felt a strong urge to come back home. Home was that small blue ball we've become familiar with on television, a small ball beyond borders. The whole planet is our concern, wherever we are.

They are little things we can do in our lives, we can listen, we can consume less, because this is the only home we have, and we should leave it clean and green for future generations.

`And maybe if I had been born a man, all this would never have struck me," she says next, looking over to her younger sister who is grinning. She talks about how she arrived at some realizations, `It happened partly because I was a woman and partly because when I was in the National Council of Women. I started listening to the women from the countryside and got interested in their issues of livelihood and their connection with the environment. The women from the countryside wanted clean drinking water, firewood, good, adequate nutritious food and they needed an income. I grew up! I realized that in the span of about 20 years, a lot of vegetation that I knew had been cleared to bring in cash crops, especially coffee and tea, and indigenous forests were being cleared to make way for forests of exotic species such as eucalyptus from Australia and the pines from the northern hemisphere. As a result, the rain patterns were changing; there was massive soil erosion, so the clean streams that I knew as a child were drying up. That, for me, was the awakening experience. `So I told the women, "Listening to you, I recognize our environment is changing and I think we can do something about it. Let us plant trees."

56. In the same book in article captioned "Nature has Rights too" written by Vikram Soni & Sanjay Parikh, the rights of Nature have been explained, as under :-

"Human rights commissions are obligatory vigilantes in all democracies. Human rights are about inequities between one set of human beings and another. These range from usurping the sovereign rights of one nation by another more powerful one, to more local violations. They arise when the rich and powerful exploit the poor and disenfranchised. They reveal themselves in violence against women, violence against members of lower caste and creeds and other such instances. They are horrible acts and are often portrayed graphically.

Violations against nature can be equally appalling despite being viewed through the filter of `environmental damage". The Stockholm Declaration accepts the environment as part of basic human rights-the right to life itself.

The United Nations Millennium Report and the International Panel on Climate Change (IPCC) Reports both indicate that 60 per cent of earth's ecosystems are experiencing terminal loss. And the loss of these natural resources, whether of the Amazon forest, of sea life, elephants and tigers, rivers and lakes, glaciers or aquifers below the ground is strongly impacting human life.

Whereas human rights occupy centre stage and deal with human conflict, loss of natural resources threatens human survival itself. We must understand that the fundamental human rights on which human survival depends are Nature's rights.

Language is such a powerful medium of communication that it colours all our

metaphors, beliefs and imagination. But language can also craft deception - it can wash over common sense and sensibility. This is the case in the present scenario of extreme material consumption powered by the global free market.

The seductive vision of development has become so pre-emptive that the few remaining original forests - our biodiversity treasury- are being destroyed to make way for huge mines or dams or lucrative real estate projects. And we attempt to balance the destruction with 'compensatory afforestation', words that suggest that whatever damage is being done can be undone or compensated by artificial plantation.

To the unschooled and unsuspecting, this would appear to be a fair trade-off for development. But it is like giving sanction to the insane national that it is all right to kill all wild tigers as long as we replace them by farming the same population in captivity. Can valuable natural biodiversity that has evolved over thousands of years ever be compensated? Such subterfuge finds acceptance by court and government and is often subsumed in the dangerous cliché; 'sustainable development'. If sustainable development finishes off all our biodiversity, heritage and resources, is it admissible?

'Green buildings' is acceptable currency in the destruction of valuable heritage and resources. In the popular imagination, the word 'green' is so comforting that it clouds, the real loss, which is irreplaceable. So do modern terms like 'ecotourism' and 'ecofriendly development', where the prefix 'eco' works to trample the true value of the natural resource. Natural water resources are exploited by commercial building activities for short-term profits; and there's the magical phrase 'water harvesting'. Apart from depleting an irreplaceable natural resource like a deep underground aquifer or a flood plain, it is a well-kept secret that water harvesting saves no more than a fraction of the original resource.

We have to remove the hypocrisy of these 'green' clichés from our dictionary before such language seals our fate.

Having a law is one thing, ensuring its implementation is quite another. The precautionary principle has not been enforced, for example, on big projects like the Three Gorges dam on the Yangtze river in China, which has not been declared a disaster by the government. The Tehri dam on the Ganga, in a seismic Himalayan zone, and the Sardar Sarovar dam on the Narmada in India may follow suit.

Another notion is that poverty is itself a cause of pollution and that economic development will remove poverty and improve the environment. Poverty alleviation is often misused to justify development at the cost of environmental degradation. Let's see what is happening to people who have no link with the global economy but live simply amidst pure unpolluted streams, clean air and forests. The environment is what gives our lives a quality that cannot be bought, and they have preserved it this way. Their simple lifestyle is non-invasive. But now this basic and essential resource is being whittled away by big companies

that acquire huge swathes of virgin land for mining or 'development', leaving these people mute and destitute.

In the present climate, when we have already lost over half our natural resources, it is evident that principles like 'the polluter pays', 'the precautionary principle' or 'sustainable development' do not work any more- we are well past and point of precaution - and must be changed to stop further damage to resources that cannot be created by man.

Instead, we must have a Nature's Rights Commission made up of concerned citizens and scientists whose integrity is above any political and monetary affiliation. We only need a simple law that provides absolute protection to all valuable natural resources, be it forests, rivers, aquifers or lakes. The law could be a public trust doctrine, which has its basis in the ancient belief that Nature's laws impose certain conditions on human conduct in its relationship with Nature. There is a precedent for this. The Israeli parliament- the Knesset - has set up the Israeli Commission for Future Generations as an innerparliamentary entity. Its charter is to safeguard valuable natural heritage and natural resources. Its role is to oversee each legislative process, with special regard to long-term issues, and to prevent potentially damaging legislation from passage in the Knesset. This Commission has been given the authority to initiate bills that advance the interests of future generations. There is a historical precedent as well. Under Byzantine law, the concept of *jus gentium*, a law for all people and nations, was developed to protect Nature's resources. Later, this led to the Public Trust Doctrine in the Magna Carta of the thirteenth century. More recently, the Water Framework Directive of the European Union recognises natural water resources as a protected heritage."

57. In the same book article captioned "Under the Banyan Tree" written by Devdutt Pattanaik, the importance of trees under Indian Mythology has been explained as under :-

"Trees are sacred in India, and are often associated with a god or a goddess. Some Scholars believe that it is the tree that was worshipped first; perhaps for its medicinal or symbolic purpose, and that the gods and goddesses came later. That may be the case, but today, trees are an integral part of a deity's symbolism. The mango tree, for example is associated with the Love God Kama, the tulsi plant is dear to Vishnu, bilva is associated with Shiva worship, blades of dhruva grass are offered to Ganesha, neem or margosa is sacred to the Mother Goddess, coconut and banana are associated with Lakshmi.

The banyan tree is associated with Yama, the God of Death, and the tree is often planted outside the village near crematoriums. It is believed to be the abode of ghosts. Vetalas and pisachas are supposed to hang from its many branches.

Indians knew that banyan tree as the vata vriksha. When the British came to India, they noticed that members of the trading or Bania community gathered under a large shady fig tree, which they named the banyan, from Bania.

Technically, *Ficus bengalensis*, the banyan, belongs to the fig family. There are various types of fig trees all over the world and some of these are sacred. The most popular one is the *Ficus religiosa*, or the peepul which became especially popular in the Buddhist times, because it was under this tree that Gautama Siddhartha of the Sakya clan attained enlightenment. It was the leaves of a fig tree that Adam and Eve used to cover their nakedness in Eden after they were tempted to eat the forbidden fruit by Satan.

The banyan tree does not let a blade of grass blow under it. Thus, it does not allow for any rebirth and renewal. While the banyan offers shade from the sun, it offers no food. That is why it is not part of fertility ceremonies like marriage and childbirth, where food-giving, rapidly renewing plants with a short lifespan such as banana, mango, coconut, betel, rice and even grass are included.

Marriage and rebirth are rites of passage; they represent major shifts in life. They are all about instability and flux; the banyan tree is the very opposite. It is stable and constant. It has a long lifespan, and hence seems immortal. Its roots descend from the branches and then anchor the tree to the ground, transforming into trunks eventually, so that decades later, it is difficult to distinguish root from stem.

Things that evolve the notion of immortality become auspicious in India; for example, the immortal mountain, the immortal sea, the immortal diamond and indestructible ash. This is because since ancient times, Indian seers were acutely aware of the transitory nature of things around us. Everything dies-every plant, every animal, even moments die; the present becomes the past in an instant. In an ever changing world, we seek constancy and permanence. The banyan tree is therefore worthy of veneration. It is evergreen and shady, hence an eternal refuge for all creatures unable to bear the vagaries of life.

Thus it emerges that in Indian thought, there are two types of sacredness-one that is associated with impermanent material reality, and the other, which is associated with permanent spiritual reality. The banana and the coconut fit into the previous category; the banyan fits into the latter. Banana is the symbol of flesh, constantly dying and renewing itself. Banyan is the soul-never needing to renew itself. The banyan is the botanical equivalent of the hermit.

Just as a hermit cannot raise a family, a banyan tree cannot support a household. It represents not the material aspiration of a people; it represents the spiritual aspiration. The banyan tree is said to be immortal; it is *akshaya*, that which survives *parlaya*, the destruction of the whole world.

The Mahabharata tells the story of a woman called Savitri, who lost her husband as destined one year after her marriage near a banyan tree. She followed Yama to the land of the dead, and through determination and intelligence, managed to secure back her husband's life. In the memory of the event, Hindu women circle the banyan tree, tying seven stings around it. This is imitative magic; by symbolically going around the immortal tree, the women are binding immortality

into their married lives. They are securing the lives of their husbands, the pillars of their households. They are protecting themselves from widowhood, which is believed by most Hindus to be the worst fate for a woman.

Under the banyan tree sat the sages of India - those who rejected the flesh and the material world and aspired for the soul alone. This was the favourite tree of the sadhu, the wandering hermit. The greatest of hermits, Shiva, was often represented in its shade as stone called the Lingam. Being an ascetic, Shiva was not part of the village; he was a hermit, not a householder; he did not fear ghosts and so was comfortable staying in the shade of this immortal, never dying, and never renewing plant.

In iconography, Shiva is visualized as Dakshinamurti, he who faces the South-South being the direction of death and change. He sits under the banyan tree, the botanical embodiment of the universal soul, facing the terror of death and change stoically, unafraid, because of his profound understanding of the world. At his feet sit sages who are recipients of Shiva's wisdom. In South Indian temples, Shiva's south facing form, under the banyan tree, is placed on the south facing wall of the temple. Like Shiva, Vishnu is also a form of God. But Vishnu is not associated with the banyan tree, perhaps because Vishnu is that aspect of God, which more associated with change. He goes with the flow- this attitude is called leela or playfulness- he does not fear change. Vishnu is therefore associated with the fragrant tulsi plant, or with flowering plants like champa and Kadamba. But there is one time when Vishnu is associated with the banyan tree. It is during the end of the world, when flood waters rise and dissolve all things. Sage Markandeya, who had a terrifying vision of this event, saw Vishnu as a baby lying on the leaf of banyan tree, cradled by the deadly waves. This form of Vishnu is called Vata-patra-Shayin, he who rests on the banyan leaf. The image is rich in symbols; the whole world may seem transitory, like the waves of the ocean, but all life can renew itself, as a baby replaces the older generation, because divine grace represented by Vishnu is eternal, like a banyan leaf."

58. Learned authors; T.S. Rana, Bhaskar Datt & R.R. Rao, in the article on Biodiversity in the Alpine Himalaya: Strategies for Conservation and Ecodevelopment which contained in High Altitudes of the Himalaya-II (Biodiversity, Ecology & Environment) have mentioned that the alpine zone in the Himalaya constitutes a unique habitat and has contributed to great biological diversity, particularly in the flora of India. In fact the alpine Himalayan Zone is a warehouse of biodiversity, botanical curiosity and valuable medicinal herbs. The conservation of its biodiversity particularly species which are in immediate danger of extinction is a great challenge for all conservation biologists of 21st century. The Himalayan chain consists of the complex system of three parallel ranges of tertiary mountains namely (i) Great Himalaya or Trans Himalaya (average elevation 6000m), (ii) Lesser Himalaya or Middle Himalaya (average elevation 4500m) and (iii) Outer Himalaya or Siwalik ranges (up to 1200m),

rising between the Indian Peninsula and Central Asia as a young system of mountains stretching over nearly 3000 Km. almost from the borders of Afghanistan in the west to the north of Myanmar in the east with altitude ranging from few hundred to over 8000 m.

59. Learned authors have described the alpine zone, alpine forests, alpine scrubs, alpine meadows and Phytogeographical considerations are as under : -

The alpine zone

Alpine zone in the Himalaya is that section, which lies immediately above the tree line and below the snow line. Generally, the lower part of the alpine zone is a summer grazing ground, with meadows bright with alpine flowers and the upper parts have a high alpine flora with species adapted to withstand the extremes of cold and desiccation (Polunin & Stainton, 1984). As started above, on account of the wide ranging climatic conditions at different latitudes and altitudes of the Himalaya, the demarcation of the alpine zone by altitude alone in the entire Himalayan belt is not possible because variation in alpine flora depends on local environment.

The western Himalayan ranges differ from their eastern counterparts in greater breadth and length, higher latitude, scanty rainfall, heavy snowfall and cool, dry climate. This marked difference in the humidity and quality of vegetation in eastern and western Himalayan is evident by the fact that the tree line in the western Himalaya is ca 3600 m as compared to eastern Himalayan where the tree line extends to ca 4600 m. The eastern Himalaya is more evenly than the western Himalaya. The degree of precipitation is due to the abruptly rising hills that directly confront the moisture laden clouds blowing from the Bay of Bengal. The high humidity is conducive for the tree growth, and therefore, the timber line or the upper limit of tree zone goes up to 4600 m compared to 3600 m in western Himalaya. The vegetation of the alpine zone is normally devoid of any tree growth, except for the stunted bushes and shrubs scattered among the characteristic cushion-forming or matted plants and colourful herbs, most of which are seasonal.

Although the species composition in the alpine belt is more or less same in the entire Himalaya, the density and frequency of the species vary considerably in the eastern and western sectors. Also, certain species are strictly endemic either to the alpine belt as a whole or confined to western or eastern sectors. The alpine belt in the western sector is more dominant and composed of open rolling grassy meadows termed as "bugyals" in Garhwal and Kumaon and "margs" in Kashmir.

The alpine vegetation is not very dense but is a store house of numerous colourful herbs many of them being valued medicinal plants like *Aconitum heterophyllum* (Atees), *A. ferox* (Bish), *Saussurea constus* (Kuth), *Dactylorhiza hatagirea* (Salam panja), *Ephedra gerardiana* (Somlata), *Gentiana kurroo* (Karu), *Picrorhiza kurroa* (Kutki), *Nardostachys jatamansi* (Jatamansi), *Podophyllum*

hexandrum (Papra), *Rheum emodi* (Dolu), *Berberis* spp. and others. The alpine vegetation of the Himalaya can be broadly discussed under:

1. Alpine forests

The alpine forests in the western Himalaya are dominated by *Betula utilis*, *Pinus wallichiana*, and *Rhododendron campanulatum*, which are all scattered and stunted. These forests are generally seen on rocks, ridges and other similar situations. The shrubby and herbaceous components of these forests are almost the same as noticed in the temperate zone. In the eastern sector, only dominant species is *Abies densa* associated with *Betula utilis* and rarely *Juniperus wallichiana*.

2. Alpine scrubs

Alpine scrubs are chiefly met with on rocks, ridges and stony slopes and generally appear above the tree limit and in similar habitats, ascending almost up to 4200 m. The chief shrubby components are *Berberis jaeschkeana*, *Myricaria elegans*, *Lonicera asperifolia*, *L. Hypoleuca*, *L. semenovii*, *L. spinosa*, *Salix flagellaris*, *S. lindleyana*, *S. pychnostachya*, *Rhododendron anthopogon*, *R. lepidotum*, *Juniperus indica*, *J. recurva* and *J. communis*. Areas where adequate water is available, the *Rhododendron* are frequently seen along with the species of *Berberis*, *Lonicera* and few others. In drier inner valleys, species like *Rosa webbiana*, *Cotoneaster pruinosis*, *C. microphyllus*, *C. gilgitensis*, *Caragana versicolor*, *C. brevifolia*, *C. gerardiana* and *Cassiope fastigiata* and *Ephedra gerardiana* are common. The herbaceous elements among these alpine scrubs are species of *Artemisia*, *Astragalus*, *Androsace*, *Anemone*, *Aster*, *Gentiana*, *Geranium*, *Mysotis*, *Oxytropis*, *Potentilla*, *Ranunculus*, *Saxifraga*, *Sedum*, *Epilobium*, *Eritrichium*, *Primula*, *Thalictrum* and several members of *Brassicaceae* and *Poaceae*.

3. Alpine meadows

The alpine meadows or alpine pastures the most fascinating areas which support unique plant species. These alpine meadows form a lush carpet in some localities and are the picturesque beauty of high lofty snow peaks. Such typical alpine meadows can be found in the "Valley of Flowers", Bishtola, Baidni, Bajmora, Lakshmiban (Garhwal) and Joharpatti (Kumaon) in the western sectors. Typical alpine meadows are not common in east Himalaya.

In the eastern sector, the alpine meadows are confined only to small pockets on hill tops surrounded by dense vegetation as one can find in Arunachal Pradesh and Sikkim. At certain places the meadows are replaced by glacial moraines, which also possess a similar type of floristic composition. Most of the alpine herbs have annual aerial parts, but perennial underground rhizomes, rootstocks and stems covered and protected by layers of leaf-bushes and scales. The distribution pattern of these alpine meadows is largely determined by the local edaphic and climatic conditions. The common herbaceous elements of the alpine

meadows are *Aconitum violaceum*, *Adonis aestivalis*, *himalaica*, *Arabis tibetica*, *Arnebia euchroma*, *Artemisia gmelinii*, *Aster flaccidus*, var. *maximowiczii*, *Delphinium brunonianum*, *D. vestitum*, *Dracocephalum heterophyllum*, *Erigeron multiradiatus*, *Gernium collinum*, *Lagotis cashmiriana*, *L. kunawurensis*, *Lomatogonium carinthiacum*, *Oxygraphis endlicheri*, *Picrorhiza kurrooa*, *Rheum spiciforme*, *Stellaria cherleriae*, *Swertia petiolata*, *Tanacetum himachalensis*, *Thalictrum alpinum*, *Trachydium roylei*, *Trollius acaulis*, *Waldheimia glabra*, *W. tomentosa* and species of *Juncus*, *Lactuca*, *Pedicularis*, *Polygonum*, *Potentilla*, *Primula*, *Ranunculus*, *Rhodiola*, *Saxifraga*, *Saussurea* and *Senecio*. Most of the alpine plants have very colourful flowers much larger in size compared to the size of the plant. This could be one of the adaptations for ensuring the insect pollination, where the insect population is scarce.

Grasses and sedges are also common in the alpine meadows, the prominent of these are *Bromus gracillimus*, *B. inermis*, *Carex cruenta*, *C. infusate*, *C. nivalis*, *C. obscura*, *Dactylis glomerata*, *Elymus nutans*, *Festuca kashmiriana*, *Kobresia pamiroalaica*, *K. pygmaea*, *Pennisetum lanatum*, *Phleum alpinum*, *Poa alpine*, *P. tibetica*, *Trisetum spicatum*, etc.

The alpine marshes, along banks and similar marshy habitats support a number of characteristic marshy plants such as *Pinguicula alpine*, *Juncus leucomelas*, *Caltha palustris* and various colourful species of *Primula*, *Corydalis*, *Pedicularis* and *Polygonum*.

At the higher limits of alpine zone which are exposed to severe cold, only characteristic cushionforming species typical of cold desert are found. Some such species form soft cushion e.g. species of *Androsace*, *Draba*, *Saxifraga*, *Sedum* and *Paraquilegia*, while other species like *Acantholimon*, *Arenaria*, *Coaragana*, *Astragalus* and *Thylacospermum* are rigid mat forming. The most curious of alpine flowering plants are the woolly species of *Asteraceae* e.g. *Saussurea gossypiphora*, *S. obvallata*, *S. simpsoniana*, *S. graminifolia*, *Soroseris glomerata* and species of *Tussilago* and *Leontopodium*. *Saussurea gossypiphora* and *S. graminifolia* commonly referred to as "Snow ball" plants are unique alpine species which look like snow ball due to the dense, white hairs which cover the entire plant and protect from severe cold wind and snow and maintains warmth inside the head even if outside temperature falls. The pollination biology of these species form a very interesting strategy. Bees and flies take shelter in the warmth and at the same time pollinate the flowers. There is yet another interesting group of "hot house" plants like *Rheum nobile* and *Saussurea obvallata* which have their inflorescences sheltered by leafy bracts that can be compared to glasses of a "hot house". The flower open inside the bracts, where insects also take shelter for warmth and at the same time pollinate the flower.

Phytogeographical considerations

The Himalaya defines the geographical boundary of India in the north and also influences the monsoon rainfall and the climate of India as a whole. The

Himalayan uplift contributed to the shaping of the biogeographical characters of India (Mani, 1978). It is presumed that the Himalayan mountains had their own flora even before the Pleistocene epoch. The intermittent warm periods during the Himalayan glaciations to some extent protected the species from total extinction. The glaciations did not affect much the foothills with result the vegetation of the lower belt was not altered. Migration of floras through new corridors of mountain chains, survival of relicts, adaptive radiation of species complexes in new ecological niches, evolution of new species by an intermixing of different flora and by mutation had a role in determining the present day composition and distribution of alpine flora (Rau, 1975).

The Himalaya forms the southern fringe of palaeartic Realm. The alpine zone represents the Turkemenian subregion in the west and Manchurian (Siberian-Mongolian) subregion in the extreme east. Good (1964) placed the Himalaya under the Sino- Himalayan, Tibetan mountain province of the Sino-Japanese region of Boreal Kingdom. Gaussen (1933) and many other considered Himalaya as a sort of phytogeographic barrier for many of the Asiatic elements. Mani (1978) considered the defile of the river Sutlej being the landmark in the Himalayan biogeography. He presented a gradual transition from east to west sector of the Himalaya. The geologic welding of Gondwana and Asiatic landmass led to the exchange of flora and fauna resulting in the biogeographic complexity. The flora of the Tertiary mountains of south China, Indo- China, Thailand and Malaya intruded westward, along the rising Himalaya. The continued uplift of the Himalaya has led to evolution of lowland steppe elements into temperate and alpine forms of Turkemenian subregion.

A study of the alpine flora of western Himalaya shows that a large number of species like *Nepeta tibetica*, *Elsholtzia densa*, *Rimula tibetica*, *P. elliptica*, *Onosma hispidus*, *Tanacetum fruticosum* of the lower alpine belt in the Garhwal-Kumaon sector and eastwards appear to have come from Tibet, W. China and adjoining northeast Asia. The northwestern sector of the Himalaya has been subjected to considerable influence from the adjoining floristically rich areas of Karakoram, Pamir and further north in the Tien Shan range of mountains. Some species of these regions which are today common in N.W. Himalaya are *Arctium lappa*, *Thalictrum alpinum*, *Astragalus coluteocarpus*, *Sibbaldia cuneata*, *Bupleurum falcate* var. *gracillimum* and species of *Potentilla*, *Geranium*, *Nepeta*, *Thermopsis*, *Danthonia*, *Rosa*, *Galium*, *Draba*, *Cousinia*, *Lagotis*, *Silene*, *Saussurea*, *Taraxacum*, *Perovskia*, *Fritillaria*, *Oxygraphis* etc., Stern (1960) considered similarity of Himalayan flora with those of China. Chinese mountains being much older than Himalaya have contributed to the present day Himalayan flora. His studies have revealed various possibilities regarding the entry of floristic elements into the alpine Himalaya from the north, west and east Asia. In the eastern Himalaya a large number of elements intrude from Indo-China subregion while some Malayan elements are also visible. According to Ohba (1988) it is quite probable that the Himalayan flora had open intercourse with those of the arctic region via the east and west margins of the highland,

particularly in ages of climatic fluctuation. According to him the "Central Asiatic Corridor" favours an important pass for the migration of the flora between the arctic regions and the Himalaya as well as E. Tibet and S. W. China. The floristic connection of the Himalaya through this corridor is supported by the distribution pattern and the presence of common or corresponding species with arctic region. Such species are *Acantholimon lycopodioides*, *Eremurus himalaicus*, *Physochlaina praealta*, *Caragana versicolor*, *C. brevifolia*, *Nepeta supine*, *Epilobium latifolium*, *Minuartia biflora* and *Saxifraga oppositifolia*.

A number of European or Eurasian elements have got introduced through the human influences. These are *Cerastium glomeratum*, *Thlaspi arvensis*, *Achillea millefolium*, *Verbascum thapsus*, *Juncus bufonicus*, *J. articulatus*, *Geranium pusillum*, etc. It is also assumed that the ancestors of some of the species which have only a scattered distribution at present may have flourished extensively during the major Himalayan uplift but later, due to competition or other adverse climatic conditions, most of them might have perished leaving behind only scattered distribution. While some of the species like *Thlaspi andersonii*, *Chorispora sabulosa*, *Beibersteinia odora*, *Chritolea himalayensis*, *Heracleum thomsonii*, *Cremanthodium nanum* and others have a restricted distribution being found only in western Himalaya or in adjacent Tibet, there are others like, *Thalictrum alpinum*, *Ranunculus hyperboreus*, *R. pygmaeus*, *Potentilla multifida*, *Saxifraga flagellaris*, *Sedum rosea*, *Oxyria digyna*, *Triglochin palustre* and several others which enjoy a world - wide distribution in both the alpine and arctic locations. Some species like *Thylacospermum rupifragum*, *Cicer soongaricum*, *Physochlaina praealta*, and *Lamium rhomboideum* extend northwards to the central Asian highlands. *Senecio coronopifolius*, *Nepeta supine* and a few others are distributed westwards to Afghanistan, Iran and the Caucasus. There are many species distributed all along the Himalaya from west to east. *Gueldenstaedtia himalaica*, *Astragalus strictus*, *Saussurea leontodontoides*, *Cicerbita macrorhiza*, *Picrorhiza kurrooa* and other are in this category. *Aletris pauciflora*, *Anemone rupicola* and *A. vitifolia* are among the species which are found in west China and also throughout the Himalaya as far as west of Kashmir.

Endemism

The Himalayan mountains are one of the active centres of endemic species. Although there is no correct assessment of the endemic flora in the alpine zone, one can fairly guess that ca 50% of the endemic plants of the Himalaya occur in the alpine or subalpine zones. The high rate of endemism in the alpine zone, particularly in largest and diversified genera is quite remarkable and is an indication of active evolution (speciation) as well as considerable degree of isolation. It is observed that majority of these endemics are neoendemics of apparently recent origin with close relatives in the alpine zone itself, in the lowland vegetation of the Himalaya and also in the region around the central Asiatic highland (Ohba, 1988).

60. Learned authors have also highlighted about endangered species and their

conservation which is as under:-

Endangered species and their conservation

Although a number of alpine species have high adaptive value and can successfully survive and multiply in prevailing adverse ecological conditions, some species perhaps because of low level of genetic diversity in them, are unable to survive the competition with other vegetation. Such species have become endangered. In other words, the endangered species are those whose reproductive capacity is far lower than the number of plants eliminated from the habitat due to natural or anthropogenic factors. This consequently leads to the decline in number and size of populations. Although species disappearance attracts wide publicity and attention, the loss of genetic diversity due to extinction of population is least studied. The decrease in the size and number of populations under a given species has deleterious effect on their breeding structure, genetic and evolutionary dynamics, all of which form the focal point of concern in conservation biology (Falk & Horsinger, 1991; Harper, 1977; Barret & Kohn, 1991, Karron, 1991). In small and isolated populations, genetic drift operates and this results in the loss of variations which ultimately reduces the ability of populations to adapt to changing environmental conditions and to increase their susceptibility against pests and diseases and are thus prone to extinction (Hamilton, 1982).

To decide a species as endangered is not an easy task, but requires very elaborate field assessments. Customarily, if a species is not represented by more collections from different localities in a herbarium, such a species is determined as rare and this may not always be correct. Sometimes if a species is collected after a gap of 25 to 50 years or more than also it is concluded as an endangered species. While partly it could be true, certain ephemeral species such as species of *Thermopsis*, *Primula*, *Saxifraga*, *Sedum*, *Gentiana* etc., complete their life cycle in a short period and die off, likely to be missed by botanists exploring the area. Hence, not collecting a plant for several decades may not always conclude in species as endangered.

All the endangered plants are certainly rare but not all rare plants are endangered. For example several sparsely distributed alpine plants like some species of *Saussurea*, *Impatiens*, *Primula*, *Corydalis*, *Thalictrum*, *Saxifraga*, etc. have developed ecological adaptations to persistence in small populations showing natural rarity and are genetically stable. On other hand, there are some rare species which were supposed to be widespread at one time have now undergone a rapid decline due to anthropogenic factors (anthropogenic rarity), for example *Aconitum heterophyllum*, *Dactylorhiza hatagirea*, *Alpinia galangal*, *Coptis teeta*, *Nardostachys grandiflora*, *Podophyllum hexandrum*, *Panax pseudo-ginseng*, *Picrorhiza kurroa*, *Dioscorea deltoidea*, *Angelica glauca*, *Allium stracheyi*, etc. These aspects require very extensive field investigations before one can decide a species endangered or not. According to the minimum viable population concept (Schaffer, 1981) a minimum of 50 individuals are

recommended for maintenance of the population. A species with less than 50 individuals is certainly critically endangered.

In the Himalaya, due to natural (such as landslides, glaciations, earthquakes, lack of pollination and regeneration etc.) and man-made (such as over-exploitation, destruction of habitats, etc.) factors the alpine bioresources are under varying degrees of threat. It is no wonder that today many of the valuable plants like *Podophyllum hexandrum*, *Nardostachys grandiflora*, *Aconitum* spp., *Picrorhiza kurrooa*, *Saussurea lappa* and *Dactylorhiza hatagirea* are not found in large populations in their natural habitats. Once the species gets fragmented and the demography of the population is altered, the genetic diversity that is essential for sustaining the species also get eroded. Steps should, therefore, be taken to ensure that their genetic diversity is not lost.

Conservation and management of an endangered species requires rather very extensive and frequent field surveys throughout the distribution range of a particular species, which is certainly time consuming, expensive and difficult. A large number of species so far listed from the alpine zone of the Himalaya are based on the scrutiny of herbaria. Therefore, what is urgently required is the assessment of status of individual species in its natural habitat.

For long term conservation and management of any species, its genetics and demography i.e. population dynamics is crucial. In case of *Eremostachys superb* the solitary population near Mohand in Siwaliks of Uttar Pradesh is so small and isolated. A strong genetic drift has set in and this results in loss and variation in the species. Another consequence of low population structure is the occurrence of inbreeding resulting in loss of fitness (inbreeding depression). Therefore, we have to think of strategies that increase the genetic diversity in rare species - say bringing together geographically isolated populations. This again requires extensive surveys to find out the distribution of various populations of a given endangered species. The reproductive biology of endangered species is another aspect of study which is almost neglected. Preservation of the habitat alone as attempted in most cases may not ensure the long term conservation of endangered species.

In situ conservation is the best method for protecting the delicate populations of endangered species. In a situation where several endangered species grow within a few hectare or sq km the whole area should be protected. The occurrence of several endemic species in a particular area also indicates the potential of that area as a centre of speciation and evolution. Furthermore, when an endangered species grows in pure population of fewer or more individuals or in association with other vegetation, it is necessary to establish a sanctuary for the individual species as for e.g. *Rhododendron* sanctuary in Sikkim.

Wide publicity regarding the critical nature of the species among the local people is also necessary. The local people should be involved in every effort of conserving species in its habitat.

The Botanical Survey of India has listed 625 species in the three 'Red Data Books' (Nayar & Sastry, 1987 1988 &1990). Nearly 214 species of flowering plants of the Himalaya (including alpine zones) are endangered. Out of them nearly 37 need priority attention. Most of them are in commerce as herbal drugs of repute. The monitoring of these species in the Himalayan region is not yet attempted. This involves the study of populations during different seasons over a period of time for finding out the adaptive ability of a particular species to its natural habitat. Where required, overgrowth of other surrounding species need to be controlled to keep the population of endangered species to a level that is can sustain itself. As collection of certain endangered species with high medicinal value offers economic subsistence to the inhabitants of the Himalaya, there is an urgent need to mass multiply them through seeds, clonal propagation and tissue culture, so that biodiversity of the region is not diminished.

61. The UN Conference on the Human Environment was held from 5 to 16 June, 1972 at Stockholm. It was convened pursuant to UN General Assembly Resolution 2398 of 3 December, 1968, on a proposal from Sweden. Delegates from 113 States attended the Conference, representing most of the UN membership with the exception of the USSR. Stockholm Declaration of the United Nations Conference on the Human Environment contained book titles as 'Documents in International Environmental Law, Second Edition' reads as under :-

" Proclaims that :

1. Man is both creature and moulder of his environment, which gives him physical sustenance and affords him the opportunity for intellectual, moral, social and spiritual growth. In the long and tortuous evolution of the human race on this planet a stage has been reached when, through the rapid acceleration of science and technology, man has acquired the power to transform his environment in countless ways and on an unprecedented scale. Both aspects of man's environments, the natural and the man-made, are essential to his well being and to the enjoyment of basic human rights - even the right to life itself.

2. The protection and improvement of the human environment is a major issue, which affects the well-being of peoples and economic development throughout the world; it is the urgent desire of the peoples of the whole world and the duty of all Governments.

3. Man has constantly to sum up experience and to on discovering, inventing, creating and advancing. In our time, man's capability to transform his surroundings, if used wisely, can bring to all peoples the benefits of development and the opportunity to enhance the quality of lie. Wrongly or heedlessly applied, the same power can do incalculable harm to human beings and the human environment. We see around us growing evidence of man-made harm in many regions of the earth: dangerous levels of pollution in water, air, earth and living beings; manor and undesirable disturbances to the ecological balance of the

biosphere; destruction and depletion of irreplaceable resources; and gross deficiencies, harmful to the physical, mental and social health of man, in the man-made environment, particularly in the living and working environment.

4. In the developing countries most of the environmental problems are caused by underdevelopment. Millions continue to live far below the minimum levels required for a decent human existence, deprived of adequate food and clothing, shelter and education, health and sanitation. Therefore, the developing countries must direct their efforts to development, bearing in mind their priorities and the need to safeguard and improve the environment. For the same purpose, the industrialized countries should make efforts to reduce the gap between themselves and the developing countries. In the industrialized countries, environment problems are generally related to industrialization and technological development.

5. The natural growth of population continuously presents problems for the preservation of the environment, and adequate policies and measure should be adopted, as appropriate, to face these problems. Of all things in the world, people are the most precious. It is the people that propel social progress, create social wealth, develop science and technology and, through their hard work, continuously transform the human environment. Along with social progress and the advance of production, science and technology, the capability of man to improve the environment increases with each passing day.

6. A point has been reached in history when we must shape our actions throughout the world with a more prudent care for their environmental consequences. Through ignorance or indifference we can do massive and irreversible harm to the earthly environment on which our life and well being depend. Conversely, through fuller knowledge and wiser action, we can achieve for ourselves and our posterity a better life in an environment more in keeping with human needs and hopes. There are broad vistas for the enhancement of environmental quality and the creation of a good life. What is needed is an enthusiastic but calm state of mind and intense but orderly work. For the purpose of attaining freedom in the world of nature, man must use knowledge to build, in collaboration with nature, a better environment. To defend and improve the human environment for present and future generations has become an imperative goal for mankind—a goal to be pursued together with, and in harmony with, the established and fundamental goals of peace and of worldwide economic and social development.

7. To achieve this environmental goal will demand the acceptance of responsibility by citizens and communities and by enterprises and institutions at every level, all sharing equitably in common efforts. Individuals in all walks of life as well as organizations in many fields, by their values and the sum of their actions, will shape the world environment of the future. Local and national governments will bear the greatest burden for large-scale environmental policy and action within their jurisdictions. International cooperation is also needed in

order to raise resources to support the developing countries in carrying out their responsibilities in this field. A growing class of environmental problems, because they are regional or global in extent or because they affect the common international realm, will require extensive cooperation among nations and action by international organizations in the common interest. The Conference call upon Governments and peoples to exert common efforts for the preservation and improvement of the human environment, for the benefit of all the people and for their posterity.

II

Principles

States the common conviction that:

Principle 1

Man has the fundamental right to freedom, equality and adequate conditions of life, in an environment of a quality that permits a life of dignity and well being, and he bears a solemn responsibility to protect and improve the environment for present and future generations. In this respect, policies promoting or perpetuating apartheid, racial segregation, discrimination, colonial and other forms of oppression and foreign domination stand condemned and must be eliminated.

Principle 2

The natural resources of the earth, including the air, water, land, flora and fauna and especially representative samples of natural ecosystems, must be safeguarded for the benefit of present and future generations through careful planning or management, as appropriate.

Principle 3

The capacity of the earth to produce vital renewable resources must be maintained and, wherever practicable, restored or improved.

Principle 4

Man has a special responsibility to safeguard and wisely manage the heritage of wildlife and its habitat, which are now gravely imperiled by a combination of adverse factors. Nature conservation, including wildlife, must therefore receive importance in planning for economic development.

Principle 5

The non-renewable resources of the earth must be employed in such a way as to guard against the danger of their future exhaustion and to ensure that benefits from such employment are shared by all mankind.

Principle 6

The discharge of toxic substances or of other substance and the release of heat, in such quantities or concentrations as to exceed the capacity of the environment to render them harmless, must be halted in order to ensure that serious or irreversible damage is not inflicted upon ecosystems. The just struggle of the peoples of ill countries against pollution should be supported.

Principle 7

States shall take all possible steps to prevent pollution of the seas by substances that are liable to create hazards to human health, to harm living resources and marine life, to damage amenities or to interfere with other legitimate uses of the sea.

Principle 8

Economic and social development is essential for ensuring a favorable living and working environment for man and for creating conditions on earth that are necessary for the improvement of the quality of life.

Principle 9

Environmental deficiencies generated by the conditions of underdevelopment and natural disasters pose grave problems and can best be remedied by accelerated development through the transfer of substantial quantities of financial and technological assistance as a supplement to the domestic effort of the developing countries and such timely assistance as may be required.

Principle 10

For the developing countries, stability of prices and adequate earnings for primary commodities and raw materials are essential to environmental management, since economic factors as well as ecological processes must be taken into account.

Principle 11

The environmental policies of all States should enhance and not adversely affect the present or future development potential of developing countries, nor should they hamper the attainment of better living conditions for all, and appropriate steps should be taken by States and international organizations with a view to reaching agreement on meeting the possible national and international economic consequences resulting from the application of environmental measures.

Principle 12

Resources should be made available to preserve and improve the environment, taking into account the circumstances and particular requirements of developing countries and any costs which may emanate from their incorporating environment safeguards into their development planning and the need for making available to them, upon their request, additional international technical and financial assistance for this purpose.

Principle 13

In order to achieve a more rational management of resources and thus to improve the environment, States should adopt an integrated and coordinated approach to their development planning so as to ensure that development is compatible with the need to protect and improve environment for the benefit of their population.

Principle 14

Rational planning constitutes an essential tool for reconciling any conflict between the needs of development and the need to protect and improve the environment.

Principle 15

Planning must be applied to human settlements and urbanization with a view to avoiding adverse effects on the environment and obtaining maximum social, economic and environmental benefits for all. In this respect projects which are designed for colonialist and racist domination must be abandoned.

Principle 16

Demographic policies which are without prejudice to basic human rights and which are deemed appropriate by Governments concerned should be applied in those regions where the rate of population growth or excessive population concentrations are likely to have adverse effects on the environment or development, or where low population density may prevent improvement of the human environment and impede development.

Principle 17

Appropriate national institutions must be entrusted with the task of planning, managing or controlling the environmental resources of States with a view to enhancing environmental quality.

Principle 18

Science and technology, as part their contribution to economic and social development, must be applied to the identification, avoidance and control of environmental risks and the solution of environmental problems and for the common good of mankind.

Principle 19

Education in environmental matters, for the younger generations as well as adults, giving due consideration to the underprivileged, is essential in order to broaden the basis for an enlightened opinion and responsible conduct by individuals, enterprises and communities in protecting and improving the environment in its full human dimension. It is also essential that mass media of communications avoid contributing to the deterioration of the environment, but,

on the contrary, disseminate information of an educational nature on the need to protect and improve the environment in order to enable man to develop every respect.

Principle 20

Scientific research and development in the context of environmental problems, both national and multinational, must be promoted in all countries, especially the developing countries. In this connection, the free flow of up-to-date scientific information and transfer of experience must be supported and assisted, to facilitate the solution of environmental problems; environmental technologies should be made available to developing countries on terms which would encourage their wide dissemination without constituting an economic burden on the developing countries.

Principle 21

States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.

Principle 22

States shall cooperate to develop further the international law regarding liability and compensation for the victims of pollution and other environmental damage caused by activities within the jurisdiction or control of such States to areas beyond their jurisdiction.

Principle 23

Without prejudice to such criteria as may be agreed upon by the international community, or to standards which will have to be determined nationally, it will be essential in all cases to consider the systems of values prevailing in each country, and the extent of the applicability of standards which are valid for the most advanced countries but which may be inappropriate and of unwarranted social cost for the developing countries.

Principle 24

International matters concerning the protection and improvement of the environment should be handled in a cooperative spirit by all countries, big or small, on an equal footing. Co-operation through multilateral or bilateral arrangements or other appropriate means is essential to effectively control, prevent, reduce and eliminate adverse environmental effects resulting from activities conducted in all spheres, in such a way that due account is taken of the sovereignty and interests of all States.

Principle 25

States shall ensure that international organizations play a coordinated, efficient and dynamic role for the protection and improvement of the environment.

Principle 26

Man and his environment must be spared the effects of nuclear weapons and all other means of mass destruction. States must strive to reach prompt agreement, in the relevant international organs, on the elimination and complete destruction of such weapons.

62. The world charter for Nature sought to have its guiding principles given effect through National legislation and international practice. These principles include respect for nature, safeguarding of habitats necessary to maintain sufficient population levels for the survival of all life forms, protection of unique areas, representative samples of all ecosystems and of habitats of rare or endangered species.

63. UN General Assembly Resolution 37/7 passed on a World Charter for Nature, 28.10.1982 reads as under :-

"Annex"

World Charter for Nature

The General Assembly,

Reaffirming the fundamental purposes of the United Nations, in particular the maintenance of international peace and security, the development of friendly relations among nations and the achievement of international co-operation in solving international problems of an economic, social, cultural, technical, intellectual or humanitarian character,

Aware that:

(a) Mankind is a part of nature, and life depends on the uninterrupted functioning of natural systems which ensure the supply of energy and nutrients,

(b) Civilization is rooted in nature, which has shaped human culture and influenced all artistic and scientific achievement, and living in harmony with nature gives man the best opportunities for the development of his creativity, and for rest and recreation,

Convinced that:

(a) Every form of life is unique, warranting respect regardless of its worth to man, and to accord other organisms such recognition, man must be guided by a moral code of action,

(b) Man can alter nature and exhaust natural resources by his action or its consequences and, therefore, must fully recognize the urgency of maintaining the stability and quality of nature and of conserving natural resources.

Persuaded that:

(a) Lasting benefits from nature depend upon the maintenance of essential ecological processes and life support systems, and upon the diversity of life forms, which are jeopardized through excessive exploitation and habitat destruction by man,

(b) The degradation of natural systems owing to excessive consumption and misuse of natural resources, as well as to failure to establish an appropriate economic order among peoples and among States, leads to the breakdown of the economic, social and political framework of civilization,

(c) Competition for scarce resources creates conflicts, whereas the conservation of nature and natural resources contributes to justice and the maintenance of peace and cannot be achieved until mankind learns to live in peace and to forsake war and armaments,

Reaffirming that man must acquire the knowledge to maintain and enhance his ability to use natural resources in manner which ensures the preservation of the species and ecosystems for the benefit of present and future generations,

Firmly convinced of the need for appropriate measures, at the national and international, individual and collective, and private and public levels, to protect nature and promote international co-operation in this field,

Adopts, to these ends, the present World Charter for Nature, which proclaims the following principles of conservation by which all human conduct affecting nature is to be guided and judged.

I. General principles

1. Nature shall be respected and its essential processes shall not be impaired.

2. The genetic viability on the earth shall not be compromised; the population levels of all life forms, wild and domesticated, must be at least sufficient for their survival, and to this end necessary habitats shall be safeguarded.

3. All areas of the earth, both land and sea, shall be subject to these principles of conservation; special protection shall be given to unique areas, to representative samples of the different types of ecosystems and to the habitats of rare or endangered species.

4. Ecosystems and organisms, as well as the land, marine and atmospheric resource that are utilized by man, shall be managed to achieve and maintain optimum sustainable productivity, but not in such a way as to endanger the integrity of those other ecosystems or species with which they coexist.

5. Nature shall be secured against degradation caused by warfare or other hostile activities.

II. Functions

6. In the decision-making process it shall be recognized that man's needs can be met only by ensuring the proper functioning of natural systems and by respecting the principles set forth in the present Charter.

7. In the planning and implementation of social and economic development activities, due account shall be taken of the fact that the conservation of nature is an integral part of those activities.

8. In formulating long-term plans for economic development, population growth and the improvement of standards of living, due account shall be taken of the long-term capacity of natural systems to ensure the subsistence and settlement of the populations concerned, recognizing that this capacity may be enhanced through science and technology.

9. The allocation of areas of the earth to various uses shall be planned, and due account shall be taken of the physical constraints, the biological productivity and diversity and the natural beauty of the areas concerned.

10. Natural resources shall not be wasted, but used with a restraint appropriate to the principles set forth in the present Charter, in accordance with the following rules:

(a) Living resources shall not be utilized in excess of their natural capacity for regeneration;

(b) The productivity of soils shall be maintained or enhanced through measures which safeguard their long-term fertility and the process of organic decomposition, and prevent erosion and all other forms of degradations;

(c) Resources, including water, which are not consumed as they are used shall be reused or recycled;

(d) Non-renewable resources which are consumed as they are used shall be exploited with restraint, taking into account their abundance, the rational possibilities of converting them for consumption, and the compatibility of their exploitation with the functioning of natural systems.

11. Activities which might have an impact on nature shall be controlled, and the best available technologies that minimize significant risks to nature or other adverse effects shall be used; in particular:

(a) Activities which are likely to cause irreversible damage to nature shall be avoided;

(b) Activities which are likely to pose a significant risk to nature shall be preceded by an exhaustive examination, their proponents shall demonstrate that expected benefits outweigh potential damage to nature, and where potential adverse effects are not fully understood, the activities should not proceed;

(c) Activities which may disturb nature shall be preceded by assessment of their consequences, and environmental impact studies of development projects shall

be conducted sufficiently in advance, and if they are to be undertaken, such activities shall be planned and carried out so as to minimize potential adverse effects;

(d) Agriculture, grazing, forestry and fisheries practices shall be adapted to the natural characteristics and constraints of given areas;

(e) Areas degraded by human activities shall be rehabilitated for purposes in accord with their natural potential and compatible with the wellbeing of affected populations.

12. Discharge of pollutants into natural systems shall be avoided and:

(a) Where this is not feasible, such pollutants shall be treated at the source, using the best practicable means available;

(b) Special precautions shall be taken to prevent discharge of radioactive or toxic wastes.

13. Measures intended to prevent, control or limit natural disasters, infestations and diseases shall be specifically directed to the causes of these scourges and shall avoid adverse side-effects on nature."

64. United Nations Conference on Environment and Development also known as Rio de Janeiro Declaration or Earth Summit was held in the year 1992. The Rio Declaration comprises 27 principles which set out the basis upon which states and people are to co-operate and further develop international law in the field of sustainable development. Declaration reads as under :-

Preamble

The United Nations Conference on Environment and Development,

Having met at Rio de Janeiro from 3 to 14 June 1992,

Reaffirming the Declaration of the United Nations Conference on the Human Environment, adopted at Stockholm on 16 June 1972, and seeking to build upon it, with the goal of establishing a new and equitable global partnership through the creation of new levels of cooperation among States, key sectors of societies and people,

Working towards international agreements which respect the interests of all and protect the integrity of the global environmental and developmental system,

Recognizing the integral and interdependent nature of the Earth, our home,
Proclaims that:

Principle 1

Human beings are at the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature.

Principle 2

States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental and developmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.

Principle 3

The right to development must be fulfilled so as to equitably meet developmental and environmental needs of present and future generations.

Principle 4

In order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it.

Principle 5

All States and all people shall cooperate in the essential task of eradicating poverty as an indispensable requirement for sustainable development, in order to decrease the disparities in standards of living and better meet the needs of the majority of the people of the world.

Principle 6

The special situation and needs of developing countries, particularly the least developed and those most environmentally vulnerable, shall be given special priority. International actions in the field of environment and development should also address the interests and needs of all countries.

Principle 7

States shall cooperate in a spirit of global partnership to conserve, protect and restore the health and integrity of the Earth's ecosystem. In view of the different contributions to global environmental degradation, States have common but differentiated responsibilities. The developed countries acknowledge the responsibility that they bear in the international pursuit of sustainable development in view of the pressures their societies place on the global environment and of the technologies and financial resources they command.

Principle 8

To achieve sustainable development and a higher quality of life for all people, States should reduce and eliminate unsustainable patterns of production and consumption and promote appropriate demographic policies.

Principle 9

States should cooperate to strengthen endogenous capacity-building for sustainable development by improving scientific understanding through exchanges of scientific and technological knowledge, and by enhancing the development, adaptation, diffusion and transfer of technologies, including new and innovative technologies.

Principle 10

Environmental issues are best handled with the participation of all concerned citizens, at the relevant level. At the national level, each individual shall have appropriate access to information concerning the environment that is held by public authorities, including information on hazardous materials and activities in their communities, and the opportunity to participate in decision making processes. States shall facilitate and encourage public awareness and participation by making information widely available. Effective access to judicial and administrative proceedings, including redress and remedy, shall be provided.

Principle 11

States shall enact effective environmental legislation. Environmental standards, management objectives and priorities should reflect the environmental and development context to which they apply. Standards applied by some countries may be inappropriate and of unwarranted economic and social cost to other countries, in particular developing countries.

Principle 12

States should cooperate to promote a supportive and open international economic system that would lead to economic growth and sustainable development in all countries, to better address the problems of environmental degradation. Trade policy measures for environmental purposes should not constitute a means of arbitrary or unjustifiable discrimination or a disguised restriction on international trade. Unilateral actions to deal with environmental challenges outside the jurisdiction of the importing country should be avoided. Environmental measures addressing transboundary or global environmental problems should, as far as possible, be based on an international consensus.

Principle 13

States shall develop national law regarding liability and compensation for the victims of pollution and other environmental damage. States shall also cooperate in an expeditious and more determined manner to develop further international law regarding liability and compensation for adverse effects of environmental damage caused by activities within their jurisdiction or control to areas beyond their jurisdiction.

Principle 14

States should effectively cooperate to discourage or prevent the relocation and transfer to other States of any activities and substances that cause severe

environmental degradation or are found to be harmful to human health.

Principle 15

In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.

Principle 16

National authorities should endeavour to promote the internalization of environmental costs and the use of economic instruments, taking into account the approach that the polluter should, in principle, bear the cost of pollution, with due regard to the public interest and without distorting international trade and investment.

Principle 17

Environmental impact assessment, as a national instrument, shall be undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority.

Principle 18

States shall immediately notify other States of any natural disasters or other emergencies that are likely to produce sudden harmful effects on the environment of those States. Every effort shall be made by the international community to help States so afflicted.

Principle 19

States shall provide prior and timely notification and relevant information to potentially affected States on activities that may have a significant adverse transboundary environmental effect and shall consult with those States at an early stage and in good faith.

Principle 20

Women have a vital role in environmental management and development. Their full participation is therefore essential to achieve sustainable development.

Principle 21

The creativity, ideals and courage of the youth of the world should be mobilized to forge a global partnership in order to achieve sustainable development and ensure a better future for all.

Principle 22

Indigenous people and their communities and other local communities have a

vital role in environmental management and development because of their knowledge and traditional practices. States should recognize and duly support their identity, culture and interests and enable their effective participation in the achievement of sustainable development.

Principle 23

The environment and natural resources of people under oppression, domination and occupation shall be protected.

Principle 24

Warfare is inherently destructive of sustainable development. States shall therefore respect international law providing protection for the environment in times of armed conflict and cooperate in its further development, as necessary.

Principle 25

Peace, development and environmental protection are interdependent and indivisible.

Principle 26

States shall resolve all their environmental disputes peacefully and by appropriate means in accordance with the Charter of the United Nations.

Principle 27

States and people shall cooperate in good faith and in a spirit of partnership in the fulfillment of the principles embodied in this Declaration and in the further development of international law in the field of sustainable development.

65. The Article 2 of the Kyoto Declaration made in December, 1997, reads as under :-

(a) Implement and/or further elaborate policies and measures in accordance with its national circumstances, such as:

(i) Enhancement of energy efficiency in relevant sectors of the national economy;

(ii) Protection and enhancement of sinks and reservoirs of greenhouse gases not controlled by the Montreal Protocol, taking into account its commitments under relevant international environmental agreements; promotion of sustainable forest management practices, afforestation and reforestation;

(iii) Promotion of sustainable forms of agriculture in light of climate change considerations;

(iv) Research on, and promotion, development and increased use of, new and renewable forms of energy, of carbon dioxide sequestration technologies and of advanced and innovative environmentally sound technologies;

(v) Progressive reduction or phasing out of market imperfections, fiscal

incentives, tax and duty exemptions and subsidies in all greenhouse gas emitting sectors that run counter to the objective of the Convention and application of market instruments;

(vi) Encouragement of appropriate reforms in relevant sectors aimed at promoting policies and measures which limit or reduce emissions of greenhouse gases not controlled by the Montreal Protocol;

(vii) Measures to limit and/or reduce emissions of greenhouse gases not controlled by the Montreal Protocol in the transport sector;

(viii) Limitation and/or reduction of methane emissions through recovery and use in waste management, as well as in the production, transport and distribution of energy."

66. The convention on International Trade in Endangered Species of Wild Fauna and Flora was held on 03.03.1973 to recognize that international co-operation is essential for the protection of certain species of wild fauna and flora against over-exploitation through international trade. The articles on convention on International Trade in Endangered Species of Wild Fauna and Flora contained in the book titled as "Documents in International Environmental Law which read as under :-

"Convention on International Trade in

Endangered Species of

Wild Fauna and Flora

The Contracting States,

Recognizing that wild fauna and flora in their many beautiful and varied forms are an irreplaceable part of the natural systems of the earth which must be protected for this and the generations to come;

Conscious of the ever-growing value of wild fauna and flora from aesthetic, scientific, cultural, recreational and economic points of view;

Recognizing that peoples and States are and should be the best protectors of their own wild fauna and flora;

Recognizing, in addition, that international cooperation is essential for the protection of certain species of wild fauna and flora against overexploitation through international trade;

Convinced of the urgency of taking appropriate measures to this end;

Have agreed as follows:

Article I

Definitions

For the purpose of the present Convention, unless the context otherwise requires:

(a) "Species" means any species subspecies, or geographically separate population thereof;

(b) "Specimen" means:

(i) any animal or plant, whether alive or dead;

(ii) in the case of an animal: for species included in Appendices I and II, any readily recognizable part or derivative thereof; and for species included in Appendix III, in relation to the species; and

(iii) in the case of a plant: for species included in Appendix I, and readily recognizable part or derivative thereof; and for species included in Appendices II and III, any readily recognizable part or derivative thereof specified in Appendices II and III in relation to the species;

(c) "Trade" means export, re-export, import and introduction from the sea;

(d) "Re-export" means export of any specimen that has previously been imported;

(e) "Introduction from the sea" means transportation into a State of specimens of any species which were taken in the marine environment not under the jurisdiction of any State;

(f) "Scientific Authority" means a national scientific authority designated in accordance with Article IX;

(g) "Management Authority" means a national management authority designated in accordance with Article IX;

(h) "Party" means a State for which the present Convention has entered into force.

Article II

Fundamental principles

1. Appendix I shall include all species threatened with extinction which are or may be affected by trade. Trade in specimens of these species must be subject to particularly strict regulation in order not to endanger further their survival and must only be authorized in exceptional circumstances.

2. Appendix II shall include:

(a) all species which although not necessarily now threatened with extinction may become so unless trade in specimens of such species is subject to strict regulation in order to avoid utilization incompatible with their survival; and

(b) other species which must be subject to regulation in order that trade in specimens of certain species referred to in sub-paragraph (a) of this paragraph

may be brought under effective control.

3. Appendix II shall include all species which any Party identifies as being subject to regulation within its jurisdiction for the purpose of preventing or restricting exploitation, and as needing the cooperation of other Parties in the control of trade.

4. The Parties shall not allow trade in specimens of species included in Appendices I, II and III except in accordance with the provisions of the present Convention.

Article III

Regulation of trade in specimens of species included in Appendix I

1. All trade in specimens of species included in Appendix I shall be in accordance with the provisions of this Article.

2. The export of any specimen of a species included in Appendix I shall require the prior grant and presentation of an export permit. An export permit shall only be granted when the following conditions have been met:

(a) a Scientific Authority of the State of export has advised that such export will not be detrimental to the survival of that species;

(b) a Management Authority of the State of export is satisfied that the specimen was not obtained in contravention of the laws of that State for the protection of fauna and flora;

(c) a Management Authority of the State of export is satisfied that any living specimen will be so prepared and shipped as to minimize the risk of injury, damage to health or cruel treatment; and

(d) a Management Authority of the State of export is satisfied that an import permit has been granted for the specimen.

3. The import of any specimen of a species included in Appendix I shall require the prior grant and presentation of an import permit and either an export permit or a re-export certificate. An import permit shall only be granted when the following conditions have been met:

(a) a Scientific Authority of the State of import has advised that the import will be for purposes which are not detrimental to the survival of the species involved;

(b) a Scientific Authority of the State of import is satisfied that the proposed recipient of a living specimen is suitably equipped to house and care for it; and

(c) a Management Authority of the State of import is satisfied that the specimen is not to be used for primarily commercial purposes.

4. The re-export of any specimen of a species included in Appendix I shall require the prior grant and presentation of a re-export certificate. A re-export

certificate shall only be granted when the following conditions have been met:

(a) a Management Authority of the State of re-export is satisfied that the specimen was imported into that State in accordance with the provisions of the present Convention;

(b) a Management Authority of the State of re-export is satisfied that any living specimen will be so prepared and shipped as to minimize the risk of injury, damage to health or cruel treatment; and

(c) a Management Authority of the State of re-export is satisfied that an import permit has been granted for any living specimen.

5. The introduction from the sea of any specimen of a species included in Appendix I shall require the prior grant of a certificate from a Management Authority of the State of introduction. A certificate shall only be granted when the following conditions have been met:

(a) a Scientific Authority of the State of introduction advises that the introduction will not be detrimental to the survival of the species involved;

(b) a Management Authority of the State of introduction is satisfied that the proposed recipient of a living specimen is suitably equipped to house and care for it; and

(c) a Management Authority of the State of introduction is satisfied that the specimen is not to be used for primarily commercial purposes.

Article IV

Regulation of trade in specimens of species included in Appendix II

1. All trade in specimens of species included in Appendix II shall be in accordance with the provisions of this Article.

2. The export of any specimen of a species included in Appendix II shall require the prior grant and presentation of an export permit. An export permit shall only be granted when the following conditions have been met:

(a) a Scientific Authority of the State of export has advised that such export will not be detrimental to the survival of that species:

(b) a Management Authority of the State of export is satisfied that the specimen was not obtained in contravention of the laws of that State for the protection of fauna and flora; and

(c) a Management Authority of the State of export is satisfied that any living specimen will be so prepared and shipped as to minimize the risk of injury, damage to health or cruel treatment.

3. A Scientific Authority in each Party shall monitor both the export permits granted by that State for specimens of species included in Appendix II and the

actual exports of such specimens. Whenever a Scientific Authority determines that the export of specimens of any such species should be limited in order to maintain that species throughout its range at a level consistent with its role in the ecosystems in which it occurs and well above the level at which that species might become eligible for inclusion in Appendix I, the Scientific Authority shall advise the appropriate Management Authority of suitable measures to be taken to limit the grant of export permits for specimens of that species.

4. The import of any specimen of a species included in Appendix II shall require the prior presentation of either an export permit or a re-export certificate.

5. The re-export of any specimen of a species included in Appendix II shall require the prior grant and presentation of a re-export certificate. A re-export certificate shall only be granted when the following conditions have been met:

(a) a Management Authority of the State of re-export is satisfied that the specimen was imported into that State in accordance with the provisions of the present Convention; and

(b) a Management Authority of the State of re-export is satisfied that any living specimen will be so prepared and shipped as to minimize the risk of injury, damage to health or cruel treatment.

6. The introduction from the sea of any specimen of a species included in Appendix II shall require the prior grant of a certificate from a Management Authority of the State of introduction. A certificate shall only be granted when the following conditions have been met:

(a) a Scientific Authority of the State of introduction advises that the introduction will not be detrimental to the survival of the species involved; and

(b) a Management Authority of the State of introduction is satisfied that any living specimen will be so handled as to minimize the risk of injury, damage to health or cruel treatment.

7. Certificates referred to in paragraph 6 of this Article may be granted on the advice of a Scientific Authority, in consultation with other national scientific authorities or, when appropriate, international scientific authorities, in respect of periods not exceeding one year for total numbers of specimens to be introduced such periods.

Article V

Regulation of trade in specimens of species included in Appendix III

1. All trade in specimens of species included in Appendix II shall be in accordance with the provisions of this Article.

2. The export of any specimen of a species included in Appendix III from any State which has included that species in Appendix III shall require the prior grant and presentation of an export permit. An export permit shall only be granted

when the following conditions have been met:

(a) a Management Authority of the State of export is satisfied that the specimen was not obtained in contravention of the laws of that State for the protection of fauna and flora; and

(b) a Management Authority of the State of export is satisfied that any living specimen will be so prepared and shipped as to minimize the risk of injury, damage to health or cruel treatment.

3. The import of any specimen of a species included in Appendix III shall require, except in circumstances to which paragraph 4 of this Article applies, the prior presentation of a certificate of origin and, where the import is from a State which has included that species in Appendix III, an export permit.

4. In the case of re-export, a certificate granted by the Management Authority of the State of re-export that the specimen was processed in that State or is being re-exported shall be accepted by the State of import as evidence that the provisions of the present Convention have been complied with in respect of the specimen concerned.

Article VI

Permits and certificates

1. Permits and certificates granted under the provisions of Articles III, IV, and V shall be in accordance with the provisions of this Article.

2. An export permit shall contain the information specified in the model set forth in Appendix IV, and may only be used for export within a period of six months from the date on which it was granted.

3. Each permit or certificate shall contain the title of the present Convention, the name and any identifying stamp of the Management Authority granting it and a control number assigned by the Management Authority.

4. Any copies of a permit or certificate issued by a Management Authority shall be clearly marked as copies only and no such copy may be used in place of the original, except to the extent endorsed thereon.

5. A separate permit or certificate shall be required for each consignment of specimens.

6. A Management Authority of the State of import of any specimen shall cancel and retain the export permit or re-export certificate and any corresponding import permit presented in respect of the import of that specimen.

7. Where appropriate and feasible a Management Authority may affix a mark upon any specimen to assist in identifying the specimen. For these purposes "mark" means any indelible imprint, lead seal or other suitable means of identifying a specimen, designed in such a way as to render its imitation by

unauthorized persons as difficult as possible.

Article VII

Exemptions and other special provisions relating to trade

1. The provisions of Articles III, IV and V shall not apply to the transit or transshipment of specimens through or in the territory of a Party while the specimens remain in Customs control.

2. Where a Management Authority of the State of export or re-export is satisfied that a specimen was acquired before the provisions of the present Convention applied to that specimen, the provisions of Articles III, IV and V shall not apply to that specimen where the Management Authority issues a certificate to that effect.

3. The provisions of Articles III, IV and V shall not apply to specimens that are personal or household effects. This exemption shall not apply where:

(a) in the case of specimens of a species included in Appendix I, they were acquired by the owner outside his State of usual residence, and are being imported into that State; or

(b) in the case of specimens of species included in Appendix II:

(i) they were acquired by the owner outside his State of usual residence and in a State where removal from the wild occurred;

(ii) they are being imported into the owner's State of usual residence; and

(iii) the State where removal from the wild occurred requires the prior grant of export permits before any export of such specimens; Unless a Management Authority is satisfied that the specimens were acquired before the provisions of the present Convention applied to such specimens.

4. Specimens of an animal species included in Appendix I bred in captivity for commercial purposes, or of a plant species included in Appendix I artificially propagated for commercial purposes, shall be deemed to be specimens of species included in Appendix II.

5. Where a Management Authority of the State of export is satisfied that any specimen of an animal species was bred in captivity or any specimen of a plant species was artificially propagated, or is a part of such an animal or plant or was derived therefrom, a certificate by that Management Authority to the effect shall be accepted in lieu of any of the permits or certificates required under that provisions of Article III, IV or V.

6. The provisions of Articles III, IV and V shall not apply to the noncommercial loan, donation or exchange between scientists or scientific institutions registered by a Management Authority of their State, of herbarium specimens, other preserved, dried or embedded museum specimens, and live plant material carry

a label issued or approved by a Management Authority.

7. A Management Authority of any State may waive the requirements of Articles III, IV and V and allow the movement without permits or certificates of specimens which from part of a travelling zoo, circus, menagerie, plant exhibition or other travelling exhibition provided that:

(a) the exporter or importer registers full details of such specimens with that Management Authority;

(b) the specimens are in either of the categories specified in paragraph 2 or 5 of this Article; and

(c) the Management Authority is satisfied that any living specimen will be so transported and cared for as to minimize risk of injury, damage to health or cruel treatment.

Article VIII

Measures to be taken by the Parties

1. The Parties shall take appropriate measures to enforce provisions of the present Convention and to prohibit trade in specimens in violation thereof.

These shall include measures:

(a) to penalize trade in, or possession of, such specimens, or both; and

(b) to provide for the confiscation or return to the State of export of such specimens.

2. In addition to the measures taken under paragraph 1 of this Article, a Party may, when it deems it necessary, provide for any method of internal reimbursement for expenses incurred as a result of the confiscation of a specimen traded in violation of the measures taken in the application of the provisions of the present Convention.

3. As far as possible, the Parties shall ensure that specimens shall pass through any formalities required for trade with a minimum of delay. To facilitate such passage, a Party may designate ports of exit and ports of entry at which specimens must be presented for clearance. The Parties shall ensure further that all living specimens, during any period of transit, holding or shipment, are properly cared for so as to minimize the risk of injury, damage to health or cruel treatment.

4. Where a living specimen is confiscated as a result of measures referred to in paragraph 1 of this Article:

(a) the specimen shall be entrusted to a Management Authority of the State of confiscation;

(b) the Management Authority shall, after consultation with the State of export,

return the specimen to that State at the expense of that State, or to a rescue centre or such other place as the Management Authority deems appropriate and consistent with the purposes of the present Convention:

(c) the Management Authority may obtain the advice of a Scientific Authority, or may, whenever it considers it desirable, consult the Secretariat in order to facilitate the decision under sub-paragraph

(b) of this paragraph, including the choice of a rescue centre or other place.

5. A rescue centre as referred to in paragraph 4 of this Article means an institution designated by a Management Authority to look after the welfare of living specimens, particularly those that have been confiscated.

6. Each Party shall maintain records of trade in specimens of species included in Appendices I, II and III which shall cover:

(a) the names and addresses of exporters and importers; and

(b) the number and type of permits and certificates granted; the States with which such trade occurred; the numbers or quantities and types of specimens, name of species as included in Appendices I, II and III and, where applicable, the size and sex of the specimens in question.

7. Each Party shall prepare periodic reports on its implementation of the present Convention and shall transmit to the Secretariat:

(a) an annual report containing a summary of the information specified in sub-paragraph (b) of paragraph 6 of this Article; and

(a) a biennial report on legislative, regulatory and administrative measures taken to enforce the provisions of the present Convention.

8. The information referred to in paragraph 7 of this Article shall be available to the public where this is not inconsistent with the law of the Party concerned.

67. United Nations Conference on Environment and Development also known as Rio de Janeiro Declaration or Earth Summit has adopted non-legally Binding Authoritative Statement of Principles for a Global Consensus on the Management, Conservation and Sustainable Development of All Types of Forests. The preamble and principles are also contained in the book titled as "Documents in International Environmental Law which reads as under :-

"Preamble

(a) the subject of forests is related to the entire range of environmental and development issues and opportunities, including the right to socioeconomic development on a sustainable basis.

(b) the guiding objective of these principles is to contribute to the management, conservation and sustainable development of forests and to provided for their

multiple and complementary functions and uses.

(c) Forestry issues and opportunities should be examined in a holistic and balanced manner within the overall context of environment and development, taking into consideration the multiple functions and uses of forests, including traditional uses, and the likely economic and social stress when these uses are constrained or restricted, as well as the potential for development that sustainable forest management can offer.

(d) These principles reflect a first global consensus on forests. In committing themselves to the prompt implementation of these principles, countries also decide to keep them under assessment for their adequacy with regard to further international cooperation on forest issues.

(e) These principles should apply to all types of forests, both natural and planted, in all geographical regions and climatic zones, including austral, boreal, sub-temperate, temperate, subtropical and tropical.

(f) All types of forests embody complex and unique ecological processes which are the basis for their present and potential capacity to provide resources to satisfy human needs as well as environmental values, and as such their sound management and conservation is of concern to the Governments of the countries to which they belong and are of value to local communities and to the environment as a whole.

(g) Forests are essential to economic development and the maintenance of all forms of life.

(h) Recognizing that the responsibility for forest management, conservation and sustainable development is in many States allocated among federal/national, state/provincial and local levels of government, each State, in accordance with its constitution and/or national legislation, should pursue these principles at the appropriate level of government.

Principles/elements

1.(a) "States have, in accordance with the Charter of the United Nations and the principles of international law, sovereign right to exploit their own resources pursuant to their own environmental policies and have the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction".

(b) The agreed full incremental cost of achieving benefits associated with forest conservation and sustainable development requires increased international cooperation and should be equitably shared by the international community.

2.(a) States have the sovereign and inalienable right to utilize, manage and develop their forests in accordance with their development needs and level of socio-economic development and on the basis of national policies consistent with

sustainable development and legislation, including the conversion of such areas for other uses within the overall socio-economic development plan and based on rational land-use policies.

(b) Forest resources and forest lands should be sustainably managed to meet the social, economic, ecological, cultural and spiritual human needs of present and future generations. These needs are for forest products and services, such as wood and wood products, water, food, fodder, medicine, fuel, shelter, employment, recreation, habitats for wildlife, landscape diversity, carbon sinks and reservoirs, and for other forest products. Appropriate measures should be taken to protect forests against harmful effects of pollution, including air-borne pollution, fires, pests and diseases, in order to maintain their full multiple value.

(c) The provision of timely, reliable and accurate information on forests and forest ecosystems is essential for public understanding and informed decision-making and should be ensured.

(d) Governments should promote and provide opportunities for the participation of interested parties, including local communities and indigenous people, industries, labour, nongovernmental organizations and individuals, forest dwellers and women, in the development, implementation and planning of national forest policies.

3.(a) National policies and strategies should provide a framework for increased efforts, including the development and strengthening of institutions and programmes for the management, conservation and sustainable development of forests and forest lands.

(b) International institutional arrangements, building on those organizations and mechanisms already in existence, as appropriate, should facilitate international cooperation in the field of forests.

(c) All aspects of environmental protection and social and economic developments as they relate to forests and forest lands should be integrated and comprehensive.

4. The vital role of all types of forests in maintaining the ecological processes and balance at the local, national, regional and global levels through, inter alia, their role in protecting fragile ecosystems, watersheds and freshwater resources and as rich storehouses of biodiversity and biological resources and sources of genetic material for biotechnology products, as well as photosynthesis, should be recognized.

5.(a) National forest policies should recognize and duly support the identity, culture and the rights of indigenous people, their communities and other communities and forest dwellers. Appropriate conditions should be promoted for these groups to enable them to have an economic stake in forest use, perform economic activities, and achieve and maintain cultural identity and social organization, as well as adequate levels of livelihood and wellbeing, through,

inter alia, those land tenure arrangements which serve as incentives for the sustainable management of forests.

(b) The full participation of women in all aspects of the management, conservation and sustainable development of forests should be actively promoted.

6. (a) All types of forests play an important role in meeting energy requirements through the provision of a renewable source of bio-energy, particularly in developing countries, and the demands for fuelwood for household and industrial needs should be met through sustainable forest management, afforestation and reforestation. To this end, the potential contribution of plantations of both indigenous and introduced species for the provision of both fuel and industrial wood should be recognized.

(b) National policies and programmes should take into account the relationship, where it exists, between the conservation, management and sustainable development of forests and all aspects related to the production, consumption, recycling and/or final disposal of forest products.

(c) Decisions taken on the management, conservation and sustainable development of forest resources should benefit, to the extent practicable, from a comprehensive assessment of economic and non-economic values of forest goods and services and of the environmental costs and benefits. The development and improvement of methodologies for such evaluations should be promoted.

(d) The role of planted forests and permanent agricultural crops as sustainable and environmentally sound be recognized, enhanced and promoted. Their contribution to the maintenance of ecological processes, to offsetting pressure on primary/old-growth forest and to providing regional employment and development with the adequate involvement of local inhabitants should be recognized and enhanced.

(e) Natural forests also constitute a source of goods and services, and their conservation, sustainable management and use should be promoted.

7.(a) Efforts should be made to promote a supportive international economic climate conducive to sustained and environmentally sound development of forests in all countries, which include, inter alia, the promotion of sustainable patterns of production and consumption, the eradication of poverty and the promotion of food security.

(b) Specific financial resources should be provided to developing countries with significant forest areas which establish programmes for the conservation of forests including protected natural forest areas. These resources should be directed notably to economic sectors which would stimulate economic and social substitution activities.

8.(a) Efforts should be undertaken towards the greening of the world. All

countries, notably developed countries, should take positive and transparent action towards reforestation, afforestation and forest conservation, as appropriate.

(b) Efforts to maintain and increase forest cover and forest productivity should be undertaken in ecologically, economically and socially sound ways through the rehabilitation, reforestation and re-establishment of trees and forests on unproductive, degraded and deforested lands, as well as through the management of existing forest resources.

(c) The implementation of national policies and programmes aimed at forest management, conservation and sustainable development, particularly in developing countries, should be supported by international financial and technical cooperation, including through the private sector, where appropriate.

(d) Sustainable forest management and use should be carried out in accordance with national development policies and priorities and on the basis of environmentally sound national guidelines. In the formulation of such guidelines, account should be taken, as appropriate and if applicable, of relevant internationally agreed methodologies and criteria.

(e) Forest management should be integrated with management of adjacent areas so as to maintain ecological balance and sustainable productivity.

(f) National policies and/or legislation aimed at management, conservation and sustainable development of forests should include the protection of ecologically viable representative or unique examples of forests, including primary/origrowth forests, cultural, spiritual, historical, religious and other unique and valued forests of national importance.

(h) National policies should ensure that environmental impact assessments should be carried out where actions are likely to have significant adverse impacts on important forest resources, and where such actions are subject to a decision of a competent national authority.

9.(a) the efforts of developing countries to strengthen the management, conservation and sustainable development of their forest resources should be supported by the international community, taking into account the importance of redressing external indebtedness, particularly where aggravated by the net transfer of resources to developed countries, as well as the problem of achieving at least the replacement value of forests through improved market access for forest products, especially processed products. In this respect, special attention should also be given to the countries undergoing the process for transition to market economies.

(b) The problems that hinder efforts to attain the conservation and sustainable use of forest resources and that stem from the lack of alternative options available to local communities, in particular the urban poor and poor rural populations who are economically and socially dependent on forests and forest

resources, should be addressed by Governments and the international community.

(c) National policy formulation with respect to all types of forests should take account of the pressures and demands imposed on forest ecosystems and resources from influencing factors outside the forest sector, and intersectoral means of dealing with these pressures and demands should be sought.

10. New and additional financial resources should be provided to developing countries to enable them to sustainably manage, conserve and develop their forest resources, including through afforestation, reforestation and combating deforestation and forest and land degradation.

11. In order to enable, in particular, developing countries to enhance their endogenous capacity and to better manage, conserve and develop their forest resources, the access to and transfer of environmentally sound technologies and corresponding know-how on favourable terms, including on concessional and preferential terms, as mutually agreed, in accordance with the relevant provisions of Agenda 21, should be promoted, facilitated and financed, as appropriate.

12.(a) Scientific research, forest inventories and assessments carried out by national institutions which take into account, where relevant, biological, physical, social and economic variables, as well as technological development and its application in the field of sustainable forest management, conservation and development, should be strengthened through effective modalities, including international cooperation. In this context, attention, should also be given to research and development of sustainable harvested non-wood products.

(b) National and, where appropriate, regional and international institutional capabilities in education, training, science, technology, economics, anthropology and social aspects of forests and forest management are essential to the conservation and sustainable development of forests and should be strengthened.

(c) International exchange of information on the result of forest and forest management research and development should be enhanced and broadened, as appropriate, making full use of education and training institutions, including those in the private sector.

(d) Appropriate indigenous capacity and local knowledge regarding the conservation and sustainable development of forests should, through institutional and financial support and in collaboration with the people in the local communities concerned, be recognized, respected, recorded, developed and, as appropriate, introduced in the implementation of programmes. Benefits arising from the utilization of indigenous knowledge should therefore be equitably shared with such people.

13.(a) Trade in forest products should be based on non-discriminatory and multilaterally agreed rules and procedures consistent with international trade law

and practices. In this context, open and free international trade in forest products should be facilitated.

(b) Reduction or removal of tariff barriers and impediments to the provision of better market access and better prices for higher value-added forest products and their local processing should be encouraged to enable producer countries to better conserve and manage their renewable forest resources.

(c) Incorporation of environmental costs and benefits into market forces and mechanisms, in order to achieve forest conservation and sustainable development, should be encouraged both domestically and internationally.

(d) Forest conservation and sustainable development policies should be integrated with economic, trade and other relevant policies.

(e) Fiscal, trade, industrial, transportation and other policies and practices that may lead to forest degradation should be avoided. Adequate policies, aimed at management, conservation and sustainable development of forests, including, where appropriate, incentives, should be encouraged.

14. Unilateral measures, incompatible with international obligations or agreements, to restrict and/or ban international trade in timber or other forest products should be removed or avoided, in order to attain long-term sustainable forest management.

15. Pollutants, particularly air-borne pollutants, including those responsible for acidic deposition, that are harmful to the health of forest ecosystems at the local, national, regional and global levels should be controlled.

68. The conference of the Parties was convened in Bali. International conference of Bali was under the frame work on Climate Change. The objectives of the conference are known as "Bali Action Plan" whereby it was resolved to urgently enhance implementation of the convention in order to achieve its ultimate objective with regard to principles and commitments. According to the Bali Action Plan which was convened in the year 2007 at Bali (Indonesia), it was decided to launch a comprehensive process to enable to full, effective and sustained implementation of the Convention through long term cooperative action. Paragraph 1(b)(iii) reads as under :-

"Policy approaches and positive incentives on issues relating to reducing emissions from deforestation and forest degradation in developing countries; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries."

69. In the book of Forest Futures (Global Representations and Ground Realities in the Himalayas) authored by Antje Linkenbach has made following pertinent observations on the concept of Chipko Andolan which was nationally and internationally acclaimed :

"With the global emergence of the ecological debate the fame of the Chipko

Andolan (i.e. the "hug the trees" movement) spread in India and abroad. This andolan was represented national and internationally by two of its leading figures, Chandi Prasad Bhatt, and, especially, Sunderlal Bahuguna. Both received several awards for their ecological commitment and are widely accepted as spokesman in ecological matters. Chipko developed into a popular subject in print and audio-visual media; it has been taken up as an issue in academic debates; it served and still serves political and ideological arguments. Numerous publications have dealt with, or have at least referred to, Chipko's incidents. And differing re-presentations of the Chipko andolan show that the movement became instrumental for various interest groups: it has been presented to the public as an "ecological movement, as a "peasant movement" with ecological impact, as a "women's or eco-feminist movement" as a "Gandhian movement" (forest satyagraha). In most of these publications a protective ("ecologically friendly") attitude is assumed to guide traditional relations with nature and the social practices of the people in Uttarakhand, who, accordingly, are believed to perceive environmental degradation as primarily an ecological problem."

70. According to the author, there are three most effective representations of Chipko Andolan which consist of Peasant movement, Ecological movement and Eco-feminist movement.

Author has translated Chipko song, composed and sung by Women of Lata which is as under :-

"Hey, didi, hey bhulli, let us all unite and with our own efforts let us save our jungle.

The maldars and thekedars want to make money.

Our cows and our cattle, they go to the jungle and with them our young people.

Hey, Rishi Maharaj, come and show yourself with your real power.

Chase for away the 600 trucks heavily loaded, and along with them drive back the strangers.

Hey, Lata Bhagvati, come and show yourself with your real power, chase for away the maldars and thekedars.

When our jungle is saved, only then will return (to our villages).

71. The Tilari Declaration was adopted by the people on 30.05.1968 in the memory of the martyrs who laid down their lives for the protection of the forest rights on 30.05.1968.

? Forests have been the basis of our cultural and economic life from the very beginning of this civilization.

? Our main duty is to protect the forest.

? We declare our birthright as being to fulfil our basic needs through forest products, through the forest, and to get employment from the forest.

? The harmonious relationship to the forest which is the basis of our happiness and prosperity should be permanent, for it is essential.

? The first use of forest wealth should be for the happiness and prosperity of the forest dwellers, of the people living near the forest.

? The forest products which are of daily use and which are used for village industries should be easily available for everybody.

? Forest industries based on forest products should be established near the forest.

? The present system of forest exploitation by the contractors should be replaced with forest labour co-operatives of the local people.

? In order to link love with knowledge about the forest in forest areas, botany and geology should be a part of curriculum at every stage of education in forest areas.

? On this day we pay our homage to the brave martyrs of Tilari and we remember them with great reverence.

? Their peaceful movement and brave martyrdom may inspire us and keep us alert for the protection of forest and forest rights.

? So we take a pledge to celebrate this day as `Forest Day'.

72. Learned author has reproduced Chipko slogans as under :-

? Protection of forests means protection of the country! (Vanon ki raksha, desh ki raksha)

? This is the call of Uttarakhand-forest rights in panchayats hands! (Uttarakhand ke yeh lalkar, panchayaton ko van adhikar)

? Stop our exploitation by the contractor system!

? Daily earnings from forest wealth - this is a right of forest dwellers! (Van sampada se rozgar, vanvasiyan ka adhikar)

73. Learned author has also translated Chipko Song composed by Ghanshyam Shailani which reads as under :-

"Brothers and Sisters from the hills! Let us all gather
and unite.

let us be ready to save our beloved jungle from the
government's forest policy.

Through auctioneers and contractors all the forests

have been cut away.
Bad times have come
and in the hills the forest has been destroyed.
The whole benefit of the jungle has been taken away by
contractors.
For years, we have cared for the forest
and for long we have protected the jungle.
Today the rich capitalists are cutting forests and
accumulating wealth,
And young people of the hills, who have real rights to
the forest
go to the plains and wash their dishes.
Today the factory for resin processing is located in
Bareilly,
But the resin, the raw material, they get from here;
and the whole profit goes to the Bareilly resin factory
In order to earn more wealth from the chir pines
deep wounds were cut in them and resulted in too
many trees dying.
The government and the rich capitalists together
are sweeping the jungle clear,
And nobody worries about planting new trees.
Instead, the Forest Department has become the
destroyer of forests.
To save the jungle there are no hopes,
to save the jungle there are no words.
Cling to the trees and don't let them be cut!
Don't let the forest's wealth be plundered!
Through the establishment of small forest-based
industries

benefit will come to the hill region,
and through it fortune and prosperity to forest
dwellers.

Everywhere in the hills socialism will come
and from village to village the sound of the conch* will
be heard.

74. The contribution of Sri Sunderlal Bahuguna is discussed as under:-

"In sum, Bahuguna's alternative concept of development is marked by an emphasis on sustainability and ethics which lead to an attitude towards nature instructed by worship and respect. To achieve sustainability, care for posterity should get at least that much, if not more" (1990:12). Therefore, the contract between the generations", to put it in the words of Jonas and King, demands not exploiting or over exploiting non-renewable as well as renewable resources. This alternative does not dismiss science and technology, but demands they be guided by 'wisdom', which is neither contained in volumes of books nor in the minds of great professors, but in the lives of the common people" (1992:9). And this wisdom lies, in part, in 'switching over from agriculture to tree farming" (1992:10). Such farming would not propagate species which are useful for commercial purposes:

The tree cover around the villages should be such as to provide food to human beings and fodder to the cattle. Priority should be given to trees yielding edible seeds, nuts, oilseeds, honey and seasonal fruits. In higher altitudes, above 1500 metres, soft walnut, sweet chestnut, hazelnut and wild apricot can be successfully cultivated. In lower altitudes mango, amla, bael, and jamun [indigenous names of local fruits] will thrive. An average hill family will need 300 nuts/fruits, 1500 fodder and 200 fibre trees (mulberry, ringal and bamboo) to be self-sufficient.

75. The damages, destructions or imbalances of the environment have now posed serious problems of social, political, regional, cultural, ecological etc. The very existence of the humanity is on stake. The landscape is changing repeatedly due to degradation and erosion. Learned Author- Sri Satish Kumar Tripathi in his Article "How Economists View the Environment?" has explained the depletion of non-renewable resources, as under :-

"Natural resources can be classified under two broad categories - renewable resources and non-renewable resources. Examples of non-renewable resources are : coal, crude oil, natural gas and minerals. The stocks of these resources are finite and hence the society's problem is optimal depletion of the resources over time. Fisheries, forests and water in lakes and rivers, and ground water are examples of renewable resources. These resources are capable of self-production and their stocks can increase with time only if their rates of harvesting are below

their natural rates of growth.

Renewable resources can be under private property, common-pool resource or open access resource regimes. Hotelling's paper on economics of exhaustible resources stresses the need for an inter-temporal approach to analyse the optimal rate of depletion of a finite stock of resource. He says that the static equilibrium type of economic theory is plainly inadequate for an industry in which the indefinite maintenance of a steady state is a physical impossibility. He uses the calculus of variations technique to study the optimum rates of depletion under competition and monopoly and also the rate of depletion from the society's point of view.

The Hotelling rule is that the price of an exhaustible resource must grow at a rate equal to the rate of interest, both along an efficient extraction path and in a competitive resource industry equilibrium. Hotelling shows that, if the elasticity of demand is decreasing as the quantity increases, the monopolist will deplete the resource more slowly than a competitor. When the cost of extraction depends on the rate of extraction and cumulative production, he shows that the royalty does not rise at the rate of interest but at less than the percentage increase in cost caused by adding to the stock of cumulative production. He analyses the effects of capital value tax upon the value of a mine and a per unit severance tax on materials extracted on conservation."

76. According to the World Commission on Environment and Development, sustainable development means meeting the needs of the present generations without compromising the needs of future generations. Nobel Laureate Robert Solow defines sustainability as making sure the next generation is as well off as the current generation and ensuring that it continues for all time.

77. Learned author -Mr. L.S. Singh in the article "Sustainable Development : Fact and Interpretation" has defined sustainable development, as under :-

"Sustainable Development - Definition

Development is the process by which people meet their needs and improve their living conditions. Only when such development leads to social, economic and cultural betterment that satisfied the needs and values of the all interest groups, not only of the present day but of future also by conserving natural resources and diversity of life, it becomes sustainable. Sustainable development is a complex and broad concept incorporating the following principles, which in one way or other are applicable to all developmental activities :

Ecological sustainability;

Social sustainability;

Economic sustainability; and

Cultural sustainability."

78. State government has not given sufficient attention to the environmental degradation caused by mining activities reducing the quality of land, water, deforestation etc. The excessive mining has affected the quality of life of the people. There is in large scale erosion in the catchment areas of the Himalaya. The deforestation in catchment area has also triggered floods.

79. Every citizen has a corresponding duty to respect nature and to protect environment and ecology. It is the duty of the Government actors as well as Non-Government actors to safeguard the environment for coming generations. We are holding the nature resources as a Trustee for future generations.

80. The sufficient material though has come on record that irreversible damage has been caused to the mountain's environment integrity and ecology by rampant mining permitted by the State Government. Yet, we are of the considered view that additional material is required to be collected now by appointing a High Powered Committee which shall go into the entire gamut with regard to the vital issue referred above as to give a finding whether the mining activity should at all be permitted in the State of Uttarakhand now/presently as well as in future.

81. The mighty Himalayan Mountain Ranges are young and fragile. The mining activity has affected the stability of Himalayan Mountains. The Glaciers are receding at an alarming rate due to pollution and global warming. The Himalayan Range Glaciers, rivers, streams, rivulets, lakes, jungles, forests and air are polluted. Their survival is at stake.

82. Accordingly, present writ petition is disposed of by issuing following mandatory directions : -

(1) A High Powered Committee is constituted comprising of the following officers:-

The Secretary, Environment, Forest and Climate Change or his nominee not below the rank of Additional Secretary would be Chairman with the following officers as members:-

1. Director General, Forest Research Institute, Dehradun.
2. Director, Wadia Institute of Himalayan Geology, Dehradun.
3. Director General, Geological Survey of India, Dehradun.

Considering the exigencies and need, the Committee would also be authorised to co-opt a maximum of two other experts, if required.

(2) The present Principal Chief Conservator of Forest Mr. Rajendra Mahajan and the present Commissioner, Kumaon, Mr. D. Sainthil Pandiyan would be the Secretary and Nodal officer of the Committee respectively.

(3) State Government is directed to deposit a sum of Rs. 50.00 Lakhs (Fifty Lakhs) with the Commissioner Kumaon, Mr. D. Sainthil Pandiyan. Nodal Officer/

Commissioner Kumaon shall open and maintain a separate account for this purpose. The Commissioner, Kumaon is authorized to pay honorarium to the members of the High Powered Committee as per their status. The amount of honorarium shall be decided by Sri Sainthil Pandiyan, being the representative of the State but taking into account the status of the members, after consultation with them. Sri Pandiyan shall also be responsible for the payment of bills as regarding traveling and other expenses.

(4) Mr. D. Sainthil Pandiyan, Commissioner, Kumaon shall be personally responsible to produce the entire data/material before the Committee from Revenue Agencies, Forest Department, Mining Department, Irrigation & Environment Department and other relevant Departments.

(5) It is made clear that till further orders of this Court, Mr. Rajendra Mahajan, Principal Chief Conservator of Forest and Mr. D. Sainthil Pandiyan, Commissioner, Kumaon shall not be transferred, without leave of the Court, in order to maintain smooth functioning of the High Powered Committee.

(6) The Chief Secretary of the State of Uttarakhand is directed to provide a separate room in the Secretariat commensurating with the status of the members of the High Powered Committee.

(7) The High Powered Committee shall submit the specific recommendations/final report in a sealed cover to this Court, within a period of nine months from today, on the following issues :-

(a) Whether the mining operations in the State of Uttarakhand can be permitted or the mining operations should be stopped completely or partially, keeping in mind the topography, particularly of the hills, the fragile mountains and the likely infraction of rural and mountain life of the inhabitants and the hazards to their health.

(b) Whether the existing mining operations can be permitted on the principle of "Sustainable Development", by imposing stringent conditions by taking further precautions on the basis of "Precautionary Principle".

(c) Whether the mining operations can be permitted in rivers, streams, rivulets etc. and beyond the height of 3000 ft. from the sea level.

(d) The High Powered Committee shall give specific recommendations whether the stage of saturation has come as far as mining activities in the State of Uttarakhand are concerned.

(e) The High Powered Committee is also directed to assess the damage caused to the rivers, springs, waterfalls and environment and ecology of the State of Uttarakhand by mining activities and to determine the just and fair compensation payable to all the persons affected by such mining activities in the State of Uttarakhand and how far these activities will affect the riparian rights of the persons concerned.

(f) The High Powered Committee is further directed to fix the responsibility of the persons who are primarily responsible for causing environmental degradation.

(g) It shall be open to the High Powered Committee to formulate more issues to save the environment and ecology of the State of Uttarakhand by taking into consideration the present status and future prospects of mining.

(h) The State Government is directed not to grant any fresh licence/mining lease/reconnaissance or prospecting licence, in any form till the final report is furnished by the High Powered Committee to this Court.

(i) The High Powered Committee is directed to provide necessary recommendations/guidelines, as to how the mining areas already mined can be reclaimed.

(j) The State Government is directed to take every possible measure under the law including the registration of first information report against the persons who are involved in illegal mining.

(k) The High Powered Committee shall determine the cleaning up cost of reclamation from the defaulters.

(l) The lease granted in favour of respondent Nos.8, 9 & 10 is therefore kept in abeyance till the above reports are submitted.

(m) The High Power Committee shall also prepare the blueprint for next 50 years taking into consideration the environment limits vis-a-vis the mining operation.

(n) The High Powered Committee is directed to submit the interim report within four months from today, whether the ongoing mining operation can be permitted or are required to be stopped in the State of Uttarakhand. Till then, there shall be a complete ban on mining activities including in forest areas, rivers, rivulets and streams in the State of Uttarakhand.

83. However, it is made clear that though the writ petition is finally disposed of but on principle of continuous mandamus, the petition would be kept alive for limited purpose for passing appropriate orders after receipt of the interim report as well final report.

84. It shall be open for the Secretary, High Powered Committee or State Government to move an appropriate application in case of any difficulty, in the implementation of the present judgment.

85. List after four months.