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Environmental Restoration around the Rihand Dam

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Abstract- Environmental restoration is not simply a practical matter. The topic carries with it immense of metaphysical and aesthetic interest. In the same way that the science of ecology and cultural phenomenon of environmental politics are inseparable, restoration of the environment is inextricably tied to and informed by several areas of discourse: ecology, cultural ecology, human ecology, environmental history and environmental ethics. The multi-disciplinary scope of the literature review undertaken for this work allowed for the reconceptualization of key terms and ideas of critical importance to restoration

The Vast stretches of Renukoot, Singrauli, Sonbhadra region were once covered with natural forests, hills and grassland with various natural resources. The tribal dwelling populations were small and interspersed. Before 1950, this area was a normal town enjoying the natural environment, traditional systems of culture and living with pollution free environment. The changes in status of environmental and development of Sonbhadra began during 1950 with the construction of two dams Rihand and Obra. Since then a number of establishment like Hindalco Aluminimum Plant (1962), Kannoria Chemicals (1964). A cement factory (1970) Followed by a number of coal, stone, mining projects and power generation units established scenario of the region and impacted human socio-cultural environment very significantly.

The Renukoot, Singrauli Sonbhadra region is now not only of India's most energy centers as well as also in Asia. Eleven open-cast coal mining sites, are occupying nearly 200 squares K.M., or about 10% of India's installed generation capacity. Chloro-alkali industry, Kannoria chemicals, thermal power plants and coal mines are responsible for discharge of various metals, especially Hg into Rihand dam with their effluents. The Rihand dam is a one of the Asia's Largest Anthropogenic reservoir developed in Mirzapur later on in. Total area of reservoir is approximately 457Sq. K.m. The capacity of the reservoir is 46,600 ha. Water of Rihand Dam is used for irrigation, drinking, fish culture, bathing, generation of power 300 M.W. electricity and industrial purpose. The whole industrial belt in Singrauli region lies practically in the close vicinity of Rihand dam, regularly discharging their effluents into the reservoir. Coal fly ash and ash slurry released from thermal power plants and coal mines serious threat to aquatic ecosystem due to presence of various pollutants (Rai and Tripathi 2006).

From this research investigation the following major points have been concluded-

- The quality of environmental health of Rihand dam with its surrounding is continuously degrading very fast.
- The environmental restoration in an around the Rihand dam is exactly improper. The parameters sets for environmental restoration have not been covered by the pollution creating agencies. The environmental restoration its objective policies is not having proper implementation. Similarly the environmental restoration have not taken the proper activation. Thus the environmental restoration catchment and command area in Rihand dam is bad condition.
- Thus, the environmental health of Rihand dam is facing very serious conditions due to improper environmental restoration.

Index Terms- Environmental restoration, Industrial pollution

I. INTRODUCTION

Environmental restoration is not simply a practical matter. The topic carries with it immense metaphysical and aesthetic interest. In the same way that the science of ecology and the cultural phenomenon of environmental politics are inseparable, restoration of the environment is inextricably tied to and informed by several areas of discourse: ecology, cultural ecology, human ecology, environmental history and environmental ethics.

Both natural and accelerated recovery methods require a good understanding of habitats and relationships between species which comprise that habitat. Like ecology, restoration ecology has developed in a social, economic and political context that has had an influence over the type of issues selected for analysis (Bocking, 1997). Cairns (1988) have stated that the discipline of restoration ecology was made academically possible by the first Earth Day celebration. Most of the work undertaken during the 1970s can be characterized as grassroots reform-oriented restoration of local environments (Sweeney, 2000). The initial plurality of meaning characteristic of the early populist interpretation of the meaning of restoration mirrors that of ecology (Westoby, 1997) both informing (Mysterud & Mysterud, 1997) and contrasting with the scientific discourse (Davis, 2000). Without this clear understanding of the ecosystem and how it recovers from damage, there is the danger of making the situation worse in the long term, or changing the ecosystem to a different one which is not sustainable. It is therefore essential to have a technical appraisal and risk assessment with the aim of avoiding the creation of an artificial or diversely poor site, or genetic pollution. It is important to examine advantages and disadvantage if possible, although the quantitative assessment of environmental benefits is very difficult.

Harmony between man and environment is the essence of healthy life and growth. The environmental protection and conservation of various National Thermal Power Corporation (NTPC) Rihand project programmes in the reference of environmental and industrial development balance. Therefore,

maintenance of ecological balance and pristine environment has been of utmost importance of the Union Ministry of Power (MOP). NTPC being the leading organization under the ministry in the areas of power generation has been taking measures discussed below for mitigation of environment pollution due to power generation.

The present paper in categorized into two factors firstly environmental restoration secondly restoration ecology. Both are interlinked by policy & management activities and options. Environmental restoration is a social activity in which theory and practical works are involved. Figure no. 1.1 explains the environmental restoration: its objective and wildness and environmental restoration ecology: objectives and ecosystem function A and B show the policy and activity between environmental restoration and environmental restoration ecology.

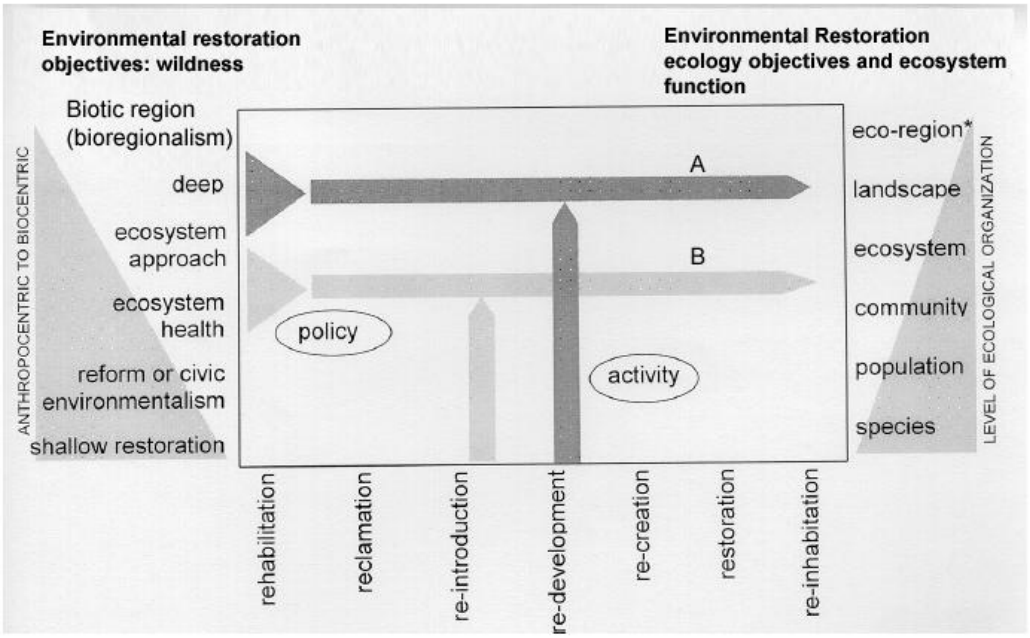

Fig.No1.1 Linking social and ecological paradigms through a continuum of restoration activities Examples A and B show a qualitative congruency between ecological and social paradigms of differing scales.

1.1. Mitigation of impacts on the Rihand dam environment:-

The ecological society, Non-Governmental Organization (NGO), NTPC and pollution control board based in Sonbhadra district, attempted to restore the natural wealth of the dam affected region by starting ecological restoration projects. One each in the command and catchment area to the find out if the rejuvenation of natural process can revive the health of natural resources in the region, which would make the living more sustainable for the local communities. The Rihand project site of ' Restoration of forest ecosystem (Upper site) was on the hill slopes facing the reservoir in catchment area of the Rihand dam and the other project site of Restoration of forest ecosystem' (Lower site) was a piece of downstream land in the catchment area. Both the sites are on the land owned by the 'Irrigation Department of Government of Uttar Pradesh (Ecological Society 2008).

The organization had kept the following objectives:-

- To restore a patch of highly degraded land in the catchment of Rihand dam of Sonbhadra to a pre-disturbed forest ecosystem.
- To restore wetland ecosystem on the barren land created by the dam construction activity and it's after effect immediately downstream of the dam.
- To integrate local community and NTPC interests in restoration efforts to the socieo-economics welfare with the strengthening of natural process.

II. Material and Methods

Location and extent of study area:-

The Rihand reservoir is located in between 24^0N, 83^0E and $24^0$2'N, $82^0$48'E, with a surface area having 30 × 15 km. with the maximum depth of 25 m (Fig.No.1.2).

The area of present study belongs to the district of Sonbhadra of Utter Pradesh state. Sonbhadra is the largest district having an area of 6788 Sq.Km. It lies in the extreme south-east of the U.P. state and north east of M.P., and is bounded by Mirzapur district to the northwest, Chandoli district to the north, Bihar state to the northeast, Jharkhand state to the east, Chhattisgarh state to the south and Madhya Pradesh state to the west. The district head quarter is in the town of Robertsganj.

The studies on the ecology of environmental studies is very important because it is not a simple and practical matter.

Some of the pollution aviating agencies are responsible to pollute the natural habitat, fulfill the gaps created by them. The ecology and habitat culture are inseparable factor of environment.

For the further study of environmental studies, various local and cited parameters have been adopted.

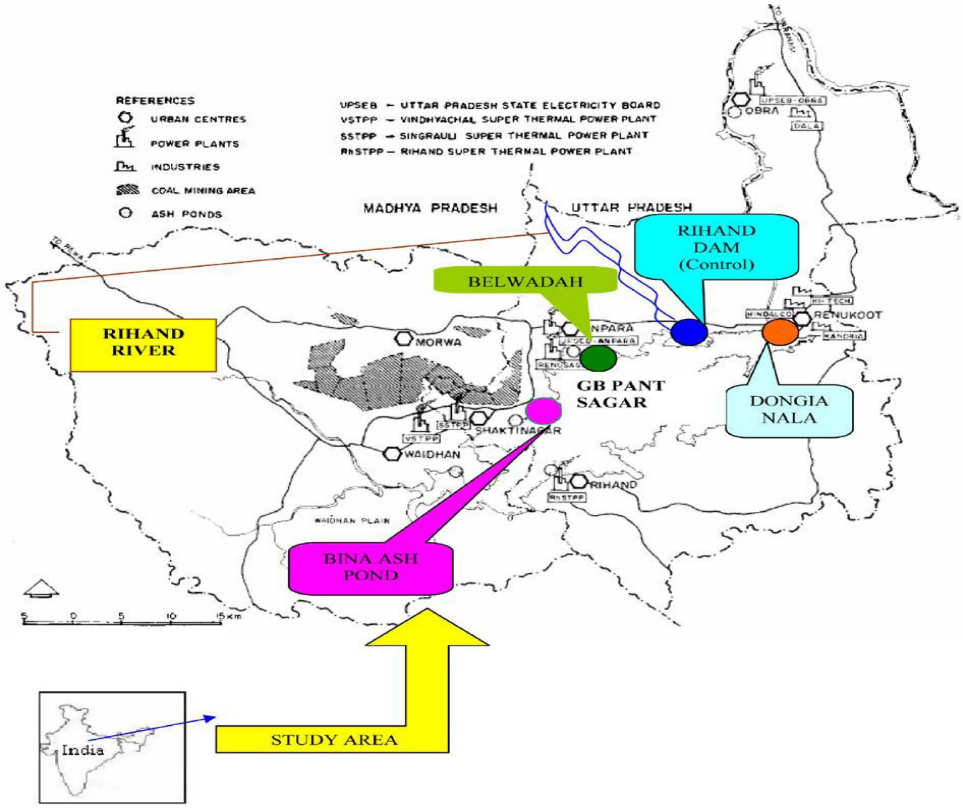

Fig. No.1.2. Rihand Dam Map and Around the Industries

III. Result and Discussion

Existing work falls into one of two main categories: environmental restoration and restoration ecology, which are linked through management and policy options (See Figure 1.1). Environmental restoration is a social movement whose theory and practice equires the critical appraisal of socially organized knowledge-claims (Sweeney, 1999) such as the moral primacy of pristine wilderness (Cronon, 1995; Denevan, 1992; Bowden, 1992), crucial ideological tenets of conventional economic discourse such as sustainable development (Descola & Pálsson, 1996), misleading social metaphor such as ecological 'investment,' 'services,' and 'debt' (Hornborg, 1996; Grange, 1977), and daring conceptual bets such as universally applicable images of environment and society (Guha, 1997; Redclift, 1995), reinhabitation (Bernard & Young, 1997; Mills, 1995) and the utopian bioregional movement (Brennan, 1998).

A very brief description of discussion is presented in the following paragraph-

1.0. Environment Management of Thermal Powers and Chemical Industries Located Around the Rihand Dam-:

The establishment of thermal power stations and chemical and cement factories has also resulted in large scale gaseous air pollution, particularly of SO_2 and HF pollution due to particulate matter through fly ash and cement dust and that due to liquid effluents. Surface coal mining has caused extensive damage to the natural ecosystems with growing dumps of overburden. The latter needs to be stabilized.

Coal spoil localities:-

The changes related to the revegetation of coal mine spoils of different ages (5, 10, 12, 16 and 20 year old spoil were examined. As the age of mine spoil increased coarse particles decreased and fine particles increase. Total nitrogen, mineral nitrogen, inorganic phosphorus and exchangeable potassium also increased with age. The plant community changed with age of mine spoils on different significantly between micro sites and between age of mine spoils and boot the root and shoot biomass increased with age. Microbial C, N and P also were significantly related to the age of mine spoils. Microbial biomass can be taken functional index of progress of succession at least during the early phase of soil redevelopment. Undulating and flat surface micro-sites were superior in terms of plant growth compared to surface micro-sites, on the 12 year-old flat surface micro-sites 24 plant species, out of 30 plant species seeded, showed satisfactory growth performance.

Agricultural impacts:-

Indirect impact of agriculture on natural ecosystems were examined by selecting five villages for case studies. Double cropping patter showed higher inputs in terms of human and bullock labour and seed quantity compared to single cropping. The output was also higher in double cropping than in single cropping. However, the output/input ratio was lower in double cropping than single cropping. The agricultural activity had profound effect on the surrounding natural ecosystems through fodder and fuel-weed extraction. The human population involved in activities other than agriculture needs about 416 MT of firewood per month.

Industrial Effluents :-

Impact of industrial effluents on the habitat and community characteristics of the riparian vegetation, limnology and phytoplankton productivity of Rihand dam and Rihand River as affected by the effluents from a chemical factory and those from a thermal power house have been studies at sites representing an effluents- Free zone, effluent mixing zone and the downstream effluent diluted zone.

Effluents from Kanorria chemical industries had quit high chloride concentration and low nutrient status and these influenced the water quality of downstream region of the reservoir. Organic carbon load was highest in sediment of the thermal power plant. Heavy mental like Cd, Cu, Fe, Ni, Pb and Cr concentration were below the threshold limit in the river water but these were relatively higher in sediment (Fe>1000ppm). Chemical parameter of water (Chloride, nitrate, phosphate and calcium) of the bottom sediment. Phytoplankton population and diversity indices were relatively higher in the pollution free zones and very low in the effluent affected zones. Chlorophyta had higher number of species whereas Bacillariophyta had higher density. Available community production of water bodies was quit low in the effluent affected regions.

Industrial activities have affected the air quality, physico-chemical characters of soil, plant structure and functions, particularly in the vicinity of emission sources. Air quality data revealed that SO_2 and HF are the major gaseous pollutants in the area. These were maximum during winter and minimum in rainy season. The combined effects of pollutants may be additive; or less than additive, depending upon pollutant concentration and duration of exposure and plants exposed.

Human Impacts:-

These are differences in attitudes among human related to the developmental activities. During the year 1955-56, data were collected from displaced persons ad their villages had been covered under the Rihand Dam (G.B.Pant Sagar) scheme, and other inhabitants of villages situated up to 30 K.M. from Renukoot. As compared to those living in remote villages, people living in villages close to Renukoot are more individualistic, having less faith in fate and the super natural. They lay more economic status, remain more anxious and tense, have more health problem and depend less on forest wood for their livelihood. Incidence of crime is more in people living close to Renukoot (town area. Displaced persons also remain more anxious and worried are more individualistic and are more aggressive, because of change in family structure and in order to cope against other demands of life and the hostile environment the people restore to alcohol cannabis and drug abuse.

1.1. Environment Management; Restoration and use of forest around The Rihand Dam:-

A. Management, renovation and use of forest-

- The existing Sal forest and the mixed forests with >40% crown cover need strict protection measure in order to maintain these at current levels of biomass and productivity and to prevent further deterioration of site quality.
- Aggressive plantation forestry measures should be adopted to enhance the current stock of those mixed forests which now have only 30-40 percent crown cover. Traits of suitable species are deciduousness, good coppicing capability profuse rooting capability and well developed internal nutrient cycling mechanisms. Grazing in these areas should be discouraged to avoid the loss of fine soil particles and consequent soil textural changes.
- Further land use change should be prohibited to avoid the breakdown of the biological soil fertility fabric and to conserve the exiting forest cover.
- In all major, forest community types 'preservation' plots should be established and used to monitor forest growth under prevailing environmental conditions on a long term basis.
- There is a potential for fuel wood production in the mixed deciduous forest region. Intensive forestry for fuel wood production should be under taken in selected forest compartments from where an appropriate harvesting and distribution system can operate to meet the needs of local inhabitants as well as those of the nearby habitations in the Gangetic plain.

B. Stabilizing agriculture:-

- Since the villages based on agriculture (Yielding insufficient agronomic production) in this area are centre of massive energy consumption causing a tremendous pressure on natural ecosystem conservation of the latter can be achieved by: 1). Finding alternative and complementary means of livelihood; 2).reducing livestock numbers, and by promoting high milk yielder; 3) developing village pastures (3.7 ha per ha of cultivation) and woodlots (0.97 ha per ha of cultivation); 4) encouraging plantations of species such as *hardwickia binata*, *Ziziphus spp*, *Anilanthus excelsa*, *cordial dichotoma* and *leucaena glauca*, etc., in non-cultivated land of villages; and 5) introducing and promoting improved dry land farming techniques such as-
    a) Introduction of crops capable of maturing in a period of 90-100 days.
    b) Adequate use of fertilizers.
    c) Planned rain water management, including storage of surface runoff, and
    d) Practices of intercropping with crops of larger duration with slow growth rate in the early part of their life cycle.

- There is a need to develop agricultural practices where the loss of soil C, N< and P and decrease in microbial C,N, and P due to cultivation can be avoided. Long term experiments are needed on till/minimum-till practices and on crop residue management.

C. Revegetation of mine-spoil sites:-

- Characteristics of micro sites should be take into consideration in revegetation attempts. Undulating surface and flat surface and flat surface micro-sites are superior in plant growth compared to slope and coal patch microsites.
- Advantage should be taken of the facts that
    a) The mine spoils are a nutritionally sub-optimal medium but non-toxic to plant growth.
    b) Application of N-P-K fertilizer in conjunction with water management practices and protection from grazing accelerate plant succession on these spoils.
- Direct seeding (seed dibbling) is a suitable method for quick revegetation of these mine spoils. Mixtures of grasses, leguminous forbs and native trees should be seeded to speed up natural plant succession. Legumes have ameliorative effects on soil physico-chemical properties. Species such as *stylosanthes hamata* and *S. humilis* should be seeded on slopes to check soil erosion. The following species have been found suitable for direst seeding on mine spoils: *alabizia procera, A. lebbeck, A. auriculformis, Pongamia pinnata, subbania aegypticca, Dichrostachys cinerea, D. corten, Clitoria ternatea, Desmanthus virgatus, Desmodium tortosum, Microptelium atroperpureum, stylosanthes hamata, Bothriochloa intermedia, B. pertusa, Cenchrus setigerous, Chrysopogen fulvus, Dendrocalamus strictus, Cajanus cajan, Phaseolus aureus, P. mungo, Pennisetum typhoides.*
- Progress of biological reclamation should be monitored by determining periodically the microbial biomass C, N and P.

D. Industrial effluent and revegetation of banks:-

- Direst discharge of liquid effluents from industries and the power houses into the Riahnd dam and Rihand Rivers should be prevented. The chloride content in the Kanoria chemical effluent and iron content in silt at Obra thermal power plant are very high. *Polygonum amphibium* which selectively absorbs and retains a high quantity of iron, can be grown on blanks.
- Effluents- affected water and channel margins have poor primary production. Banks of streams, the G.B. Pant Sagar and Rihand River need revegetation with locally adapted plants. *Lantana camara* and *Lenotis sp*. Are good conservers of soil water and nutrients and well adapted to prevailing environmental pollution and biotic stresses.

E. Air pollution monitoring and abatement:-

- Electrostatic precipitators and wet scrubbers should be used to minimize the stack emission of particulate and gaseous pollutants in the area, and control equipment already installed must be made to perform at maximum efficiency to reduce the emission at source.
- Peak concentrations of pollutants are important in causing severe foliar injury and should be given more importance than ambient average concentrations.
- Measurement of shifts in growth rates and patterns of biomass allocation are more important for response evaluation than the determination of final biomass accumulation.
- Parameters such as reduction in chlorophyll and dry matter accumulation, and increase in peroxidase activity, can be used as indicators parameters to assess pollution impact.
- Sensitive crops may be used as bio-indicators of air pollution status.
- A massive tree plantation programme should be under taken to alleviate the effects of particulate and gaseous pollutants in the area specially in the vivinity of emission source.
- Plant species such as *peltophorum ferrugineum, Acacia nilotica, Eucalyptus hybrid, Dalbergia sissoo, Pithocolobium dulce, Phyllanthus distichus, Tamarindus indica* and *Eugenia operculata* should be planted around the factories. Along road side *Nerium odorum, Tabernaemontana coronaria, Hibiscus rosasinensis* and *Callistemon lanceolatus* should be planted.
- *Cicer arietinum, Brassica campestris, Sorghum vulare* and *Cjanus cajan* which are tolerant to industrial pollutants should preferably be grown in place of sensitive crops such as *Pisum sativum, Phaseolus mungo, Triticum aestivum* and *Oryza sativa.*
- Field grazing by domestic animals should be avoided within 3 K.m. from aluminium factory especially during the winter in order to protect the animals from massive fluoride ingestion.
- Continuous air monitoring stations should be installed in this rapidly growing industrial region to correlate to ambient air quality with the changes in vegetation pattern due to industrialization.

F. Environment and Human Health:-

- Educative and acculturative programmes need to be made available to the inhabitants of this region on a larger scale.
- Adequate recreational facilities also need to be provided.
- Prime importance should be given to efficient medical care and health-monitoring services, not only inside the industrial establishments, but also for the inhabitants of the larger surrounding area.
- Environmental monitoring of the area should be carried out regularly and frequently to determine whether the dust and gases being released into the atmosphere are within the limits of permissible concentrations. Frequency and duration of the extremely high ambient concentrations and their effects on human health need to be assessed.

IV. SUMMARY AND CONCLUSION

To be successful restoration projects demand a comprehensive approach, viz. remedial action planning (LaViolette, 1993; Meine, 1992). There is a need for "multispectral restoration" (Sweeney, 2001) because effective measures of restoration are incomplete without social and economic components. Such an approach has the advantage of moving beyond both inadequate ecosystem understanding within the public sphere, i.e., air and water as public goods, and the adversarialism encountered in resolving common property resource issues. By restructuring the "ownership" of restoration projects support is more likely to develop to ensure initiation, long-term maintenance and monitoring.

Environmental restoration and restoration ecology while employing different means do have shared ends. Restoration, continues to be a "bridge" between the natural and the social sciences and will doubtless continue to benefit from other more established disciplines on both sides of the "two cultures divide" (Snow, 1959; Worster, 1996). Instead of firmly dividing nature and culture, restoration goals, forwarded by the inclusion in the project of all stakeholders, are capable of drawing insight from a variety of sources and proposing common ground for the common concern of environmental security

Due to the rapid development of civilization and industrialization various type of artificial resources and ecosystem have made, amongst them one is the anthropogenic reservoirs, which are constructed to fulfill the need of hydroelectricity, irrigation, power generation, pissiculture etc. These anthropogenic dams are responsible to convert to lotic water system into lentic water ecosystem. Thus, due to this (ecosystem) conservation various types of morphological water characteristically and eco-development or eco-devastation conditions take place.

From this research investigation the following major points have been concluded-

- The quality of environmental health of Rihand dam with its surrounding is continuously degrading very fast.
- The environmental restoration in an around the Rihand dam is exactly improper. The parameters sets for environmental restoration have not been covered by the pollution creating agencies. The environmental restoration its objective policies is not having proper implementation. Similarly the environmental restorations have not taken the proper activation. Thus the environmental restoration catchment and command area in Rihand dam is bad condition.
- Thus, the environmental health of Rihand dam is facing very serious conditions due to improper environmental restoration.

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