International Environmental
Law Research Centre

GUIDELINES FOR ENVIRONMENTAL IMPACT ASSESSMENT OF RIVER VALLEY PROJECTS

Department of Environment, Ministry of Environment and Forests
January, 1985

International Environmental Law Research Centre
International Environment House
Chemin de Balexert 7
1219 Châtelaine
Geneva, Switzerland
E-mail: info@ielrc.org

TABLE OF CONTENTS

CHAPTER 1 : RELEVANCE OF ENVIRONMENTAL ASPECTS FOR THE RIVER VALLEY DEVELOPMENT PROJECTS

(Dr. S. Maudgal)*

Concern for environmental pollution is rather a recent phenomenon which has been triggered mainly by the backlash effect of accelerated industrial growth in the developed countries. The two major criteria-the project should maximise economic returns; and it should be technically feasible-are no longer considered adequate to decide the desirability or even the viability of the project. It is now widely recognised that the development effort may frequently produce not only sought for benefits, but either-often unanticipated-undesirable consequences as well which may nullify the socio-economic benefits for which the project is designed.

2. (sic) Development Priorities

The two biggest polluters, undoubtedly, are hunger and poverty. Struggle for mere survival is unfortunately a stark reality in a majority of the developing countries. Development priorities are governed by the nature of the economy which has the following general characteristics:-

(i) Agricultural Economic Base:

Many of the developing countries have an agricultural economic base which; in turn, is characterised by rather perennial foodgrain shortages. Frequent famines resulting from inadequate or untimely rains are a common feature of these economies.

The planners as well as the decisions makers, therefore, always stress the need for increased output of foodgrains through better seeds, fertilisers and intensive irrigation practices. Creation of a network of irrigation facilities is thus a priority area as far as the development effort in the third world countries is concerned. Coupled with the foodgrain production is also the necessity of generating power, which puts premium on the construction of Hydroelectric Projects on a priority basis. Power generated is essential not only for the industries but also for ground water pumping and irrigation.

(ii) Infant Industrial Base:

The industrial-base in most of the developing countries is almost in its infancy. There is a mad rush, therefore, to rapidly develop a network of industries to meet atleast the demand of consumer products and to setup industries for ancillary units. The objective being to catch up with other nations that started on the industrialisation trail long ago. The setting up of industrial units also is, therefore, considered to be a priority development area, which further puts premium on power generation.

(iii) Archaic Administrative and Organisational Structure

The administrative machinery in all the developing countries is a relic of their colonial past and is characterised by red-tape and bureaucracy. The bureaucratic structure unfortunately is burdened by all its negative aspects with none of the redeeming features thereby making the administrative and decision making process biased against innovative and dynamic decision making to meet the changing situations. Indeed, there is a strong built-in inertia and resistance to innovative and scientific approach to problem solving with the result that anything new becomes suspect and gets dubbed as undesirable.

(iv) Over Population:

One common denominator of all the developing countries is their large population base. The situation is further aggravated by an alarming rate in the increase of population, which adds millions of new individuals to be fed, clothed and sheltered with the already limited resources. Perspective planning is the obvious casualty because the emphasis is on ad-hoc measures that seek short-term solutions to the immediate crisis situations.

* Director, Department of Environment and Member Secretary of the Inter-Ministerial Environment Appraisal Committee for River Valley Development Projects

Under such circumstances, provision of adequate food and shelter to the teeming millions is of top priority. Any aspect deviating from these pressing demands is perceived to be obstructionist and, therefore, undesirable. Therefore, one naturally poses the question: -

Should environmental considerations be allowed to hinder economic development?

Indeed, one often encounters such arguments as:

- how can we force our people to go hungry for the sake of protecting the environment; or
- the environmental lobby is the creation of the developed countries so as to perpetuate the economic stagnation in the developing countries.

Such strong feelings are easy to understand in the context of the prevailing economic stagnation. It does not, however, follow that the arguments advanced are valid. The basic flaw in these arguments is that they presume incompatibility between environmental conservation and the development effort. In reality, the objective of considering environmental aspects as part and parcel of development projects is to achieve:-

(a) sustained development with minimum environmental degradation; and

(b) prevention of long-term environmental side effects by incorporating mitigative measures so that the remedies do not become unmanageable and prohibitive in the long run.

Fortunately; apart from some very selected cases where the uniqueness of the natural resources - wildlife, flora and genetic-pool - may demand exclusive earmarking of a given region for their specific use, majority of the cases do not call for an either/or option to choose between development projects & preservation of natural environment. In all such cases, there is a strong need for considering the environmental aspects alongwith the other feasibility considerations of the development projects.

3. Economics of Incorporating Environmental Considerations

It is imperative to analyse whether the adoption of environmental measures is going to result in any short or long-term social and economic benefits or not.

Environmental protection for sentimental reasons alone is neither desirable nor can it be defended. . A careful study of even the direct costs involved which would be demonstrated to be caused by the absence of environmental mitigative measures in River Valley Projects would be an eye opener. Some of these may be listed as follows: -

(i) Health Effects:

Creation of large water bodies is known to have resulted in the introduction of water borne diseases through such vectors as snails. Malaria, filarid & schistosomiasis epidemics have known to occur because of disregarding the introduction of parasites and vectors through the creation of large water bodies. The loss to the nation, in terms of man-hours lost and the consequent loss to the GNP and additional cost on medi-care etc. can be crippling especially in situations where the health delivery system is already in a rather precarious condition. The introduction of a development project, in such a situation can become a harbinger of disaster rather than ushering in an era of prosperity.

(ii) Plant Genetic Resources:

The food requirements of man are met largely by high yielding food plants like wheat, rice, maize, millets, pulses, tapioca, oilseeds and a variety of fruits & vegetables that have been developed by him, during a period of less than ten thousand years, from their wild and weedy relatives which hardly gave any yields. But, the fact that progenitors of our widely cultivated and high yielding varieties are indeed the wild varieties underscores the vital importance of wild species of plants as basic resources for future requirements.

The prosperity of mankind can depend upon our capability to keep the evolved foodgrains free from destruction by insects and pesticides. As more and more high yielding varieties of crop and other economic plants are released for general cultivation, the problem of heavy losses through diseases & pests which thrive under conditions of intensive agriculture, will become increasingly important and the plant breeders would have to turn to the genetic

resources found in the primitive type varieties and their wild relatives. Preservation of the areas rich in plant genetic resources as Biosphere Reserves is thus imperative. Destruction of these resources that have been created by many countries of evolution, for short-term gain, would indeed be an unmitigated disaster. Therefore, the need for a careful study before establishment of traditional development projects in such areas can hardly be over emphasised.

(iii) Aquatic Resources:

Fish in most of the developing countries is a rich protein source. The creation of a barrier across the migration path of the fish can considerably undermine the survival of the affected fish. Simple fish ladders, or quite elaborate mechanised lifts, can be provided to permit fish to reach their breeding spots. Adequate attention, however, needs to be paid to proper designs of the engineering structure so as to effectively help the fish to cross the hurdle. Otherwise, overlooking of a simple factor can be disastrous to the regional economy.

(iv) Water-logging and Salinity of Irrigated Soils:

Inadequate attention to the provision of drainage works in irrigation projects is known to have caused more damage than bringing commensurate benefits. According to estimates of the Ministry of Agriculture, almost 17.5 m.ha - 87 m.ha agricultural land and 88 m.ha other area is affected by degradation caused mainly by serious soil erosion, water-logging and salinity. Thus, almost 61% of our agricultural land is degraded. Moreover, 10 m.ha out of the 42 m.ha irrigated area under agriculture is affected by water-logging and salinity. Reclamation of water-logged and saline soils is an expensive and time consuming process which the growing economies can ill-afford. Even though the initial investments may seem forbidding, integrated planning of irritation, drainage & soil conservation aspects is a must.

(v) Deforestation & Soil Conservation:

The development projects are accompanied by extensive road building activity, creation of new settlements, destruction of forest areas and introduction of new industries. All these factors cause irreparable damage to the soil cover resulting in increased sedimentation, flash floods and loss of land fertility. Land slides that accompany the road construction activity, specially in the hilly tracts is a common, and unfortunately a routinely accepted sight. The excessive blasting operations loosen the whole slope, which becomes susceptible to serious land and mud slides.

The factors listed here are by no means uncontrollable. Indeed, the detailed study of the problems involved can help to arrive at a judicious solution where the soil-conservation and afforestation measures can be intermeshed with engineering solutions to provide long-term stability.

Even a cursory analysis would reveal that the environmental planning is absolutely essential to achieve long-term sustainable economic development. Short-term gains, at the cost of natural environment, may be tempting but can end up only in disaster.

4. Ecological Considerations in Planning of Development Projects

Since, the natural environment can no more be considered a free and inexhaustible -resource; all development activity impinging upon the natural environment needs to be carefully selected & controlled. Development of water resources is a major challenge to be accomplished in an environmentally, sound manner for achieving economic development. This calls for incorporation of ecological parameters in the planning and execution stages of these projects.

4.1 Planning Phase

During the planning & feasibility assessment stages of River Valley Projects, the following aspects need to be seriously considered:-

(i) Locational Aspects.

In addition to the techno-economic considerations, site selection must incorporate environmental considerations as well. Some of the major environmental components that need to be kept in view during site selection include:-

- Short & long-term impact on population/human settlements in the inundated and watershed areas;
- Impact on flora and fauna (wildlife) in the vicinity;
- Impact on wildlife (including birds) breeding area/feeding area/ migratory route;
- Impact on national parks & sanctuaries—both existing and potential;
- Impact on sites & monuments of historical, cultural and religious significance;
- Impact on forests; agriculture; fishery, and recreation & tourism etc.

Being a relatively new discipline, requisite data for impact assessment may not be readily available and may have to be generated through such field-surveys as:

- Pre-impoundment census of flora & fauna, particularly the rare & endangered species, in submergence areas;
- Census of animal population and available grazing areas;
- Land-use pattern in the area with details of extent & type of forest;
- Pre-impoundment survey of fish habitat and nutrients levels;
- Groundwater level, its quality, and-existing water use pattern;
- Mineral resources, including injurious minerals, in the impoundment;
- Living conditions of affected tribals /aboriginals etc.

(ii) Physical Aspects

The impoundment creates altered surface water patterns that may have far reaching impact on underground aquifers and their recharge Major aspects to be considered include:

- Landslides on the periphery of the reservoir;
- Siltation or sedimentation expected in the reservoir - identification of critical areas susceptible to erosion and methods of possible treatment;
- Groundwater recharge or other ground water charges;
- Expected water quality (salinity) charges over time and their effect on rIvenue eco-system, both impoundment & downstream;
- Land use patterns and practices in the vicinity of waterspread that would affect aquatic vegetation growth patterns;
- Potential seismic impact of reservoir loading; and
- Favourable aspects of impoundment on project area.

(iii) Resource Linkages Aspects:

Creation of an impoundment causes considerable disruption and results inevitably in the adoption of alternative land uses. Careful evaluation of the impact should be undertaken of such factors as:-

- Resource trade-off, such as, loss of optional land uses due to impoundment —mineral deposit loss, forest reserve diminution, monuments inundated, recreational facilities lost, dislocation of existing settlements etc;
- Compatibility of dam's creation and operation with present or planned development of the region;

Effect on resident and migrating fish and other aquatic life and assessment of new fishing potential;

(iv) Socio-cultural Aspects:

Since relocation may strain/disrupt the social fabric of the affected population, efforts should be directed towards betterment of their quality of life and preserving, to the extent possible, the special characteristics of their life-style by adequate provision of:

- population relocation requirements in inundated as well as watershed areas. This aspect has special bearing on the relocation of Tribals and Adivasis etc;

- identification of educational and vocational training programmes to be imparted to the affected population so that they can cope better with the new life style;
- resettlement area planning for housing and other amenities of community life (water supply, sanitation, schools, health services etc.) to be provided at resettlement sites.

(v) Public Health Aspects:

It is imperative that a serious consideration be given to:

- new health problems or vector patterns that may arise due to changes in water velocities, temperature, quality or other physical change factors caused by water -impoundment;
- adequate public health planning to create facilities for migrant construction - workers and immigrant influx. Possibility of disease aggravation or new public health problems introduced due to changes in population density and distribution also need to be looked into. Measures to control contamination of surface and ground water due to pesticides and fertilizers need also to be drawn up in advance,

(vi) Cost Benefit Analysis:

The cost of proposed remedial and mitigative measures, if any, to protect the environment must be included in the project costs. Mitigative measures may include:

- compensatory afforestation;
- restoration of land in construction areas by filling, grading etc. to prevent further erosion;
- control of aquatic weeds in submerged areas to provide improved habitat for aquatic life;
- measures to salvage/rehabilitate any rare or endangered species of flora and fauna found in the affected area;
- measures to salvage and relocate monuments from inundated zones;
- enforcement of anti-poaching laws;
- measures to prevent forest fires, over-grazing etc.;
- establishment of fuel depots to meet fuel requirements of labour force for preventing indiscriminate falling of trees;
- public health measures to control spread of water and soil-borne diseases.

Also should be included the cost of:

- Field surveys and studies undertaken to create the environmental data-base;
- Technical and administrative measures to effectively MONITOR the observance of suggested safeguards and mitigative measures etc.

4.2 Construction Phase

A judicious sequencing of construction operations and appropriate location of labour camp and project colony etc. can go a long way to reduce environmental damage. The following factors are worth considering :-

(i) All road construction and blasting operations, specially upstream of the reservoir, should be completed before reservoir filling is commenced so as to reduce excessive sedimentation load;

(ii) Excessive blasting recorded to by contractors should be controlled, specially in hilly terrain, so as to check the incidence of land-slides in the area;

(iii) Temporary labour camps must be located, to the extent possible, in areas which will later be submerged so as to reduce the loss of forest cover. Even though the sites for resettlement & project colonies are selected well in advance, there should be no need to cut all the trees on these sites. Only those trees should be cut which stand on the residential plots or on the proposed roads and paths. Cutting of these trees should be taken up only when construction operations are imminent.

(iv) The extent of clearance under the transmission lines should be related to the height of the standing trees, and the clearance restricted to minimum necessary width.

(v) Vegetation on island-formations in the reservoir above FRL should not be removed so that they may be developed as bird sanctuaries at a later stage

5. Conclusion

Only when the incorporation of environmental aspects in the planning & execution is made a part and parcel of all River Valley and other Development projects, there would be hope to protect and preserve our natural environment and to fulfill the objective of rapid economic development on a sustained basis while safeguarding the natural resources including the air, water, land, flora and fauna for the benefit of present and future generations.

CHAPTER 2 : DATA COLLECTION FOR IMPACT ASSESSMENT

The following data shall be collected to study the above environmental aspects of the project. The sources from where the data is to be collected and whose opinion is to be sought and incorporated within the project report are listed below:

Notation	Department
1.	State Forest Department
2.	Indian Meteorological Department
3.	State Fisheries Department
4.	Zoological Survey of India
5.	State Wildlife Department
6.	Slate Health Department/State Public Health Department
7.	Botanical Survey of India
8.	Geological Survey of India

Note:- For preparation of this Chapter, Department of Environment may be consulted as and when required.

1. Basic Information

1.1 Existing land-use in the catchment upto the source of the river or 100 km upstream of the structure whichever is less

(a) Agricultural land (ha.)

(b) Forests

(i) Reserved

(ii) Unreserved

(c) Barren land etc.

1.2 Submerged Area (ha.)

(a) Cultivated land

(b) Forests

(c) Shrubs and fallow

(d) Wet lands

(e) Area under ponds and tanks etc.

(f) Other uses

(g) Total

1.3 Forests types in the catchment and submerged area (types of trees, sparse or thickly wooded and other details). /1

ii) Extent and nature of forest in the area proposed to be cleared for construction of roads, colonies and other uses of the project.

1.4 Proposed period of construction.

1.5 Labour

(a) Estimated strength (peak)

i) Total

ii) Skilled and Semi-skilled (separate)

iii) Un-skilled

(b) Availability of labour from the affected area

i) Total

ii) Skilled

iii) Un-skilled

1.6 Population density (per sq. km.)

(a) Catchment

(b) Submerged area

(c) Command

1.7 Villages affected and population displaced

(a) Number of villages

(b) Population

a) Scheduled Caste

b) Scheduled Tribe

c) Others

d) Occupation of the affected people

i) Agriculturists

ii) Agricultural Labour

iii) lndustrial Labour

iv) Forest Labour

v) Artisans

vi) Any other

e) Land Ownership

i) Marginal farmers	(0-1.0 ha.)
ii) Small farmers	(1-2.5 ha.)
iii) Medium farmers	(2.5-5.0 ha.)
iv) Big farmers	(over 5.0 ha).

1.8 Resettlement

(a) Details of rehabilitation committee, if any

(b) Existing guidelines for resettlement, and compensation in cash and/or kind, if any

(c) Compensation proposed to be paid

(d) Resettlement plans for oustees (number of persons and families)

i) In existing villages

ii) At new villages sites

iii) Plan of the new village

iv) Facilities being provided (school, post office, bank, panchayat ghat, police station, roads, drainage, water supply, vocational training etc.)

(e) Proposals to provide vocational training and employment to oustees

1.9 Details of development activity in the affected area

(a) Drought-prone Area Programme
(b) Small Farmer Development Agency
(c) Rural Development
(d) Tribal Development
(e) Other programmes.

1.10 Sedimentation of the reservoir

(a) Expected rate of siltation
(b) Proposed/existing soil conservation programme/ measures in the catchment
(c) Problems of slips and slides on the periphery of the reservoir and proposed remedial measures.

1.11 Present flood situation in the command

1.12 Wind rose diagram, wind speed (maximum average) direction (seasonal) etc. at the headworks site/2

1.13 Frequency of occurrence of tornadoes, cyclones, hurricanes (maximum and minimum wind velocity)

1.14 Ground water (command)

(a) Depth and seasonal variations (pre and post monsoon)
(b) Quality-potable, fit for irrigation/industry
(c) Present use
  i) Area under irrigation
  ii) Extent of industrial use
(d) Interaction between the altered surface water patterns and under ground water recharge etc. (based on the experience of similar projects)

2. Environmental Status

2.1 Known sources of pollution in the region

a) Industrial units
b) Thermal Power House
c) Mining Operations etc. .

2.2 Industrial development in project area

a) Present status
b) Future plans (10 years)

2.3 Broad details of the aquatic life (fish, crocodiles etc.) supported by the area. If economically viable, indicate the breeding grounds in the river tributary(s)/ area(s) coming under submergence/3.

2.4 Wild animals and brids/4 & 5

a) Existence in the area
b) Rare/dying species (number), if any

c) Breeding/feeding area(s)

d) Migration routes

e) Is the area a potential wild life sanctuary?

2.5 Flora, fauna in the submerged area/ 5 & 7

a) Broad details of the rare/dying species

b) Number of affected valuable wild life

c) Measures proposed to salvage/rehabilitate

2.6 Tourism

a) Is the area a tourist resort?

b) Broad details of religious, archeological and recreational centre, wildlife sanctuaries, national parks, likely to be affected by the project etc.

2.7 Broad details of endemic health problems due to soil and water borne diseases/ 6.

3. Environmental Impact

3.1 Proposal to develop the site to attract tourism (recreation, water sport, picnic sites etc.)

3.2 Effect of the storage in flood mitigation

3.3 Changes in salinity of underground water expected and remedies, if required.

3.4 Expected water-logging problems and remedies.

3.5 Aquatic Life.

a) Existence of migratory fish life and proposals for fish ladder, if any.

b) Proposals for fisheries development and crocodile farming, if any.

c) Loss in aquatic production up or downstream, if any

3.6 Broad details of mines, mineral, commercial timber and other natural resources 1 & 8 coming under submergence with estimated loss

3.7 Broad details of injurious minerals coming under sub-mergence

3.8 Effect of water body in enhancement of water borne diseaseg/6.

3.9 Broad details of likely growth of weeds (salvinia. water hyacinth etc.), intermittent host vectors like snails, mosquitoes/3/8/7 and proposed remedial measures.

3.10 Effect of project on climatalogical changes (temperature, humidity, wind and precipitation including-modification to micro and macro climate)

3.11 Measures to prevent animal over grazing and cultivation of fore-shore on reservoir to prevent premature silting.

3.12 Likely impact of reservoir loading on seismicity

3.13 Likely impact of population pressure on (during construction)

a) Felling the trees for fire wood

b) Forest fires

c) Overgrazing leading to depletion of pasture lands

d) Visual pollution and damage to scenary.

3.14 Arrangement made for

a) Fuel requirement of the labour force during construction period to prevent indiscriminate felling of trees for fire wood (fuel depots)

b) Compensatory afforestation

c) Enforcing of antipoaching laws

d) Control of sediments and pollution

4. Proposals for observance and monitoring of suggested safe-guards and mitigative measures etc. during and after construction, of the project.