Topic 6

Impact analysis

The 'impact analysis' or detailed study phase of EIA involves:

- identifying the impacts more specifically
- predicting the characteristics of the main impacts
- evaluating the significance of the residual impact

The term ‘environment’ includes

- human health and safety
- flora, fauna, ecosystems and biodiversity
- soil, water, air, climate and landscape
- use of land, natural resources and raw materials
- protected areas and sites of special significance
- heritage, recreation and amenity assets
- livelihood, lifestyle and well being of affected communities

Impact identification methods

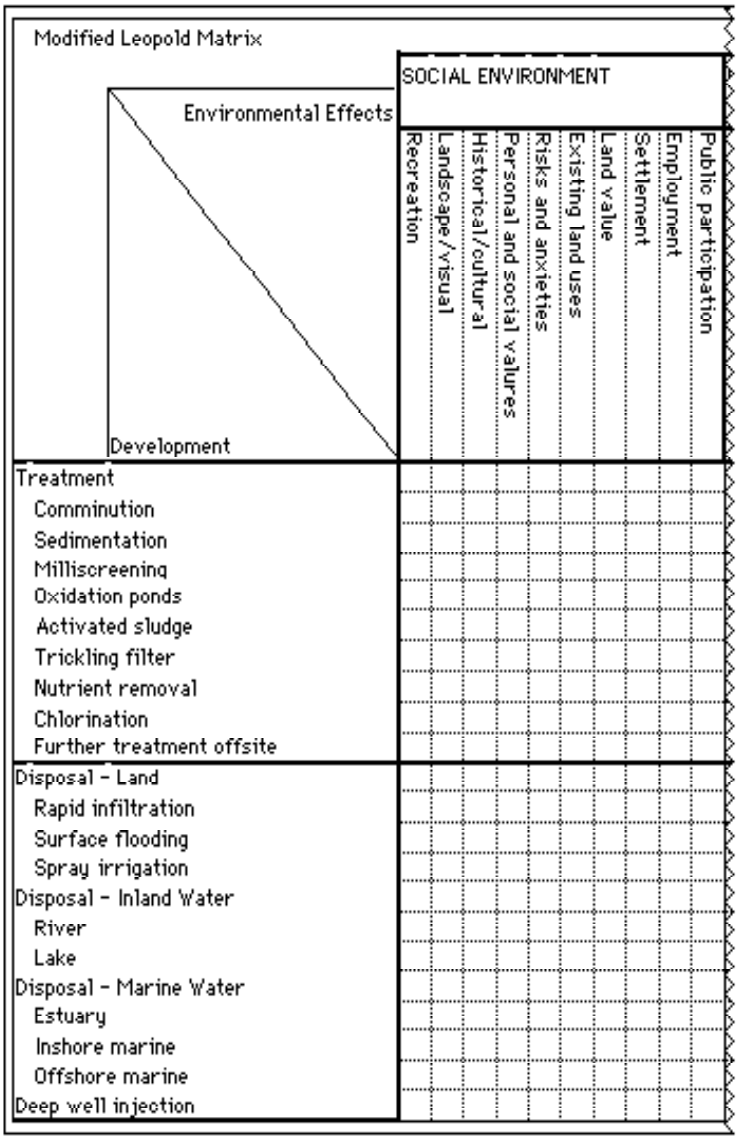
- checklists
- matrices
- networks
- overlays and geographical information systems (GIS)
- expert systems
- professional judgement

Example of a checklist

(For rural and urban water supply and sanitation projects)

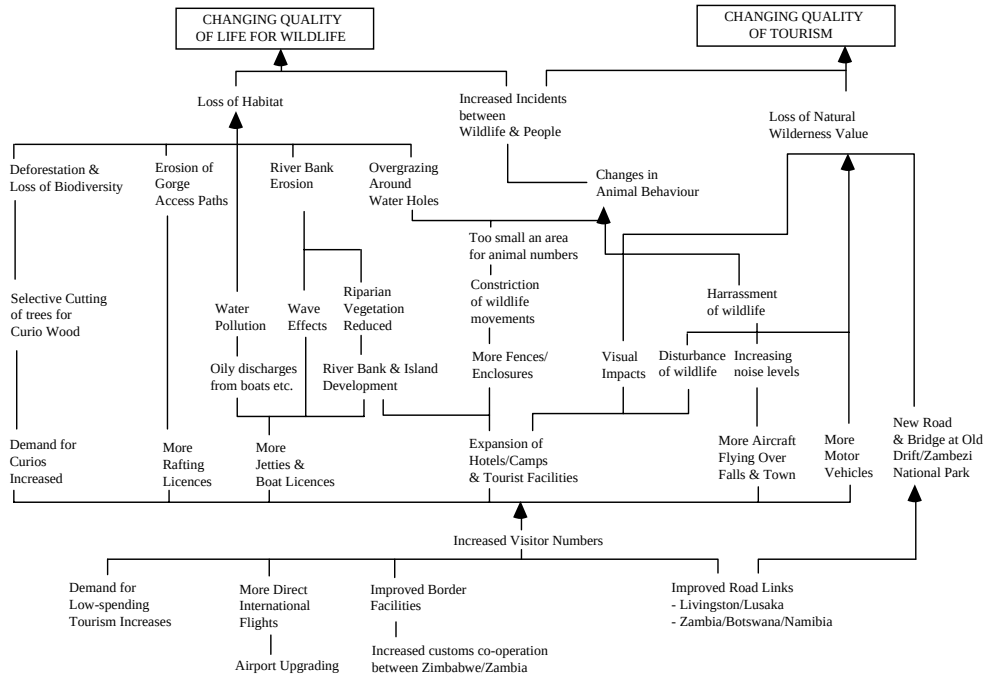
Aspects of EIA	Checklist Questions Will the project:	Yes	No	Additional Data needs
Sources of Impacts	1. Require the acquisition or conversion of significant areas of land for reservoir/treatment works etc. (e.g. > 50 ha rural, > 5 ha urban)?	☐	☐	☐
	2. Result in significant quantities of eroded material, effluent or solid wastes?	☐	☐	☐
	3. Require significant accommodation or service amenities to support the workforce during construction (eg > 100 manual workers)?	☐	☐	☐
Receptors of Impacts	4. Flood or otherwise affect areas which support conservation worthy terrestrial or aquatic ecosystems, flora or fauna (eg protected areas, wilderness areas, forest reserves, critical habitats, endangered species); or that contain sites of historical or cultural importance?	☐	☐	☐
	5. Flood or otherwise affect areas which will affect the livelihoods of local people (eg require population resettlement; affect local industry, agriculture, livestock or fish stocks; reduce the availability of natural resource goods and services)?	☐	☐	☐
	6. Involve siting sanitation treatment facilities close to human settlements (particularly where locations are susceptible to flooding)?	☐	☐	☐
	7. Affect sources of water extraction?	☐	☐	☐
Environmental Impacts	8. Cause a noticeable permanent or seasonal reduction in the volume of ground or surface water supply?	☐	☐	☐
	9. Present a significant pollution risk through liquid or solid wastes to humans, sources of water extraction, conservation worthy aquatic ecosystems and species, or commercial fish stocks?	☐	☐	☐
	10. Change the local hydrology of surface water-bodies (eg streams, rivers, lakes) such that conservation-worthy or commercially significant fish stocks are affected?	☐	☐	☐
	11. Increase the risk of diseases in areas of high population density (eg onchocerciasis, filariasis, malaria, hepatitis, gastrointestinal diseases)?	☐	☐	☐
	12. Induce secondary development, eg along access roads, or in the form of entrepreneurial services for construction and operational activities?	☐	☐	☐
Mitigation Measures	13. Be likely to require mitigation measures that may result in the project being financially or socially unacceptable?	☐	☐	☐
Comments				
	I recommend that the programme be assigned to Category ☐ Signature: Delegation.....Desk.....			

Example of a Leopold matrix



Example of a network

(showing linkages leading to changes in quality of life, wildlife and tourism)



Bisset

Choice of EIA method depends on:

- the type and size of the proposal
- the type of alternatives being considered
- the nature of the likely impacts
- the availability of impact identification methods
- the experience of the EIA team with their use
- the resources available - cost, information, time, personnel

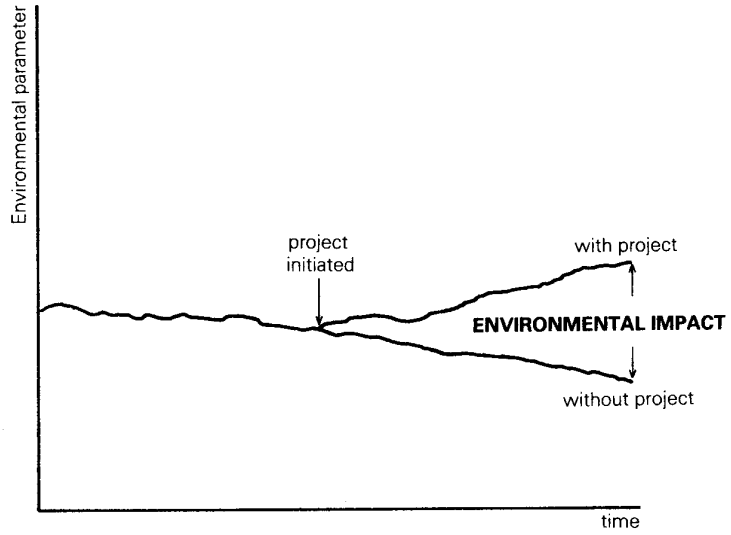
Main advantages and disadvantages of impact identification methods

	ADVANTAGES	DISADVANTAGES
Checklists **–simple** **–ranking and weighting**	o simple to understand and use o good for site selection and priority setting	o do not distinguish between direct and indirect impacts o do not link action and impact o the process of incorporating values can be controversial
Matrices	o link action to impact o good method for displaying EIA results	o difficult to distinguish direct and indirect impacts o significant potential for double-counting of impacts
Networks	o link action to impact o useful in simplified form for checking for second order impacts o handles direct and indirect impacts	o can become very complex if used beyond simplified version
Overlays	o easy to understand o good display method o good siting tool	o address only direct impacts o do not address impact duration or probability
GIS and computer expert systems	o excellent for impact identification and analysis o good for 'experimenting'	o heavy reliance on knowledge and data o often complex and expensive

Information required to establish baseline conditions

- current conditions
- current and expected trends
- effects of proposals already being implemented
- effects of other proposals yet to be implemented

An environmental impact



Wathern, 1988

Impact characteristics can vary in:

- nature (positive/negative, direct/indirect)
- magnitude (severe, moderate, low)
- extent/location (area/volume covered, distribution)
- timing (during construction, operation etc, immediate, delayed)
- duration (short term/long term, intermittent/continuous)
- reversibility/irreversibility
- likelihood (probability, uncertainty)
- significance (local, regional, global)

Impact characteristic summary table

IMPACT CHARACTERISTIC	IMPACT TYPE		
	air quality	health	etc
nature			
magnitude			
extent/location			
timing			
duration			
reversibility			
likelihood (risk)			
significance			

Methods of impact prediction

- ‘best estimate’ professional judgement
- quantitative mathematical models
- experiments and physical models
- case studies as analogues or references

Types of uncertainty in impact prediction

- **scientific uncertainty – limited understanding of the ecosystem or community affected**
- **data uncertainty – incomplete information or insufficient methodology**
- **policy uncertainty – unclear or disputed objectives or standards**

Types of social impact

- **demographic – changes to population numbers, distribution**
- **cultural – changes to customs, traditions and values**
- **community – changes to cohesion, relationships etc.**
- **socio-psychological – changes to quality of life and well being**

Health impacts

Examples of health impacts by sector

	Communic-able disease	Non communic-able disease	Nutrition	Injury	Psychosocial disorder and loss of well-being
Mining	Tuberculosis	Dust induced lung disease		Crushing	Labour migration
Agriculture	Parasitic infections	Pesticide poisoning	Loss of subsistence		
Industry		Poisoning by pollutants		Occupational injury	Disempower-ment
Forestry			Loss of food production	Occupational injury	
Dams and irrigation schemes	Water borne diseases	Poisoning by pollutants	Increased food production	Drowning	Involuntary displacement
Transportation	HIV/Aids	Heart disease		Traffic injury	Noise and induced stress
Energy		Indoor air pollution		Electro-magnetic radiation	Community displacement

Source: Birley, 2000

Factors affecting economic impacts

- duration of construction and operation
- workforce requirements for each period
- skill requirements (local availability)
- earning
- raw material and other input purchases
- capital investment
- outputs
- the characteristics of the local economy

Factors affecting fiscal impacts

- size of investment and workforce requirements
- capacity of existing service delivery and infrastructure systems
- local/regional tax or other revenue raising processes
- demographic changes arising from project requirements

Examples of threshold tests for environmental acceptability

Box 3: Examples of threshold tests for environmental acceptabilty	
Level of acceptability	Potential impact threshold
Unacceptable	Exceeds legal threshold, e.g. quality standard
Unacceptable	Increases level of risk to public health and safety above qualitative or quantitative criteria (e.g. in some jurisdictions an increased risk of death of 1 in million per year)
Unacceptable	Extinction of biological species, loss of genetic diversity, rare or endangered species, critical habitat
Normally unacceptable	Conflict with existing environmental policies, land-use plans
Normally unacceptable	Loss of populations of commercial biological species
Normally unacceptable	Large-scale loss of productive capacity of renewable resources
May be acceptable only with minimisation, mitigation, management	Avoidance of spread of biological disease, pests, feral animals, weeds
May be acceptable only with minimisation, mitigation, management	Taking of rare or endangered species
May be acceptable only with minimisation, mitigation, management	Some loss of threatened habitat
Normally acceptable	Some loss of populations and habitats of non-threatened species
Normally acceptable	Modification of landscape without downgrading special aesthetic values
Normally acceptable	Emissions demonstrably less than the carrying capacity of the receiving environment
Source: Sippe 1999	

Key elements for assessing impact significance

- environmental standards
- level of public concern
- scientific and professional evidence concerning:
  - resource loss/ecological damage
  - negative social impacts
  - foreclosure of land and resource use options

Guiding principles for determining impact significance:

- use established procedure or guidance
- adapt relevant criteria or comparable cases
- assign significance rationally and defensibly
- be consistent in the comparison of alternatives
- document the reasons for judgements

Test for significance by asking three questions

- Are there residual environmental impacts?
- If yes, are these likely to be significant or not?
- If yes, are these significant effects likely to occur?

Impact significance criteria

- environmental loss and deterioration
- social impacts resulting from environmental change
- non-conformity with environmental standards
- probability and acceptability of risk

Ecological significance criteria

- reduction in species diversity
- habitat depletion or fragmentation
- threatened, rare and endangered species
- impairment of ecological functions e.g.

  - disruption of food chains;
  - decline in species population;
  - alterations in predator-prey relationships.

Social significance criteria

- human health and safety
- decline in important resource
- loss of valued area
- displacement of people
- disruption of communities
- demands on services and infrastructure

Environmental standards

- limits on effluent discharge concentrations
- clean air standards, water quality standards
- policy objectives and targets
- plans or policies that protect or limit use of natural resources

Alternative approaches to determine significance

- apply technical criteria when changes are predictable
- use negotiation when significance is disputable

Practical guidance

Impacts are likely to be significant if they:

- **are extensive over space or time**
- **are intensive in concentration or in relation to assimilative capacity**
- **exceed environmental standards or thresholds**
- **do not comply with environmental policies/ land use plans**
- **affect ecological sensitive areas and heritage resources**
- **affect community lifestyle, traditional land uses and values**