1.4 Biological and Ecological Issues

1) Deterioration or Degradation of Vegetation

Definition

Deterioration or degradation of vegetation is defined as direct or indirect deterioration or degradation of biomass or flora change due to development activities.

Major Potential Impacts

Major potential impacts include:

Soil erosion;

Reduction of valuable or important fauna and flora;

Reduction of biological diversity; changes in microclimate;

Degradation of scenery; and

Reduction of forests and grass lands.

Development Activities Generating Impacts

Development activities generating adverse impacts include:

Removal or cutting of forest cover;

Alteration of land use;

Effects of over-grazing on surrounding areas;

Shifting cultivation, forest fire, chemical use; and

Careless changing from natural forests to 'artificial'.

Special Considerations for Environmental Assessment

Special considerations for environmental assessment include:

Possible deterioration or degradation of vegetation in tropical forests, habitats of important or indigenous species, and alteration of ecosystem should be carefully studied.

Mitigation Measures

Mitigation measures include:

Appropriate land use planning; establishment of preserved areas or buffer zones; modification of a project, and review of technical systems.

Monitoring and application of necessary restrictive measures, and restrictions on land use.

Related Studies Required

Related studies required include:

Soil and vegetation surveys; surveys on existing utilization of plant resources; socio-economic baseline data.

Analyze of air photos and satellite imagery.

2) Impacts on Important or Indigenous Fauna and Flora

Definition

Impacts on important or indigenous fauna and flora are defined as reduction or extinction of important or indigenous animal and plant species due to the development activities.

Major Potential Impacts

Major potential impacts include:

Reduction or extinction of important or indigenous species.

Development Activities Generating Impacts

Development activities generating adverse impacts include:

Development activities in or around the habitats of subject species involving modification or disturbance of earth surfaces such as logging operation, forest road construction, re/afforestation, and the use of agrochemicals; and

Increased encroachment on habitats by human activities and forest fire.

Special Considerations for Environmental Assessment

Special considerations for environmental assessment include:

As the reduction or extinction of important or indigenous species caused by development is a global environmental issue, conservation measures including modification of projects and establishment of protection areas and buffer zones are required when such a threat exists.

Mitigation Measures

Mitigation measures include:

Identification of distribution of important fauna and flora; establishment and management of conservation areas; introduction of conservation measures; modification of a project.

Monitoring of environmental impacts; implementation of necessary mitigation measures including relocation of subject species and studies on execution of mitigation measures.

Related Studies Required

Relation studies required include:

Surveys and identification of distribution of important or indigenous species; studies on government conservation policies and functions and capabilities of related government agencies.

3) Degradation of Biological Diversity

Definition

Degradation of biological diversity is defined as reduction or extinction of the biological varieties with gene resources and of the ecosystem resulting from the destruction of environment due to development activities.

Major Potential Adverse Impacts

Major potential impacts include:

Reduction of useful, valuable or indigenous fauna and flora;

Reduction or extinction of biological diversity as gene resources; and

Increase in vulnerability of ecosystems.

(Refer to Appendix A, Section 2)

Development Activities Generating Impacts

Development activities generating adverse impacts include:

Development activities involving wide-scale or long-term modification or disturbance of earth surfaces in or around the habitats of subject species ; and

Increased encroachment on habitats due to development projects such as clear cutting, large scale re/afforestation with introduced species and forest road constructions.

Special Considerations for Environmental Assessment

Special considerations for environmental assessment include:

primitive forests such as tropical rain forests and tropical forests are ecosystems with high biological diversity. Therefore, adequate protection measures are essential in these areas in order to conserve precious genetic resources.

Mitigation Measures

Mitigation measures include:

Identification of distribution of important fauna and flora; establishment and management strengthening of conservation areas; introduction of conservation measures; due consideration to local population and those depending on gathering and hunting for livelihood; modification of projects.

Monitoring of environmental impacts; implementation of necessary mitigation measures including relocation of subject species and studies on execution of mitigation measures.

Related Studies Required

Related studies required include:

Ecological surveys; land or resource use surveys; studies on the distribution of similar ecosystems in a country or region; and studies on government conservation policies, and functions and capabilities of related agencies.

4) Proliferation of Hazardous Species

Definition

Proliferation of hazardous species is defined as introduction of pathogenic agents or spreading of hazardous species due to the creation of an environment conducive to their propagation.

Major Potential Impacts

Major potential impacts include:

Outbreak or spread of pests and diseases affecting plants and animals.

Pernicious animals.

Development Activities Generating Impacts

Development activities generating adverse impacts include:

Introduction of monocultural plantations with exotic species; increased traffic resulting from movement of human beings and livestock with their equipment and crops;

Disturbance of the ecosystem caused by alteration of technological patterns; and

Creation of an environment conducive to habitation by hazardous species.

Special Considerations for Environmental Assessment

Special considerations for environmental assessment include:

It should be remembered that introduction of monocultural plantations and exotic species can create environments suitable for propagation of pathogenic agents or parasites; and

The potential for introduction of diseases by increased traffic of humans, livestock, agroforestry crops and equipment are high.

Mitigation Measures

Mitigation measures include:

Project formulation duly considering measures to avoid outbreak of pests and diseases, in particular measures to avoid outbreaks of endemic diseases.

Monitoring of environmental impacts; studies on execution of mitigation measures.

Related Studies Required

Relation studies required include:

Studies on outbreak and spread of epidemic pathogenic agents in surrounding or related areas; case studies of similar projects.

5) Destruction of Swamp and Peatlands (Forests)

Definition

Destruction of swamp and peatlands is defined as extinction of swamp and peatlands due to direct destruction caused by forest logging activities such as large-scale felling; or extinction indirect effects such as drying and decomposition due to changes in hydrological regime.

Major Potential Impacts

Major potential impacts include:

Decrease in swamp and peatlands;

Reduction or extinction of useful, valuable, and indigenous species; and

Decrease in fishery resources.

Development Activities Generating Impacts

Development activities generating adverse impacts include:

Large-scale or long-term disturbance of earth surfaces such as logging operations, forest road construction, and drainage development;

Population increase resulting from settlement, etc.;

Improvement of access to project areas; and

Burning of peatlands and swamp due to fires used in shifting cultivation, field burning, or other human activities.

Special Considerations for Environmental Assessment

Special considerations for environmental assessment include:

Wetlands in most cases comprise primeval forests with valuable ecosystems.

The most important roles which swamp perform are a) production of services (wetlands can contribute to local precipitation and can be an efficient, low-cost water purification system, a recreation area, buffer against floods, and protection from coastal erosion), 2) preservation of biological diversity, and 3) production of resources (swamp are among the most productive ecosystems on the earth).

Mitigation Measures

Mitigation measures include:

Appropriate land use logging plan and road network; establishment or strengthening of management of conservation areas and buffer zones; baseline survey of distribution of important fauna and flora; due consideration to those

engaging in gathering or hunting in subject areas.

Studies on construction methods; monitoring and application of restrictive measures.

Monitoring of environmental impacts; restrictions on land use.

Related Studies Required

Related studies required include:

Ecological surveys; soil and land use surveys; hydrological surveys; studies of government conservation policies and functions and capabilities of related government agencies.

Analyze of air photos and satellite imagery.

6) Degradation of Natural Forests

Definition

Degradation of natural forests is defined as decrease or disappearance of natural forests due to direct or indirect effects of development.

Major Potential Impacts

Major potential impacts include:

Disappearance of tropical forests in term of volume and quality.

Decrease or extinction of useful, valuable, or indigenous fauna and flora;

Reduction of biological diversity throughout monoculture;

Increased vulnerability of the ecosystem;

Reduction of soil conservation functions;

Exhaustion of industrial resources; and

Alteration of people's natural way of life.

Development Activities Generating Impacts

Development activities generating adverse impacts include:

Large-scale or long-term disturbance of earth surfaces such as logging operations, forest road construction, shifting cultivation, illegal logging and the establishment of agricultural crops and grazing;

Population increase resulting from illegal settlement;

Improved access to project areas.

Special Considerations for Environmental Assessment

Special considerations for environmental assessment include:

Development which promotes encroachment on tropical rain forests and wildlands should be carefully addressed.

Mitigation Measures

Mitigation measures include:

Baseline surveys of distribution of important fauna and flora; establishment or strengthening of management of conservation areas and buffer zones; due consideration to those engaging in gathering or hunting in subject areas; modification of a project.

Monitoring of environmental impacts; implementation of necessary mitigation measures including relocation of threatened plant and animal species and studies

on execution of mitigation measures.

Related Studies Required

Related studies required include:

Investigation of distribution and ecology of tropical forests or wildlands and resource use in tropical forests or wildlands by local people; studies on government conservation policies and functions and capabilities of related government agencies.

Analyze of air photos and satellite imagery.

7) Destruction of Coral Reefs

Definition

Destruction of coral reefs is defined as encroachment due to direct destruction, or damage to and deterioration of the supporting environment caused by sedimentation, etc.

Major Potential Impacts

Major potential impacts include:

Disappearance of coral reef;

Reduction of fishery resources; and

Loss of aesthetic features or recreational sites.

(Refer to Appendix A, Section 2)

Development Activities Generating Impacts

Development activities generating adverse impacts include:

Large-scale or wide-scale disturbance of earth surfaces in upper stream such as logging operation and road construction;

Sedimentation of soils on coral reefs in which eroded in upper basin areas due to forest operation.

Special Considerations for Environmental Assessment

Special considerations for environmental assessment include:

Coral reefs constitutes a precious ecosystem in which diversified marine fauna and flora reside, therefore protection of these areas should be integrated into projects. Sedimentation due to soil erosion in upper basin areas as a result of development activities should be carefully addressed.

Mitigation Measures

Mitigation measures include:

Baseline surveys of distribution of fishery resources; establishment or strengthening of management of conservation areas; due consideration to fishermen; modification of projects.

Monitoring of impacts; introduction of necessary restrictive measures; and

Studies and execution of mitigation measures.

Related Studies Required

Related studies required include:

Investigation of distribution and ecology of coral reefs; studies of economic value of coral reefs and their inter-relationship with economic activities in the area; studies of government conservation policies and functions and capabilities of related government agencies.

1.5 Soil and Land Resources

(1) Soil and Land Resources

1) Soil Erosion

Definition

Soil erosion is defined as the washing or blowing away of soil from the earth surface by the actions of rain water, running water or wind etc. Soil erosion is a smoothing or leveling process, with soil particles being carried, rolled, or washed down by the force of gravity. The main agents which loosen and break down the soil particles are wind and water (differentiated into water erosion or wind erosion according to the agent involved);
Soil erosion is aggravated by artificial impacts.

Major Potential Impacts

Major potential impacts include:
Degradation of land productivity;
Land deterioration and desertification; and
Adverse impacts on lower basin areas (sedimentation and deterioration of water quality).

Development Activities Generating Impacts

Development activities generating adverse impacts include:
Removal of vegetation cover;
Development of land on slopes;
Land use, land management, and cultivation practices conducive to erosion;
Forestry operations (in relation to inherent physical conditions such as topography, soil properties, and precipitation patterns sensitive to soil erosion).

Special Considerations for Environmental Assessment

Special considerations for environmental assessment include:
Upland crop cultivation on sloping lands and light soils such as volcanic ash soil, and removal of vegetation during rainy or windy seasons are conducive to erosion. Characteristics of precipitation and wind and plant covers should be examined carefully.

Mitigation Measures

Mitigation measures include:

Formulation of physical and agronomical soil conservation measures; appropriate land use planning; modification of projects.

Studies on construction methods and period; monitoring of impacts; introduction of necessary restrictive measures.

Monitoring of impacts; restrictions on land use.

Related Studies Required

Related studies required include:

Surveys and investigation of vegetation, topography, geology, soil, land use, characteristics of precipitation and wind, areas degraded by landslide and erosion.

2) Soil Salinization

Definition

Soil salinization is defined as phenomenon condition in which soluble salts accumulate in the surface layer of soils and crop growth is consequently adversely affected. Soils with EC (electric conductivity of saturated soil moisture) higher than 4 m S / cm are classified as saline soils.

Major Potential Impacts

Major potential impacts include:

Decrease of land productivity;

Deterioration and desertification of lands.

Development Activities Generating Impacts

Development activities generating adverse impacts include:

Inadequate irrigation, drainage, and water management;

Poor water quality; and

Rise in groundwater level in lower basin areas.

Special Considerations for Environmental Assessment

Special considerations for environmental assessment include:

Salinization is liable to occur in areas where availability of irrigation for afforestation activities is limited and water with high salt content is used in poorly drained plain areas in arid or semi-arid regions with limited precipitation.

Due attention should be given to the rise in groundwater level in lower basin areas or in lower parts of the irrigation command areas.

Due attention should be given to the physical conditions of areas such as topography and soil prone to salinization.

Mitigation Measures

Mitigation measures include:

Review of irrigation for tree plantation.

Introduction of salt tolerant species; alteration of sites.

Monitoring of environmental impacts (salt accumulation); studies on execution of mitigation measures.

Related Studies Required

Related studies required include:

Surveys and investigations on soil, geology, water quality, groundwater and climatic conditions; studies on water use in surrounding areas and potential effects on lower reaches.

3) Soil Acidification

Definition

Soil acidification is defined as the excessive leaching of cations from the soil or the accumulation of acidic humus resulting in soil acidity problems. In the case of low swamp areas, cation exchange can be reduced due to the accumulation of acidic sulphate.

Major Potential Impacts

Major potential impacts include:

Decrease in the growth of tree crops due to the production of nitric acid in the soil following the introduction of nitrogen-fixing agroforestry species;

Degradation of agricultural lands due to the over application of phosphate rich fertilizers; and

Inhibition of the growth in agricultural crops and tree species due to soil acidification.

Development Activities Generating Impacts

Development activities generating adverse impacts include:

Accumulation of litterfall in coniferous plantations due to decomposition difficulties;

Industrial processes causing acid rain; and

Excessive leaching of cations from bare soils under rainy condition.

Special Considerations for Environmental Assessment

Special considerations for environmental assessment include:

Species selection for monocultural plantations is important due to difficulties in litterfall decomposition of some species and its effect on soil acidity.

Soil acidification due to bare land in a long periods as a result of large-scale cutting activities should be carefully addressed, especially deterioration of soil caused the growth of monocultural plantation to have adverse impacts.

Mitigation Measures

Mitigation measures include:

Investigation of appropriate species for artificial plantations;

Establishment of mixed forests;

Appropriate logging operations;

Enforcement of forest management; and
Appropriated enforcement of forest operations.

Related Studies Required

Related studies required include;
Surveys of soils and similar projects elsewhere; and
Surveys for land utilization planning.

4) Deterioration of Soil Fertility

Definition

Deterioration of soil fertility is defined as deterioration of soil productivity due to leaching and decomposition of nutrients, nutrient absorption by plants, surface soil erosion, salinization, etc.;

Forest conditions maintain high bio-mass productivity based on a delicately balanced plan and soil nutrient cycle in the tropics.

Removal of vegetation will result in rapid deterioration of soil fertility due to leaching of nutrients, decomposition of organic matter, and erosion of surface soil.

Major Potential Impacts

Major potential impacts include:

Deterioration of land productivity;

Frequent outbreaks of pests and diseases; and

Increased vulnerability of soil ecosystem.

Development Activities Generating Impacts

Development activities generating adverse impacts include:

Poorly managed forestry operations (large-scale logging, monoculture plantation establishment and short rotation of cutting periods)

Special Considerations for Environmental Assessment

Special considerations for environmental assessments include:

Removal of vegetation cover, soil erosion, the remains of clear cutting areas, cultivation and continuous cutting of short-term monocultural species may result in deterioration of soil fertility.

Mitigation Measures

Mitigation measures include:

Planning for implementing appropriate forestry management.

Selection of the most suitable species.

Careful attention to alteration of soil environment due to logging operations and re/afforestation.

Monitoring of environmental impacts; establishment of research and extension systems.

Related Studies Required

Related studies required include:

Surveys and investigations of soil characteristics (including chemical, physical and biological status), topography, land erodibility and geology.

5) Soil Contamination

Definition

Soil contamination is defined as accumulation of agrochemicals with high residual toxicity in the soil.

Major Potential Impacts

Major potential impacts include:

Agrochemical contamination of running water;

Harmful impact on humans and animals through progressive biological concentration of toxic substances along the food chain; and

Alteration of the ecosystems.

Development Activities Generating Impacts

Development activities generating adverse impacts include:

Inappropriate or illegal use of agrochemicals and lack of guidelines or restrictions on use of agrochemicals.

Special Considerations for Environmental Assessment

Special considerations for environmental assessment include:

Continuous application of agrochemicals with high residual toxicity or otherwise inappropriate use or excessive use of agrochemicals are major causes of soil contamination by agrochemicals.

Mitigation Measures

Mitigation measures include:

Use of agrochemicals having no or limited residual toxicity; thorough education regarding appropriate application methods of chemicals.

Monitoring of environmental impacts; studies on execution of mitigation measures.

Related Studies Required

Related studies required include:

Studies of agrochemical use and restrictions on use.

(2) Land Resources

1) Devastation or Desertification of Land

Definition

Devastation or desertification of land is defined as deterioration of land productivity or desertification caused by artificial and natural impacts or phenomenon. Accelerated and irreversible devastation of lands constitutes an important global environmental issue.

Major Potential Impacts

Major potential impacts include:

Devastation or desertification of lands to surrounding areas;

Creation of refugees;

Destruction of the ecosystem.

Favourable impacts on erosion control resulting from re/afforestation projects.

Development Activities Generating Impacts

Development activities generating adverse impacts include:

Inadequate cutting trees and shifting cultivation;

Inadequate use and management of land;

Irrational water management;

Over-grazing;

Soil erosion and salinization;

Population increase;

Changes in the microclimate; and

Inherent natural conditions vulnerable to devastation such as climatic conditions in the area.

Special Considerations for Environmental Assessment

Special considerations for environmental assessment include:

Lands under a sensitive ecosystem such as arid and semi-arid lands are prone to irreversible devastation or desertification. Special attention is therefore essential for forestry development in areas around devastated or decertified lands when the development is expected to have favourable impact.

Mitigation Measures

Mitigation measures include:

Formulation of an adequate land use plan, establishment of conservation areas and buffer zones, suitable forest management and introduction of agroforestry.

Studies on construction methods and period; monitoring of impacts; introduction of necessary restrictive measures and land use restriction.

Related Studies Required

Related studies required include:

Investigation of topography and soil, vegetation, climate, land use, forestry, socio-economic activities and population statistics; studies on distribution, alteration, and factors in formation of devastated lands.

Analyze of air photos and satellite imagery.

2) Devastation due to landslide

Definition

Devastation due to landslide is define as severe loss of soil mass or rocks from hillside slope due to development activities in forest areas.

Major Potential Impacts

Major potential impacts include:

Transported sediment, sedimentation, damage to constructions (building, dams etc.) and human being; and

Favourable impacts on landslide control, as a component of erosion control, of re/afforestation projects.

Development Activities Generating impacts

Development activities generating adverse impacts include:

Destabilization of basal rock or soil due to unsuitable cutting trees, forest management, forest road construction, and artificial plantation establishment.

Special Considerations for Environmental assessment

Special considerations for environmental assessment include:

Destabilized regions, in potential landslide areas, such as steep hillside and granite areas need special consideration in forest development plans and methods.

Mitigation Measures

Mitigation measures include:

Careful studies of logging operations, forest road construction and artificial plantation plans and methods;

Review of soil conservation works for prevention of landslide;

Monitoring impacts; introduction of necessary restrictive measures and ;and use restriction.

Related Studies Require

Related studies require include:

Analyze of air photos and satellite imagery;

Investigation of topography and geography;

Gathering of precipitation statistics; and

Studies of records concerning damages in the past.

3) Detriment of Forest Functions for Public Interest

Definition

Detriment of forest functions for public interest is defined as deterioration or loss of particular forest functions such as wind breaks, tide breaks, sand breaks, and fire breaks due to forest degradation resulting from development activities in the forest areas.

Major Potential Impacts

Major Potential Adverse Impacts include:

Adverse impacts of environmental damages to agricultural and village land around project area causing changes in the way of life and industrial base of local inhabitants.

Development Activities Generating impacts

Development activities generating adverse impacts include:

Degradation of forest areas due to inappropriate forest road construction, cutting trees and mis-management in protected forest.

Special Considerations for Environmental assessment

Special considerations for environmental assessment include:

Potential damaged regions due to windbreak, tidebreak, sandbreak, firebreak need special consideration in forest development plans and methods.

Mitigation Measures

Mitigation measures include:

Careful studies of the plans and methods for logging and forest road construction in potentially dangerous zones.

Establishment of protected forest or alternative methods of the above functions for public interest.

Improved management of protected forests for public interest.

Monitoring of impacts; land use restrictions and other necessary restrictive measures.

Related Studies Required

Related studies required include:

Investigations of statistics;

Studies to determine suitable conservation methods; and
Studies of records concerning damages in the past.

4) Ground Subsidence

Definition

Ground subsidence is defined as depression of ground level caused by the dehydration or drying of wetlands, peat swamp, or reclaimed lands, or excessive exploitation of groundwater.

Major Potential Impacts

Major potential impacts include:

Subsidence of canals or structures;

Deterioration of land drainability.

Development Activities Generating Impacts

Development activities generating adverse impacts include:

Reclamation and drainaging of wetlands or peat swamps.

Special Considerations for Environmental Assessment

Special considerations for environmental assessments include:

Design of structures with careful attention to potential subsidence;

Detailed investigations and studies on the properties of peatland, swamp and drainage conditions, as shrinkage and decomposition of the peat layers are largely influenced by the depth of groundwater levels.

Mitigation Measures

Mitigation measures include:

Careful studies of construction plans, period, and management.

Monitoring of environmental impacts; studies on execution of mitigation measures.

Related Studies Required

Related studies required include:

Investigations of geology, soils, hydrology, and groundwater.

1.6 Hydrology and Air and Water Quality

(1) Hydrology

1) Changes in Surface Water Hydrology

Definition

Changes in surface water hydrology is defined as alteration of river discharge or the water level as resulting from a project in upper basin areas.

Major Potential Impacts

Major potential impacts include:

Flooding or water shortage in lower basin areas;

Inadequate maintenance flow and violation of the integrity of existing water rights in lower basin areas;

Adverse impacts on fishery; and

Reduced erosion due to the favourable effects on water flow due to re/afforestation and soil conservation projects in upper basin areas.

Development Activities Generating Impacts

Development activities generating adverse impacts include:

Deterioration of water reservouis function due to degradation of vegetation resulting from inadequate logging.

Special Considerations for Environmental Assessment

Special considerations for environmental assessment include:

Seasonal changes in river water level and discharge before and after implementation of a project should be carefully examined.

Mitigation Measures

Mitigation measures include:

Careful studies on the physical environment of project areas and surrounding areas, hydrology, and construction plans.

Monitoring of environmental impact; studies on execution of mitigation measures.

Related Studies Required

Related studies required:

Studies on existing water rights in lower basin areas, intake structures, inland navigation and waterways, and fishery; flood mark surveys.

2) Changes in Groundwater Hydrology

Definition

Changes in groundwater hydrology is defined as changes in the groundwater recharge mechanism or groundwater table caused by development activities in water shed.

Major Potential Impacts

Major potential impacts include:

Deterioration of drainability of land;

Soil salinization; and

Adverse effects on existing groundwater uses.

Development Activities Generating Impacts

Development activities generating adverse impacts include:

Changes in groundwater table due to inadequate logging, abuse of ground water caused by wood processing and distribution.

Special Considerations for Environmental Assessment

Special considerations for environmental assessment include:

Special consideration is required with regards to deep ground water development and over-exploitation of groundwater.

Drain treatment in areas of poor drainage or in arid areas should be given careful attention.

Mitigation Measures

Mitigation measures include:

Careful studies, project and planning for water supply and drainage; control of ground water utilization.

Monitoring of environmental impacts; studies on execution of mitigation measures.

Related Studies Required

Related studies required include:

Studies on groundwater development for industries with regard to hydrogeology and existing well inventory; and soil surveys.

3) Water Shortage or Flooding

Definition

Water shortage or flooding are defined as drying up or overflowing of a river, and caused by poor watershed management or increased discharge.

Major Potential Impacts

Major potential impacts include:

Harmful effects on humans and livestock;

Outbreak of diseases; and

Disturbance and degradation of the ecosystem.

Development Activities Generating Impacts

Development activities generating adverse impacts include:

Insufficient flow control capacity due to deforestation;

Insufficient attention to adverse impacts on lower basin areas.

Special Considerations for Environmental Assessment

Special considerations for environmental assessment include:

Attention is necessary to changes in the run-off coefficient caused by conversion of forests to upland agricultural lands.

Mitigation Measures

Mitigation measured include:

Planning for adequate erosion control, uplands discharge and flood control reservoirs.

Monitoring of environmental impacts; studies on execution of mitigation measures.

Proper operation of alarm systems.

Related Studies Required

Related studies required include:

Topographic surveys; hydraulic, hydrological and vegetation studies.

4) Sedimentation

Definition

Sedimentation is defined as settlement of transported sediment in rivers, estuaries, and reservoirs.

Major Potential Impacts

Major potential impacts include:
Serious disturbance of water conditions;
Inundation and flooding; and
Destruction of habitats of important fauna and flora.

Development Activities Generating Impacts

Development activities generating adverse impacts include:
Inadequate logging and shifting cultivation;
Soil erosion due to forest road construction ;
Top soil run-off attributable to degradation of plant cover; and
Erosion in canals and river banks.

Special Considerations for Environmental Assessment

Special considerations for environmental assessment include:
Development activities involving vegetation alteration and forest road construction must be reviewed carefully.

Mitigation Measures

Mitigation measures include:
Erosion control planning.
Careful estimation of volume of sediment transport; planning of soil conservation.
Review of counter measures and watershed management planning.
Monitoring of environmental impacts; studies on execution of mitigation measures.

Related Studies Required

Related studies required include:
Investigations of soil erosion, hydrology, and forest road construction planning.

5) Riverbed Depression

Definition

Riverbed depression is defined as deepening of riverbeds due to insufficient sediment load to maintain riverbed level in lower basins.

Major Potential Impacts

Major potential impacts include:

Serious disturbance of water intake due to the draw-down phenomenon of water level downstream;

Destruction of habitats of important fauna and flora.

Development Activities Generating Impacts

Development activities generating adverse impacts include:

Stoppage of sediment supply to downstream areas due to dam construction.

Special Considerations for Environmental Assessment

Special considerations for environmental assessment include:

Reservoir construction is a typical development component with potential to bring about riverbed degradation.

Mitigation Measures

Mitigation measures include:

Formulation of adequate mitigation measures such as ground sills.

Monitoring of environmental impacts; studies on execution of mitigation measures.

Related Studies Required

Related studies required include:

Studies on hydrology and river conditions.

6) Impediment to Inland Navigation

Definition

Impediment of inland navigation is defined as adverse impacts on navigation due to development activities.

Major Potential Impacts

Major potential impacts include:

Hindrance to inland waterway traffic and waterborne delivery of goods to market.

Development Activities Generating Impacts

Development activities generating adverse impacts include:

Draw-down of water level in downstream due to inadequate watershed management;

Impediments to inland navigation due to log storage operations in water courses.

Special Considerations for Environmental Assessment

Special considerations for environmental assessment include:

Log storage operations in water courses; and

Development activities involving vegetation alteration.

Mitigation Measures

Mitigation measures include:

Studies on existing inland navigation and water-ways; planning of alternatives and mitigation measures.

Monitoring of environmental impacts; studies on execution of mitigation measures.

Related Studies Required

Related studies required include:

Studies on draft depth, hydrology, river conditions, and erosion.

(2) Water Quality and Temperature

1) Water Contamination and Deterioration of Water Quality

Definition

Water contamination and deterioration of water quality is defined as deterioration of water quality due to development activities.

Major Potential Impacts

Major potential impacts include:
Adverse impacts on water utilization and fishery in downstream areas;
Eutrophication of water; and
Deterioration of habitats for aquatic fauna and flora.

Development Activities Generating Impacts

Development activities generating adverse impacts include:
Soil erosion;
Agrochemical and fertilizer run-off; and
Discharge of waste in waterways from domestic, livestock, and agroforestry product processing.

Special Considerations for Environmental Assessment

Special considerations for environmental assessment include:
Impacts on downstream areas of waste disposal into waterways (particularly closed water bodies) should be assessed carefully.

Mitigation Measures

Mitigation measures include:
Studies on erosion control measures; extension of appropriate fertilizer and agrochemical application practices and waste disposal.
Monitoring of environmental impacts; studies on execution of mitigation measures; surveys of aquatic ecosystem.

Related Studies Required

Related studies required include:
Investigations of hydrology and water quality; case studies on adverse impacts experienced in similar projects.

2) Water Eutrophication

Definition

Water eutrophication is defined as accumulation in water of nutritive soluble salts such as nitrate and phosphate.

Major Potential Impacts

Major potential impacts include:

Deterioration of function of irrigation and drainage canals due to dense growth of aquatic plants and algae; and

Adverse impact on water use and fishery downstream.

Development Activities Generating Impacts

Development activities generating adverse impacts include:

Adverse impacts on aquatic ecosystems due to development;

Discharge or run-off of fertilizers and domestic and livestock waste into waterways.

Special Considerations for Environmental Assessment

Special considerations for environmental assessment include:

Increased application of fertilizer, livestock development and settlement programs require careful review.

Mitigation Measures

Mitigation measures include:

Studies of mitigation measures such as waste water disposal planning; careful studies of adverse impacts on a closed water body.

Appropriate disposal of waste water during construction.

Monitoring of environmental impacts; studies on execution of mitigation measures.

Related Studies Required

Related studies required include:

Case studies of similar projects.

3) Sea Water Intrusion

Definition

Sea water intrusion is defined as intrusion of a salt water wedge along a riverbed.

Major Potential Impacts

Major potential impacts include:

Deterioration of water quality;

Salt injury to forestry; and

Adverse effects on habitats of fish and shellfish.

Development Activities Generating Impacts

Development activities generating adverse impacts include:

Intrusion of salt water wedges due to development activities which reduce river discharge during low flow periods in the upstream of an estuary.

Special Considerations for Environmental Assessment

Special considerations for environmental assessments include:

Reduction of river discharge during the dry season due to deforestation and removal of vegetation cover; and

Construction of reservoirs and diversion weirs should be carefully reviewed.

Mitigation Measures

Mitigation measures include:

Studies of river conditions and mitigation measures.

Monitoring of environmental impacts; studies on execution of mitigation measures.

Related Studies Required

Related studies required include:

Studies of hydrology, river conditions and vegetation.

4) Change in Water Temperature

Definition

Change in temperature of water is defined as adverse impact on agriculture and fisheries due to the change of water temperature in rivers and lakes.

Major Potential Impacts

Major potential impacts include:

Reduction of crop yield due to low or high water temperature; and

Adverse impact on fish and shellfish habitat.

Development Activities Generating Impacts

Development activities generating adverse impacts include:

Irrigation water intake from the deep portion of a reservoir (cold water); and

Warm water discharge from the processing and manufacture of forest products.

Special Considerations for Environmental Assessment

Special considerations for environmental assessment include:

Water supply and discharge, via canal.

Mitigation Measures

Mitigation measures include:

Studies of water intake from shallow depth and temperature increase in river, canal or ocean systems.

Monitoring of environmental impact; studies on execution of mitigation measures.

Related Studies Required

Related studies required include:

Surveys of water temperature in existing reservoirs.

(3) Atmosphere

1) Atmospheric pollution

Definition

Atmospheric pollution is defined as diffusion of agrochemicals and sand dust and odoriferous particles such as exhaust from vehicles and machinery into the air.

Major Potential Impacts

Major potential impacts include:

Deterioration of the living environment, harmful effects on humans and livestock.

Development Activities Generating Impacts

Development activities generating adverse impacts include:

Odoriferous elements entering the atmosphere as a result of exhaust from forest product processing, diffusion of agrochemicals, dust caused by construction works, and gas exhaust from vehicles and machinery.

Special Considerations for Environmental Assessment

Special considerations for environmental assessment include:

Careful review of the impacts of aerial spraying of agrochemicals, large-scale logging operations, and establishment of forest product processing facilities around residential areas is necessary.

Mitigation Measures

Mitigation measures include:

Studies on siting of livestock and processing facilities and planning for appropriate methods for application of agrochemicals.

Studies on construction methods and period; monitoring of impacts; employment of restrictive measures; studies on execution of mitigation measures.

Related Studies Required

Related studies required include:

Investigation of environmental conditions in project areas; studies on climatological conditions such as wind velocity and direction.

2) Production of Carbon dioxide

Definition

Carbon dioxide can be produced due to combustion or decomposition residues.

Major Potential Impacts

Major potential impacts include:

Impact on the global warming due to the accumulation of greenhouses gases,

Fixation of carbon dioxide by re/afforestation especially with fast growing species.

Development Activities Generating Impacts

Development activities generating adverse impacts include:

Carbon dioxide can be produced due to decomposing plant material, the production of charcoal and general combustion in wood processing industries.

Special Considerations for Environmental Assessment

Special considerations for environmental assessment include:

Positive impacts of carbon dioxide fixation resulting from increased biomass production of artificial tree plantation in grasslands.

Forestry operations must take into account the poor net growth of the old primary forest, that is, over mature forests must be considered in any forestry management

programs.

Mitigation Measures

Mitigation measures include:

Rational planning for forest product processing industries;

Planning for the establishment of artificial plantations;

Adequate forest management plan must consider the limited growth of over mature

primary forest; and

Enforcement of the above matters.

Related Studies Required

Related studies required include:

Studies must be undertaken regarding the forest product processing industries

Surveys of present condition of the forests.

3) Change in Microclimate

Definition

Change in microclimate is defined as changes in temperature, soil moisture, evaporation, precipitation and wind power at local field due to the alteration of natural vegetation conditions resulting from development activities.

Major Potential Impacts

Major potential impacts include:

Amplification of the differences in the daily and yearly minimum and maximum temperature differentials.

Reduction in precipitation, soil moisture, air evaporation and wind damage due to clearing of forests.

Positive effects on microclimate of biomass increase due to re/afforestation activities.

Development Activities Generating Impacts

Development activities generating adverse impacts include:

Normal functions of weather phenomena are reduced due to deforestation and degradation of estuarine areas.

Special Considerations for Environmental Assessment

Special considerations for environmental assessment include:

Population density and lifestyle of rural communities in arid and semi-arid areas depends heavily on weather conditions.

Mitigation Measures

Mitigation measures include:

Appropriate planning, regarding logging operations, to avoid the clear felling of large scale areas;

Re/Afforestation operations must be planned and executed;

Monitoring of meteorological data; and

Control of logging operations.

Related Studies Required

Related studies required include:

Monitoring of meteorological data; and

Vegetation surveys to determine forest type, age, volume, etc.

4) Noise Pollution

Definition

Noise pollution is defined as mechanical or other kinds of loud noise created by development activities.

Major Potential Impacts

Major potential impacts include:

The effect of noise pollution on neighboring people due to the operation of machineries and plants.

Development Activities Generating Impacts

Development activities generating adverse impacts include:

Sawmill and woodchip operations.

Special Considerations for Environmental Assessment

Special considerations for environmental assessment include:

investigation of noise reduction methods in processing plants and determination of the most acceptable location for these plants.

Mitigation Measures

Mitigation measures include:

Investigation of noise reduction methods and their enforcement;

Maintenance and inspection of machinery and plants; and

Site locations.

Related Studies Required

Related studies required include:

Surveys of similar machinery or plant systems and their associated noise reduction

methods; and

Surveys of residential environments surrounding processing plants.

1.7 Sustainable Functions of Forest Resources

1) Detriment of sustainable functions of forest resources as raw materials.

Definition

Detriment of sustainable functions of forest resources as raw materials is defined as the unsustainable development of forest resources due to over logging in poorly or unmanaged forest areas.

Major Potential Impacts

Major potential impacts include:

Socio-economic status of local people is reduced due to extinction of forest industries resulting from elimination of the forest resources.

Development Activities Generating Impacts

Development activities generating adverse impacts include:

Forest resources are exhausted due to inappropriate logging operations, poorly sustainable forestry management and regeneration.

Special Considerations for Environmental Assessment

Special considerations for environmental assessment include:

Long term surveys on the viability of forest resources;

Planning for the on going rotation of logging operation systems and yield control;

Proper preparation for re/afforestation operations;

To achieve long term sustainability, logging operations in some forest areas must be interrupted due to economic, social or environmental factors; and

In most cases interruption to operations will not be necessary.

Mitigation Measures

Mitigation measures include:

Examination of forest resource planning;

Preparation and planning for development projects;

Monitoring of forestry operations; and

Enforcement of sustainable management measures.

Related Studies Required

Related studies required include:

Surveys on forest resources and product demand.

2) Detriment of sustainable functions of forests as environmental conservation.

Definition

This term is defined as the over-exploitation of forest areas resulting in damage to the natural and social environmental conservation functions of forests.

Major Potential Impacts

Major potential impacts include:

Socio-economic status of local people is reduced due to extinction of forest industries resulting from elimination of the forest resources.

Development Activities Generating Impacts

Development activities generating adverse impacts include:

Forest resources are exhausted due to inappropriate logging operations, poorly sustainable forestry management and regeneration.

Special Considerations for Environmental Assessment

Special considerations for environmental assessment include:

Long term surveys on the viability of forest resources;

Planning for the on going rotation of logging operation systems and yield control;

Proper preparation for re/afforestation operations;

To achieve long term sustainability, logging operations in some forest areas must be interrupted due to economic, social or environmental factors; and

In most cases interruption to operations will not be necessary.

Mitigation Measures

Mitigation measures include:

Examination of forest resource planning;

Preparation and planning for development projects;

Monitoring of forestry operations; and

Enforcement of sustainable management measures.

Related Studies Required

Related studies required include:

Surveys on forest resources and product demand.

Section 2. Significant Natural and Social Environments

This section presents general guidance on the significant natural and social environments to be carefully reviewed in the environmental impact assessment procedures set out under the Guide-lines. The environments discussed include the following:

2-1 Social Environments Requiring Special Attention

1. Involuntary relocation of residents
2. Effect on pre-existing resident and indigenous people

2-2 Natural Environments Requiring Special Attention

1. Arid and Semi-arid zone
2. Seasonal forest / monsoon forest zone
3. Tropical rain forest zone
4. Tropical Montane forest / tropical highland
5. Swamp and peatlands
6. Mangrove forest

2 - 1 Social Environments Requiring Special Attention.

(1) Involuntary relocation of residents

In forest development projects, depending on the components, such as logging operation, re/afforestation, or wildlife conservation, in general, the areas in question are vast areas. Due to this vastness, there are, at times, as will be discussed in the following point, minority people who live on the land, or illegal land users, who practice shifting cultivation, or who enter forests illegally. In such cases, in order to ensure the successful completion of the projects at hand, especially when dealing with re/afforestation or wildlife sanctuaries, the people may be forcibly or involuntarily moved out of the land. A fair amount of care and caution is necessary here, because these residents are, in many respects, socially vulnerable, and their lifestyle after relocation would not be easy and could lead to social problems.

As possible solutions, one could consider switching from forced relocation to a bilaterally planned and agreed movement, or creating a buffer zone for the residents, or changing the plans and introducing an agroforestry component to the projects.
At present, if the planned relocation options were taken, then the project must provide for adequate roads, housing, water supplies and infrastructure. Also, in such relocation projects, it is necessary to consider the inclusion of agroforestry, as well.

(2) Effects on pre-existing residents and indigenous people

As stated in the previous section, when dealing with vast areas, there are often people already living there, such as indigenous groups, small tribes, nomadic tribes, or sometimes illegal landholders practicing shifting cultivation or who have obtained illegal entry to the forest. When large scale logging or commercial re/afforestation project is involved in areas in which pre-existing residents or minority people live,, there is a fear that the rights of the people to use or own the land or the forest, and their living environment will be diminished. However, forest development projects must keep in mind that as development sustains and utilizes the natural resources, including the environment as a whole, it must also benefit to these resident groups. This fact, along with the plans, must be reviewed and understanding of these groups must be promoted, and every effort should be made to gain their support.

In summary the following must be considered: (1) creation of a buffer zone, (2)

bilaterally agreed relocation plans (including housing, infrastructure, agricultural land and better employment etc.), (3) the development project, including agroforestry and social forestry through appropriate technology, (4) other development projects which promote resident participation, (5) the provision of extension, education and training for the residents, (6) the strengthening of related government or organizations and directing institutions.

2 - 2 Natural Environments Requiring Special Attention

(1) Arid and semi-arid zone

This zone has an average annual precipitation of 1000mm or less, and can be further classified in semi arid (500-1000mm), in arid(200-500mm), and in desert zone(200mm and less). However, depending on the precipitation patterns (summer precipitation, winter precipitation, no pattern), the situation of the vegetation differs. In general, these zones, according to degree precipitation, can be listed as follows: dry tropical forest -> savanna forest (low woodland consisting of thorned brush, such as acacia) -> savanna -> desert.

Since it is rare for any type of logging or timber processing operation to go on in such regions, and any forest development projects that do go on are limited to re/afforestation, or agroforestry, it is relatively accurate to assume that forest development does not cause great adverse impact. In fact, the establishment of forestry development projects based on concepts such as social forestry, agroforestry, fuelwood plantation, etc. must bring about many favourable environmental effects.

(2) Seasonal forest / monsoon forest zone

This zone has an average annual precipitation of over 1000mm, and has distinct rainy and dry seasons. Latitudinally, these areas appear between 15 degrees North and South of the Tropics of Cancer or Capricorn, in the tropical to subtropical areas. The forests there are made up of relatively tall trees which lose their foliage in the dry season and which grows back in the rainy season.

These regions often have high quality timber species such as Teak and African Mahogany, and logging and timber processing (often milling) projects are abundant because of these commercial timbers. These high quality woods are often over exploited, leading to the degradation of the forest and bring about adverse environmental impacts. Furthermore, these regions are traditionally known for widespread shifting cultivation, and many other environmental issues. In these conditions the developments of social forestry project, etc. like those in the arid and semi-arid zones mentioned above would have favourable impacts.

(3) Tropical rain forest zone

This zone has an average annual precipitation of over 2000mm, and have no clear dry season. Latitudinally, these areas appear 15 degrees North and South of the Equator.

The natural forests in this zone have very complex ecosystems, consisting of many plants and animal life which do not exist anywhere else. However, because of the abundance of giant commercial woods, such as the dipterocarpaceae, forest development projects often involve in large scale logging operation. These logging projects practice selective cutting due to both economic reason and general policy. Clear cutting, except in cases of land development, is rare.

However, due to enormously high cutting rates, insufficient tending of logged over areas or encroachment of shifting cultivators, the natural logged over forests tend to be degraded. This makes timber harvesting in the next felling cycle, or in other words, the overall sustainability of forest development difficulties.

As a result, re/afforestation with fast growing species in degraded areas or grassland has been occurring. This type of forestry establishment is good for the preservation of the landscape, however, the biological diversity of life and the ecosystem, high praise cannot always be given. Therefore, in order to bring about a more long term favourable impacts it is a necessary to make enrichment planting with indigenous or climax species following the maturation of the fast growing species.

(4) Tropical Montane forest / tropical highland

Unlike the areas in (3) which are defined by the meteorological zone, These areas, are in vegetation areas defined by the elevation. In other words, even though the meteorological classification is semi arid, in the montane areas over 1000m elevation the precipitation is greater than in the lower elevations. If also located in a rainforest region, it become an even more humid forest areas.

Although the temperatures are relatively low, and unlike the tropical rainforest of (3), there are few giant species of mature trees, same tropical conifers are indigenous in these regions. So, logging operation is sometimes done by development projects which target the conifers. As an industrial plantation project, re/afforestation has long been established. Furthermore, because the soil conditions are often fertile, farm

communities have often been established. Therefore, in considering the plans and operations of forest development projects, the effects on the environment of these residents must be considered. However, because these regions are mountain forests and water source areas, careful consideration must also be given to water and land preservation, especially in the logging, forest road construction, and afforestation processes that are often involved in a project.

(5) Swamp and peatlands

These areas have edaphic vegetation, appearing in all climates, dry and humid. These areas can occur in low elevations (low swamp) and high elevations (high swamp). In terms of vegetation, there are types ranging from swamp to scrub to high forests. However because of technological reasons, it is usually not a site for large scale felling or re/afforestation type of development projects. However, for instance, in Southeast Asia, some of the swamp lands can be converted into productive land for Ramin, lowland Agathis, Alan, Pulai and other commercial materials. In these development projects, it is very important to protect the weak ecosystem of the swamp and peat swamp from the effects of logging operation and road construction.

(6) Mangrove forest

Mangrove forests are also edaphic vegetation areas occurring throughout the tropic and subtropics, in shallow coastal areas, deltas, and brackish waters. Mangrove is a general term used for the various families, genera and species which exist in these types of areas.

Compared with tropical rainforests, mangroves are monocultural in terms of variety of plant life component, however species of fish and crustacean and other marine life are prevalent and it is an important ecosystem for these and other wildlife which are very susceptible to small changes in the water quality and earth around them. In addition, mangroves are important as providers of fuelwood, fishing areas and honey gathering for many residents around them. Therefore, at the same time that large scale logging projects are avoided, it is important to consider forest operations which would be beneficial to the residents that depend on mangrove areas.