

1.2 Impacts of Landuse on Basin Hydrology

1.2.1 *Categorisation of Impacts*

Pre-Project or "Background" Impacts

Any anthropogenic intervention in the natural ecosystems causes an "impact", which may be positive or negative, usually the latter, on the atmospheric, hydrospheric and regospheric components of the environment. These, in turn, impact upon the natural food chain, which has eventual implications for the survival of the various species in the natural ecosystem and thereby upon human livelihoods.

Even before any hydropower project intervention in the Mekong Basin, the mobile and rapidly growing rural population has already been causing adverse impacts on the ecosystem, the hydrology, etc., through unsustainable landuse practices.

Well before civil works construction commenced, external factors, including warfare, logging, population increase, migration due to land degradation elsewhere and highway construction were severely impacting the environment and the biodiversity as well as the poor communities themselves in the catchments of the Nam Ngum and Theun-Hinboun schemes and on the Boloven Plateau in Lao PDR and in the Vietnam Central Highlands catchments of the Xe San and the Sre Pok. In the case of the Theun-Hinboun Hydropower Project for example, the existence of these background impacts implies that the direct impact compensation efforts of the THPC, when

completed, will leave the directly impacted communities slightly better off than the pre-project situation, but still perilously close to the poverty line and still pursuing environmentally and ecologically hazardous shifting cultivation, forest degradation and wildlife poaching.

Most of the rural families throughout the catchment are in the same situation because hydropower developers cannot be reasonably expected to redress all landuse and environmental problems that were extant before their advent on the scene; some of these issues (health, education, wildlife management) are being addressed in the catchments upstream of the proposed Nam Theun 2 Reservoir by governmental rural development projects supported by World Bank and the Government of Japan.

The issues of rainfed land development, soil conservation and forest rehabilitation are still to be addressed however. Truly relevant environmental and social impact analyses therefore should address the impact of historical as well as expected future conditions. The environmental and social mitigation action plan should provide for an equitable attribution of mitigatory interventions and their financing between the project developer and the host government (presumably financed by start-up grants or loans from international development donors/lenders). Even without the intervention of hydropower projects, the "background" residual effects of warfare (UXOs, displacement of communities, etc.), exploitive logging, narcotics production and trade, and other unsustainable landuse practices of the indigenous communities are identified as needing remediation under the Lao PDR Government's National Environmental, Social And Poverty Alleviation Action Plans.

Direct or Project-specific Impacts

If the impacting intervention concerned is the construction of a reservoir storage hydropower scheme, the impacts will be felt upstream (better access but increased landuse pressure on the catchment), downstream (improved irrigation water supply but impaired water quality); down wind (reduced smoke emissions but increased atmospheric water vapour and methane) and down-line (cheaper and more plentiful electric power).

"Added" Impacts

In the case of the NT2-HPP, added impacts can be defined as the impacts that other and/or foreseeable hydropower developments may have on the NT2-HPP specific impacts and upon the pre-project background impacts in the vicinity.

"Induced" Impacts

These are the effects - social, economic, environmental or ecological - within the Basin that may be brought about by developments in other sectors, that could be induced by the construction and operation of the NT2-HPP, and which would not be expected to occur if the NT2-HPP were not constructed.

"Regional" or "Trans-boundary Impacts"

The NT2-HPP direct impact zone abuts Vietnam to the east and Thailand to the west, whilst downstream impacts extend into Cambodia and the Mekong Delta in South Vietnam. To the East, growing concern for the integrity of the catchment of the NT2-HPP and other hydropower projects in the Theun-Kading Basin will eventually constrain the current access to resources in Lao PDR enjoyed by both traders and rural communities from the Vietnamese side of the border. To the West, apart from enhanced availability of electricity, alteration of the Mekong mainstream river level and sedimentation regimes will have a slight impact on irrigators farming near the mainstream and around the flood-protection reticulation wetlands on the Thai side of the Mekong River. In the Cambodian wetlands and the Mekong Delta these effects will

be somewhat masked by the wet season rainfall regimes of Northeast Thailand and Central Lao PDR and by their dry season irrigation regimes.

1.2.2 *Impactors*

The main impactors on hydropower or irrigation schemes are those who reside in or utilise the catchments upstream of reservoirs or irrigation headworks. Negative impactors are those who misuse land in the catchments, leading to water pollution (which depresses the reservoir fish catch) or to erosion, which causes sedimentation that progressively reduces the active storage capacity of the reservoir and ultimately useful life of the generating facilities, culminating in decommissioning.

In the pre-project ("background") situation, forest type (particularly in China, Lao PDR and the Vietnam Highlands), forest-cover degrading agricultural landuse practices are exacerbating erosion and consequent sedimentation which leads to aggradation of the Mekong mainstream and tributaries. This adversely impacts the fishery, increases the risk of flood-damage and impedes navigation. When new hydropower or irrigation scheme diversions and storage reservoirs are constructed, the rate of downstream aggradation will diminish due to the trapping of sediment in the reservoirs behind the dams. When the dams are ultimately de-commissioned by dismantling or sluicing, extremely high rates of sedimentation and downstream aggradation could be expected until the sediment-filled ex-reservoir basins once again stabilise.

Positive impactors are those in the catchment who install soil conservation measures in the farmlands or regenerate forests on the steep areas, or who effectively manage wildlife conservation habitats and production forests. Any expansion of bunded paddy field irrigation would be expected to reduce the rate of sedimentation through trapping in the paddy fields sediments emanating from the surrounding foothills and slopes.

1.2.10 *Impactees*

Potentially positively affected impactees of hydropower project construction and operation include the following:

- Those whose cash wage employment opportunities become enhanced.
- Those who benefit from electric power supply.
- Those whose irrigation water supplies are augmented by power station discharges.
- Those living in areas where transportation facilities are enhanced by hydropower scheme access roads and reservoirs.
- Those living in areas developed for resettlement of reservoir oustees, whose road access, health, education and other facilities, as well as irrigation systems, are enhanced as a result of the facilities installed for the resettlers.
- Those whose business or trading livelihoods become enhanced as a result of increased economic activity in the vicinity of construction camps and power station operator's camps.
- Those whose fishing opportunities become enhanced by the filling of hydropower reservoirs.
- Those in downstream flood-prone areas, where the incidence of flood-damage will be reduced due to the retention of run-off in hydropower reservoirs.
- Those living in salinity-affected delta areas, where increased dry season stream flow from hydropower generation will reduce the intrusion of saline tidal waters.

Those who would be potentially positively impacted by the construction, expansion or upgrading of irrigation schemes would include:

- Those whose agricultural cropping seasons are extended by the availability of irrigation water.
- Those in surrounding areas having rice-deficits, thus benefiting from easier access to low-cost rice supplies.
- Those whose business or trading livelihoods become enhanced as a result of increased economic activity in the vicinity of the irrigated farmlands.
- Those in downstream flood-prone areas, where the incidence of flood-damage will be somewhat reduced by the routing of rainfall through bunded paddy fields.

Potentially, positively impactees of landuse stabilisation, land development and rehabilitation measures in the hilly and mountainous catchments will include:

- The local, regional and international present-day and trans-generational communities, who will benefit from improved air quality and carbon-sequestration attendant on reforestation and from the stabilisation of the food chain through the conservation of biodiversity.
- Hydropower and irrigation scheme operators, who benefit from the increased longevity of their schemes attendant upon their reduced rate of sedimentation, brought about by watershed protection.
- Timber users and processors who will benefit from reliable and durable supply from sustainably managed forests.
- Those in downstream flood-prone areas, where the incidence of flood-damage will be reduced due to increased retention of incident rainfall in the soils and aquifers in the catchments.
- Those living in salinity-affected delta areas, where enhanced dry season stream flow from forested catchments will reduce the intrusion of saline tidal waters.

Those who could be potentially negatively impacted by the construction and operation of hydropower projects and for whom the appropriate compensation and restitution measures should be incorporated in planning, would include:

- Those whose residences, business premises or farmland are to be occupied by hydropower scheme facilities.
- Those whose livelihood would be impaired by increased competition for resources from oustees in the event that the needs of the latter were not sufficiently catered for by restitution measures.
- Upstream fishing communities affected by the impediment to migration of fish species inherent in damming the river.
- Downstream fishing communities, where the poor quality of turbinated water and alteration of natural stream flow regimes may lead to depression of traditional fish catches.
- Irrigators downstream of trans-basin diversions, where flooding may be exacerbated by power station discharges.
- Potentially negatively-affected impactees of irrigation scheme construction, expansion or upgrading would include:
 - Those whose residences, business premises or farmland would need to be relinquished to make way for irrigation reservoirs, headworks, canals or drainage systems.

- Downstream fishermen in the event that the irrigation civil works impedes natural channels of fish migration to and from spawning grounds, or when previous fish spawning grounds are drained and converted to irrigated agriculture, or when over-intensive farming on irrigated fields leads to the run-off of chemical fertilisers or pesticides into the drainage water.
- Those living in salinity-affected delta areas, where reduced dry season stream flow due to abstractions for irrigation upstream increase the risk of intrusion by saline tidal waters.

Potentially negatively-affected impactees of landuse stabilisation, land development and rehabilitation measures in hilly and mountainous catchments (including the exclusion of all users from wildlife sanctuaries and nature conservation core zones) would include:

- Those previously dependent for a part of their livelihoods upon the garnering of natural resources from the forest.
- Those remote-area and highland residents whose current agricultural livelihoods depend upon slash and burn cultivation.