Rapid Hydrological Appraisal: an integrated rapid approach to assess watershed function

**Watershed function: why do we want to assess it?**
Hydrological functions of watersheds are very much influenced by the amount of rainfall that the watershed area receives and its underlying geology and land form. The functions include the capacity to:

- Buffer peak rain events,
- Release water gradually,
- Transmit water,
- Maintain water quality and
- Reduce mass wasting (such as landslides).

The relation between land use and the flows of water to downstream areas is important, because human-demand on water for agricultural production, industries and domestic use are globally increasing, while supply is stable. Fears that the quality, quantity and regularity of water from upstream is affected by 'deforestation' are an important concern for stakeholders and entitlements of upland people to manage the way they want and use it.

Land use mosaic in upland areas provide important parts of environmental service functions. Communities gain incomes/direct benefits from what they harvest, grow or earn from these upland landscapes. Yet, there is no common understanding on how Regulation and/or river basins managers in order to produce environmental service functions for off-site and downstream beneficiaries. Maintaining or enhancing these functions that remain an 'unreality' within their decision-making.

The current perception in watershed management is that forest is the land use that can 'best' maintain watershed functions and changing landscape mosaics from forest into other forms of land use will reduce the ability of the watershed to maintain its functions. This perception is debatable. How good is or bad actually are non-forest land uses in maintaining the watershed function? Can tree-based systems provide similar service as forest in maintaining the watershed function? The answer to these questions are of interest and importance to the policy makers in developing the watershed management policy. These answers are also of interest for the development of reward mechanism for the upland people for the environmental services they provide.

A Rapid Hydrological Appraisal was conducted in the Singkarak Basin of West Sumatra (Indonesia) to assess the hydrological situation in the context of the development of payments for environmental services (ES) that are aimed at rewarding the upland poor for protection and/or rehabilitation of watershed functions. The main issues that the focus of the study is the relationship between the hydroelectricity project (HEPP, PLTA Singkarak), the fluctuations in the level of the lake, the water quality in the lake and the land cover of the catchment areas that contribute water to the lake. Payments made by the PLTA to the local government can, in part, be seen as rewards for maintaining or improving environmental services.

There is a broad agreement on 'the need to maintain a clean lake, productive landscapes on both upland and irrigated plains as well as produce electricity for the provinces of West Sumatra and Riau. A widely held perception is that the current landscape is not meeting all these expectations; the PLTA is not able to provide as much electricity as was expected, the fluctuations in the level of the lake are a concern to the people surrounding the lake, the water quality of this lake is a concern, the population of the endemic fish (ikan bilih) is declining and two previous efforts to rehabilitate the lake have not been very successful.'

For policy makers, reforestation, either using the local Pinus patula or other fast growing tree species is the main approach. But villagers in Pasingahan are convinced that streams dry up in the dry season after reforestation with pine trees, while the natural forest is providing regular stream flows. The water balance model with the default parameter values for Pinus patula confirmed a higher water use by canopy interception and transpiration compared to more open landscapes, but no substantial difference with natural forest. Impacts of land cover via soil properties may need to be further tested. Further hydrological distinctions between the humour and granitic parts of the landscape are needed as well.

Overall the water balance model suggested that the possible performance of the PLTA is only mildly influenced by land cover within the range of variation tested. A change in mean annual rainfall under the influence of global climate change will have a strong effect on PLTA performance. Declining water quality in the lake leading to reduced information will offset any gains in water supply that could result from 'land degradation'. Reformation with fast growing eucalyptus will have little negative effect on water quality by the PLTA. A basic assumption for 'payments for environmental services' is that the supply of these services does depend on activities of those 'around'. For the PLTA this assumption is not supported by much evidence.

**Conclusion**
Payments made by the PLTA may have various types of rationales:

- Compensation for damage caused by the HEPP project, to the farmers along the Ombilin river whose watershed irrigation systems are disturbed and to farmers with rice fields surrounding the lake affected by increased flooding.
- Shared responsibility for maintaining the water quality in the lake as the HEPP project modified outflow rates and increases debris accumulation.
- Payments of tax to local government.
- Goodwill-enhancing payments to the local community.
- Payments for environmental services conditional to the delivery of these services.

At this stage the evidence for the last component is relatively weak. Efforts of all lake-side nagar's will be needed to deal with the issues of lake water quality as well as rehabilitating the other inflows to the lake.

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