Identification of regional priorities for conservation and production in forest areas in SE Asia

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Abstract
Land use change is a major driver for deforestation and forest degradation in South East Asia. Natural forests in SE Asia continue to be degraded. In addition to national policies for sustainable land management, policies formulated in commodity producer countries (guided by civil society pressure), that make companies trading in the consumer countries accountable for sustainability of production, are gaining importance for sustainable land management. New evaluation methods and tools are needed to support companies and local authorities in the identification of land areas for sustainable production forms and areas that should be rehabilitated or conserved because of its environmental value. A methodology was developed and tested that indicates potential environmental hazards of land management and assesses priorities for production and conservation.

The result of the analysis is a map indicating the vulnerability of areas under current land cover and based on an analysis of ecosystem stability and resilience to the impacts of human interventions. Broad management classes are defined with indication of priority for conservation (highly vulnerable to degradation) or production (lowly vulnerability to degradation). The area of study is the Chittagong Hill Tracts of Bangladesh, comprising three districts. This study concludes that for sustainable use, CHT lands require adaptive management with conservation strategies to ensure both productive and sustainable land management. The methodology as tested identified areas according to their potential and constraints for various uses and management types. Management alternatives may be indicated for current practices where appropriate.

Key Words
Conservation, production, land use planning, biodiversity, forest management, soil and water conservation.

Introduction
Land use change is a major driver for deforestation and forest degradation in South East Asia. Associated traditional land management systems, such as slash-and-burn rotational schemes, are under pressure and cause further degradation. Natural forests in SE Asia continue to be degraded. Associated traditional land management systems, such as slash-and-burn rotational schemes that were sustainable under conditions of low population pressure, have often changed due to land access restraints and cause further degradation. Conversion of forest areas for timber extraction and the establishment of tree crop plantations, such as oil palm or teak, leads to biodiversity loss and soil degradation.

Forest should be managed in a way and in those areas where it can be done sustainably and land use in non-forested areas should be practices there were environmental impact is limited. In many countries demography is changing quickly and quality of land declines due to degradation. Policies for sustainable land management are not only formulated in commodity producer countries, but also in commodity consumer countries (guided by civil society pressure) that make companies trading in the consumer countries accountable for sustainability of production. New evaluation methods and tools are needed that identify land areas for sustainable production forms and areas that should be rehabilitated or conserved because of its environmental value.

A new methodology was tested that identifies regional priorities for production and conservation and classifies land into management recommendation domains within those classes. The methodology consists of a multi-layered analysis of environmental constraints on watershed management which may support decisions in: 1) forest management; regeneration of forest land protects the genetic resources and diversity of forest flora and fauna, which in turn is beneficial for village communities, 2) agricultural management to increase productivity and decrease degradation, 3) identification of conservation areas and areas that have a potential for production.

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This study focused on the Chittagong Hill Tracts of Bangladesh (CHT) where lands are degrading due to deforestation, shortening of the shifting cultivation cycle, and consequent soil erosion, floods and water pollution. The slash and burn system (*jhum*) as practiced in the CHT is sustainable if practiced with long enough fallows, but due to an increased population and scarcity of suitable land, the fallow periods have shortened from 15-20 to 3-5 years. Inappropriate forest and plantation management also contribute to severe land degradation. Soil erosion and forest degradation, resulting in declining crop production and loss of biodiversity, also have off-site effects on downstream and urban areas, i.e: flash floods, landslides, Kaptai dam-siltation and declining water quality. Extensive erosion is a serious threat to soils in the CHT and is one of the major degradation issues.

Methods

A methodology was developed to indicate potential environmental hazards of land management and to assess priorities for production and conservation. The result of the analysis is a map indicating the vulnerability of areas under current land cover and based on an analysis of ecosystem stability and resilience to the impacts of human interventions. Based on this analysis a map was created that indicates broad management classes with indication of priority for conservation (highly vulnerable to degradation) or production (lowly vulnerability to degradation). The zonation for the assessment of priorities for conservation and recommendation for sustainable watershed management is the result of a multi-layered analysis of environmental constraints on watershed management (Tyrie *et al.* 1999). It encompasses relevant environmental constraints concerning soil erosion and land degradation, actual land cover, and social constraints through land use and tenure issues, and forest land status (RF, USF, PF). Each of the mapped classes represents a unique combination of these basic factors, which provide a basis for a sustainable management strategy.

The land classification method is based on the following features:
Land Status. Forest Reserve Land, inside or outside of Forest Reserve Land.

Erosion Risk. Calculated erosion risk threshold under bare soil conditions that indicates the potential impact of vegetation removal.

Conservation status (if known). Current conservation status regulated by law or from land management review.

Critical and Fragile Land as defined by environmental type, but based on propensity to degrade, e.g. Mountain forestland.

Ruggedness. Areas classified as having a low erosion risk, but with steep slopes are separated out at the land system level based on 3 classes of dominant slopes.

Slope
Very steep slopes (>45%) are indicative of the sensitivity of areas for degradation upon disturbance.

Land cover. Protection (C) factor is the degree of protection from soil erosion under present land cover.

Forest density. Current forest status (no, low, middle dense and dense forest cover).

Presence of downstream infrastructures. When the area is part of a watershed that drains into reservoir of hydropower installations, it is given higher priorities for conservation, rehabilitation and reforestation.

The flow diagram of land classification method is given in Figure 1.

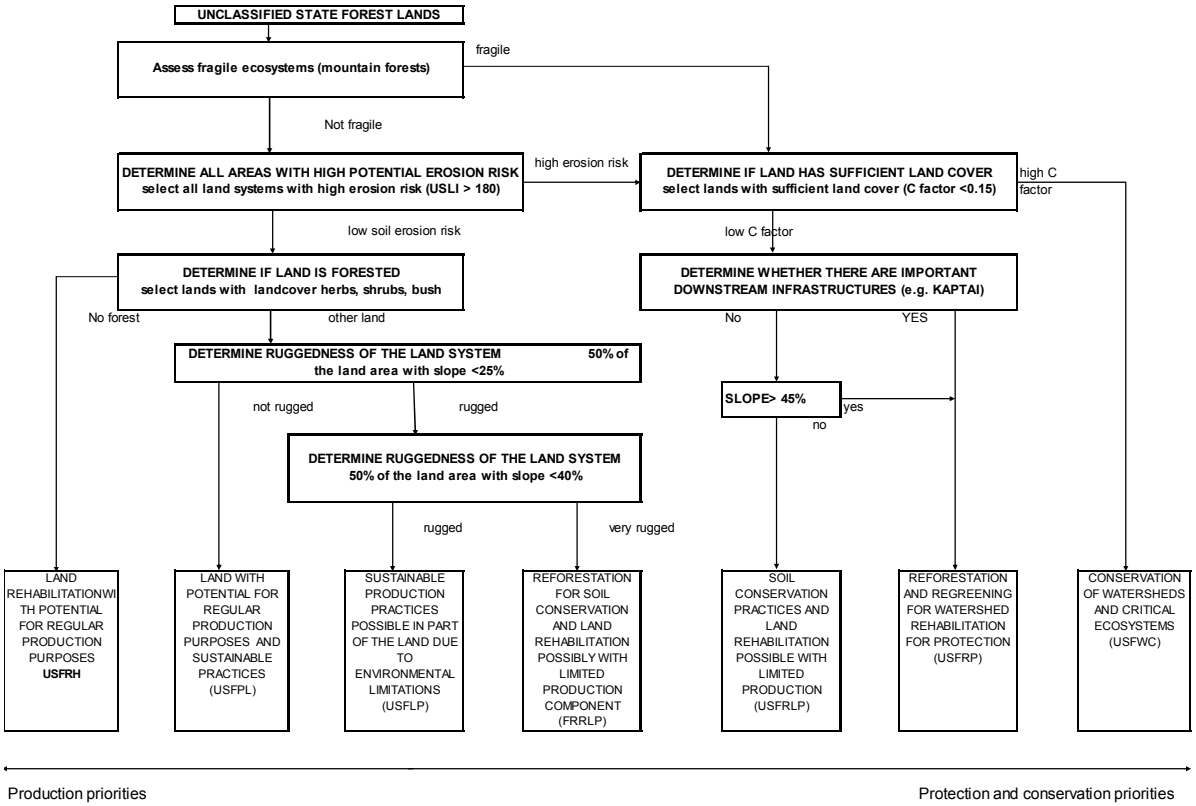

Figure 4. Flow diagram of land classification for unclassified state forest land.

The definition of each class and the management strategy recommended is given in Table 1.

Results

Table 1 shows the area of classes in the CHT with production or conservation priorities according to biophysical criteria.

Table 1. Area of land with recommended production/conservation priorities.

Conservation and production priority class	Total area (km^{-2})	Area %
Conservation & land rehabilitation	4895	41%
Conservation of critical watersheds	2709	23%
Land rehabilitation & SWC	769	6%
Soil conservation for watershed protection	578	5%
Soil conservation & land rehabilitation	12	0%
Production/ reforestation, SWC	70	1%
Reforestation & conservation	86	1%
Regular production/reforestation	176	1%
Regular production (forested)	1832	15%
Regular production (non-forested)	794	7%
Total area	11921	100%

Not all environments have the same inherent stability. From an ecological and production perspective those ecosystems which are unlikely to recover to their former quality after disturbance, such as logging or burning, can be considered critical or fragile. Thresholds are reached in such systems that will cause a change in the inherent properties and possible loss of unique biodiversity and conservation value. With change and degradation the resilience of these ecosystems often decreases and therewith productive capacity and the ability to regenerate successfully. Critical systems should not be exploited. Fragile systems should be exploited only on a limited basis or not at all. They include ecosystems such as mangroves and montane forests, forests on limestone, ultra-basic rocks, or on steep slopes and shallow soils. The methodology tested indicated that the larger area (65%) of the CHT must be under conservation area. Larger parts if the CHT should be conserved or rehabilitated because they are part of a critical watershed that have a high propensity to degrade or that drains into reservoir of hydropower installations (Kaptai dam). From a biophysical point of view an area of 9295 km-2 (78% of the total area) has limitations for use and requires some form of

conservation, land rehabilitation or protection. The traditional land management systems, which were applied with long term rotational schemes under low population pressure, were sustainable. After creation of the Kaptai lake for the hydropower dam and the large influx of people in the region, small holder land management is no longer sustainable and yields are declining (Olarieta *et al.* 2007). In addition, large scale clear felling for timber harvest and teak planting was introduced in the CHT leading to severe land degradation. The analysis shows that 22% of the CHT is sufficiently stable to allow regular production without additional SWC management measures.

Conclusions

Mapping and documentation of the natural resources and their management is a way to illustrate the biophysical resources. The methodology as tested in this study may support policy prioritization with environmental information such as land cover change, erosion risks under current land cover, priority areas for forest and biodiversity conservation, and areas with potential for production forest, agriculture, and tree crops. Such information values land in an economic and environmental sense, giving options for land management and showing potential impacts of interventions.

For sustainable use, CHT lands require adaptive management with conservation strategies to ensure both productive and sustainable land management. Vulnerable areas are better left for nature conservation or rehabilitation. People downstream will benefit from better managed land, with less erosion and forest logging, through reduction of river siltation and flooding hazard and improved river water quality. Such considerations need to be based on proper information and judgment and need to be taken into account in broader cross-sectoral planning for the development of the CHT region. Making sound policies and decisions on sustainable land management requires adequate information on natural resources. The methodology as tested in this study can support policy formulation and local spatial planning by local authorities and companies. Through the process of land use planning, areas may be identified according to their potential and constraints for various uses and management types. Management alternatives may be indicated for current practices where appropriate.

References

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