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# **Healthy headwater areas**

**by**

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## Summary

A headwater area is an upper part of a river basin, often hilly or mountainous, possibly with steep slopes, and with a rainfall that is higher (or much higher) than in the lower parts of the river basin.

Healthy headwater areas (areas covered by dense evergreen forest cover) have significant benefits: Lower peak surface run off and lower soil erosion; lower landslide risk; lower flash flood risk on the downstream flood plains; higher groundwater recharge; higher annual minimum flows, providing improved water availability and reduced salt water intrusion into the river mouths; and lower sediment yields, reducing the siltation in the downstream areas and hereby the flood risk, while extending the lifetime of storage and hydropower reservoirs. Also, healthy headwater areas can provide sustainable livelihoods and precious ecosystems.

Threats to headwater areas include drought; forest fires; shifting cultivation; deforestation; improper land uses; and unsustainable logging.

Management options include preservation of healthy areas and rehabilitation of degraded ones. This may involve protected forest designations, and community forestry, implemented with appropriate administrative, technical and financial support.

## Acronyms and abbreviations

RGC	: Royal Government of Cambodia
MAFF	: Ministry of Agriculture, Forestry and Fisheries
NTFP	: Non-timber forest products
O&M	: Operation and maintenance
RECOFTC	: Regional Community Forestry Training Center for Asia and the Pacific, (Bangkok, Thailand)
SCW	: Save Cambodia's Wildlife
SNEC	: Supreme National Economic Council

## 1 Introduction

Healthy headwater areas will generate direct social, economic and environmental benefits in their own right, and provide important additional benefits to downstream areas: Reduced risk of flash floods and landslides, reduced erosion and siltation, and improved groundwater availability and dry season surface water availability.

The present paper applies a Cambodian perspective, but it is hoped that some of the observations will be of interest to other countries as well.

*Figure 1: Headwater area damaged by forest fire*



*Photo from Dauntri River Basin, Battambang Province, February 2015*

## 2 Pressures and impacts

Significant threats to headwater areas include *drought, deforestation, shifting cultivation, improper land use, and forest fires*.

*Slash-and-burn cultivation* is still practised in some remote mountain areas. The affected area is estimated at 350,000 ha (2009).<sup>1</sup> Apart from the environmental implications, this livelihood can hardly be regarded as sustainable due to the meagre income generated.

Examples of pressures and potential related impacts are listed in the table below. Several of them interact negatively with each other.

*Table 1: Pressures on headwater areas and related impacts*

Pressures	<ul style="list-style-type: none"> <li>• Drought</li> <li>• Deforestation</li> <li>• Forest conversion</li> <li>• Forest fires</li> <li>• Excessive logging</li> <li>• Shifting cultivation (slash-and-burn)</li> <li>• Climate change (causing erratic rainfall, and affecting the balance of species in diversified habitats)</li> </ul>
Direct impacts	<ul style="list-style-type: none"> <li>• Degradation of forest cover</li> <li>• Reduced biodiversity</li> <li>• Soil erosion, soil degradation</li> <li>• Flash floods, land slides</li> <li>• Reduced runoff retention capacity (more abrupt runoff)</li> <li>• Reduced groundwater table</li> <li>• Increased soil erosion and sediment yield</li> <li>• Reduced scope for forestry-based livelihoods</li> </ul>
Potential impacts further downstream	<ul style="list-style-type: none"> <li>• Higher peak flows, increasing the risk of floods, bank erosion and scour around structures (such as bridges)</li> <li>• Siltation in reservoirs, increasing their O&amp;M costs</li> <li>• Siltation in streams, wetlands and stormwater drains, increasing the flood risk</li> <li>• Lower annual minimum flows, reducing the dry season water availability, and increasing the extent of intrusion of saline seawater, further reducing the water availability</li> <li>• Lower groundwater table</li> <li>• Various livelihood implications related to increased flood risk and reduced water availability</li> </ul>

*Climate change* is expected to cause erratic rainfalls. In its 5th assessment report (September 2013), IPCC notes that *'globally, for short-duration precipitation events, a shift to more intense individual storms and fewer weak*

<sup>1</sup> Sovuthy Pheav (April 2011)

*storms is likely as temperatures increase. Over ... wet tropical regions, extreme precipitation events will very likely be more intense and more frequent in a warmer world'. This will increase the soil erosion and the sediment transport capacity to downstream areas. Furthermore, even moderate changes of rainfall, temperature and sunlight radiation can affect the species composition of diverse forest habitats: What is an 'optimal' biodiversity today may not be optimal in the time to come.*

Drivers of deforestation and forest degradation are listed in Appendix A.

*Figure 2: Idle land affected by deforestation and drought*



*Photo from Dauntri River Basin, Battambang Province, February 2015*

### 3 Development opportunities

A clear distinction must be made between

- preservation of healthy headwater areas, and
- rehabilitation of degraded headwater areas.

Both have substantial (and comparable) social, economic and environmental benefits; but the technical and financial implications are quite different, as outlined below.

#### 3.1 Preservation of healthy headwater areas

Benefits (in terms of livelihoods, income generation and environmental quality) are immediate, and no major investments are required.

Operation can be based on local, traditional wisdom. Still, some technical support, including extension services, can be required for management planning of sustainable resource utilization; for response to various pressures; and for marketing of products that are intended for sale outside the households.

A legal framework exists for forestry and protected areas, but its application is not yet fully consolidated. Awareness raising on forest conservation needs to be carried out among local communities.

#### 3.2 Rehabilitation of degraded headwater areas

Livelihood generation can be achieved *'up front'*, as rehabilitation will require soil preparation, perhaps preparation of appropriate tree species saplings, planting, tending the young vegetation, and responding to threats such as drought, pests and insect attacks. The environmental benefits will evolve gradually along with the vegetation cover. Revenues, however, will not materialize until after quite some time.<sup>2</sup>

Technological support will be required for cultivation planning, and is of particular importance because traditional local wisdom cannot always be relied upon - for example in case of introduction of unfamiliar tree species or forest products. The site-specific weather and soil conditions must be assessed and duly observed when selecting appropriate species. Furthermore, rehabilitation of degraded lands can be quite a technical challenge, due to steep slopes, and poor and eroding soils without nutrients and a low moisture retention capacity. A combination of species must be applied, in order to reduce the various risks, and to provide for a gradual logging cycle that maintains a largely intact vegetation cover during harvesting (which must be gentle and gradual).

Financial support is required due to a substantial time lag between initial investments (for land preparation, planting and nurturing of the juvenile vegetation) and the income generated by sale of the products - perhaps 3-7 years for bamboo, 20-25 years for teakwood, and even more for some high-

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<sup>2</sup> Rehabilitation of degraded lands on the flood plains will have similar benefits. The technical implications may be simpler (due to the absence of steep slopes), but the rainfall will be less



value timber species. Revenue from non-timber forest products will emerge gradually along with the progress of rehabilitation.

Pressures from shifting cultivation and forest conversion can be eased by access to new sources of income, for example livestock raising, permanent rice cultivation, and ecotourism. Training of local communities is needed about modern agriculture.

Some sort of risk coverage is desirable, covering severe losses due to drought, forest fires, land slides and insect attacks.

Even when including risk coverage, estimates indicate that rehabilitation of degraded headwater areas can be highly profitable, with an Internal Rate of Return (IRR) of 16-18 pct/year for bamboo and teak (illustrating a short-term and a medium-term investment horizon, respectively).

The cash flow may involve a community-operated evolving fund for disbursement of interests, risk coverage, and re-planting.

*Figure 3: Land exposed to erosion*



*Photo from Stung Chinit River Basin, Kampong Thom Province, March 2015*

## 4 Community forestry

### 4.1 Terminology

The following definitions are made in the Sub-Decree on Community Forestry Management (RGC, December 2003):<sup>3</sup>

**Community forest:** A forest plantation or a state forest where the right is granted to a local Community living in or near the forest to manage and utilize the forest in a sustainable manner.

**Forestry community:** A Community that voluntarily undertakes forest development activities and sustainable utilization of forest resources.

**Community forest agreement:** A written agreement that grants and protects the Community's rights within any specific area to access, use, manage, protect and benefit from forest resources in a sustainable manner.

**Community forest management plan:** A document detailing the sustainable use and management of the Community Forest.

**Sustainable harvest rates:** The amount of forest resources to be harvested by a Community within a specified period, as set by the Community Forestry Management Committee and approved by the Forestry Administration.

### 4.2 Objectives

In its Guideline on Community Forestry (December 2006), MAFF states the following objectives of community forestry:

- To manage, use, protect, conserve and develop community forests in a sustainable way;
- to use forest and NTFPs in a customary way, for the livelihoods, traditions and religious beliefs;
- to extract forest and non-forest products in accordance with the potential and availability of community forest resources; and
- to support the policy of the Royal Government in poverty reduction.

### 4.3 Sub-decree on community forest management

Community forestry can be initiated by the local communities or by the Forestry Administration. This requires a written application to the Forestry Administration. Once approved, the community achieves user rights and obligations as follows:

- Traditional user rights as defined in the Forest Law
- Harvesting, processing, transport and marketing of non-timber forest product as defined in the Forest Law

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<sup>3</sup> The definitions are abbreviated. Please refer to the sub-decree for the full text, as well as additional definitions

- Continued traditional shifting cultivation for a certain period of time defined in the forest community management plan, and reflecting the Forest Law.
- Protection against violation of the community's rights.
- Ensuring the utilization of forest resources in a sustainable way.

#### 4.4 Formalization and operation

The National Forest Programme (RGC, October 2010) envisages around 1,000 community forest sites by 2029, covering 2 million ha. By 2013, 455 such sites were under development, covering 400,000 ha, with 246 having reached a formal agreement.<sup>4</sup>

Preparation of a community forestry agreement can take up to 2 years. It covers a period of 15 years, with a provision for an extension by another 15 years.<sup>5</sup>

*'Payment for ecosystem services'* is an arrangement where tangible economic benefits of maintaining (or restoring) a healthy headwater area are shared between a downstream operation, perhaps an irrigation scheme or a hydropower plant, and an upstream community that can assist with the conservation or rehabilitation. Such arrangements have not yet been applied in Cambodia, but might be applicable to headwater areas that are located upstream of reservoirs.<sup>6</sup>

#### 4.5 Good management practices

The community forest management plan provides an important reference for feasible and sustainable technical and financial management of headwater areas. The plan must be practical (implementation-oriented) and easy to understand for the community.

The plan may conveniently be divided into a technical and a financial part. The technical part should

- provide for a species-rich vegetation, reflecting site-specific rainfall, soil and terrain conditions;
- describe a diverse combination of species to be cultivated, expectedly ranging from short-term to long-term species;
- describe access (roads and pathways), with a view to orderly stormwater runoff;
- provide site-specific guidance on good practices for water management (including small storage ponds if feasible); soil management; and use of fertilizers and pesticides;
- consider (and minimize) relevant risks (drought, forest fires, insect attacks), and make suggestions on responsive mitigation; and

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4 SCW (2014)

5 In comparison, economic land concessions can be granted for up to 99 years. (In July 2015, however, the government announced that the concession period will be lowered to 50 years for new as well as existing economic land concessions)

6 For details, please refer to Milne, Sarah and Colas Chervier (2014)

- provide guidance on sustainable harvesting of NTFPs and timberwood.

The financial plan may

- describe routines for marketing and revenue-sharing; and, if relevant,
- make provisions for a revolving fund owned and operated by the community.

Formulation of the plan requires particular expertise. It should be made in a collaboration between the community and specialists from MAFF, along with guidance and training.

The plan must be approved by MAFF as a basis for the community forestry agreement.

Implementation of the plan will require continuous access to technical coaching and backstopping, particular in case of rehabilitation of idle areas. Without such support, the whole effort will be at risk.

## 5 Discussion

Both in headwater areas and on the floodplains, healthy forests, including the few remaining primary forest areas in Cambodia, should be preserved.<sup>7</sup> Idle lands, on the other hand, can be seen as dormant opportunities that can be pursued by a combination of plantation forestry and conservation forestry, aiming at a balance between environmental health, socio-economic benefits, and flood and siltation control.

The direct economic benefits can be substantial. Highly attractive Internal Rates of Return (IRRs) can be expected for species ranging from bamboo to teakwood to rosewood. External benefits include livelihoods generation and an improved hydraulic regime (peak flows, minimum flows and sediment yield) to the benefit of downstream flood plains in terms of flood risk and dry season water availability.

Headwater areas upstream of hydropower and irrigation reservoirs require particular attention due to the potential impacts of excessive siltation. Those areas need to be conserved to maintain an all-year availability of water for hydropower and irrigation.

A time horizon of 15 years for community forestry agreements may be adequate for preservation of healthy areas, but is on the low side in case of rehabilitation of degraded areas, where the economic benefits may not materialize fully until after 20 years or more.

Marketing of precious hardwood can be facilitated by trustworthy certification of sustainable forestry, for consideration where appropriate.<sup>8</sup> Where applied, this

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7 In 2010, primary forest covered 3% of Cambodia's area (2010) (according to Broadhead, Jeremy and Rebeca Izquierdo, August 2010, quoting FAO)

8 For example by the *Forest Stewardship Council*

can add a substantial value at a marginal extra cost. Otherwise, the marketing (and price generation) can become entangled with the complexities of the prevailing grey and black markets for such products.

There are unserved needs of technological support, such as extension services and bridging between research and implementation:

- Site-specific guidance on soil properties and soil management options, crop selection and cultivation routines, including fertilizer and insecticide application;
- guidance on sloping cultivation techniques to reduce soil erosion and preserve soil fertilities.
- guidance on risk preparedness and resilience (floods, drought, forest fires, pest and insect attacks);
- extension services for damage control in case of pest and insect attacks; and
- national and international liaison, outreach and knowledge-sharing, including exchange of experience among forestry communities.

Cambodia Agricultural Research and Development Institute is an example of a successful national '*centre of excellence*' with an impressive record of valuable guidance to the agricultural sector. There is a clear scope for a similar body serving the forestry sector. The benefits can be further strengthened by collaboration with universities with an interest in related research and education.

## 6 Conclusion

Healthy headwater areas are important for sustainable economic, social development and environmental protection. Rehabilitation of degraded areas can improve the water availability and preserve and retain the topsoils.

Conservation of healthy areas and rehabilitation of degraded ones can be achieved with substantial benefits, preferably undertaken by forestry communities with adequate technical support. Some financing is required to bridge between initial investments and revenue generated in the medium and long term, but the benefits - including the direct, economic benefits - can reliably be expected to exceed the costs.

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*Most publications are available from the Internet*

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## Appendix A: Drivers of deforestation and forest degradation

*Modified after Broadhead, Jeremy and Rebeca Izquierdo (August 2010)*

	<i>Within the forest sector</i>	<i>Outside the forest sector</i>
Direct	<ul style="list-style-type: none"> <li>• Illegal logging</li> </ul>	<ul style="list-style-type: none"> <li>• Agricultural expansion</li> <li>• Low agricultural yields</li> <li>• Expansion of settlements</li> <li>• Infrastructure development</li> <li>• Drought, forest fire</li> <li>• Timber demand</li> <li>• Fuelwood demand</li> </ul>
Indirect	<ul style="list-style-type: none"> <li>• Low institutional capacity and weak policy implementation</li> <li>• Weak governance</li> <li>• Weak enforcement and control</li> <li>• Low levels of stakeholder participation and involvement</li> <li>• Corruption, clientelism and nepotism</li> <li>• Lack of transparency and accountability</li> <li>• Lack of assessment of social and environmental impacts</li> <li>• Lack of demarcation of forest areas</li> <li>• Low awareness of forest management rights and responsibilities</li> <li>• Lack of sustainable or alternative supply of wood and energy</li> <li>• Lack of incentives promoting sustainable management of forests</li> <li>• Low efficiency of wood use</li> <li>• Inadequate information and statistics on forest resources and products</li> </ul>	<ul style="list-style-type: none"> <li>• Population increase</li> <li>• Rising incomes and demands for resources</li> <li>• Increasing accessibility of forest areas</li> <li>• Low agricultural yields</li> <li>• Migration into forest areas</li> <li>• Large scale agri-industrial development (economic and social land concessions)</li> <li>• Lack of information on national land use and land use plans</li> <li>• Governance</li> <li>• Overlapping/unclear jurisdictions</li> <li>• Weak land tenure – tenure is weakest in forests and other areas outside residential or farming zones</li> <li>• Weak enforcement of the law</li> <li>• Lack of a fair and transparent conflict resolution mechanism</li> <li>• Lack of interministerial and interagency coordination</li> <li>• Social norms (claiming land through utilization)</li> <li>• Low awareness of environmental roles of forests</li> </ul>

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