

Issues (theory and practice)

Participatory environmental valuation technique allows villagers to express the value of forest products within the context of their own perception, needs, and priorities rather than through conventional cash-based techniques. Its strength is that it relies on local knowledge.

However, wealth ranking was found to be a flawed technique, because of personal relationships between people assisting with the ranking and the interviewees. The most accurate method was found to be accompanying resource users into their fields, to observe the parts of plants gathered and gauge the volume of harvest. This method can be time consuming however, and becomes increasingly challenging when there is an increase in participants involved.

Participants were not willing to value the use of the forest for rituals and cultural ceremonies. They stated that it was the realm of the community sages and therefore the value of such services was above their wisdom.

Conclusions and recommendations

Dependency upon the forest by locals cannot be ignored if forest management plans are to be suc-

cessful. Understanding forest income-dependence is important in guiding plans for forest product use at all levels of governance. It is also very important to find win-win solutions, such as conservation strategies that involve local people and provide for sustainable livelihoods. For instance, local communities could cultivate more of the useful trees for household use and sale, whilst forest management activities could be developed to support indigenous tree planting for reforestation. In addition, governments could help build partnerships with local communities and NGO's, so as to reduce population pressure on the forest. This could be done by focusing on improved health and nutrition for improved family planning as well as improved education of local populations for forest conservation.

The original publication includes a figure showing wealth levels and forest resource dependence per household near Kiang'ombe hill forest. This figure could be used to inform prioritizing action over current forest uses. The most important use of the forest is for medicinal purposes – therefore, action could be taken to ensure sustainability of this use, or to provide suitable alternatives that would be acceptable to and preferred by the local community.

CASE STUDY 10

South East Asia: The values of land resources in the Cardamom Mountains in Cambodia
(Soussan & Sam 2011¹⁵⁶)**Objective of the study**

Ecosystems in the Mekong region contain biodiversity resources of global significance and provide services to both locals and non-locals. This study attempted to value all ecosystem services provided by a smaller area of the Mekong region, the Central Cardamom Mountains in Cambodia. This area contains globally threatened species and high levels of endemism, and its services include: carbon sequestration, non-timber forest products, and watershed protection functions. This study identified the role and value of land resources to livelihoods of local communities, and aimed to generate evidence to support sustainable land management policies and investments, based on existing and potential contributions to national development and poverty reduction.

Method overview (including aggregation method)

This study used the 6-step methodology (detailed in Chapter 2) to assess the value of sustainable

land management and the cost of land degradation. It also informed potential action by identifying sustainable land management policies and options that would contribute to the maintenance of ecosystem integrity and land resource values of the Cardamom Mountains and comparable areas in Cambodia. This study involved assessing the distribution and inherent quality of land resources, analysing the role of these resources in the livelihoods of local communities and wider ecosystems services functions, and assessing the main degradation pressures on these resources.

Economic valuation of **timber** (provisioning service) was based on the benefit transfer approach from recent studies in the same region. Two alternatives were taken for valuation: the value of the stock of timber available if forests were clear-felled, and the value of the timber services provided by the forest through sustainable harvesting and thus for a longer period of time.

Economic valuation of **agricultural lands** (provisioning service) was based on two methods of estimation: the first one was the market price of rice (border export price for South East Asia) multiplied by the quantity of rice produced to estimate the overall value of rice production in the area; and the second estimated the value of rice production as a proportion of household income. Non-marketed crops values were not estimated in this study.

Economic valuation of **watershed functions** (regulating service) was based on a benefit transfer approach, from a recent study of the value of watershed functions in relation to hydropower in Vietnam.

Economic valuation of **biodiversity** (regulating service) was based on a benefit transfer approach, derived from a study on the value of biodiversity for high quality forests. The value was updated based on inflation and increased biodiversity pressures, as well as on international comparisons. Appropriate values were also estimated for other land cover types (with an unspecified valuation method).

Economic valuation of **carbon sequestration** (regulating service) was based on the value of the carbon stored by the forest in the study area, and estimated using the market price and quantity of carbon stored by tropical forests from REDD-related studies in the Mekong region.

Economic valuation of **tourism and other cultural (spiritual) services** (cultural service) was not specifically assigned in this study. Biodiversity richness and the beauty of the landscape make the central Cardamom Mountains an area of great (eco-)tourism potential (high value niche market). However, the lack of facilities and poor transportation means that tourism is small scale and confined to limited parts of the region that are close to main access points. The extent and value of potential tourism is a matter of speculation, and will depend on the level of investments made in transport, accommodation, and other facilities. Cultural (spiritual) values are of great significance, but difficult to quantify in monetary terms, and so this study did not estimate them.

Contextual pressures

Livelihoods of the communities in and around the study area are completely dependent upon access to land resources. The main sources of livelihoods are derived from a combination of farming (rice), livestock rearing (with fodder collected from or grazing in the forests) and the collection of fuel, foods, and other forest products. There are also a

small number of traders and shopkeepers who service the rest of the population, and a few people employed by the government or other outside agencies as rangers or similar positions. They do not depend directly on the land resources for their livelihoods, but rather indirectly through their customers or because of the nature of their jobs.

This study has identified a "livelihood support zone" surrounding each village, as the forest and land resources of these zones underpin the villagers' livelihoods. Access to these resources is essential for basic survival.

There are concerns over the extent and severity of land resource degradation in this area due to soil erosion and deforestation. Traditional and sustainable systems of land resource management are increasingly under pressure following recent influxes of migrants to the area, which has led to new forms of land resource exploitation and encroachment as well as increased use pressures. Pressure on land resources have also increased because of illegal forest exploitation (e.g. illegal logging or wildlife trade), and are threatening the ecological integrity of vulnerable ecosystems.

Economic valuation results

Economic value of **timber** (provisioning service): total stock values were estimated as high as USD 20,000/ha if forests were clear-felled, and the total timber service value with sustainable harvesting ranged from USD 200–450/ha/year, depending on forest type and quality. If the entire area was sustainably harvested, this would have an aggregate income of **nearly USD 440 million annually**.

Economic value of **agricultural lands** (provisioning service): the average rice production is 758 kg per household per year, which is lower than subsistence needs. The border price for South-East Asia available from FAO at the time of the study was USD 460/ton, making rice production worth USD 349 per household per year. This provides a total of just under USD 1,400,000 per year for the whole study area. A second method of estimation gave the same estimates: rice production amounts to 66% of household income, representing about USD 363 per household per year and a total of just over USD 1,450,000 per year for the whole study area. The total economic value of the 6,682 ha of agricultural lands in the study area is thus estimated to amount to **USD 1,500,000 per year**.

Economic value of **watershed functions** (regulating service): estimated annual benefits to hydropower schemes from erosion protection

were USD 55/ha/year, and from water conservation were USD 15/ha/year. Thus, the value of watershed functions of the study area are **over USD 75 million a year**.

Economic value of **biodiversity** (regulating service): biodiversity value was estimated at USD 650/ha/year for the richest forests, and USD 550 for the remaining forest areas, amounting to an estimate of **USD 1.36 billion per year** for the study area.

Economic value of **carbon sequestration** (regulating service): sequestration was estimated at **USD 3,669 million**, one of the highest value for an ecosystem service in the region. This is a globally significant resource.

Economic value of **tourism and other cultural values** (cultural service): there was no available value estimate, but they are suspected to be economically significant.

Issues (theoretical and practical)

An issue in this study was the lack of data in the area of estimating potential economic benefits from tourism in the Mekong region. Additionally, some of the values estimated reflect potential benefits (e.g. carbon storage) rather than actual benefits, and may not be realised fully.

Conditions for successful action

All of the values cannot be realised at the same time (e.g. clear-felling trees and storing carbon), so choices will have to be made amongst the options. Further, it should be clear who would pay for each of these services and how. For there to be successful management of service-providing resources, there must be effective, legitimate, and understood governance in sustainable land management, as well as access to the benefits of ecosystem services.

Conclusions and recommendations

The land resources of the Cardamom Mountains have multiple values, many of which have traditionally not been taken into account in planning decisions. These resources underpin local livelihoods and are of national and global significance. There are several options to develop sustainable land management strategies that reflect local dynamics of change and can provide a more harmonious relationship between desirable development (e.g. livelihood changes, hydropower investments) and long-term sustainability of land resources.

The livelihood of local communities depends on sustainable access to a variety of resources gathered from local forests and lands, in addition to farming. Most of the resource uses are based on a customary rights system rather than land ownership, and come from a zone within five kilometres of villages. This zone could be placed under a form of communal management, with safeguards for sustainable management. Local communities have shown great interest in being involved in the management of the resources they depend upon.

Hydropower schemes currently being developed in the area will bring great benefits to Cambodia's overall development. In turn, they would gain enormous economic benefits from effective watershed conservation that conserves water and reduces sedimentation. A payment for ecosystem service could be implemented, with income for this scheme levied based on electricity consumption.

The forest conservation measures already in place in the Cardamom Mountains should be continued and strengthened, so as to maintain the high value biodiversity, watershed maintenance, and carbon sequestration ecosystems services that are contingent upon continued integrity of its large forest ecosystems. A payment for ecosystem service could be implemented, with income for this scheme levied from tourists and downstream water users.

There is also a need to better regulate and limit the impact on resources from 'outsiders' who illegally occupy land newly made accessible by road transport improvements. This could be achieved through working with existing and new migrants to assist them in developing sustainable systems of land management compatible with the actions taken by local communities. These systems could include the development of appropriate and sustainable upland farming systems on permanent plots closer to the villages, which would also help reduce "slash-and-burn" farming.

