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Participatory assessment and mapping of ecosystem services in a data-poor region: Case study of community-managed forests in central Nepal

Kiran Paudyal [a,*], Himlal Baral [b], Benjamin Burkhard [c,d], Santosh P. Bhandari [e], Rodney J. Keenan [a]

[a] Department of Resource Management and Geography, University of Melbourne, 221 Bouverie Street, Carlton VIC 3053, Australia
[b] Centre for International Forestry Research, Jalan CIFOR, Situ Gede, Sindang Barang, Bogor (Barat) 16115, Indonesia
[c] Institute for Natural Resource Conservation, Department of Ecosystem Management, Kiel University, Olshausenstr. 40, 24098 Kiel, Germany
[d] Leibniz Centre for Agricultural Landscape Research ZALF, Eberswalder Str. 84, 15374 Müncheberg, Germany
[e] Indufor Asia Pacific, Auckland, New Zealand

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ABSTRACT

Community-managed forests (CMF) provide vital ecosystem services (ES) for local communities. However, the status and trend of ES in CMF have not been assessed in many developing countries because of a lack of appropriate data, tools, appropriate policy or management framework. Using a case study of community-managed forested landscape in central Nepal, this paper aims to identify and map priority ES and assess the temporal change in the provision of ES between 1990 and 2013. Semi-structured interviews, focus group discussions, transect walks and participatory mapping were used to identify and assess priority ES. The results indicated that community forestry has resulted in the substantial restoration of forests on degraded lands over the period of 1990–2013. Local community members and experts consider that this restoration has resulted in a positive impact on various ES beneficial for local, regional, national and international users. Priority ES identified in the study included timber, firewood, freshwater, carbon sequestration, water regulation, soil protection, landscape beauty as well as biodiversity. There were strong variations in the valuation of different ES between local people and experts, between genders and between different status and income classes in the local communities. In general, whereas CMF provide considerable benefits at larger scales, local people have yet to perceive the real value of these different ES provided by their forest management efforts. The study demonstrated that participatory tools, combined with free-access satellite images and repeat photography are suitable approaches to engage local communities in discussions regarding ES and to map and prioritise ES values.

1. Introduction

In recent years, community forestry (CF) has become a globally popular approach to forest management (Agrawal and Chhatre, 2006; Purnomo et al., 2012). CF has been considered a successful national strategy to improve rural livelihood and environmental protection in Nepal, where local communities are protecting and managing forest resources to increase forest cover and conditions (Acharya, 2004; Khadka et al., 2012; Måren et al., 2013; MFSC, 2013; Niraula et al., 2013; WB, 2001) to provide forest products such as firewood, timber, fodder, leaf litter (Birch et al., 2014, Gautam et al., 2004; Pokharel, 2012) and other ecosystem services (ES). Although community-managed forests (CMF) are protected and managed by local communities, the benefits are consumed by local, regional, national and international users (FAO, 2013; Muhamad et al., 2014; TEEB, 2010). For example, many provisioning ES such as food, timber for local construction, firewood and fodder are used by local people, whereas other services, such as watershed protection, wildlife habitat and recreation, benefit users at the national or international level (Birch et al., 2014). ES, such as increased carbon sequestration, have a global significance (Bowler et al., 2012; Costanza et al., 2008). However, there have been few studies to assess and map ES supplied from CMF to date, in part because of a lack of clear policy directive or management framework but also because of a lack of data, methods and tools in developing and data-poor countries, such as Nepal. These two challenges interact, and identifying, assessing and mapping ES

* Corresponding author. Tel.: +61 3 8344 9308; Mobile: +61 406214006; fax: +61 3 9349 4218.
E-mail address: kpaudyal@student.unimelb.edu.au (K. Paudyal).

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from CMF are key requirements to creating an awareness of the values obtained from CMF amongst planners and decision makers and to providing a basis for policy and management (Burkhard et al., 2012; Crossman et al., 2013; MEA, 2005; Muhamad et al., 2014). For example, ES quantification can improve efficiency investment to support improved forest management (Crossman et al., 2011; Crossman and Bryan, 2009; Farley and Costanza, 2010) and determine the extent to which compensation should be paid for the loss of ES in liability regimes (Payne and Sand, 2011).

Spatial information on the local uses and perceptions of ES can improve landscape planning and management within rapidly changing landscapes (Abram et al., 2014; Baral et al., 2014c), and a wide range of methods and tools have been utilised to assess ES. These include: biophysical and environmental models (Bryan et al., 2010; Crossman et al., 2012); expert opinion or professional judgment (Burkhard et al., 2010a, 2010b, 2012; Vihervaara et al., 2010; Yapp et al., 2010, Palomo et al., 2013); users perception (e.g., Smith and Sullivan, 2014) or social and community values (Raymond et al., 2009; Sherrouse et al., 2011; van Oort et al., in this issue); participatory approaches (Fagerholm et al., 2012; Palomo et al., 2013); visual knowledge by repeat photography (Garrard et al., 2012; Niraula et al., 2013; Webb et al., 2010); participatory geographical information system (PGIS) tools (Baral, 2008; Brown, 2013; Brown and Donovan, 2014; Brown et al., 2012; Sieber, 2006); and remote sensing and GIS tools (Baral et al., 2014b; Frank et al., 2012; Vihervaara et al., 2012).

Each approach has its strengths and limitations. For example, participatory approaches and expert opinion can provide rapid ES assessment but the accuracy and reproducibility of results may be lower (Krueger et al., 2012; Jacobs et al., 2015). In contrast, on-site measurement and mapping may be more accurate but it takes more time and resources (Baral et al., 2014c). In data-poor regions such as Nepal, participatory approaches are preferred as they do not require a substantial amount of expensive biophysical data (Baral et al., 2014c; van Oort et al., in this issue), and they can be applied rapidly. Local situations are often better understood by local people than by outside experts (Nightingale, 2005; Ojha et al., 2009) and their perceptions of the value of different ES are critical for future management (Paruelo, 2012; van Oort et al., in this issue).

This study aims to assess a local community's priority ES and their perceptions of changes as a result of the implementation of CF in a landscape in the middle hills of Nepal between 1990 and 2013. A spatial analytical approach and rapid assessment techniques were used to identify, map and assess trends in the supply of ES across the landscape and to rank the importance of different ES for local livelihoods and community welfare.

2. Methods

2.1. Study area

Dolakha district is located in the central mid hills of Nepal, 133 km northeast of Kathmandu, the capital city (Fig. 1, see KML file). The district covers 219,100 ha, of which 35% are Himalaya/high mountains, 40% high hills and 25% mid-hills (DDC, 2011) that range in elevation from 732 m to 7148 m above sea level (DDC, 2011). Although small in area, the Dolakha district has a high diversity in climate, vegetation and land uses because of the variation in altitude (DDC, 1999). This district is typical for the variety of landscapes and ecosystems in the mid-hills of Nepal (Niraula et al., 2013).

In the district, the watersheds of two small rivers, the *Charnawoti* and *Dolati* – tributaries of the *Tamakoshi* River – were selected for the study. CF has been implemented in these watersheds since the early 1980s with the support of a Nepal–Swiss CF Project, financed by the Swiss Development Cooperation. Management of most of the forests in these watersheds has been transferred to local communities. The total area of the two watersheds is

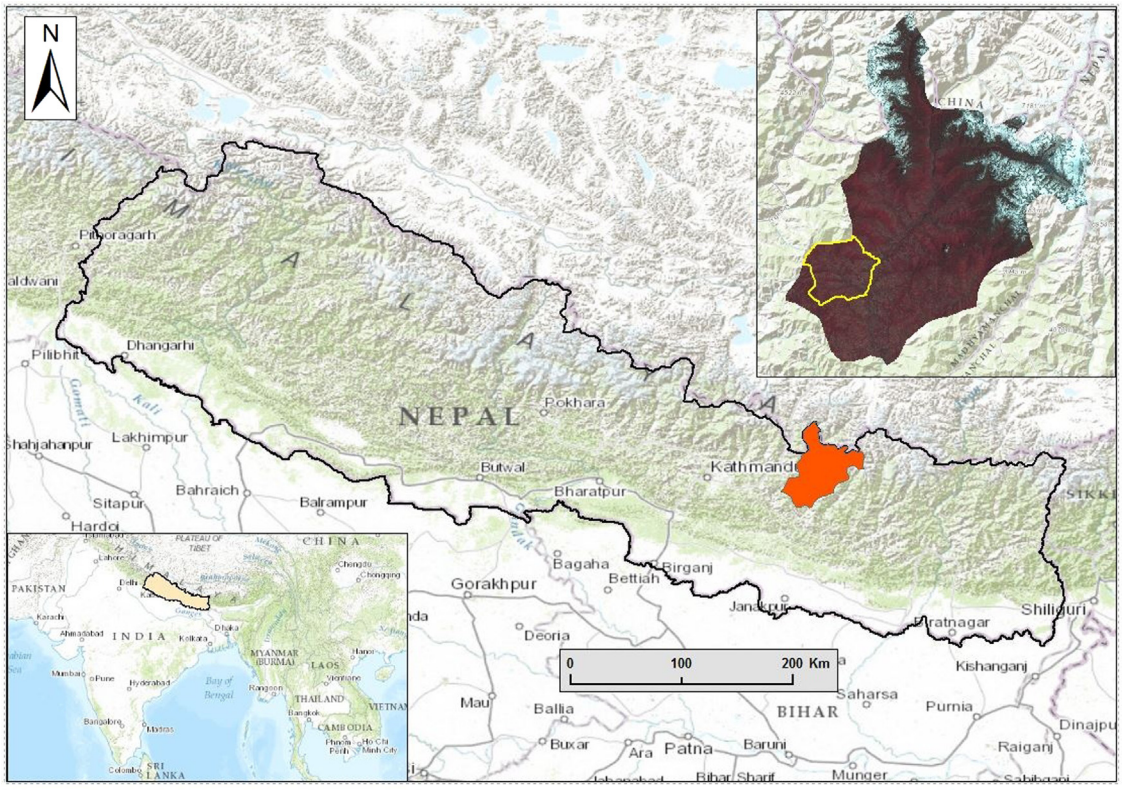

Fig. 1. Location of the study area: catchment of the *Charnawoti* and *Dolati* rivers, tributaries of *Tamakoshi* river surrounding of Charikot, district headquarter of the Dolakha district (Base map source: www.esri.com).

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