Juggling multiple dimensions in a complex socio-ecosystem: The issue of targeting in payments for ecosystem services

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A B S T R A C T
Proponents of payments for ecosystem services (PES) schemes advocate targeting payments to geographical areas that can: (a) maintain or enhance ecosystem services, (b) permit economically efficient arrangements and (c) address poverty objectives. The location of these efficient, effective and equitable (or triple-win) solutions is viewed as the ‘holy grail’ of PES and is often sought in isolation to broader socio-economic pressures, political relationships, or local cultural conditions. While the plethora of PES design perspectives often follow the concepts of efficiency and effectiveness, they seldom relate to pluralistic value systems and may disparage local self-determination for influencing the form and terms of negotiation. This paper critically analyses the assumptions underpinning the design of PES schemes which seek to optimise or target efficient, effective and poverty objectives. Using a case study for a proposed PES initiative in the Kathmandu Valley of Nepal, we employ spatial analysis to geographically visualise the discrepancy between the location for a typology of targeted objectives and actual preferences which support local perceptions of natural resource use and conservation. The case study highlights the inequity inherent in targeting payments under a neoliberal framing. Instead, spatially differentiating incentives according to socially determined priorities and collective management is suggested.

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Introduction

Market-oriented instruments for environmental protection seek to efficiently modify the behaviour of land-users to correspond to the needs and values of paying beneficiaries who can compensate the former for the foregone benefits of land-use change (Wunder, 2005; Engel et al., 2008). One such instrument which has sparked widespread enthusiasm from researchers, government agencies, development banks, and donors in the last decade is ‘payments for ecosystem services’ (PES). It has been argued that PES and other market-like environmental policies subjugate nature and diverse social relationships as being inferior to rational self-interest and simplistic yet mythical cause-and-effect relationships (Kosoy and Corbera, 2010). Such policies rooted in neoclassical economics essentially reinforce the notion that human society is not only distinct from nature, but also that human value systems are fixed and are not shaped by social influences (Sagoff, 1998). Despite these criticisms, the quest for the optimum PES scheme according to economic, ecological and poverty alleviation objectives remains a seemingly obvious and unwavering priority for PES practitioners (Kroeger, 2013).

The optimisation of PES is increasingly being aligned with several key features of neoliberal economic policy, as identified by Castree (2008), namely: privatization (e.g. once private property rights are established, social actors can voluntarily negotiate and incentivize each other to influence behaviour given complete information and minimal costs of negotiation); marketisation (e.g. trading ecosystem services in markets where monetary compensation is considered the dominant exchange value), and market-supporting policies and organisations designed to develop the necessary institutional apparatus that facilitate the application of PES through a market lens. Despite reference to these considerations, very few operating PES schemes exhibit characteristics of sheer market arrangements, such as conditionally-dependent payments and voluntary participation (Muradian et al., 2010; McAfee, 2012). Regardless of these ecological and socio-economic assumptions, the conceptually attractive objectives of cost-efficiency, environmental
effectsiveness (measured as ‘additionality’ defined as the perceived ecological service benefits in relation to what would have been provided without the payments) and the combination, cost-effectiveness (ecological service value provided per money spent), have been identified in optimizing ecosystem service provision through PES payments under the pretence of a ‘market-based’ arrangement (Wünscher et al., 2006; Chen et al., 2010). Further studies have included poverty alleviation or social equity as another targeting goal and have sought to identify locations tagged as having the ‘gold standard’, by targeting service providers and their lands according to low opportunity cost, high potential additionality and managed by poorer households (Gauvin et al., 2010; Jack et al., 2009; Alix-Garcia et al., 2008).

A wealth of studies have emerged attempting to map ecosystem services according to areas of potential supply and demand across varying spatial and temporal scales (Naidoo et al., 2008; Nelson et al., 2009; Daily et al., 2009; Zhang and Pagiola, 2011; Bagstad et al., 2013). The popularity of visualising ecosystem services has resulted in a number of decision-support toolkits of differing degrees of sophistication to generate spatial information on the extent or magnitude of ecosystem service delivery potential or defined metrics quantifying particular services (Potschin and Haines-Young, 2011). Identifying “hotspots” of ecosystem services valued by certain social groups has been suggested to facilitate the prioritisation or targeting of policy efforts to improve the delivery of services and avoid untargeted expenditure of scarce resources. Indeed, both local and global-scale efforts have been made to map the spatial concordance of areas that produce ecosystem services to the values held by beneficiaries of these services (Newburn et al., 2005; Naidoo and Iwamura, 2007; Naidoo et al., 2008; Crossman and Bryan, 2009).

In this study, we develop a tool to geospatially visualise the interactions between targeted objectives which exposes the political embeddedness of various PES distribution strategies. The spatially explicit nature of the tool also serves to reveal the absurdity of seeking ‘gold standards’ in the face of substantial epistemological and ontological complexity. We argue that targeted payments lacking local cultural meanings, attention to the situational context of poverty, or an analysis of existing political relationships influencing natural resource management will at best fail to result in long-term positive outcomes and at worst reinforce the cycle of poverty and environmental degradation.

In the following section, we outline the objectives of the paper and critically review recent studies which have applied spatial analysis to map ecosystem services and others which leverage upon such techniques to improve PES targeting. Section three describes the case study and the methodology in addressing the above research objectives. Sections four and five offer results of the analysis and a discussion of what these results suggest for improving PES arrangements. A conclusion is then given proposing further research that adopts a collective-action framing for PES as incentive-based negotiations for socio-ecological stewardship.

Objectives and background

While PES targeting cannot derive from a purely technical process, we argue there is value in making ethical and political ramifications explicit in the allocation of PES payments. We propose a PES targeting matrix that incorporates the various objectives in different combinations that PES proponents seek to enhance in the negotiation of incentives for ecological stewardship. In this manner, not only are trade-offs between the allocation of payments identified, but the implications of each PES design scenario become open for critical inquiry in relation to local informal institutions, power relations between actors and inequities of resource access.

**PES targeting matrix**

The development of the matrix employs geospatial techniques to visually illustrate how each targeted PES design scenario identifies unambiguously which households in geographic space would benefit from a given targeting scenario. Such a representation can reveal the extent to which targeting scenarios align with local norms, cultural and informal relationships, or local decision-making institutions and hence the legitimacy of the design. An empirical case study of a proposed PES scheme in the Kathmandu Valley of Nepal is examined using the PES targeting matrix in order to identify geographical locations where payments align with objectives prioritised by PES proponents. These include economic efficiency, environmental effectiveness (e.g. PES ‘additionality’), cost-effectiveness, and equity. The latter is measured across two dimensions considering: (a) poverty using income distribution as a measure of welfare and, (b) poverty in relative terms based on perceived well-being. The interactions of each objective are presented within the matrix in order to illustrate the range of potential payment design scenarios, allow critical judgement on each objective in relation to others according to the preferences of involved social actors, and to determine the extent to which each scenario aligns with or deviates from local understandings of payment distribution preference. Moreover, to reveal the inherently political nature of choosing a particular design scenario, the distributional ramifications of using the presumably ‘objective’ parameter of ‘opportunity cost’ is critically analysed. While previous studies have recognized the mismatch between externally defined political goals and local legitimacy in PES (Corbera et al., 2007; Pascual et al., 2010; Vatn, 2010; Van Hecken et al., 2012; Fisher, 2013; Zander et al., 2013) this study is the first to adopt an explicitly spatial argument to illustrate this point.

Specifically, this paper contains the following research objectives:

1. Introduce a targeting matrix to spatially visualise the trade-offs between targeting designs prioritising economic efficiency, ecological effectiveness (i.e. additionality) and poverty alleviation.
2. Reveal the distributional consequences of using opportunity cost as a benchmark for cost-efficiency or cost-effectiveness targeting by considering livelihood constraints between more and less wealthy households identified as potential service providers.
3. Identify the diverse social, economic and environmental preferences of both upstream and downstream social actors.
4. Compare the payment design and distributional preferences of identified service providers with the full set of spatially defined targeting strategies reflecting the objectives of PES proponents.
5. In the light of these results, this paper discusses the extent to which informal institutions and asymmetries of power between social actor groups determine the degree of self-determination and legitimacy of a particular PES targeting scenario.

The targeting matrix serves to illustrate the point that optimising PES payments according to neoliberal economic is more likely to divide rather than align ecological and social interests. At the heart, lies the inherent injustice of imposing a single value metric to reflect changes in social welfare. Indeed, there is a real risk that optimising payments serves to reward those individuals who are ironically least allied with the social interest, specifically those with greater bargaining power and resources to dictate patterns of land-use management to serve their own conceptualizations of nature’s benefits.
Spatial identification of ecosystem services for PES targeting and the market-based myth

A few studies have emerged which have collated household or parcel-level data on ecosystem service generating potential, opportunity costs, and/or qualitatively expressed socio-economic ‘story-lines’ to spatially identify areas of greatest additionality, lowest cost, or potential for land-use change in the future (Wendland et al., 2010; Swetnam et al., 2011). Satake et al. (2008) used spatial mapping for PES targeting at different scales to reveal landscape heterogeneity in the distribution of carbon stocks on private land and potential equity considerations of global beneficiaries of the service. Elsewhere, Zhang and Pagiola (2011) examined the spatial feasibility of optimizing PES in Costa Rica by identifying synergies determined as the extent of spatial overlap of differing PES objectives, including poverty alleviation, biodiversity conservation and water provisioning. These studies have used different proxies for mapping optimal locations for PES targeting and have paid differential attention to trade-offs in service provisioning according to variations in scale and economic drivers over time. Yet, the prioritisation of conservation areas was often measured according to a single metric of value, such as annual water tariff revenues in the case of prioritising water conservation areas in Costa Rica (Zhang and Pagiola, 2011).

The most convincing studies have involved spatial mapping of conservation ‘opportunity’ as opposed to conservation ‘priority’ by incorporating social values, and the capacity of local institutions and engaged populations to enhance the effectiveness of conservation investments. These studies recognize that technological, economic or biophysical characteristics may indicate levels of conservation priority in terms of threat or cost-effectiveness but that social approval, cultural values and existing public policies shape conservation opportunity (Bryan et al., 2010a,b; Knight et al., 2010; Raymond and Brown, 2011). However, mapping areas of high and low social and ecological values respectively to identify policy strategies under each combination treats the development and evolution of social values as separate from natural functions and processes portending that nature and society are mutually excludable. Moreover, the overlap of compartmentalized social, economic, and biophysical information in a seemingly ‘integrated’ fashion errantly obscures how entrenched institutions and powerful discourses underpin collective norms or social obligations and are inextricably linked to perceptions of nature and hence natural resource management (Lele, 2013).

Thus, despite attempts to map scenarios of land-use change, these spatial analyses are essentially ‘snapshots’ which conceal substantial epistemological (e.g. plural versions of value legitimacy) and ontological (e.g. scales of analysis) uncertainties inherent in dynamic socio-ecological systems. Such reductions refer to the consideration of households as self-interested actors responding purely to compensation of opportunity cost (Wendland et al., 2010) or simplifications of social processes in order to strike a balance between relevant detail of the model and usefulness for policy-makers (Swetnam et al., 2011). Accordingly, little explicit attention has been given to distributional concerns or perceptions of fairness inherent to these mapping approaches.

As Potschin and Haines-Young (2011: p. 576) argue, the transdisciplinary challenge of bridging societal and ecological knowledge forms cannot be met by “uncritical puzzle solving”. Dis-associating social processes from the management of public goods by compartmentalizing them under individual self-interest is analytically imprecise regardless of the methodological sophistication of the spatial analysis. Consequently, transient and shifting micro-scale relationships among actors which create spatially variable patterns of access and overexploitation of natural resources are ignored (Lele, 2013).

Alix-Garcia et al. (2008) was among the first empirical investigations of PES optimisation, examining cost-effective payment targeting in comparison to egalitarian flat-rate payments for PES to maintain common property forests in Mexico. Elsewhere, Gauvin et al. (2010) found that China’s ‘Grain for Green’ PES was being targeted for parcels of land of high environmental vulnerability and low opportunity cost for land managers, but not the poverty levels of service providers. However, the authors did not provide an ‘evaluative space’ to judge poverty through a multidimensional interpretation of well-being. By assuming an increase in income through cash and grain payments as a proxy for well-being improvement and as the motivational stimulus for behavioural change, other deprivations related to human dignity, empowerment and ability to control one’s destiny risk being ignored. The authors of both of these studies acknowledge the trade-offs that targeting payments according to efficiency or effectiveness might have on numerous and often poor smallholders or households without land-use rights. However, they purport to address this inequity problem by combining site selection based on service protection with a uni-dimensional conceptualization of poverty isolated from existing political realities and economic drivers of land-use. The ramifications of this simplification for targeting may lead to gross inequities that reinforce the poverty-environmental degradation cycle by displacing patterns of degradation across the landscape (i.e. ‘leakage’) (McAfee, 2012). Moreover, the decision to base compensation according to opportunity cost is a far from unbiased and objective standard. It is itself a political decision to reduce the suite of human value ethics to a single one: Homo economicus. Such a perspective is confirmed in the following statement: “...because we are paying exactly the value of the alternative use for the hectares of land they wish to deforest, ejidos¹ will always accept the contract” (Alix-Garcia et al., 2008: 380).

Targeting PES schemes based on cost-efficiency often reduce ecological processes as being precise relationships that align consistently and uniformly with patterns of property boundaries. While such relationships may be possible in the case of well-defined point-source pollution in relatively small geographical areas, these situations represent the minority of PES contexts (Kosoy and Corbera, 2010). The logic of optimisation also implies that complex ecological processes spanning large spatial and temporal scales somehow result in ecosystem services traceable to individual actions on small geographical areas over a short timescale. Indeed, highly simplified relationships between the mere presence of forests and resulting hydrological benefits have become entrenched in our collective psyches that national environmental policies are being constructed according to unverifiable ‘truisms’ of nature (Calder, 2005). In reality, relationships between ecosystem processes or functioning and the delivery of ecosystem services that yield direct benefits from nature for human well-being are non-uniformly distributed in space and time. Furthermore, they are subject to dynamic pressures in both the anthropocentric realm of the institutional economy, the biophysical realm such as macroscale topography and species diversity, and the evolving combination of these factors at the macroscale (Norgaard, 2010).

Case study

Study site

The Sundarijal catchment covers 15.76 km² within the eastern edge of Shivapuri Nagarjun National Park (SNNP) and is a critical

¹ Mexican villages which hold forest or grazing lands in common property.
watershed supplying the larger Bagmati River watershed, contributing approximately one-third of the total piped water entering the Kathmandu Valley. The case of SNNP represents a classic dilemma of conservation at the cost of local well-being, since households within the park do not have legal access or rights to manage forest resources extending beyond the boundaries of private land deeds. Since the park was gazetted in 2002, households within the park have essentially been ‘fenced in’, breaking traditional productive landscapes of forest use and subsistence agriculture with the necessity to obtain competitive livelihoods under a context of restricted mobility and limited market access.

The hydrological services of the catchment largely accrue to hydropower generation, irrigation for rural agriculture in and around Kathmandu Valley, and urban consumption of drinking water by city residents. In addition to downstream hydrological benefits, over 400 households from three villages located within the park benefit from resources such as timber, fuelwood, and fodder to fulfill basic needs ranging from shelter, energy for cooking and heating, and food sovereignty. The villages located within SNNP and identified as upstream service provider communities for PES include Mulkharka, Chilauneua and Okhereni (Fig. 1). These three villages form a part of Sundarijal village development council (VDC). With few alternatives to utilise surrounding forest resources combined with growing populations, the majority of households have begun cultivating millet for the production of an illegal liquor as a means of livelihood. While the collection of fuelwood is necessary for cooking and heating in many parts of rural Nepal, the production of the liquor for commercial sale requires a steady energy source, forcing villagers to increase fuelwood collection.

In 2008, a report by the World Conservation Union (IUCN) determined that co-managed forest and agricultural landscapes were the most cost-effective land management strategy over expansion of agricultural areas or even strict forest protection and resettlement of local villages in the Park (Karn, 2008). As such, they proposed a PES mechanism which would offer park settlements a role in land-use stewardship for sustained hydrological benefits (primarily water quality improvements) to downstream beneficiaries in return for payments that would enhance local development potential. Within the park settlements, there exists a set of informal social institutions governing collective activity known as guthi. These are essentially social norms regarding collective management of private land that takes on a combination of religious as well as altruistic aspects of labour and financial allocation. Regular meetings are held calling for neighbouring farmers to offer support to meet labour deficits of households in tilling, seeding, and harvesting primarily millet and maize. Decisions are also made on communal work days in which men and women decide to forego household activities for the day in order to repair damages to common resources such as the path leading to the villages from Sundarijal town, or avoiding soil loss and other damage associated with land-slides. Financial contributions are collected into a fund which is used to invest in tools or resources needed to undertake repair work. Through this fund, the guthi finances the resource and labour requirements for marriages, funerals and village festivals. The system represents a well-functioning mechanism for supplementing household-level labour and family necessities with the common interests in maintaining resources of collective benefit such as soil, road, pest management, and spiritual services. Membership to specific guthi associations reflects histories of inter-marriage and kinship rather than political boundaries or the present spatial proximity of particular households. The endogenously formed social preferences and associated institutions in the form of guthi relations suggest that land-use behaviour in these villages has been built upon cooperation and reciprocity rather than according to purely isolated household decisions.

Descriptive statistics

Table 1 provides a description of household income, environmental effectiveness and well-being characteristics of the three upstream villages in order to illustrate how targeting objectives differ broadly across villages. It can be seen that the heterogeneity of opportunity cost and net income is substantial, given the high standard deviations of the averages. While the existence of such heterogeneity may appear conducive to the spatial targeting of payments, there is little understanding of how existing social processes or individual household constraints explain this heterogeneity. For example, household capabilities to engage in income-generating activities as well as customary or cultural land-use patterns are not reflected in these opportunity costs. The variability of wealth, livelihood opportunities and well-being perspectives indicates that collective resource management potential may also vary between the villages. In terms of social capital, the strength of guthi relations was more evident in Chilauneua (and to a lesser extent Okhereni) where collective meetings were held fortnightly in comparison to Mulkharka where such meetings were held haphazardly or coinciding only with major festivals. Additionally, ethnic diversity was greater in Mulkharka with just over 20% of the sampled population belonging to ethnicities other than the dominant Tamang (compared to ethnic heterogeneity of less than 10% in Chilauneua and Okhereni). While there does not exist evidence to suggest that ethnicity might influence preference for payment distribution, villagers interviewed agreed that ethnicity influenced established guthi memberships and other aspects of community life. Finally, limited economic opportunity was recognised as the primary obstacle to improving collective well-being in Mulkharka while mobility was more of a burden for the farther villages. As a result, potential distributional risks of prioritising certain households over others are ignored, raising concerns over the legitimacy of externally defining how payments should be targeted. Given the heterogeneity and dynamic nature of socioeconomic, well-being and cultural characteristics within these villages, any interaction of targeted objectives for payment design requires spatially explicit recognition and social deliberation of its distributional consequences.

Methodology

In order to illustrate trade-offs in spatially prioritising PES objectives for upstream service provision with local institutional and political realities, data collection requirements were substantial. Specifically, data were derived from potential service providers regarding opportunity costs of land-use management, perceptions of soil and forest management, formal and informal governance institutions, perceptions of household and village well-being as well as preferences for payment type and distribution. A total of 135 households, or one-third of the total number of households (i.e. 405), were selected through a stratified random sampling procedure according to the division of wards following Uchida et al. (2009). The identification of households was carried out by pooling all the households within a single ward and randomly selecting one-third for the interviews. Semi-structured interviews with an adult member of each selected household were

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2 The municipal level jurisdiction of central government in Nepal; each VDC is composed of wards, the number of which depends on population size.

3 As of 2014, the IUCN and other intergovernmental and non-governmental organisations that have pushed for PES implementation in SNNP have retracted interest due to claims by downstream stakeholders that they are powerless to mobilise resources or engage in further discussion without clear legal definition of the PES mechanism at ministerial level. Thus, despite the failure of the PES proposal in the Valley, we aim to critically analyse external ‘targeting’ of PES as was envisioned for the Sundarijal catchment and which continues to be promoted elsewhere.
conducted. Due to the substantial data requirements, interviews were split into three surveys: (1) opportunity cost; (2) land-use management, and (3) household well-being with questions pertaining to PES design and preference common to each survey. The selected households were randomly apportioned to one of the three sets of surveys. While we recognise the limitations of this approach in reducing the overall data sets for spatial interpolation, we were also aware that households within SNNP were being selected for other government-related research taking place at the same time regarding perceptions of buffer zone management. Given the considerable data needed for opportunity cost collection and understanding household perceptions of well-being, we had reason to believe that questionnaire fatigue and possible strategic response bias could affect the data collected. Accordingly, each survey contained data from 45 households selected across the three villages. The geographic coordinates of each sampled household were taken in order to carry out spatial targeting analysis of opportunity cost distribution, environmental effectiveness and poverty classifications using ArcGIS.

Opportunity costs were calculated for the most profitable land-use activity\(^4\) which was identified as liquor production. Following Richards et al. (2003), opportunity cost was identified through the following equation:

\[
VA_x = \left[\frac{(I_x - C_x)}{A_x}\right] - \left[\frac{C_x}{A_x}\right]
\]

where the added value or rent of a particular product \((VA)\) was calculated by the total income \((I)\) minus the costs \((C)\) divided by the total area in hectares \((A)\) under production by product \(x\). Costs

\(^4\) While there was reason to indicate that the sale of cannabis provided significant returns, the sensitive nature of questioning made it impossible to determine opportunity cost data for cannabis production.

**Fig. 1.** Location of study site. The insert depicts the location of sampled households and the three villages identified as potential PES service providers within the Sundarijal catchment of SNNP.
include expenditures on fertilizer, trips to Kathmandu to sell the liquor, hired labour as well as the value of household labour measured through the minimum wage for agricultural activity in Nepal.5

According to the feasibility studies as well as interviews with key informants, three main threats to water quality were identified and traced to the land-use activities of the villages within the Park (Niraula, Unpublished results, 2008; Karn, 2008). These included:

- Practicing open defecation (determined by stated use of a private or shared toilet).
- Cultivating land within 1 metre of a water body.
- Collecting more than the average bhari of fuelwood per year (206 bhari).
- Collecting more than the average bhari of livestock fodder per year (379 bhari).
- Claiming frequent soil loss problems.
- Using more than the household average of 100 kg of urea fertilizer per year.

Poverty was classified both as: (a) net income and (b) well-being measured through a series of variables reflecting health, literacy, equality, physical assets, and food security. Data for poverty by net income was derived from households who were randomly selected to assess livelihood information and was classified according to the central government determination of the national poverty line.6 However, a multi-dimensional conceptualization of poverty, on the basis that poverty is an experience that can be present in multiple dimensions at multiple points of time for a given household, underpins the rationale for expanding consideration beyond income effects (Alkire and Santos, 2010). This data was determined from households surveyed for household well-being. Thus, in measuring poverty as well-being, we attached a score of one point for each household that satisfied each of the following queries:

1. Not having enough to eat at some point in the year.
2. Having no access to vehicles that offered mobility (e.g. bicycle, motorcycle).

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Table 1
Descriptive statistics characterizing livelihoods, land-use management, perceptions of well-being, and social capital among the villages within SNNP.

<table>
<thead>
<tr>
<th>Description</th>
<th>Mulkharka Mean (SD)</th>
<th>Chilauneaugan Mean (SD)</th>
<th>Okhereni Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Income and land area</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opportunity cost of liquor production</td>
<td>USD 4878.9/ha (7116.9)</td>
<td>USD 5315.8/ha (8307.7)</td>
<td>USD 8571.1/ha (9298.5)</td>
</tr>
<tr>
<td>Land area under production</td>
<td>0.13 ha (0.11)</td>
<td>0.18 ha (0.11)</td>
<td>0.13 ha (0.11)</td>
</tr>
<tr>
<td>Average net income per household/year</td>
<td>USD 2607.5 (2666.3)</td>
<td>USD 2171.4 (1332.7)</td>
<td>USD 1623.8 (1042.5)</td>
</tr>
<tr>
<td>Percentage below 'income' poverty line</td>
<td>33.3%</td>
<td>25.0%</td>
<td>25.0%</td>
</tr>
<tr>
<td><strong>Environmental effectiveness</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open Defecation</td>
<td>52.9%</td>
<td>25%</td>
<td>25%</td>
</tr>
<tr>
<td>Bhari of fuelwood collected per household/year</td>
<td>171 (137.8)</td>
<td>228 (148.8)</td>
<td>236.4 (94.7)</td>
</tr>
<tr>
<td>Bhari of livestock fodder collected per household/year</td>
<td>251.3 (306.2)</td>
<td>447.0 (333.1)</td>
<td>461.4 (504.7)</td>
</tr>
<tr>
<td>Stated soil loss problems ('always')</td>
<td>23.5%</td>
<td>50.0%</td>
<td>60.0%</td>
</tr>
<tr>
<td>Households using 100 kg or more of urea fertilizer/year</td>
<td>33.3%</td>
<td>37.5%</td>
<td>35%</td>
</tr>
<tr>
<td><strong>Well-being</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I ≠ Not having enough to eat during the year</td>
<td>0.13 (0.05)</td>
<td>0.50 (0.05)</td>
<td>0.35 (0.05)</td>
</tr>
<tr>
<td>I ≠ Lack of mobility</td>
<td>0.76 (0.04)</td>
<td>0.88 (0.04)</td>
<td>0.95 (0.02)</td>
</tr>
<tr>
<td>I ≠ Disability</td>
<td>0.71 (0.05)</td>
<td>0.75 (0.05)</td>
<td>0.50 (0.05)</td>
</tr>
<tr>
<td>Adult Literacy: ≤50%</td>
<td>47.1%</td>
<td>50.0%</td>
<td>50.0%</td>
</tr>
<tr>
<td>Children not attending school</td>
<td>5.9%</td>
<td>25.0%</td>
<td>45.0%</td>
</tr>
<tr>
<td>I ≠ Water enters roof</td>
<td>0.25 (0.04)</td>
<td>0.38 (0.05)</td>
<td>0.20 (0.04)</td>
</tr>
<tr>
<td>Sickness in preceding month</td>
<td>0.35 (0.05)</td>
<td>0.75 (0.05)</td>
<td>0.45 (0.05)</td>
</tr>
<tr>
<td>Consumer durable assets: 2 or less</td>
<td>35.3%</td>
<td>75.0%</td>
<td>55.0%</td>
</tr>
<tr>
<td>Poverty Score (max: 9)f</td>
<td>4.25 (1.2)</td>
<td>4.0 (1.1)</td>
<td>5.2 (1.2)</td>
</tr>
</tbody>
</table>

### Social perceptions of obstacles to well-being

#### Household-level obstacles to well-being

- Physical house improvement (24%)
- Economic Opportunity (63.3%)

#### Community-level obstacles to well-being

- Mobility (83.3%)
- Mobility (65.0%)

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5 As of 2008, this value was NPR 18.75 (USD 0.22) per hour (Nepal Gazette, 2008).
6 Land holding size was not considered, since on average households utilise only 10.5% of their total land holding for cultivation and habitation. Household interviews indicated that the remaining land holding is left fallow or abandoned due to limited labour or material resources.
7 'bhari' is a local unit of measuring firewood and fodder. 1 bhari = 30 kg.
8 National poverty line was taken from the Third Nepal Living Standard Survey (2011) by the Central Bureau of Statistics. The survey used a food equivalent of 2200 calorie consumption per person/day as well as access to essential non-food items as an index to measure poverty. According to market prices from 2011, it was determined that a person requires a net income of NRs 14,430 per year to meet essential food and non-food requirements (CBS, 2011).
3. Having a mental or physical disability in the household.
4. The percentage of adults capable of reading and writing is less than 50%.
5. One or more school-age children are not attending school.
6. Water enters through the roof during rain events.
7. One more member of the household was sick in the last month.
8. Having the perception of lacking equal opportunities to acquire vocations or other skills desired.
9. The number of household assets, measured as 5 consumer durables variably possessed by households (TV, mobile phone, computer, radio, satellite dish), was limited to two or less.

The maximum possible ‘poverty score’ is 9, with each query weighted equally. The choice of categories reflects a tentative set of measurable indicators consistent with a holistic perspective of poverty comprising multiple dimensions of human well-being (Alkire and Santos, 2010).

An ordinary Kriging interpolation model was used within ArcGIS to identify poor areas according to each classification (poverty targeting). This procedure was also used to interpolate opportunity costs of producing liquor (to spatially assess areas for cost-efficiency targeting) and the distribution of ecologically vulnerable areas (‘additionality’ targeting). The completed interpolations were then analysed to spatially determine areas where opportunity costs of producing liquor were lowest as well as where ecologically vulnerable areas were highest (cost-effectiveness targeting). The identification of these areas was carried out by grouping interpolated values into three classes using Jenk’s Natural Breaks, which has been identified as a reliable method to optimize breaks between classes through the minimisation of the sum of squares error (Swetnam et al., 2011). Areas of higher cost-effectiveness were identified where areas of low opportunity cost and high ecological threat overlap. Where areas of higher poverty (measured respectively as income effects and state of well-being) overlap with cost-effective areas, presumably ‘triple win’ targets can be spatially identified.

In assessing whether discrete PES objectives of cost-efficiency, effectiveness or even poverty alleviation correspond to local institutions, political realities or local perceptions, two specific analyses were carried out. The first was to assess the distributional implications of identifying ‘efficient’ service providers by means of opportunity cost for land-use change. This was conducted through a factorial ANOVA in analysing whether the proportion of net income allocated to different land-use activities between households varied with annual household income. The second analysis involved a series of focus groups with upstream households in each village and interviews with key informants representing service beneficiaries and intermediaries for the proposed PES. The resulting information was also used both to triangulate the data emerging from a household perspective and to assess whether group dynamics or social perceptions towards well-being, deprivations, and PES perspectives offered additional insight. Household preference for payment type and distribution was determined and analysed using a Fisher’s Exact Test to assess whether there were significant differences in payment type and management preferences between villages. The focus groups were conducted in each village according to gender (i.e. 6 focus groups for the 3 villages). An additional focus group was conducted in Okhereni to consider the views of two separate ethnic groups, Tamang and Chhetri, residing in two informally named villages within the same ward. Those selected to attend the focus groups were the same households interviewed. This was done to build rapport from the previous encounter and to encourage neighbours to also attend. Each focus group had between 10 and 20 individuals and was moderated by the lead author and four additional assistants and native Nepali speakers from the environmental NGOs advocating for PES. The resulting data were analysed for common themes exposing perceived obstacles to well-being, informal institutions, and preferences for alternative management strategies for SNNP including the role of PES.

**Results**

**Targeting matrix**

Fig. 2 incorporates collected data on opportunity cost, land-use practices, net income and perceptions of well-being to create a spatially explicit targeting typology for identifying the most feasible areas for PES implementation in the Sundarijal catchment. The boundary layer depicted represents the area of each of the three human settlements within SNNP as replicated from Fig. 1. The Ordinary Kriging interpolation model was based on the smoothest presentation of variance between household waypoints. The accuracy of the interpolation was assessed by examining the semivariogram of the model which indicated low variance of responses between neighbouring households and increasing variance the farther away households were located from each other. This provides a reasonable estimate that geographically delineated ‘targets’ of low-cost, ecologically effective, higher poverty and the combination of these classifications could be identified.

Beginning with the first row (e.g. ‘no consideration of poverty’), it can be seen that the most inclusive coverage of the settlements is considered where cost-efficiency is optimized. It should be noted that households on northern and western fringes of Okhereni village are not included within the targeted zone because compensation would be considered overly high due to above average opportunity costs in producing liquor. Yet, it is these households who are the most isolated within the National Park and have argued for greater access to new markets to improve their well-being. The minimal change in area between cost-effective and ecological vulnerable areas illustrates a possible correlation between soil productivity for growing millet and the net rent of profit that emerges from the land indicating that wiser soil practices in these areas may improve productivity of the land. However, the overall targeted area within each community diminishes under these targeting strategies.

Moving on to the second row of Fig. 2, with the consideration of poverty measured as lower than the national poverty rate in terms of income, the targeted area under each additional consideration of efficiency and effectiveness becomes smaller. While two small impoverished zones are present in Chilaneugan and have low opportunity costs for millet production, these areas are not considered ecologically vulnerable and hence do not fall within the ‘triple win’ zone depicted as cost-effective and ‘income-poor’. The more inclusive consideration of poverty as well-being in the third row expands the area under consideration as impoverished. Households located within these areas scored a ‘poverty’ score (as described earlier) of 5 or greater. These zones shrink in size when other targeting objectives are incorporated. The ‘gold standard’ as coined by Gauvin et al. (2010) and shown at the bottom right-most image would appear to encompass the smallest number of household areas of any of the strategies.

The misleading targeting of ‘efficiency’: Linking livelihood choice with patterns of poverty

Fig. 3 illustrates the proportion of total net income between different economic activities across all sampled households (from survey 1) as well as the poor and least poor of those sampled. The factorial ANOVA analysis indicates that the mean proportion

While obtaining a ‘poverty point’ was made through binary classifications for most of the categories (fulfilling the query or not), the choice of ‘poverty’ scoring for the number of assets possessed as well as adult literacy was made in order to clearly distinguish differences between households for these categories.
<table>
<thead>
<tr>
<th>Targeting typology</th>
<th>Poverty Distribution</th>
<th>Cost Efficiency</th>
<th>Ecological Vulnerability (areas of ecological additiveness)</th>
<th>Cost-effectiveness (greatest ecological additiveness in areas of lowest cost of compensation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No consideration of poverty</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
<tr>
<td>Poverty (below national poverty rate)</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
<tr>
<td>Poverty (categories of well-being)</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
<td>![Image]</td>
</tr>
</tbody>
</table>

Fig. 2. Geo-spatial visualisation of a typology of targeting scenarios for PES in the Sundarijal catchment, according to the objectives of economic efficiency, ecological vulnerability and two considerations of poverty alleviation. The first row of the matrix assumes the position of status quo in relation to poverty alleviation while the second and third rows adopt the two perspectives of poverty targeting. The first image in the first row does not apply a targeting scenario but simply illustrates the location of sampled households within the three villages.

Fig. 3. The distribution of economic activities and net income per year of randomly sampled households from Survey 1. Least poor households are classified as those with the top third net annual income of the total households sampled. Poor households are classified according to the national poverty line of Nepal. A factorial ANOVA model indicates significance of mean proportions between economic activities ($p < 0.01$) as well as from the interaction of economic activity and poverty class ($p < 0.05$). There was no significance in mean proportions between poverty classes.
of net income is significantly different both between different economic activities as well as the interaction between economic activity and degree of poverty. For the poorest households, the proportion of livelihood that comes from the sale of cannabis and the sale of subsistence food crops (e.g. rice, maize, wheat, potatoes, radish) increases in importance; whereas for the least income-poor households, the sale of liquor, livestock husbandry and off-farm income such as commercial, tourism activities and overseas remittance represents a greater proportion of livelihoods. While the spatial targeting of cost-efficient payments compensating liquor production corresponds to poorer households, such payments will clearly not be adequate in compensating opportunity costs as liquor production represents only 5.5% of total household income. Moreover, cost-efficient targeting will not be effective in reducing pressure on forest resources when more well-off households (from an income perspective) are responsible for the greatest pressure on forest resource degradation and potential impacts to water quality downstream.

**Perspectives of social actors**

Table 2 offers a number of perspectives from key social actors who represent the beneficiaries of the proposed PES in the Sundarijal catchment. The viewpoints of these actors highlight the emphasis on targeted payments in identifying where and in what form land-use change should be modified so as to enhance the likelihood for improvements in water quality. While there is agreement that livelihoods should shift to align with emerging markets, there is less unanimous support for the consideration of distributional equity of payments. Table 3 illustrates a social counterpoint to spatial targeting of payments according to externally determined objectives. According to a gamut of efficiency, effectiveness, and equity-oriented PES designs adapted from Pascual et al. (2010), preferences between villages for payment type and distribution are shown. In communicating payment designs to households, we emphasized that payments would be given in cash in relation to opportunity costs for 'compensation' and 'environmental additionality' designs, and based on a fixed overall budget for the 'egalitarian' design (e.g. equal distribution of payments across all households). Furthermore, we emphasized that 'household deprivation' based payments would reflect the elucidation of collective and household needs respectively and would thus be delivered as either cash or in-kind rewards. Overall, payment preference was significantly in favour of communal rather than individual payments; with particular emphasis on local user group management of the fund rather than control by local government (VDC) or SNNP authorities.

**Determining the legitimacy of PES targeting scenarios**

From household interviews and focus group discussions in the SNNP villages, it was suggested that payments should form a combination of individual incentives to improve skills sets and deprivations afflicting individuals as well as village-level benefits for collective activities that improve soil-quality, forest status and waste management. Indeed, the actual land-use activities of households are a function of a variety of capabilities in terms of intra-household dynamics and biophysical opportunities to manage land in particular ways. Moreover, we find a divergence between the degree of trust residing in formal institutions at the local level and more informal institutions built along existing social norms as well as between the actual wellbeing of communities and their terms for relocation. If not feasible, a communal payment might work. **Table 2** shows how perspectives of key social actors downstream implicated as beneficiaries (B) or intermediaries (I) towards targeting payments to achieve social, ecological and/or economic objectives. The perspectives provided here were obtained from individuals whose viewpoints do not necessarily reflect the institution to which they belong.

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Equity targeting</th>
<th>Environmental targeting</th>
<th>Economic efficiency targeting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sundarijal VDC (I)</td>
<td>“Land-use decisions must come from villagers themselves, according to their understanding.”</td>
<td>“Waste management and avoided deforestation are key.”</td>
<td>“Payment should be greater than benefits from alcohol production to spur economic activity.”</td>
</tr>
<tr>
<td>High Powered Commission for Integrated Development of Bagmati River Civilisation (I)</td>
<td>“Stakeholders downstream must be consulted before deciding how payments will be distributed.”</td>
<td>“Improving sanitation and reducing forest degradation are most important.”</td>
<td>“Generating alternative livelihoods that involve forest protection for these people. Loans can stimulate local entrepreneurship.”</td>
</tr>
<tr>
<td>Asian Development Bank (I; B)</td>
<td>“Surely payments should reflect what communities require in terms of basic needs.”</td>
<td>“Payments should be specifically targeted to particular forest conservation and sanitation activities that directly promote watershed protection.”</td>
<td>“Providing alternative energy options reducing pressure on the forest as well as livelihood training in new skills can shift the local economy.”</td>
</tr>
<tr>
<td>Kathmandu Upatyaka Khanepani Limited (B)</td>
<td>“...best solution is to compensate according to their terms for relocation. If not feasible, a communal payment might work.”</td>
<td>“Targeting deforestation requires shifting them [villagers] away from liquor production.”</td>
<td>“Demand for flower farming is high and this can be an alternative economic activity for them.”</td>
</tr>
<tr>
<td>Chief Warden- SNNP (I)</td>
<td>“This is a very delicate issue and exceedingly important. If locals are not satisfied with the outcome, at the household and user group level, it must be scrapped.”</td>
<td>“Minimal damage on forest resources should be key in any programme design.”</td>
<td>“The area is very viable for domestic and international tourism.”</td>
</tr>
<tr>
<td>Nepal Electricity Authority (B)</td>
<td>No comment</td>
<td>“We need to identify the specific areas where siltation and debris input to watersways is most extreme and target these areas first.”</td>
<td>“A portion of royalty can and has been going for local infrastructure development.”</td>
</tr>
</tbody>
</table>

**Table 2** Perspectives of key social actors downstream implicated as beneficiaries (B) or intermediaries (I) towards targeting payments to achieve social, ecological and/or economic objectives. The perspectives provided here were obtained from individuals whose viewpoints do not necessarily reflect the institution to which they belong.

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10 Preference for communal payments determined and managed by local user groups was significantly different from preference for any other payment type, regardless of whether payments were individual or communally provided by the VDC [Fisher’s Exact Test: p < 0.01].
“They [Sundarjal VDC] have not delivered benefits to our villages in relation to the resources they receive from central government. There is too much corruption, so whatever payment is allocated through the VDC, local user groups should have greater involvement in discussions with experts over payment choice and distribution.”

[Male focus group: Chilaunegaun]

The latter quotation reinforces the findings of Kerr et al. (2012) in which the reception to individual or collective PES payments to villages in Mexico was contingent on levels of trust between households and local leaders. A similar plea for self-determination through community deliberation and elected representatives for decision-making and payment allocation was evident in Chiapas, Mexico with regards to carbon payments (Corbera et al., 2007). Moreover, emphasis on the collective determination of payment choice and administration was a greater determinant of potential participation in the SNPN villages than whether payments should be individual or collective, in cash or in-kind, or whether they addressed targeted efficiency, effectiveness and development goals. From the interviews, it was determined that dissatisfaction with SNPN authorities was widespread due to the perception that villagers were unable to enhance their mobility or obtain the necessary forest resources they need for survival. Security measures were also identified as lacking within SNPN and perceived to be the responsibility of the VDC and SNPN authorities.

**Discussion**

At this point, it is necessary to emphasize the analytical rather than methodological support that the targeting matrix provides in elucidating our arguments by clearly acknowledging four response errors. These errors reflect: (a) information given by survey respondents rather than attempting to model water quality impacts associated with faecal coliform, eutrophication and soil erosion at the land-parcel level; (b) the subjective choice of delimiters for poverty and environmental effectiveness classification as averages, binary responses, or simply to distinguish differences between households; (c) the assumption of linear ecological impacts associated with calculating environmental effectiveness, and (d) interpolating household level data to spatially visualize discrete polygons of the geographical area where PES could be specifically optimized. However, we argue that collecting more sophisticated measurements of dynamic ecological flows entails substantial costs which are unlikely to be met (Norgaard, 2010). Furthermore, the measurement of poverty is itself a value judgement, which we have attempted to expand upon rather than narrowly confine to income effects. Delimiters were chosen expressly to illustrate variations between households and can very easily be modified to reflect social interests rather than to impose an arbitrary ordering of the state of the human condition. These response errors mirror those of previous studies that have sought to optimize PES design (Jack et al., 2009; Gauvin et al., 2010; Wünscher et al., 2006; Narloch et al., 2011). Indeed, the crude nature of our own targeting strategy serves to reinforce the argument of this paper that it is impossible to ignore uncertainty in optimizing payments by conveniently defining boundaries devoid of political context and assumptions of static ecological relationships.

The power behind the ‘targeting’ discourse of PES

In examining the targeting typology presented in Fig. 2, it is clear that trade-offs between the objectives are inherent in the choice of targeting strategy. These trade-offs between effectiveness, efficiency, cost-effectiveness and poverty alleviation are however only the tip of the iceberg as geographic patterns of well-being deprivation and/or land-use practices are often intertwined with household capabilities which themselves are linked to social processes between neighbouring households. For example, the distribution of opportunity costs for liquor production between households is influenced by family size (e.g. the larger the size, the less hired labour required) as well as caste divisions within the Tamang ethnicity (e.g. the Lamas or priest caste are not willing to sell alcohol on religious grounds). Optimizing payments according to opportunity cost or environmental additionality raises the question of how such behaviour is determined not only by household population dynamics, but also land endowment and quality as well as individual capabilities to transport liquor, graze livestock, or collect fuelwood (Corbera et al., 2007). Keeping in mind micro-scale differences between households, the more inclusive the targeting strategy purports to be, the more constrained is the understanding of the underlying dynamics causing specific configurations of deprivation, profitability and ecological vulnerability at the household level.

Stepping back from the perspective of household capabilities, the implications of the targeting matrix from a distributional perspective warrant a closer examination. While the proportion of ‘cost-efficient’ areas is fairly uniform as mentioned above, different households stand to gain or lose from targeting specific areas. For example, if environmental additionality alone is prioritised in distributing conditional payments, households who are less well-off in the villages of Chilaunegaun and Okhereni will be excluded in the distribution of payments. This can be seen by examining the two targeting scenarios where the two interpretations of poverty alone are illustrated. Conversely, when considering the two scenarios in which areas of poverty and environmental additionality overlap, the targeted areas are reduced substantially hence influencing the efficacy of prioritising environmentally vulnerable

<table>
<thead>
<tr>
<th>Community: any payment type&lt;sup&gt;a&lt;/sup&gt;</th>
<th>No payments&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Individual payments&lt;sup&gt;c&lt;/sup&gt;</th>
<th>Communal payments&lt;sup&gt;d&lt;/sup&gt;</th>
<th>Of communal: VDC/LUG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mulkharka (n = 51)</td>
<td>6 (12%)</td>
<td>18 (35%)</td>
<td>27 (53%)</td>
<td>8/53</td>
</tr>
<tr>
<td>Chilaunegaun (n = 24)</td>
<td>0 (0%)</td>
<td>6 (25%)</td>
<td>18 (75%)</td>
<td>0/67</td>
</tr>
<tr>
<td>Okhereni (n = 60)</td>
<td>2 (3%)</td>
<td>3 (5%)</td>
<td>55 (92%)</td>
<td>17/68</td>
</tr>
<tr>
<td>Community: of individual payments only&lt;sup&gt;e&lt;/sup&gt;</td>
<td>Cost-effectiveness or compensation</td>
<td>Environmental additionality</td>
<td>Household deprivations</td>
<td>Egalitarian payments</td>
</tr>
<tr>
<td>Mulkharka</td>
<td>6 (33%)</td>
<td>4 (22%)</td>
<td>3 (17%)</td>
<td>5 (28%)</td>
</tr>
<tr>
<td>Chilaunegaun</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>1 (17%)</td>
<td>5 (83%)</td>
</tr>
<tr>
<td>Okhereni</td>
<td>0 (0%)</td>
<td>3 (100%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>

<sup>a</sup> Statistically significant differences in payment preferences between the three communities (Fisher's Exact Test: p < 0.05).

<sup>b</sup> Statistically significant differences in payment preferences between communal and individual payments (Fisher's Exact Test: p < 0.01) as well as communal and preference for no payments (Fisher's Exact Test: p < 0.01).

<sup>c</sup> Statistically significant differences between villages in terms of preference of individual payment (Fisher's Exact Test: p < 0.05) with Chilaunegaun and Okhereni preferring Egalitarian and Additionality targeted payments respectively in relation to the more even distribution of individual payment preference in Mulkharka.
areas. In this manner, a clear trade-off between the objectives of effectiveness and poverty alleviation is visualised. Attempts to minimise trade-offs by targeting overlapping objectives will increase the funding available to induce land-use change and improve incomes or perceptions of well-being in small isolated areas, but fall short of confronting why such social and ecological patterns occur across the landscape. Moreover, by atomising poverty (both well-being and income poverty) as isolated from social norms and institutions, external targeting attempts are likely to exacerbate perceived inequity leading to new constellations of social and ecological vulnerabilities.

Of course, this logic is extolled by some hardliners of market-based PES theory who argue that PES should be about ‘paying for what you want’ rather than integrated approaches which consider social complexity and human well-being (Ferraro and Kiss, 2002; Engel et al., 2008; Wunder, 2008; Zhang and Pagiola, 2011). For these authors, PES is a technical process of matching nature with exchange value and associated financial flows clearly linked to the conservation objective at the lowest overall cost. Replacing trade-offs with ‘win-win’ solutions is a puzzle-solving process of merely rearranging financial incentives (Martin et al., 2013). Engagement with social actors is done on an individual basis under a strictly rational interpretation of costs and benefits as imposed by external actors. The perspectives of local people are either not prioritised or are simply dismissed as universal and subject to rational self-interest; hence manifesting a disparity of power between downstream proponents of PES and service providers upstream (Fisher, 2013).

In considering the power asymmetry between actors calling for targeted payments, it is necessary to reflect upon the ‘framing’ in which the proposed PES is being articulated. Far from an objective science of how environmental problems can be solved, there exists multiple ways of knowing, value sets and modes of governance for understanding, communicating, and approaching environmental problems (Sikor, 2013). It is pertinent that we understand how PES targeting privileges some values or modes of governance over others so as to identify how power differentials exist and how they may lead to injustice and unsustainable outcomes. The narrow economic focus of maximising ecological gains at the least monetary cost forms a part of a fundamental facet of the existing political economy. This refers to the expansion of markets into the environmental realm for the sake of capital accumulation (Kosoy and Corbera, 2010; Martin et al., 2013). The repercussions of this particular framing of eco-social relations serves to enhance control over resources by powerful actors downstream, glorifies self-interest over social norms for cooperation, and realigns priorities based fundamentally on economic priorities rather than ecological ones (Harvey, 2005).

Accordingly, sketching the contours of any externally determined payment distributions despite inclusive consideration of diverse equity and effectiveness objectives falls short of aligning with local self-determination. For example, providing payments to households located in the ‘gold standard’ targeting scenario will not compensate for histories of institutionalised racism against the Tamang ethnicity that cause variable patterns of well-being deprivation across households (Campbell, 1998). Such social reflections may explain why collective compensation was significantly preferred over individual payments in each of the three villages. It is interesting to note that preference over individual payments was significantly greater in the village of Mulkharka than the farther villages. It can be surmised that Mulkharka, with a greater divide between resource wealthy and resource poor households, associated perceptions of unequal opportunities, weaker social institutions, as well as preference for new economic opportunities might have influenced a different preference for individual payments than the more interior villages of SNNP.

Towards greater socialisation in the targeting process

Amidst the backdrop of mistrust and lack of consensus over common needs and priorities for natural resource management in the Sundarjal catchment, additional attempts to impose external objectives may exacerbate perceptions of inequity. This possibility may have particularly negative ramifications given a history of wider socio-political tensions in Nepal. Indeed, evidence has indicated that greater inequity amongst rural villages in the mid-hills led to an escalation of violence during the Maoist insurgency (Nepal et al., 2011). The implications of historical political economy in the region underscore the perils of poorly conceived or overly simplified conceptions of equity and the salience of legitimate and contextually crafted arrangements for land-use and natural resource management. Consequently, external perspectives of distribution efficiency and effectiveness contrast with local understandings of fairness, with such misalignment reinforced by differential power gradients between the sponsors of PES and identified service providers to the scheme (Van Hecken et al., 2012).

However, the use of incentives remains a powerful motivator of behavioural change (Fehr and Falk, 2002). We therefore make the argument that PES should return to its bare bones...as an incentive-based negotiation. If such a negotiation is to play a role in addressing socio-ecological conflicts, it is necessary to question who proposes particular targeted objectives and what power or legitimacy such actors possess in pushing a particular agenda forward. The legitimate needs and values of negotiating parties should be articulated through continuous deliberation to bear upon what is an intrinsically political decision. We propose that PES should not be viewed merely as an instrument to better align social interests under any externally imposed value system. Rather, it should be oriented as a collective action exercise that emerges endogenously (or not) from reciprocal interactions over time in which the use of incentives (however negotiated) forms an integral component of sharing benefits in the management and access of natural resources (Kerr et al., 2014).

PES objectives should be malleable to existing and evolving social understandings and norms at various spatial and temporal scales. The form and condition that the payment takes must also be embedded within existing social norms appropriate for influencing individual behaviour. While our argument has been centred against the prioritisation of payments as a purely neoliberal exercise, there is nothing wrong with differentially distributing and allocating incentives across the landscape in order to satisfy both human well-being and long-term ecological health. Indeed, common pool resource regimes have successfully co-created their own natural resource management rules in this way resulting in resilient socio-ecological systems (Singh, 2013). The keyword here is ‘co-create’, in which the deliberation of evolving needs and diverse languages of valuation is a critical procedural component of distributional outcomes and resulting land-use practices. In this manner, a ‘social vetting’ process would result in vastly different outcomes than those ‘targeted’ under a neoliberal stance and would do so by placing justice and collective benefit as core components of resource distribution rules.

Given this understanding, there is room to experiment with amalgamating the more procedural justice-oriented features of collective resource management with the use of incentives to target particular objectives. An interesting avenue of research lies in using social multi-criteria evaluation to design a PES strategy according to a set of criteria reflecting the conflicting values and perspectives that exist between different social actors. Alternatives to be considered can reflect a diversity of PES targeting strategies which would be evaluated against the criteria set to allow critical judgement to bear upon each proposed eventual incentive arrangement. The ultimate objective would be to design a PES scheme...
which ‘targets’ as many identified criteria as possible while maintaining the legitimacy of the process through continuous deliberation. We can then move beyond isolated and objective solutions in favour of a targeting approach to PES that is based upon the social resolution of diverse and legitimate ways of knowing (Garmendia and Pascual, 2013).

Conclusions

While conceptually convenient, we argue that externally imposed strategies of cost-effectiveness, efficiency and poverty alleviation for optimising PES reinforce the atomized nature of black-boxing ecological and societal relationships under a dominant neoliberal narrative. Ecosystem services are fundamentally socially interpreted benefits provided by nature and result from systems of local knowledge and land stewardship that together manifest in the delivery of particular services that are not only of value for human well-being but also permit society to exist (Muradian and Rival, 2012). While social norms have the potential to exhibit a strong ethic of self-maximisation, such as in market-integrated societies, why must natural resource managers ignore the possibility that different social norms or less convincingly, that any social norms influence the rational self-interested individual in making land-use decisions? Thus, if environmental concerns have social emergent properties, it is not possible to capture collective dynamic relationships with the environment through a single narrative no matter how holistic it is in considering multiple scales or precisely addressing multiple political objectives. Spatial visualisations that fail to be explicit about the legitimacy of the social narrative considered (or not considered) will not challenge or compare existing human-environment value systems. Rather than picking and choosing services for beneficiaries with the greatest purchasing power, we must acknowledge that socio-ecological systems are complex mosaics of highly managed and natural systems which provide a multitude of ecosystem services through a process of dynamic and evolving social processes. Hence even the most inclusive attempts at “win-win” (or even win-win-win ad infinitum) outcomes will still lose unless researchers, scientists and project managers move beyond treating socio-ecological systems as mathematical puzzles to be solved and instead recognize the inherent tensions and trade-offs of local and expert knowledge and irreducible value systems.

We suggest that PES should not be viewed merely as an instrument to better align social interests under any externally imposed value system, but should rather be understood as a social construction that is mediated by local realities and how these realities may influence the form and terms of negotiation and design of solutions (Corbera et al., 2007). The emphasis on the social construction of nature’s benefits to humanity and the fragile and dynamic balance between ecological relationships, human management systems and the confrontation of value ethics that underpin them preclude the possibility that conservation policy tools such as PES can be implemented ex-situ. Instead, deliberative processes for the distribution of landscape management providing a suite of social and ecological benefits can highlight the relevance of group identity and collective consciousness that may result in the negotiation of outcomes that are considered more fair or legitimate (Parks and Gowdy, 2013). Targeting efforts for PES should not only identify trade-offs between multi-dimensional objectives but assess the extent to which such trade-offs are socially legitimate. Spatial visualisation for targeting ecosystem services to compare multiple legitimate narratives and therefore sets of criteria held by different sets of social actors can act as a form of sensitivity analysis not of variation across scales but across different languages of valuation.

More research is needed which examines the nuanced responses of endogenous preferences or participation in collective action when a varied set of both individual and communally-oriented incentives are introduced (Narloch et al., 2012). Such analysis would be particularly relevant for the proposed PES scheme in the Sundarijal catchment, where levels of social capital and gradients of household well-being differ between villages. Spatial analysis of socio-ecological systems could involve the development of maps reflecting formal and informal institutions as well as plural values and perspectives regarding ecosystem services and local needs or constraints. These maps could be developed in concert with a participatory method such as systems dynamics modelling to examine how multiple interpretations of socio-economic and ecological systems are intertwined and how these might change over time. Only when multiple conceptualisations of eco-social relations are expressed and open to critical deliberation will PES optimisation have the legitimacy for achieving what the various ‘publics’ have to value.

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