ADAPTIVE VALUE OF PARTICIPATORY BIODIVERSITY MONITORING IN COMMUNITY FORESTRY, NEPAL

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SUMMARY

In the context of action research in community forests, stakeholders' values for biodiversity can be elicited, communicated and understood with the help of a multidimensional conceptual framework. This incorporates levels of diversity (genes, species, habitats and processes), types of values (direct use, indirect use, option and existence) and stakeholders. We explore the effect of using this framework on forest monitoring, learning and communication, and wider implications for conservation, in Baglung District (Nepal). Monitoring was initially an unfamiliar concept to villagers, but the process clarified its purpose, whilst helping to elicit and exchange values and knowledge amongst stakeholders. This precipitated proposals for silvicultural experimentation and social inquiry into the diversity of users' needs. The framework allowed the translation of local value statements into categories recognised by other actors. It aided external stakeholders in understanding the factors contributing to values held by community forest users. Villagers' appreciation of 'quality' forest did not necessarily equate to the most 'biodiverse' forest, but rather the greenest and densest and that stocked with useful species. Elite domination, tenure and access to markets affected values assigned and behaviour in forest management. Elicitation of these values provoked questioning of forest management decisions and benefit sharing among community forest users. This in turn stimulated more democratic forest management and more inclusive, wide-ranging biodiversity values. We suggest that participatory monitoring is more conceptually challenging than is usually recognised, and that the links between equity and conservation merit further attention in different cultural contexts.

KEY WORDS

Adaptive management; environmental democracy; equity; ethnobotany; forest management; indicators; tenure

INTRODUCTION

Community or participatory forest management has become a popular model for sustainable resource management over the last decade (e.g. Gibson *et al.* 2000; Poffenberger 2000; Skutsch 2000; Agrawal & Ostrom 2001). Although monitoring and evaluation (M&E) of forest management is key to success (Sokh & Iida 2001; Wollenberg *et al.* 2001a; Hartanto *et al.* 2002), most assessments are through the eyes of outsiders rather than of the forest users themselves, using criteria such as forest cover, land use change and floristic composition (e.g. Jackson *et al.* 1998; Webb & Khurshid 2000; Nagendra 2002; Straede *et al.* 2002; Gautam *et al.* 2004; ChunQian *et al.* 2005). Whilst forest users have contributed to externally-led evaluation processes, for example through the interpretation of aerial photography (Mather 2000), rapid rural appraisal (Jackson *et al.* 1998) and responses to forest extraction surveys (Nagendra 2002; Straede *et al.* 2002), practitioners take the view that community forestry monitoring will only be sustainable and meaningful if developed by the communities themselves as tools to enhance their own learning and understanding (Wollenberg *et al.* 2001a; Wollenberg *et al.* 2001b; Hartanto *et al.* 2002). In short, scientific evaluations are useful to scientists, but a more participatory adaptive approach is needed by community forest managers.

The biodiversity concept might at first seem an odd addition to participatory monitoring processes. Participatory approaches often pay more attention to social, economic and organisational indicators (Hartanto *et al.* 2002; Smith *et al.* 2003; Springate-Baginski *et al.* 2003). Rural communities are attributed with holding values in relation to biodiversity (Brown 1998; Lawrence *et al.* 2000; Nunes & van den Bergh 2001; Brandon *et al.* 2005), but the term originates in, and the discourse is dominated by, the conservation ethics of the industrialised world (Gaston 1996; Tangwa 1999; Potvin *et al.* 2002). Within that discourse, its meaning is contested, varying between the descriptive, quantitative, conceptual and normative (Gaston 1996; Perlman & Adelson 1997; Mayer 2006). In this paper we propose that the interactive use of a conceptual framework of 'biodiversity' values has an important contribution to make to participatory forest monitoring, precisely because of this richness of meaning. We describe the framework and its use in exploring participants' awareness of their own values, knowledge and goals in relation to biodiversity. We also analyse its potential contribution to communication between local and scientific perceptions, and in turn to conservation.

In doing so, we acknowledge the strong scientific literature about local knowledge and values for biodiversity. This paper is not concerned primarily with describing local values for biodiversity, but rather analysing a process for understanding and communicating those values. Much ethnobotanical work has a strongly utilitarian focus (Lawrence *et al.* 2000; Potvin *et al.* 2002), many studies being based on counts of 'useful species' or uses of species (Boom 1987; Prance *et al.* 1987; Phillips & Gentry 1993a; Phillips & Gentry 1993b; Campbell *et al.* 1997; Fabricius & Burger 1997; Hellier *et al.* 1999). Indices of 'species used' may not correlate with habitat

values (Phillips *et al*. 1994), and recent work has moved towards more locally defined values (Lawrence *et al.* 2005). Whilst recognising the value of such external analysis, and participating in it ourselves, in this paper we aim to focus more on the utility of the analysis to the communities themselves. Recent work analyses the range of methods available for participatory biodiversity assessment (Sheil 2001; Sheil & Lawrence 2004; Danielsen *et al.* 2005a). A particularly significant quantitative analysis of the conservation actions taken by local people as a result of participating in biodiversity assessment was conducted in protected areas, where conservation is the primary land use objective (Danielsen *et al.* 2005b). In contrast, our focus in this paper is to reconcile the management objectives of community forestry with the need for understanding and communication about biodiversity.

Building on these ethnobotanical and participatory experiences, it is logical to explore the full range of values associated with all the constituent parts of biodiversity, and to recognise that different actors value components in different ways (Brown 1998; Lawrence *et al.* 2000). Our conceptual framework (Table 1), is based on three dimensions:

- constituents of biodiversity – often defined as genes, species, habitats and the processes that link them (e.g. Nunes & van den Bergh 2001), including the values of individual components, and of diversity itself, at each level;
- types of values associated with each constituent - often categorised by economists and others as direct use (e.g. food, fuel), indirect use (e.g. environmental services such as soil conservation), non-use or existence (e.g. spiritual) and option values (reserved in case of future need) (e.g. Blench 1997); and

- different stakeholders, or communities, attributing each type of value to each constituent of biodiversity.

In doing so, we address the following questions: (1) what is the usefulness of the biodiversity conceptual framework in (a) contributing to community forest monitoring and indicators, (b) stimulating a learning process among forest users, and communicating between stakeholder groups? and (2) what are the wider implications for conservation of both the process, and the knowledge gained through this process?

This paper is based on qualitative action research conducted within a wider participatory research project which aimed to develop community monitoring systems for forest management in Nepal (Malla *et al.* 2002). Forests play an important role in rural livelihoods in Nepal, providing inputs to farming systems and subsistence resources for the landless (Malla 2000). Nepal has a long history of community forestry, from the National Forest Plan of 1978 to the Forest Act of 1993, in which Forest User Groups (FUGs) were clearly defined, and implementation guidelines produced (Acharya 2002; Edmonds 2002). In contrast to the Indian model of Joint Forest Management (Rishi 2003), in Nepal management is formally handed over to the FUG after approval of an operational plan.

Action research is self-reflective enquiry undertaken to improve the rationality and understanding of practices and their contexts (Carr 1986, p. 162). This approach is highly relevant in complex social and ecological systems (Bawden 1991), but can be unfamiliar to natural scientists more accustomed to relying on objectively-gathered quantitative data. Reliability derives from the commitment of participants and

relevance to their livelihoods (Pretty *et al.* 1995), the reflective and iterative approach (Reason & Bradbury 2006), and the internal logic of connection between findings and context; validity derives from the examination of patterns across a range of case studies (\ 2003). The authors of this paper sought to interpret these experiences as facilitators and researchers, in the context of international concerns about biodiversity conservation.

METHODS

Research site and participants

The research was conducted in Baglung District in the middle hills of Nepal. Planning and decision-making within the FUGs is carried out by executive committees. Many FUGs in Baglung have banned grazing and extraction in order to promote forest regeneration, but this is determined by committee members who have not taken part in open discussions about the potential supply of forest products such as firewood, fodder and timber, a situation not uncommon in Nepal (Branney *et al.* 2001; Ojha & Bhattarai 2003; Adhikari *et al.* 2004). Methods which explicitly help FUGs to plan and monitor their management can therefore enhance the value of the forest to members, by clarifying the consequences of over- or under-harvesting and of distribution of benefits, and contribute to more equitable decision-making.

The goal was to support FUGs and foresters in each of five villages of Baglung District, in developing forest monitoring systems. It was facilitated by researchers from the UK and ForestAction, a national NGO based in Kathmandu (Paudel *et al.*

2000; Malla *et al.* 2002). A shortlist of villages representing different social and environmental conditions was prepared with the District Forest Office, and FUGs were then invited to participate (Table 2). To ensure participation by different interest groups, including men and women, and to avoid the tendency for domination by wealthy and high caste groups (Timsina 2003), participants were selected by *tole* groups (close social units which are relatively socially homogeneous), into which villages in the middle hills and mountains of Nepal are structured. One woman and one man were selected by each *tole*, thereby ensuring representation of the range of social groups.

In addition to the FUG members, forest rangers and local representatives of national FUG networks also took part. Forestry officials were responsible for handing over forests to local communities and providing legal and technical advice as well as for monitoring the management of forest resources. The FUG networks were campaigning for users' rights and awareness.

Workshops, reflective meetings and field activities were conducted over eight months, and designed to develop goals, criteria and indicators for monitoring (Malla *et al.* 2002) in a process similar to that described by Ritchie *et al.* (2000). The biodiversity component evolved within this framework, and used semi-structured interviewing in combination with workshops and field visits (Table 2) to help participants explore the significance of biodiversity in their forest management activities. Semi-structured interviewing started with a checklist of open questions designed to stimulate discussion around the components of biodiversity and their values. In this case, the facilitators kept the biodiversity framework constantly in mind, focusing on the three

dimensions of level of diversity (gene, species, etc.), type of value (use, existence, etc.) and stakeholder (Table 1).

Values for habitats and ecological processes were relatively abstract concepts for many villagers and were best explored in the forest itself, where they became more immediate and tangible (Lawrence *et al.* 2000). Questions such as 'What do you like about this place?', 'What do you not like about this place?', 'Has it changed since it became a community forest?' and 'Do you prefer this place to the last one? Why (not)?' stimulated discussion and elicited values related to habitat and set species values in a wider context.

Detailed notes were taken of the discussion to allow later analysis of the discourse in relation to the biodiversity values expressed. Analysis was conducted both *in situ*, through reflection on changing values and relevance of the themes identified (Reason & Bradbury 2006), and through thematic analysis (Yin 2003) of the transcripts of interviews and workshop presentations. The conceptual framework (Table 1) provided the structure for organising the qualitative results, and the documentation of interviews and workshops provided the explanatory context for analysis (Yin 2003).

RESULTS

Contribution to community forest indicators

At an early stage the words 'monitoring' and 'indicators' were found to be problematic in a community forestry context. Literal translations (*anugaman* and

suchak, respectively), commonly used by foresters, were not used by villagers, and the word anugaman was even understood rather negatively to refer to seniors checking the work of junior staff, or foresters checking on villagers. Villagers found the link between criteria and indicators too abstract, while brainstorming led to a disparate list of immediate concerns (subsistence, income and labour inputs, resource rights, and FUG organisation). The focus therefore shifted to developing a novel approach which provided insights both in relation to indicators and the interactive learning process stimulated by participatory monitoring.

As a first step in developing biodiversity indicators, facilitators reflected on the focus group discussions, inferred possible biodiversity indicators and presented them to the participants for consideration. This led to clearer understanding of the utility of an indicator and heated discussion about the lack of tangible information available to FUG members (or indeed foresters). Participants could then explain what indicators were and why they were needed, and identify their own biodiversity indicators in some of the communities (Table 4). Two FUGs set up permanent forest monitoring plots, and others proposed experiments to address the information gaps.

Change in values and knowledge

Perceptions, awareness and values were not only revealed but also changed through the research process itself. The notion of what constitutes an ‘important’ species evolved through forest walks, where groups argued about which species had uses, and advocated the value of beauty or ecological diversity as well as use. FUG members themselves came to general agreement that it is very difficult to define importance,

and one pointed out ‘You can’t ask which is the most important species, it is like asking which child is the most important in the family.’

FUG members in both Pallo Pakho and Bhane revised their views on how many useful species there were in their forests. In Pallo Pakho the forest walk led to an increased estimate from 24 to 38 species, and by the next day to a total count of 55. One participant noted, ‘Before, we thought that only sal [*Shorea robusta*] and chilaune [*Schima wallichii*] were important but since the forest visits we see there are other valuable species.’

Discussion around these observations led to an awareness that the forest as a whole was more valuable than had been hitherto stated, and that a diverse and healthy habitat was more important than the sum of its ‘useful’ species, as illustrated in the comment, ‘We take interest in any new species because it shows that the forest is improving.’

Communication between stakeholder groups

Observations and group discussions during the forest walk led to an energetic exchange of views, which prompted experimentation. For example, whilst discussing how to eliminate an invasive ‘weed’ [*Eupatorium adenophorum*], some participants asserted that the plant was also a soil improver. This discussion led participants to take foliage home to test it in making their own compost and months later they reported success. Other experiments were proposed as a result of differences of opinion. For example in Pallo Pakho, different views were expressed as to whether regeneration should be cleared in an area up to 12 or 17 times the diameter of the tree

until one participant proposed observation to resolve the argument. In Sirupata, participants proposed experimental or learning actions at their FUG meetings, including ‘observe which species grow best under what conditions and plant accordingly’; ‘regularly check the growth and condition of seedlings after cleaning’; ‘categorise those plants that have regenerated naturally or been planted’.

In most villages it was the first time that women had participated with men in mixed group discussions. Women took the initiative in proposing experiments based on their field observations, revising estimates of species richness, and writing and performing songs as a spontaneous form of feedback during the workshops. Women’s values emerged particularly strongly after the forest walks, where the demonstration of their knowledge and experience increased their confidence in summarising their opinions to the full group.

Relations between foresters and villagers were also affected positively by the process. During forest walks and workshops, foresters found that they did not have the answers to all villagers’ questions, for example about the effect of *Eupatorium* in improving soil fertility. Such revelations surprised FUG members and could have been threatening to the foresters’ professional standing, but because they were involved in the action research, they were able to support the villagers’ proposals for experimentation. In reflection sessions, one forest guard said for example ‘I feel much clearer what outsiders mean by ‘biodiversity’ and I can contribute more easily to a discussion about it.’

FUG members and foresters also became more aware of the diversity of forest users’

needs. In the three least effectual communities the action research showed that earlier species choices for reforestation projects had been dominated by development agencies or local 'elites' (a term common in Nepal for powerful groups within villages); 'The sallo [*Pinus roxburghii*] that we planted is not in fact all that useful to us and we might as well get rid of them. [We should] plant as many species as possible to see what will grow' (Sirupata FUG resolution).

In addition to learning amongst villagers, the facilitators learnt about local values through relating discourse to the biodiversity framework (Table 1) and summarising it (Table 5). This information is consequently available in terms comprehensible to other, absent, stakeholders such as conservationists.

In these communities, biodiversity was valued most at the species level, followed by processes and habitats. The components of biodiversity most explicitly valued were, in decreasing order of importance:

- individual species: expressed as those useful for timber, fodder and fuel;
- species richness: expressed as numbers of useful species, and increase in species richness;
- ecosystem integrity: expressed as forest health and quality;
- ecosystem function: expressed as effect on climate and soil erosion;
- ecosystem diversity: expressed as a range of different types of forest;
- within-species diversity: low awareness in the forest context.

The kinds of value most in evidence were direct use values, followed by indirect use. Compared with species preferences, preferences for particular habitats were less clear-

cut and related more to general principles about what is valued in a habitat (e.g. that it should be sustainable, shady, diverse, with good soil and water). For example, 'thick' forest was good not only because it was better stocked, but also because it was healthier. Diversity was also valued as 'diversity of use': 'This is good forest because it has many useful things in one place. Usually sal [*Shorea robusta*] and chilaune [*Schima wallichii*] grow in different places, but here they are all together'. At the same time, habitat diversity value was expressed: 'We like each place for what it has, the only thing we don't like is barren land'. Option values were expressed only where rights were secure. FUGs were prepared to invest in forest management for potential future benefits, where they believed that the forest belonged to them. Indirect use-values such as ecosystem function and existence values were expressed only later in the process, and in the forest itself, 'Here is better because of the shade. It is more than a question of the usefulness, here we have shade to sit in'. Existence values expressed across the socioeconomic range indicated appreciation of the 'greenery', peace provided by the forest, and the beauty of bird song.

The comparison of five communities permits interpretation of the factors contributing to biodiversity values. Two of the FUGs had large, relatively healthy forest (Pallo Pakho and Jana Chetana) while the others had small forest areas (Bhane and Sirupata FUGs, and Jyamire non-FUG). However, tenure had more effect on values than did forest quality. For example, from a viewpoint in Pallo Pakho, clear differences were visible between the dense green community forest, and an area of scattered trees on bare slopes where tenure conflicts with a neighbouring FUG had led to overgrazing. In Jyamire, where the forest was still under Forest Department control, the forest was neglected. Even in community forest, villagers had little confidence in the stability of

tenure policy, and it was only in the long-standing FUG in Pallo Pakho that trust had been built up through experience.

DISCUSSION

Community forest monitoring and the links with learning

The term 'monitoring' has a number of meanings, including the rational process of checking on project implementation and progress, and the more open processes related to action learning. The management rationale of working backwards from targets to indicators, and the abstractions involved in working from principles to criteria and indicators (Mendoza & Prabhu 2000) are products of formal education and modern (in the sense of reductionist, materialist) culture. Confusion about monitoring is not however limited to the community level (Ojha *et al.* 2003).

Yet these challenges are rarely discussed. Our experience shows that communities could identify biodiversity indicators and found them useful, but that this occurred in a non-linear fashion through processes of social and biological inquiry, being linked inevitably to informal types of adaptive management. Some communities included biodiversity indicators in their action plans, all of them however gave more attention to the information needs identified through the attempt to define indicators, for example in defining the experiments described.

Consequently, the emphasis in community forest monitoring is firmly on learning, a central concept in adaptive management (Allen *et al.* 2001; Douthwaite *et al.* 2003;

McDougall & Braun 2003). Importantly therefore, the process of identifying indicators here stimulated a research process, as part of a more active (and adaptive) approach to forest management. M&E is usually considered to be the end point in a project process or management cycle. Here, however, the order was reversed, and by starting with a participatory monitoring process, questions were asked and information needs identified, that led to new research processes integrated into the forest management.

Learning through participatory action research also strengthens participants' awareness of their own and each others' values and knowledge (Hartanto *et al.* 2002). Here for example, participants questioned past species choices, and the value of species and management actions. Furthermore, the comparison of five villages shows the effect of action research in different contexts. While the more established FUGs decided to set up forest monitoring plots, those still struggling for representative organisation focused more on actions relating to clarification of roles, rules and benefits. Instead of adopting biodiversity indicators, the three less functional communities decided to collect systematic information about the forest product needs of their members. It is clear that biodiversity benefits from stability, not only in relation to the tenure issues, but also through transparent and shared decision-making processes.

Bridging stakeholder interests

The participatory nature of this type of monitoring can lead to a 'convergence of interests and concerns' among stakeholders (Hartanto *et al* 2002). This is not to say

that participation leads to consensus and improbable levels of mutuality. Transparency can however (1) expose political interests and enhance democratic processes, (2) increase awareness of rights and therefore commitment to resource management, and (3) improve understanding amongst stakeholders so that they are able to work together more efficiently. Here, this research process contributed clearly to the first and second of these, and by elucidating and translating local values into biodiversity terms, contributed indirectly to the third. Such analysis helps planners and facilitators understand the factors affecting biodiversity values, and therefore address those that undermine them, such as insecure tenure, elite withholding of information, or incomprehension of policy.

Little has been written about the impact of tenure on biodiversity values, perhaps on the assumption that it may be inferred from the much larger literature on tenure and management of forests and trees (Akhter & Sarker 1998; Nagendra 2002). Our research demonstrates that the same species and habitats were valued in different ways according to whether they were on private farmland, forest land with secure access rights, or land with contested rights. In Bhane and Jyamire, the communities with least clear forest tenure, trees on private land were managed better than in the forest. Even in the well-organised Pallo Pakho FUG, three participants summarised their experience of the biodiversity research process as ‘Before, we thought there were more tree species on the private land than in the forest but now we are increasingly finding more and more species in the forest’.

While there is a clear implication that secure tenure rights enhanced biodiversity value, there were other aspects of security that also contribute. These were revealed

through an analysis of values within each community, in relation to wealth and social status. The relatively long history of community forestry in Nepal has prompted considerable analysis of social diversity (caste, ethnicity, gender, wealth) (Agarwal 2001; Smith *et al.* 2003; Adhikari 2004; Adhikari *et al.* 2004). The FUG represents the interests of different wealth groups, castes and sexes, but has commonly been dominated by elites (Timsina 2003), which are more market-oriented, and consequently hold values for a narrower range of species. Poorer households, which are more subsistence oriented, are more dependent on traditional medicine and use a wide range of medicinal plants. Here, furthermore, the poorer households expressed only use values, while the elites showed more tendency to express option values, indicating their relative freedom to consider longer time frames.

While biodiversity values are both actor- and location-specific, power relations among those actors also influence the values held (Brown 1998). Conservation discourses are important strands in rural people's struggle to manage local forests (Ganjanapan 1998; Kijtewachakul *et al.* 2004). It was evident in the case studies here, especially where community forestry was not functioning well (Jyamire, Sirupata and Bhane), that elite interests could serve to monopolise communication and decisions (e.g., species selection examples mentioned above). Elite groups had started to use biodiversity as a means to gain external approval, recognising the centrality of biodiversity in national and international policy: 'We decided to leave the forest alone [i.e. prohibit harvesting], because we hoped that in future someone might come and reward us for protecting it' (Bhane FUG committee member).

Many have pointed out the need for community forestry to become more inclusive (e.g. Agarwal 2001; Timsina 2003). This type of participatory monitoring process can stimulate a more democratic FUG, which in turn responds to a wider range of needs and therefore wider range of (and more local) species valued, because those are those preferred by the poor. As long as use is managed within a process ensuring sustainable harvesting, there is a link between democracy and conservation. Nevertheless, this interpretation must be cautious. If the values and actions of FUG members were contributing to conservation, this was not necessarily explicit and conscious. Changes in tenure, markets and economic development could all affect values. Many communities were becoming more market-oriented with a shift to increased values for a smaller number of commercially valuable species.

Implications for conservation

There is currently much debate and concern about the links between participation and conservation (Campbell & Vainio-Mattila 2003; Wells & McShane 2004), with one school of thought proposing a move away from the conservation agenda to adaptive co-management (Armitage 2003; Berkes 2004; Armitage 2005). The objectives of community forestry are related. Many authors suggest that community forestry has contributed to biodiversity conservation (Nurse *et al.* 1994; Klooster & Masera 2000; Bray *et al.* 2003; Adhikari *et al.* 2004; Kijtewachakul *et al.* 2004). However, as we have shown, biodiversity is not an uncontested, universally understood term. Whilst villagers could and did express their appreciation of ‘quality’ forest, that appreciation did not necessarily relate to what ecologists identify as the most biodiverse forest, but rather to that which was greenest, most dense and stocked with useful species.

Individuals valued biodiversity through lenses of cultural and social meaning. In this case both internal factors (status and domination of the FUG committee) and external factors (tenure, markets and power relations) affected values and behaviour.

Using an action research approach, and a biodiversity framework that facilitates learning and communication about the full range of values, conservationists and policy makers can understand and address constraints to valuing biodiversity. They can thereby more clearly appreciate where community forestry contributes to conservation, and understand where complementary approaches are needed, for example in protecting species that are overlooked by communities.

This research took place in Nepal, where community forestry operates within a specific policy and cultural context. To what extent might the experiences described here apply to other contexts? It is in the nature of action research that the outcomes are highly context specific, an aspect that can be daunting to more conventional researchers, but which is intrinsically linked to the need for participants to experience the research process to understand their own and others' perspectives and to take action. We therefore suggest that while the method is widely applicable, there are a number of questions which will benefit from further research. In particular, it will be valuable to investigate how widespread are the cultural and conceptual challenges of monitoring, which we believe are more prevalent than is revealed in the existing literature. Longer term research is needed to track the durability of the value changes that result from the kind of participatory processes described here.

CONCLUSIONS

Including biodiversity as a guiding framework within an action research process demonstrated new insights into the participatory monitoring process, the kinds of values that forest users have in relation to biodiversity, and the contribution that institutional and social factors make to such values. Rather than being a fixed stage in a management cycle, somewhere between planning and achievement of targets, monitoring is an on-going stage in the adaptive management cycle, and can itself lead to the identification of information needs and experimentation. While indicators are an unfamiliar notion to many community forest users, the action learning process can demonstrate their utility and lead to the adoption of indicators relevant to the community's needs.

Biodiversity is valued in many ways by community forest users, and the use of a multidimensional framework to guide facilitators in action research helps participants identify and communicate values that go beyond the utilitarian, and beyond individual species. While this helps to show that community and conservation stakeholders have more in common than is often recognised, it also helps to identify areas where conservation action can support community forestry, and where complementary action is needed.

By introducing biodiversity as a concept which could help the FUGs to shape indicators, in particular for forest condition, participants developed their views on which species and habitats are useful, how many species there are in the forest, became more curious about the concept of biodiversity; and chose to include

biodiversity indicators in their monitoring plans. The method helped to stimulate discussion about useful indicators of forest condition, and thoughts and debate about what had changed and why. In addition, it provided a useful framework for highlighting differences between individuals in terms of what they value. This is an important foundation for exploring who makes decisions based on whose values. By making such differences explicit and transparent, the approach can help to enhance consciousness of environmental quality and the equity of decision-making and benefit-sharing, which can in turn contribute to stronger biodiversity values. Conversely, the research showed that where institutional and organisational aspects are insecure or poorly understood, forest quality and silvicultural experimentation are low priorities. In short, the social and technical go hand-in-hand, such that when the ground rules are sorted out, the way is cleared for the development of ecological values and knowledge which helps community forestry contribute to conservation.

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Table 1. The biodiversity values framework. In each cell different stakeholders may have different values and diversity or specific individuals may be valued.

	Direct use	**Indirect use**	**Existence**	**Option**
Genes				
Varieties				
Species				
Ecosystems				
Processes				

Table 2: Characteristics of the villages

Characteristics	Pallo Pakho	Jana Chetana	Bhane	Sirupata	Jyamire
FUG	Well-established, functioning, representative	Disorganised, unrepresentative	Highly disorganised, unrepresentative	Disorganised, unrepresentative	none
Ethnic composition of FUG	Homogeneous	Mixed	Homogeneous	Mixed	Mixed
Forest type	Sal (*Shorea robusta*) and chilaune (*Schima wallichii*)	Mixed (natural)	Katus (*Castanopsis* spp.) - chilaune (natural)	Pine (plantation)	Mixed (natural)

	(natural)				
Forest area / household ratio	0.1	0.8	0.1	<0.1	0.1
Forest resource utilisation	green firewood	green firewood	grass / dry leaves and twigs	grass / dry leaves and twigs	grass / dry leaves and twigs
Altitude (m a.s.l.)	<1000 m	>1500 m	<1000 m	1000-1500 m	1000-1500 m

Table 3: Steps in the biodiversity action research process

Day	Activity	Description
1	Group discussion	Facilitators introduce the topic and participants discuss values around the guide questions
1	Resource map	Villagers and foresters prepare a map of the community forest and use this as the basis for planning the forest walk
2	Forest walks	The group plan a route to visit a range of sites intended to help them and the researchers discuss the different kinds of forest which they manage. The discussion during the walks focuses on species and habitats observed and on ecological processes
2	Feedback discussions	At the end of each day reflection meetings with participants, and later with forest guards, clarify and consolidate the findings of the day
3	Reflection and analysis	Further discussion with villagers and forest guards draws out patterns and explanations from the results

Table 4: Biodiversity indicators identified by workshop participants

Community	Indicators
Pallo Pakho	Resource increment in sample plots; like natural forest; appearance of natural regeneration in plantations; depth of leaf litter; number of species in forest; so thick you cannot see people in the forest
Jana Chetana	Increasing numbers of good plant species; Thinning, pruning and cleaning activities carried out; No damage from grazing; Dead, dying and diseased trees removed (in particular, removal of *liso*); Forest productivity; Landslides and soil erosion reduced; Wild animals (birds); Condition of different age groups of trees; Tree density; Shade; Presence of plants with market value; Potential to meet the requirements of the users
Sirupata	[most indicators were of management activities, but included:] Encourage natural regeneration; Reassess forest products needs; Categorise those plants that have occurred as natural regeneration and plantation
Bhane	Both communities were concerned with establishing and observing rules and procedures.
Jyamire	

Table 5. Biodiversity values inferred through the PM&E process, classified according to the framework used in the study

D = direct use (consumption or sale)

I = indirect use (environmental service)

E = existence value (appreciation of beauty; intrinsic value)

O = option or bequest value (here including political value, or the realisation that it is of value because others want it)

	Village				
Value	**Pallo Pakho**	**Jana Chetana**	**Bhane**	**Sirupata**	**Jyamire**
Infraspecific	D: two varieties of *Ficus* named; one valued more than other	None	None	None	None
Species	D: value range of uses; 'useless' species cleared D: Non-used species described as 'bad'. E: some species valued	D: interest in species identification to enhance marketing of non-timber products; 'useless' species cleared. Market influences	D: FUG has planted more species (all useful). Cannot identify 'useless' species. D: Elites focus on narrow	D: Want local species instead of planted ones. Will enrich forest with local broadleaved fodder species.	D: interested in few species because they don't own the forest. D: species suggested for enrichment are not local.

	Village				
Value	**Pallo Pakho**	**Jana Chetana**	**Bhane**	**Sirupata**	**Jyamire**
	for beauty; some for religious use (not in forest). O: (negative) lack of individual ownership restricts management rights, and decreases interest in fodder trees Diversity O: more species better than few; increased awareness of number of useful species; need for enrichment planting to enhance future diversity	no. of species valued. E: Cultural value of medicinal plants decreasing. Diversity O: need enrichment planting	range of commercial species I: identified local species as priority for enrichment planting. O: need enrichment planting to enhance forest value Diversity D: previously unaware of the number of useful species in the forest.	O: need enrichment planting. Diversity O: Plant as many species as possible (risk management).	Management not seen as feasible. Diversity D: prefer landslide areas to undisturbed forest because there are many useful species in one place. O: need enrichment planting to enhance future value

	Village				
Value	**Pallo Pakho**	**Jana Chetana**	**Bhane**	**Sirupata**	**Jyamire**
Habitats	Diversity D: need range of habitats; no single habitat is best. E: the forest is peaceful and birdsong is beautiful.	D: Appreciate natural habitat more than degraded, or plantation, but want to change the dominant species [*Pterocarpus santalinus]* which is little used.	E: Unsure of change in forest condition, due to previous lack of interest. Concern focuses on Hade unyun (fern regarded as weed) which prevents tree seedling establishment.	D: Want forest instead of plantation. Focus on protecting natural regeneration rather than plantation - local broad-leaved species of more use to them than pine E: elites want more greenery O: joined CFUG to assure rights to share of benefits. O: (negative) don't trust government not to take	D: appreciation of negative effects of poor forest condition, on productivity; appreciation of importance of soil condition for forest regeneration. O: only interested in forest if their ownership is clearly recognised, permitting their access and management. Otherwise, encroach. O: access to forest is

	Village				
Value	**Pallo Pakho**	**Jana Chetana**	**Bhane**	**Sirupata**	**Jyamire**
				the forest back once improved.	through political allegiance. E: no existence values, not very interested in forest because not theirs.
Processes	I: appreciation of role in water and soil regulation; birds in distributing seed.	Negative I: competition with farming		I: want to benefit from more water sources within protected forest, and from soil conservation.	
Biodiversity as a whole	O: Understanding outsiders' interests in conservation, whole group looking for recognition and honour.	O: political capital gained by elites and officials, in conserving biodiversity.	O: elite groups seeking outside recognition have over-protected forests, with negative impact on biodiversity		O: political capital to be gained by elite groups in conserving biodiversity.

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