Progress report on country workshops to initiate development of monitoring indicators

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Executive summary

1. There seems to be a lot of enthusiasm about certification of ecosystem services among the project sites. Hence, it will be important to capitalize on the feeling and turn it into actions.

2. The concept of ecosystem services is rather complex and hence, identifying users and attributes of ecosystem services can be sometimes challenging. However, the participants managed the task well and provided plenty of information due to their different perspectives on identification. It is important to keep in mind that people have different perspectives on ecosystem services and hence, the indicators should be adaptable to local context.

3. There are numerous threats to the services but most of these are linked to the land use. When considering indicators that will address the threats, different scales that the threat can take place should be kept in mind to determine whether the threat in question can be avoided or reduced. Where the opportunity costs of avoidance and/or reduction are high, no permanence in service provision can be expected.

4. The participants identified a large number of indicators that can be further refined in by the standard development groups. The next step will be to decide what the final indicators tested in the ForCES project are. For the identification of suitable indicators and their measurement it is recommended that country teams clearly identify what are the management goals and/or options and also which practices they want to change or undertake. This will also help to target resources correctly.

5. An important aspect of monitoring management outcomes will be to decide on whether only the impact of management activities will be monitored or whether the impact of the intervention, i.e. certification, will be evaluated.

6. The lack of suitable data before project activities are implemented make it challenging at some of the sites to implement Before-After Control-Impact (BACI) design which would be the recommended impact evaluation method. However, it is recommended to use experimental design where possible as the empirical evidence-base that certification has a positive impact is weak and the measured outcomes vary temporally and spatially in the absence of the project. The experimental approach should be complemented with non-experimental methods, such as the theory-based approach and case-based approach.

7. Although there are gaps in terms of understanding as well as in terms of baseline data, these are not insurmountable. It will require time and effort from the country teams to address these issues, especially to build partnerships to collect and obtain data and to build capacities of the local communities involved. It is important to address these issues early in the project as the continuity of the activities after the project will depend on the local capacity.

1 Introduction

‘Expanding FSC certification through incorporating additional ecosystem services’ is a four year multi-partner project, funded by the Global Environment Facility (GEF). The project will test expanded Forest Stewardship Council (FSC) standards applied to emerging markets for ecosystem services in Chile, Indonesia, Nepal and Vietnam, and will involve local and international NGOs, research institutions, private sector partners and government agencies. A key component of the project is the development of appropriate and measurable compliance and impact indicators to be incorporated into FSC national standards in the abovementioned countries and into international standards.

In the current FSC system the purpose of indicators is to inform forest managers on whether pre-established objectives are being achieved. An indicator is defined as “a quantitative or qualitative variable which can be measured or described, and which provides a means of judging whether a forest management unit complies with the requirements of an FSC Criterion” (FSC 2010). It outlines the type of evidence that should be provided by the forest manager and checked by the certifier to ensure the operation meets all the criteria and complies with all the principles. As is clear from the definition above, the current system focuses on compliance indicators and not on impact indicators although there is some overlap between the two types[1]. To broaden the FSC system to cover certification of ecosystem services, impact indicators are needed to help evaluate whether the ecosystem services are provisioned.

Beside the requirement that indicator needs to be measurable or describable, there are other important qualities of indicators that should be considered. First, an indicator needs to be representative, thus providing useful data to guide management action. It also needs to be reliable to give truthful information on the impacts. Finally, an indicator needs to be practical. This does not mean that an indicator needs necessarily to be simple. Instead, the level of complexity of suitable indicators depends on the context where the monitoring takes place, e.g. skills of the people conducting monitoring and available equipment.

To initiate the selection of indicators a workshop was held in each of the four pilot countries. The key objective of the workshops was to select a list of preliminary indicators linked to ecosystem service provision that could be further refined as the project progresses as well as tested for their appropriateness. This report discusses the results of the workshops and suggests way forward in regard to monitoring. It is organized in four main sections: 1) Following the introduction section two describes the methods to select the indicators; 2) In section three the results of the workshops are discussed: the identified uses and users of the ecosystem

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[1] The purpose of compliance monitoring is to prevent, minimize or mitigate negative environmental and social impacts. The management actions needed are set in a standard and communicated in the form of compliance indicators. Thus, compliance monitoring checks whether the level required by the standard is implemented on the ground whereas impact monitoring evaluates the impact of existing management practices on ecosystem service provision.

services; the attributes of the ecosystem services that are important to the users; threats to the ecosystem services; and finally the preliminary list of indicators. At the end of the section three, the current data availability and capacity to conduct monitoring are discussed; 3) Section four addresses gaps and challenges; and 4) the final section of the report focuses on way forward. It introduces shortly two types of impact monitoring (the impact of management and the impact of intervention) and then offers an overview of potential ways to monitor impact of intervention which is a key to show the benefits of certification.

2 Methods

A participatory approach was taken to select the indicators. In addition to people who will be directly involved in monitoring activities of the ForCES project (e.g. local people, representatives of government, timber companies, and non-governmental organizations), government representatives and experts from variety of backgrounds and organizations attended the workshops. The list of participants can be found in appendix 1. Before the workshops background material regarding monitoring and indicators[2] was provided to the participants.

To guide the discussion on possible indicators a framework by Ringold et al. (Ringold, Boyd et al. 2009) was adapted (Box 1). To identify users/uses, attributes, and threats participants were divided into small groups either according to the study sites (Indonesia, Chile) or services (Vietnam, Nepal). It should be noted that flexibility in the use of the framework was allowed to foster discussion and to provide possibilities for the participants to bring forth their ideas that did not fit strictly under the framework. Following the identification of indicators, the results were presented and discussed. During the discussion the results were modified if necessary according to suggestions of participants of the other groups.

Following the identification of use/user groups, attributes and threats, possible indicators that would address the needs of the users and protection from threats were discussed. As there is some overlap between compliance and impact indicators, a general term indicator was used. Thus, some of the indicators in this report will act as a basis for refining compliance indicators although the emphasis is on impact indicators.

In connection to indicators it was discussed which data already exists and what are possible sources that can provide data to form a reference point before the project monitoring commences. Finally, the capacity to conduct monitoring at each of the sites was discussed. Key

[2] Savilaakso, S., Meijaard, E., Guariguata, M., Boissiere, M., and Putzel, L. 2012 Forest Certification of Ecosystem Services (ForCES) – A review on compliance and impact monitoring to develop indicators for ecosystem services within certification system. Internal project document.
Meijaard, E., Sheil, D., Guariguata, M.R., Nasi, R., Sunderland, T. and Putzel, L. 2011 Report on barriers and constraints to ecosystem services certification. Occasional Paper 66, Center for International Forestry Research (CIFOR), Bogor, Indonesia.

elements of monitoring were identified and then the resource availability in regard to these elements was discussed.

In the next section results of the workshops will be presented in the following order: 1) uses or users of ecosystem services; 2) attributes; 3) potential threats; 4) identified indicators; and 5) monitoring capacity.

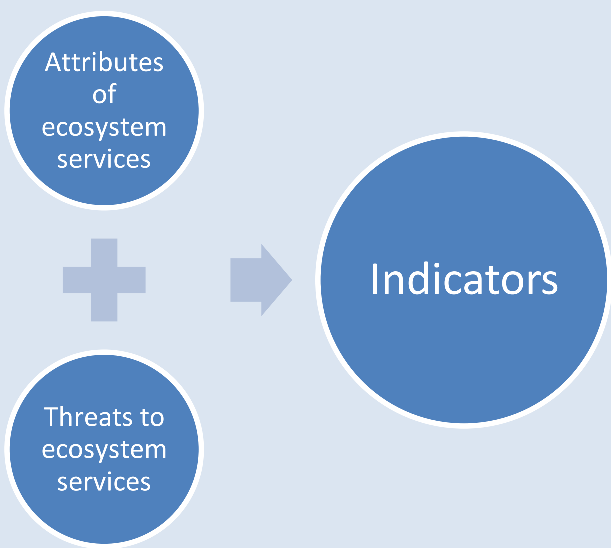
Box 1. Framework to identify indicators (Ringold, Boyd et al. 2009)

Within the framework indicators are identified through a process that begins by identifying potential users of the services. These can be, for example, local communities, tourists, and different companies. In the first workshop in Indonesia it was suggested by the participants that the term *use* should be added to the *user group* category and therefore, in the following workshops both terms, *user groups* and *uses*, were used.

After the users are identified, the participants identify attributes of ecosystem services. These are qualities or features of the service that are important to the user. For example, fish catch is an attribute for a fisherman whereas an orangutan is an attribute for a nature tourist.

In our workshops one category, threats, that is not addressed in the original framework, was added as they are important when identifying whether certain areas providing ecosystem services are in need of protection for further damage (van Noordwijk 2007), and hence are a candidate for payments for ecosystem services.

The last step is to identify indicators that address both the important features of the ecosystem service and the threats that the services or the areas where the services originate face. The process ensures that the indicators are concrete and relevant to different users.



3 Results

3.1 Use and/or users of ecosystem services

The management of ecosystem services is a challenging task. Different stakeholders have competing demands and needs that need to be taken into account when deciding management actions (Wollenberg, Anderson et al. 2005; Naidoo and Ricketts 2006). In order to target the management actions correctly and to create a possible payment scheme it is important to know how human activities affect service delivery and who are the beneficiaries and the providers (Brauman, Daily et al. 2007). Therefore, the participants of the workshops started the selection of indicators by identifying different user groups of the services.

Identifying uses or users of carbon and biodiversity proved to be rather difficult among participants. This reflects the complexity of the concept of ecosystem services and how the link between the service and land use is sometimes difficult to understand. However, once it was clear that for the non-tangible services, such as carbon, the use or user is related to the area where the service originates instead or in addition to the service, the participants easily identified user categories for the services.

The compiled use and user categories provide a relatively comprehensive list of possible users of ecosystem services and the areas that provide the services (Appendix 2). Obviously there are many users that recur across the services, such as local communities, NTFP gatherers, and farmers. However, there is also plenty of variation between the countries, which illustrates not only the different conditions at the study sites but also different perspectives of the participants. Although the focus was on human uses and users, a group in Chile identified a non-human user group, certain tree species that use plenty of water. Also, it is a good remainder that there are non-human users of the water that have potentially big impact on the service provision.

There were differences in the level of detail provided. Some participant groups provided very detailed accounts on who uses the service whereas others were more general. For example, NTFP gatherers were often identified but whether they were from the local community or outsiders from another community was rarely mentioned. Of course this may have been obvious to the local participants and hence, the absence of the information does not mean that the information does not exist. In any case, the distinction between local actors is important when management options are considered.

3.2 What attributes are linked to the ecosystem services?

Ecosystem services and the areas that the services originate have different features that have different importance to different users. These are the attributes that form a link between the service and the user. For example, a tourist appreciates a beautiful lake landscape whereas a fisherman is more concerned about the amount of fish in the lake. The landscape and the fish are both attributes of the same recreational service and hence, important when the impact indicators are considered. Thus, following the identification of the users and uses of the ecosystem services the participants discussed what aspects of the service are important to different groups.

For hydrological services the important aspect for most users is water quality and/or water quantity regardless whether the use is extractive, such as agriculture or in situ, such as recreation. There are also inherent trade-offs in the supply of hydrological services (Brauman, Daily et al. 2007), for example the water used for irrigation may limit the supply of drinking water. The subcategories within water quantity and quality which the users identified and which are represented in the identified indicators reflect the different needs of the users. Also, to some users water quality and water quantity represent intermediate attributes that influence the final service although these are not the goals in themselves (Ringold, Boyd et al. 2009). For example, fishermen want to have enough of water and clean enough water so that their fish catch remains stable but their primary concern is fish stock not water quality. Important attribute of water although not directly connected to water was also scenic beauty.

Forest attributes identified depended on the service in question. However as the forest areas have often common users regardless of the service, there were also some common attributes, such as forest condition and biomass. Key species were often mentioned but they vary depending on the user, e.g. hunter, farmer (bees for pollination), pharmaceutical company, and tourist. As with water there are trade-offs in regard to provision of biodiversity services as well (Naidoo and Ricketts 2006). Certain key species may have importance for different users but for different management needs, for example a hunter and a tourist may be interested in the same species but for different reasons. Also, non-timber forest products were referred to. The attributes linked to them were diversity of products, quantity, and quality of products. Regarding biodiversity different species and habitats were key attributes. In addition, cultural places as well as sacred places and trees were highlighted.

In addition to attributes linked to forest and water, ecotourism and recreation had attributes that referred more to aspects of human life, such as infrastructure, accessibility, and security. Service providers and other things that contribute how tourists experience the site, e.g. clean environment, were also seen important.

3.3 What are the potential threats to the services?

The participants identified a large number of potential threats to the provision of ecosystem services (table 1) that can cause either direct or indirect pressure to ecosystem services. Some of the threats can be addressed in the context of certification whereas others, for example changing political situations, cannot but it is still important to be aware of them as they can have profound effect on the success of certification. Those that cause direct pressure are usually easier to address, for example by monitoring harvesting practices or the number of forest fires whereas those creating indirect pressure, for example from migration or incoherent land use policies, are typically more difficult to deal with. This is not to say that the threats putting indirect pressure on the provision of ecosystem services should not be addressed.

Instead, it should be carefully considered what kind of safeguards can be designed against these threats. For example, asymmetries in power relations can hinder access to service; they can push the prices of ecosystem services very low; or skew allocation of property rights and benefits, thus contributing to keeping the existing social order intact with a possible consequence of keeping the poor in poverty (Kosoy and Corbera 2010) .

In the context of threats it is useful to consider different scales at which threats take place: 1) forest management unit (FMU) or another clearly defined area in a broader landscape, for example natural forest patch within forest concession, 2) the whole forest or other entity, for example a national park or subwatershed, and 3) landscape, for example whole watershed. Those that happen within defined areas are easier to address than those that happen at the landscape level. However, threats at all levels should be considered to determine whether those threats can be avoided or reduced. Where the opportunity costs of avoidance and/or reduction are high, no permanence in the service provision can be expected (van Noordwijk 2007).

Deforestation, forest degradation and forest fires were the three most commonly cited threats to the ecosystem services. Probably due to their importance all three are already incorporated into the current FSC forest management standards. However, there are threats, especially those related to watershed services that are not address by the current FSC system and hence, need to be considered. Such include, for example, floods, overuse of water, and water pollution.

Table 1. Identified threats to ecosystem services at the workshops.

Threats	**Biodiversity**	**Carbon**	**Ecotourism**	**NTFP**	**Water**
Direct pressure					
Cattle raising	v				
Diversion of water					v
Drought		v			
Encroachment of salty water					v
Floods		v			v
Glofs					v
Forest conversion / deforestation / land use change	v	v	v		v
Cropping		v			
Hydropower		v			
Oil palm			v		
Other infrastructure development	v	v	v		
Forest degradation	v	v		v	v
Grazing		v		v	
Illegal logging	v	v			
Logging (firewood and construction)	v				v

Low use of good forest management practices					v
Pests		v			
Unsustainable harvesting	v	v	v	v	
Forest fire	v	v	v	v	v
Illegal fishing					v
Invasive species	v		v		
Land degradation					v
Erosion					v
Local climate change					v
Natural disasters			v		v
Climatic-related disasters					
Eruptions					
Landslides		v			
Overuse of groundwater					v
Overuse of water					v
Pests			v		
Poaching			v		
Product adulteration				v	
Promotion of plantations of rapid growth species (e.g. Eucalyptus sp.)					v
Roads	v	v	v		
Main road: potential damage to the park related to access			v		
Road construction	v	v	v		
Sedimentation of water			v		
Use of monocultures	v				
Use of pesticides and insecticides	v			v	
Waste			v		
Pollution			v		v
Access of cattle to the water					v
Detergent use					v
Domestic waste					v
Overuse of fertilizers	v				v
Siltation					v
Indirect pressure					
Access to water (power relations)					v
Change in life style			v		
Closeness to the city					v
Global market influence - demand and price		v			

Inconsistent policy (e.g. land use) and changing political situation		v			
Lack of integration between national and local policy		v			
Industrialization			v		
Lack of alternative energy		v			
Lack of awareness	v	v			
Lack of cohesion of central and local government		v			
Lack of resources and capacity to attract alternative livelihood long/short term	v	v			
High dependency of local people				v	
Life trends/mindset changing to conservation	v				
Migration			v		
Insufficient local involvement			v		
Politics			v		
Population growth			v		
Poverty	v	v			v
Water use conflicts					v

3.4 Identified indicators

The participants identified indicators that were common to most of the ecosystem services (Table 2). These indicators addressed threats such as land use change. Encroachment was a common threat not only from the communities surrounding the area providing the ecosystem service but also from the (local) government that tend to give forest land to other uses.

In the current FSC forest management standards these threats have been addressed, except for the extent of land use change, and hence, guidance to develop standards to certify ecosystem services can be drawn from there.

Table 2. Common indicators to most of the ecosystem services proposed at the workshops.

Category	Indicator
Area of forest	Area of protected forests
	Reduction in incidence of encroachment and conversion
Deforestation	Measures to prevent deforestation
	Rate of deforestation
	Reduced illegal activities
Forest degradation	Improvement in forest condition
	Measures to prevent forest degradation
	Reduced illegal activities
Fire	Forest fire control plan

	Number and size of annual forest fires Reduction in incidents of forest fire or reduction in area lost to fire
Hunting	Number of poaching cases filed Reduced illegal activities
Land use change	Extent of land use change

3.4.1 Biodiversity

The indicators proposed for conserving biodiversity function at three different levels: species, stand, and landscape level (table 3). The general consensus was that it is not important to know and protect every single species; instead the efforts can be concentrated on key species. What are the key species will depend on the management goals: The species can be those valuable to communities or they can be of high conservation importance (e.g. orangutans) or otherwise valuable species for conservation, e.g. those of important ecological roles (e.g. hornbills). This is a deviation from the current FSC forest management requirements but as the standards for ecosystem services are in the development phase, requirements regarding to biodiversity are an important aspect to consider. However, it should be noted that a certain species is not necessarily indicative of the presence and/or performance of other species or for biodiversity as a whole. Thus, when a given species is used as an indicator for other species or entities, causal and functional linkages between these indicator species and other entities will need to be established (Lindenmayer 1999; Leal, Bieber et al. 2010).

At the stand/forest level, it was agreed that forest structure could act as a proxy for biodiversity. This conclusion is supported by the literature as well (e.g. Lindenmayer, Margules et al. 2000). Related to forest structure is the stage of development which can give an indication of the state of biodiversity. It was felt important that habitats of the important species are identified, at least roughly, and measures to conserve them are put in place. Finally, invasive species present at the ecosystem (whether forest or water) can act as an indicator of the current state of the ecosystem.

Table 3. Indicators for conserving biodiversity proposed at the workshops.

Spatial level	Indicator
Species level	Population size of endangered species and other valuable species for conservation Population size of key species Species richness maintained over time Variety of species
Stand/forest level	Forest structure Home range and habitat Invasive species Stage of development

Landscape level	Additionality in area conserved Connectivity Forest area Fragmentation Land use change Land use diversity

At the landscape level a set of well known indicators were highlighted. It was felt important to maintain connectivity, assess the extent of forest area in the landscape and the fragmentation of the forest which are key components to maintain population viability (Bennett 2004; Debinski 2006). To know the level of threat to biodiversity, changes in land use as well land use diversity should be determined. In addition to the well known and used indicators, it was also proposed that a simple indicator that measures an additional area conserved should be put in place. For example, the biodiversity indicator could be 10 % of the area conserved voluntarily.

Also, indicators for biodiversity values for different stakeholders were proposed. Community's dependency of biodiversity for their livelihood, for example as a rate of consumption of non-timber forest products including bushmeat, was seen as one aspect of biodiversity that should be included when impact is evaluated. Furthermore, places where biodiversity occurs can also have significance for cultural believes and hence, those places should be protected.

3.4.2 Carbon

All participants agreed that selecting indicators for carbon is relatively straight forward as it will depend on the methodology that will be used to account the carbon credits. In general, emissions from deforestation and degradation can be estimated from two important variables: areal extent of deforestation and degradation; and carbon stock densities per area (Wertz-Kanounnikoff 2008). The participants identified a set of key indicators in regard to carbon stock densities per area (table 4).

Also, a set of indicators related to the condition for payments of carbon credits were identified (table 5). These highlight some of the social indicators but further guidance on the development of social indicators is in separate section. The participants felt that part of the payments should be invested in the management activities as well as to socio-economic activities to ensure sustainability of the scheme.

Table 4. Indicators proposed at the workshops for carbon storage and variables linked to the indicator.

Indicator	**Variables**
Above-ground biomass	Canopy coverage Change in bushes and underground vegetation Growth rate Harvest volume (illegal and legal)

	Harvesting cycle Natural regeneration and enrichment planting Size of the area where reduced impact logging (RIL) is introduced Volume of standing stock per hectare Wood density
Below-ground biomass	Root biomass
Soil carbon	
Leaf litter	
Wood debris	

Table 5. Indicators related to the payments of carbon credits proposed at the workshops.

Payment indicators	**Examples of activities**
Benefit sharing to community and government	Benefit sharing mechanism is put in place.
Percentage of benefit sharing to women, poor, and disadvantaged groups	
Composition of user committee	Women, poor, and disadvantaged groups are included.
Amount of money invested in forest management activities	Nursery Plantation Grazing management Silvicultural operation Forest protection Fire management Soil management
Amount of money invested in socio-economic activities	ICS Biogas Awareness raising and capacity building. Income generation activities for poor, women, disadvantage groups.
Harvesting practice	Sustainable harvest practices are used.

3.4.3 Ecotourism and recreation

The variety of activities linked to ecotourism and recreation is reflected in the large number of indicators the participants proposed. Biodiversity and cultural heritage are inherent to ecotourism (Coria and Calfucura 2012) but may have nothing to do with recreation activities. Thus, the indicators proposed in table 6 are very much context specific and flexibility regarding them in the standard development is encouraged. However, such aspects as human rights and safety should be considered regardless whether the ecosystem service provided is ecotourism or recreation.

Some of the indicators are redundant. For example, one would not necessarily measure all the economic indicators. Instead one would concentrate on those that show the trends in the management objectives best or are the most important ones for the stakeholders.

Also, some of the indicators are debatable. For example, should high conservation value (HCV) areas be accessible for tourists? Or what is the role of capacity in certification? It was proposed that a certain minimum level could be applied but how to set that minimum level? Furthermore, to attain sustainable use of ecosystems, it is important to address the underlying causes of loss of ecosystem services by raising the awareness of people. However, whether awareness rising should be compulsory certification requirement is an entirely different matter.

Table 6. Indicators proposed for ecotourism and recreation at the workshops.

Category	Indicator
Biodiversity	Accessibility to HCV areas/species/places
	Conservation of key tree/plant species (e.g. Alerce): number of hectares of species preserved
	Measures for management of biological hotspots/key species habitats
	Number of sightings of key species
	Improved forest protection
	Negative impact of visitors is prevented or mitigated
Awareness	Increased awareness of the importance of the area
	Information availability for visitors ensured
	Extent of application of environmentally friendly measures on infrastructure construction
Cultural heritage	Number cultural villages / natural heritage declared
	Number of visitors who came to see traditional event
	The number of event types maintained or increased
	Number of days per year
	Number of trainees maintained or increased
	Number of women group that can handle handicraft skill maintained or increased

Economic	Amount of income generated Change in income Expenditure per visitor Extent of use of local products Income from local products (e.g. Honey, fish) Involvement of local communities to tourism activities Number of days of local employment from tourism business Number of local entrepreneurs related to the park Number of locally owned tourism related business enterprises per number of total tourism enterprises Number of visitors and returning visitors
Human rights	Complaints against inhumane behavior
Pollution	Extent of pollution in key tourism destinations Maintenance of clean environment (e.g. Regular waste collection, rubbish bins, information) Sanitation and drinking water facilities provided along the trekking routes
Safety	Infrastructure accessibility maintained or increased. Measures to control landslides and physical infrastructure in place and contingency plan for natural disasters. Minimum safety conditions in place Number of accidents, lootings, thefts Number of work accidents System for accident treatment exists Use of building code of construction
User satisfaction	Satisfaction of visitors on different facilities and services Value price rating of visitors
Capacity	Number of people that can stay in overnight Number of hotels and other accommodation Number of trekking routes Number of guides available The amount of time it takes to access the park Transportation availability

3.4.4 Hydrological services

Hydrological services were another ecosystem service that got plenty of indicators from the participants (table 8). This reflects the multiple uses of water as well as the importance of it. The participants identified indicators that were 'pure' water indicators linked to quality and quantity of water as well as indicators linked to the land use and land management that have implications on water quality and quantity. Some of the proposed indicators are also interlinked and rather complex, for example, the volume of water in natural water bodies depends on rainfall but also reflects the changed water storage capacity of the forest which depends on, for example, forest canopy cover, soil structure and forest composition (Falkenmark, Andersson et al. 1999).

Table 8. Indicators related to hydrological services proposed at the workshops.

Category	**Indicator**
Water quantity	Amount of rainfall
	Duration of rainfall
	Baseflow
	Speed and volume of water flow
	Volume of surface water flow
	Volume of water in natural water bodies
	Number of functional springs (not dried out) monthly/annually
	Number of flash floods per year
	Timing of water events
	The amount of water used (households, agriculture)
	Water level
Water quality	Amount of chemicals in water (contamination)
	Amount of pollutants in water
	Biological indicators (insects, invertebrates, microbes, water mapping)
	Fish species
	Pathogens and bacteria (E. Coli)
	Odor
	Sight
	Turbidity
	Water siltation ratio
	Reduced volume of sediment treated at hydro-power stations
Economic	Amount of fish harvested in a year
	Fish quota
	Number of people making livelihood by fishing
	Share of fish income in livelihoods
	Number of people making livelihoods out of water mill
	Number of registered and implemented micro-hydro schemes
	Number of PDAM customers maintained or increased
	Number of people engaged in water recreation business

	Percentage of share of local people in micro-hydro
	Number of households having access to hydroelectricity
	Productivity per hectare
	User satisfaction survey
	Creation of alternative/additional income sources
	Number of seedlings for the community members; additional income - forest dependency has decreased
	Number of NTFP products at the market (as a result of the payment scheme where farmers get for example fruit tree seedlings)
	Income valuation (economic activities preferred by the inhabitants)
Social	Number of drinking water groups existent
	Number of hours spent to fetch water
	Number of registered water use conflicts and sorted out cases
	Number of sorted out cases of water usage
	Benefits distributed equally
	Equal participatory rights
Health	Number of households having access to safe drinking water
	Number of households having toilets
	Number of soak pit toilets
	Number of water borne diseases
Management	Existence of water management mechanism
	Understanding of good management practices and their maintenance through time
	Buffer zone created around the reservoir to protect erosion prone areas
	Water reservoirs for cattle built and used
	Number of additional native species planted
	Restoration of erosion prone areas
	Substitute firewood species (use invasive instead of native)
	Vegetation inventory (degradation/improvement)
	Usage restriction
Other land use	Farm and forest ratio
	Farming practices
	Livestock density
	Carrying capacity (cattle raising)
Threats	Distance to the catchment area
	Firewood quantity (sold-consumed)
	The type of firewood used (native-exotic)
	Distance to the firewood collection area
	Number of cases notified in illegal fishing

3.4.5 Non-timber forest products

At the study sites in Nepal non-timber forest products (NTFPs) are considered along other ecosystem services and hence, although technically ecosystem goods, they are included here. The indicators proposed considered quality of products as well as markets in addition to more commonly addressed sustainable harvesting aspects.

There are several indicators related to the quality of products but the most useful will depend on the product that is monitored as well as on the level of skill of the person conducting monitoring. For example, non-experts may have difficulties to detect the quality of product based on aroma. Further limiting issue in what kind of indicators to monitor is money. It can be relatively expensive to determine the chemical composition of the product (Kalyan Gauli *pers. comm.*) and hence, this is probably not that feasible indicator. However, management objectives and the use of the NTFP will determine the most useful indicators.

Table 7. Indicators related to different aspects of NTFP harvesting and management proposed at the workshops.

Category	**Indicator**
Sustainable harvesting	Extend of cultivation in land use
	Maturity of the plant (height, diameter, age)
	Methods of harvesting
	Percentage of harvesting in the given area
	Rotational harvesting - harvesting system and cycle
	Timing of collection
Quality	Aroma
	Chemical composition
	Cleanliness
	Color
	Knowledge of identifying NTFP
	Level of adulteration
	Moisture content
	Size
Markets	Cost/benefit ratio
	Existence of processing enterprises
	Number of traders
	Price
	Quality
	Quantity

Investment of the income (community forest user groups only)	Community development
	No of days of employment and income received
	NTFP management in forest
	Poverty reduction activities (% of income to support income generating activities of women, dalits, and other disadvantage groups)

3.4.6 Social impact indicators

The participants tended to focus on environmental indicators and as the time was limited not much progress was made on social indicators. However, the social issues related to ecosystem services were discussed and the categories in table 9 were identified as important and indicative of social impacts. Some of the indicators related to the categories were proposed by the participants and others subsequently by the author. The list is not comprehensive and some of the social indicators have been proposed already under the ecosystem service specific indicators. However, the purpose is to provide a starting point for the standard development groups to discuss and refine further.

Most of the indicators can be applied across the ecosystem services but some will need to be adapted to suit specific situations. Also, the applicability of some of the social indicators will depend on whether payments for ecosystem services are made, for example benefit sharing indicators.

Table 9. Indicators related to the social impacts. The indicators in unformatted text were proposed by the participants at the workshops. The indicators in italics are complementary indicators proposed by the author at the time of writing.

Category	**Indicator**
Benefit sharing	Are benefits shared?
	How are benefits shared?
	Who decides how benefits are shared?
	How is equality ensured when benefits are shared?
Economic	Change in people's dependency on forest livelihood
Food security	Total number of households suffering from food shortage
	Agricultural yield
	Changes in production within plantation
Human rights	Complaints against inhumane behavior
Land tenure and access rights	Does land tenure exist?
	What kind of land tenure it is?
	How secure land tenure is?
	Are there exclusion rights?
	Do access rights exist?
	Who has access rights?

	How secure are access rights?
Participation	*Equal right to participate in the scheme* Free and Prior Informed Consent (FPIC) obtained *FPIC obtained in fair manner* Information availability and access to information *Negotiation support to the groups that have weak bargaining power* *Representativeness of different groups in stakeholder consultations* *The possibility to participate in decision-making (e.g. where are stakeholder consultations held)*

3.4.7 Gender

Indicators related to gender were hardly considered, except in Nepal where some indicators related to gender were included in the indicators of payment schemes for carbon. However, gender is an important component of sustainable natural resource management and hence, should be considered in a certification scheme. Thus, we propose a set of indicators that can act as a starting point for discussion and further refinement. These indicators have been developed for the CGIAR centers' Consortium Research Program on Forests, Trees and Agroforestry (CGIAR Research Program 6 2011) and have been only slightly modified to suit the purpose here.

Table 10. Proposed gender indicators. Adapted from the CGIAR centers' Consortium Research Program on Forests, Trees and Agroforestry (CGIAR Research Program 6 2011).

Indicator	Measurements
Gender equality in decision-making and control over resources results in increased incomes and benefits for women.	Incomes of men and women, and spending decisions
Women's increased control over resources enhances family nutrition and health.	Number of days without food shortage
More secure tenure and rights for men and women increases access to diversified and improved food and tree species/varieties.	Number of days without food shortage
Gender equality in participation in and influence over resource use decisions and benefits increases investments in sustainable resource management and reduces degradation.	Number and type of trees planted Number of women and men in forest committees/councils Range of rights to forests and trees held by women and men Number of management activities
Men and especially women aware of individual and collective rights and claims and able to exercise and/or defend them	

Safeguards for protecting/strengthening tenure and rights of women and other marginalized groups, including FPIC and consultative processes are implemented

3.5 Existing baseline data and capacity to monitor the provision of ecosystem services

Those study sites that are already FSC certified for forest management, Kutai Barat in Indonesia and Carahue in Chile, have a wealth of environmental and social data, for example biodiversity surveys and social impact assessments have been conducted, and conflict records exists. In Kutai Barat, also a carbon accounting study has been conducted. Thus, a lot of data for establishing a baseline is available. Similarly, in Vietnam in Quang Tri, which has 249 ha of plantation FSC certified and Ha Tinh, which is a state owned timber concession, a forest inventory has been conducted and hence, some baseline data exists. Common advantage of all three concession sites (Kutai Barat, Carahue, and Ha Tinh) is that they have a relatively highly educated labor force and access to people with experience on monitoring. Also, they are in relatively good shape in regard to equipment as well as financial requirements of monitoring. In Ha Tinh the community participation is active and hence, it may be possible to conduct joint monitoring program between the communities and the company. Similarly, it has been indicated that community can be involved in monitoring activities in Carahue but their willingness is not yet known.

It was recognized among the participants that there is potential for collaboration with the water companies at the following sites considering hydrological services, Lombok in Indonesia, Mechaico in Chile, and Ghaurishankar and Charnawati in Nepal. The companies most likely already have data on water quality and possibly also on water quantity. In Lombok the collaboration with the water company has already been established as the company administrates the payments against a fee. Therefore, it should be relatively easy to obtain monitoring data. In regard to other factors, data on the number of seedlings exist but so far socio-economic surveys have not been conducted. Most likely these will be conducted by the Multi Stakeholders Institution (IMP) but first a training needs to be organized as currently the IMP does not have the capacity to conduct the survey.

Similar to Indonesia no data on water quality and quantity exists yet in Nepal. However, there is plenty of other data accessible that has relevance to hydrological services, for example, deforestation rate, farm-forest ratio, rainfall data, the number of flash floods and the amount of chemicals used in farming. Also, some socio-economic surveys have already been conducted. Contrary to the situation in Nepal and Indonesia, in Vietnam in Quang Tri data on stream flow and rainfall exist. There are also observations on water level and timing of water events. Furthermore, data on water use conflicts is available. However, no data on water quality exist.

In Mechaico a third party will most likely bear the responsibility for monitoring activities but the community can be involved in designing the framework for monitoring. INFOR (Forest Institute in Chile) has conducted quite a lot of work already in the area, for example a market study and a socio-economic survey on a subsample of the farmers, and hence, the level of knowledge about the area is relatively high. Data on rainfall, overall turbidity, and water flow exist and hence, provides a baseline for monitoring those indicators.

All sites that consider ecotourism and recreation services (Charnawati in Nepal, Kapuas Hulu in Indonesia, Pumalin in Chile and Quang Tri in Vietnam) have at least some data to establish the baseline. They all have information about visitor numbers. In Quang Tri there is also data on deforestation but so far socio-economic surveys have not been conducted. In contrast, there is plenty of information available on Kapuas Hulu. A biodiversity assessment has been conducted as well as socio-economic survey according to the participants. Also, data on ecosystem functions, such as carbon and pollination and community activities and traditional knowledge, exist. There seems to be fair amount of capacity at the local level and hence, the outlook for conducting monitoring is positive.

In regard to Charnawati site, other socio-economic data than only the number of visitors exist. For example, there is some data on the businesses owned by the locals, on the extent communities are involved in the tourism activities, and on the number of days of local employment by the tourism industry. The participants raised a possibility to work closely with tourism association, travelling companies, and the National Trust for Nature Conservation to gather the necessary data. In regard to the monitoring capacity, there is interested in the monitoring activities at both sites in Nepal but knowledge to conduct monitoring needs to be improved. Hence, capacity building is needed.

In Pumalin the situation is different in regard to other study sites as the site is privately owned. The extent of current data availability is not known but monitoring capacity exists at the site. Most likely the monitoring will be conducted by the park employees and paid by the owner of the park. If communities are involved in monitoring, training and capacity building are needed. However, the willingness of communities to be involved is not known at this stage.

Regarding the monitoring of NTFP production in Nepal, the participants recommended the establishment of a quality standard. No data exist currently about the quality of the products but there is data on the harvesting aspects, such as harvesting cycles and systems. There is also data on markets, such as the number of existing processing enterprises, quantity of the products, and prices.

The next section discusses some of the gaps and challenges that are linked to monitoring. These will need to be addressed in order to ensure successful monitoring in a long-term.

4 Gaps and challenges

There are some data gaps in regard to baseline data that will need to be addressed and that will have influence on what designs are possible for impact evaluation. At some sites there may not be enough of baseline data before the project activities were started to use Before-After Impact-Control (BACI) design which is recommended for impact evaluation (Ferraro 2009). This is a real concern as it limits the possibility to draw valid conclusions about the social and environmental impacts of a certification system. At some sites an opposite problem may be encountered as there may not be enough time to collect data after the intervention is first implemented. These concerns should be taken into account when the future project activities are planned.

At the moment another big gap in most of the sites is the lack of information about the markets. There is only a few study sites were the market assessment has been conducted, for example in Mechaico, Chile, and hence, it seems that there is no clear idea where the money to pay for the provision of ecosystem services will come from. For example, in Quang Tri the beneficiaries are mainly the same people who do the soil conservation activities. However, in the case of Quang Tri, the soil conservation can be bundled with other services. During the project cycle, the project will pay for monitoring activities and facilitate progress towards certification of the sites but an understanding where the money will come after the project ends is of outmost importance. The global market study that will be conducted by Center for International Forestry Research as well as the national market studies will fill this knowledge gap once they have been performed.

One of the challenges mentioned in relation to Carahue site, but possibly exists in others, is the effective engagement of local communities. Conducting joint monitoring may provide a way to engage the communities, especially when they are compensated properly either through direct payments or through the payment scheme for ES. However, care should be taken to obtain Free, Prior, and Informed consent from the communities before further project activities take place in order to ensure that the communities want to take part in the project.

There seems to be a need for capacity building so that the local stakeholders understand what ecosystem services are. This challenge can be complicated by the low literacy levels of the communities, as is the case in Ha Tinh. Furthermore, it is not always understood what payments for ecosystem services and certification of them mean. For example, in Lombok the people are paid for planting trees but not for conserving the forest. It has been so far difficult to justify payments on the grounds of conserving the forest as people don’t understand why somebody should be paid for doing nothing. Only in Nepal seems the understanding about ecosystem services, their certification and possible payment schemes to be relatively high among the local communities. The country teams have already started addressing the gap in understanding and it is expected that once the project progresses the local participants will gain knowledge to make informed decisions about the certification as well as possible payments for ecosystem services.

Now that the preliminary indicators have been presented and monitoring capacity addressed it is time to look at the next steps. Next section discusses management objectives, two types of impact monitoring and provides an overview of possible ways to evaluate the impact of certification of ecosystem services.

5 Ways forward

5.1 Defining management objectives and action

The next step will be to decide what the final indicators are and start planning the monitoring activities in detail. This will include decisions on who will do the monitoring and for that it is important that the country teams have an idea of the willingness of the communities to participate.

The prerequisite for the selection of indicators is that management objectives are clearly defined and articulated (UNEP-WCMC 2011). Currently not all the sites have defined plans on what are the management objectives to maintain or else enhance delivery of a given ecosystem service, and how to achieve these. There are also financial resource constraints as highlighted in the previous section and hence, a targeted monitoring is recommended. Below the management objectives stated at the workshops are briefly summarized to highlight next steps.

Biodiversity: In regard to biodiversity the management objective stated was conservation of biodiversity. How biodiversity is defined is less clear, and hence there are not yet specific objectives beyond controlling forest disturbance to which the indicators can be linked except for Pumalin, which has the aim to conserve Alerce trees. Questions such as are there invasive species that need to be controlled or eradicated?; are there endangered or otherwise valuable species that will be important for the management goals?; and what are the key features of the habitats for valuable species that need to be protected, can guide the identification of the management goals.

Carbon: The projects sites considering carbon all plan to implement reduced impact logging (RIL) to generate carbon benefits. Also, threats from deforestation and forest degradation are planned to be addressed. In regard to expected monetary benefits arising from the carbon conservation, it is important to recognize that currently reforestation and afforestation projects qualify for carbon credits under the Clean Development Mechanism (CDM), whereas improved forest management practices do not.

Ecotourism and recreation: Sites considering ecotourism and recreational services identified a general management objective as the increment of number of tourists to create livelihood benefits for local people and to conserve biodiversity, which in this context was defined as species of interest to tourists (i.e. key species). The participants also identified suitable indicators for the general goal, e.g. change in income and number of visitors and returning visitors. However, what will be the management action taken to achieve the goals was less clear. Awareness raising was mentioned but how this will be implemented was not defined. As a next step it will be important to define what action to take to reach the management objectives so that the indicators measuring impact can be targeted correctly.

Non-timber forest products: In regard to NTFPs sustainable harvesting and maintaining the quality of products were identified as the main management objectives. Several indicators related to them were proposed and creation of quality standard discussed as a potential course of action. As there are plenty of potential NTFPs and several uses for them, it should be considered which of them will be the most important ones in regard to monitoring activities.

Hydrological services: In the sites where provision of hydrological services is considered the management goals are linked to improvement of either water quantity or quality. It seems that there is rather good understanding of what management actions would need to be conducted, e.g. establishing buffer zones and substituting firewood species, planting trees, and reducing chemical run-off from agricultural practices. However, it may not be possible to do everything and hence, the efforts should be targeted to those activities that will create the largest benefits. Based on those activities the indicators can then be defined.

5.2 Monitoring the impact of management and evaluating the impact of intervention

An important aspect of monitoring will be to decide on what kind of impact monitoring will take place. There are two types of impact that can be monitored: the impact of management and the impact of intervention (certification/payments). It is important to differentiate between the two. The former means measuring certain indicators to evaluate existing management practices, thus, it is done for a specific purpose. By tracking the status and trends of these indicators, it can be seen whether the existing management practices are delivering desired management objectives or whether they need to be changed. For example, a group of farmers decides to reduce the use of fertilizers in the farms along the river to improve the water quality. By measuring the chemical content of the river repeatedly over time, it can be seen whether the management action taken actually improves the water quality. If it does not, an additional action may be needed but without measuring, it is impossible to say how successful the management action has been.

The other type of impact monitoring, monitoring impact of intervention, is more commonly called impact evaluation or impact assessment. The purpose of impact evaluation is to attribute changes in the status and trends of indicators to an intervention (Ferraro 2009). In other words, it tries to prove that the impact happened, for example, because the area was certified or payments for ecosystem services were made. The underlying question is what would have happened if the project had not been undertaken. For example, would the number of visitors to an ecotourism or recreation area increased without certification? In the context of ForCES evaluating the impact of certification is the key to provide the evidence-base needed to prove that the FSC certification creates monetary as well as non-monetary benefits. Below we discuss experimental and non-experimental designs related to impact evaluation.

5.2.1 Experimental designs

In a recent STAP advisory document Ferraro et al. (2012) describe experimental designs that can help to evaluate the social and environmental impacts of certification. There are three conditions that advocate using experimental design to evaluate the impact of ForCeS: 1) The empirical evidence-base that certification has a positive impact is weak; 2) the measured outcomes vary temporally and spatially in the absence of the project (e.g. the number of trees cut), and 3) selection into project treatments is systematically related to characteristics that affect the expected outcome (e.g. timber companies that are already interested in sustainability).

Behind any experimental design there needs to be a theory that specifies the causal link between the treatment (i.e. a project or aspects of a project) and outcome(s). Another key component of experimental designs is to have a control group that is not exposed to the project activities. In the ForCES project control groups were not included in the project design and this creates a challenge for impact evaluation. However, as monitoring has not yet begun, it may be possible to identify suitable groups. It is also possible to compare two or more treatment groups without a control group (i.e. all groups are exposed to some activity but the activities differ). The downside of working without a control group is that even when it can be shown that a certain type of activity has a positive impact it is impossible to say what would have happened in the absence of any activity.

When the control groups are selected it is important that both groups have relatively similar characteristics to make comparisons credible. Also, variation should be generated in the areas or people that are exposed to the project to avoid selection bias, for example people who have no intention to log their forest are likely to want to participate in a project that pays to them for conserving their forest and hence, this creates an inherent bias in the project outcome (the forest area may have been conserved in the absence of the project so the positive impact cannot be attributed to the project). Finally, it should be ensured that the created variation is not related to potential outcomes in the absence of the project.

There are five main ways to create experimental variation in project designs. The candidates in these designs are either the actors whose behavior the project tries to modify (individuals, households, or areas) or an aggregation of these actors at higher level (larger areas, villages, administrative units). Randomization will not be possible in all the ForCES sites as the sites have already been selected (randomization of the sites is hence not possible) and as the activities have already started in some of them, e.g. in Lombok (randomization of the participants is not possible). However, this does not mean that the impact evaluation should not be carried out as quasi-experimental methods can be used at those sites where randomization of participants is not possible. However, at those sites where the activities are just starting, randomization of participants should be carried out.

1. *Simple randomization.* The candidates are randomly selected to control and one or more treatment groups.

2. *Randomization in oversubscribed projects*. When there are more willing and eligible people to participate than the project can accommodate, the project can use lottery to select the candidates.

3. *Randomized phase-in projects*. When the project will be phased in over time, a lottery can be used to select the order in which the eligible and willing candidates will enter the project. Those candidates that enter the project later will be used as a control. This is probably the most suitable way to create experimental variation in the context of ForCES as all willing participants can in the end participate in the project.

4. *Randomized encouragement*. Instead of randomizing the candidates into treatment and control groups the effort that is used to encourage the candidates to participate in the project is randomized, i.e. some candidates are encouraged more to participate in the project than others.

5. *Discontinuous eligibility criterion.* Rather than randomizing the candidates, the project selects an eligibility criterion, such as cut-off score, that creates control and treatment groups around the cut-off score that are supposedly relatively similar in their characteristics.

It may not be possible to experiment with the main intervention, which is certification in the context of ForCES, for example as it may take time to get the site certified. Instead it can be opted to experiment with features of the intervention. For example, payments for ecosystem services can be randomized: in some communities households get the payments whereas in other communities the community gets the payment. A third group could get a mix of the both.

There are issues in experimental project design that may cause concern. The most obvious one is the costs associated with design of the project and the additional sampling effort required to collect data about the control group. In ForCES an additional burden is to identify suitable control sites or control groups that have matching characteristics with the existing project sites and participants. This is not a simple task but a control group will increase the credibility of the evidence enormously. Also, with a project design that makes inferring project effects easier, it may be possible to reduce the number of indicators monitored and hence, save money. Therefore, the total costs of monitoring are not necessarily larger with design that incorporates control group than with designs that do not.

Validity is another issue. Even with the most careful design the results of the evaluation are context specific: they describe certain effect under certain circumstances at certain time. Thus, there is uncertainty whether the results can be generalized to other locations, times or people. To reduce this uncertainty it is important to ensure that the sample of units in the experiment represent relevant populations in which random sampling of the candidates helps. Another way to increase the validity of the results is to include measurements of observable characteristics of the experimental population. This will help to determine how applicable the results are in other contexts. Considering that some of the sites, e.g. Pumalin, are quite unique, validity of the results is a real concern and hence, care should be taken to address it.

There is also the issue of temporal scale. It is very likely that the impact of certification cannot be detected during a project lifespan as the process to certify the sites is at the very early stages. However, it is possible to measure the uptake of actions that are connected to certification. If the causal model that connects management actions to certification outcomes is correct, it is possible to make tentative conclusions about the outcomes. Additionally, when the project has been well designed and documented, a follow-up research can be done and see whether the original evaluation based on actions holds.

Related to issues of validity are all the potential things that can go wrong in an experimental design. These create a potential bias in the results and hence, reduce credibility of the results. For example, participants in the control group are exposed to treatment, some participants may move away thus reducing the number of participants, or people may behave differently when they know that they are being observed. It is important to measure the right variable as causal inference can be drawn only if measurement is valid (construct validity). Also, there may be spillover from treatment groups to control groups, which violates the assumption that the outcome of control group is unaffected by the project. For example, reducing deforestation in one community may increase it in another. However, these issues are not inherent to experimental designs but rather exist in both experimental and non-experimental projects. Fortunately, there are methods to address some of these biases and in many cases their presence bounds the impact estimates rather than invalidates them.

5.2.2 Quasi-experimental and non-experimental project designs

5.2.2.1 Before-after comparisons

In before-after comparisons data on relevant impact indicators is collected before and after an intervention. Thus, the pre-intervention information forms a control to which data after the intervention is compared. It is assumed that changes detected in the indicators are due to the intervention and thus, conditions in which the intervention takes place stay stable (Frondel and Schmidt 2005). However, in reality environmental or macroeconomic conditions rarely stay stable over the years, for example market prices fluctuate. Some of the variation can be controlled but this may require extensive data collection on the factors that can influence the outcomes of the project. Another assumption is that the outcomes before treatment are not influenced by anticipation of the intervention. These two assumptions make before-after comparisons most suitable to situations where the causal link between action and impact is simple, for example when the water fetching time is compared before and after building a well in the village. An additional problem in before-after comparison in regard to ForCES is that certification may take place at rather late stages of the project and hence, there won't be enough time to collect data on the impact of certification.

5.2.2.2 Case-based approach

In the case-based approach systematic causal analysis takes place in the context of the case. This differs from the earlier case study based approaches where variables were analyzed out of the context (Stern, Stame et al. 2012). Conducting within-case analyses together with comparisons across the cases makes it possible to draw conclusions "under certain conditions". This approach is entirely possible within the context of ForCES and probably should be used together with the experimental design as some of the sites have rather unique characteristics, e.g. Pumalin as well as the sites in Vietnam due to their special market situation.

5.2.2.3 Matching estimators

The idea behind matching is simple: the participants or areas are matched with non-participants or areas from a non-experimental control sample who are similar in terms of their observed characteristics (Frondel and Schmidt 2005; Ferraro and Pattanayak 2006). The data is collected from both groups before and after the intervention and a difference between the groups imply impact of intervention. The advantage of this method is that it allows for changes in environmental and economic conditions as these affect, at least in theory, both groups equally (Frondel and Schmidt 2005). The disadvantage is that exact matching is relatively difficult and a large sample may be needed which is a problem in the context of ForCES as there are only ten project sites in total. A way to circumvent the sample size problem can be to match the project participants and not the sites. However, it is important to bear in mind that a participant's anticipation to be part of the project may change the pre-intervention behavior and may bias the results as this method is not able to deal with the anticipation effects.

5.2.2.4 Participatory approach

Participatory designs focus on the stakeholders and participatory methods to demonstrate the impact of intervention (Stern, Stame et al. 2012). Participation, accountability, and benefit sharing are central aspects of certification and payments for ecosystem services. Questions such as who participates and who benefits are important as they may have implications on the success of the intervention. Thus, the focus is on participatory content when the impacts of the intervention are interpreted. For example, the extent of local community participation is studied to see whether the level of involvement makes a difference to the success of the project's outcomes. Again, this is a very suitable method in the context of ForCES and considering that participation is one of the challenges at least in Carahue it may be possible to draw conclusions about the importance of it. However, this approach is focused on a narrow set of explanatory factors and thus, conclusions based on this approach are limited as well.

5.2.2.5 Theory-based approach

Regardless of the method chosen to study the impacts, it is useful to formulate some kind of theory on how the intervention impacts the outcomes (theory of change). Theory-based approaches are usually process oriented (Stern, Stame et al. 2012). The project implementation is seen as steps from the project initiation through causal links to the outcomes. Underlying the process is a theory on how and under what circumstances an intervention achieves its goals. The causal chains that describe the process are theoretically explicit narratives that carefully trace and compare the sequences of events constituting the process. Based on the causal chains a causal map can be drawn that illustrates an impact pathway to achieve the goals, the assumptions made, rival explanations for the causal links, and external factors.

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7 Appendices

Appendix 1. The participants of the workshops at different countries.

Chile

Name	Organization
Patricio Herranz	Forestal Mininco
Andres Venegas	Conaf
Oscar Sanchez	MASISA
Paula Andrea Mendez	DAS
Mario Rivas	DAS
Luis Alfaro	Bosques Cautín
Hernan Mladinic	Parque Pumalin
Ingrid Espinoza	Parque Pumalin
Luis Astorga	Astorga Consultores
Ana Young	FSC-Chile
Claudia Cuiza	FSC-Chile
Alison Ketteler	FSC-IC
Sini Savilaakso	CIFOR
Juan Jose Aguirre	INFOR
Jorge Cabrera	INFOR
Fernando Aizman	MMA SIRAP-GEF project
Carlos Zambrano	PUMA VERDE
Yasna Rojas	INFOR
Jose Alfredo Alvarez	CONAF
Roxana Ayllon	ForCES Project

Indonesia

Name	Organization
Aditya Bayunanda	WWF
Dita Ramadhani	WWF
Joko Sarjito	WWF
Kurniawan	WWF Lombok Program
Baharudin, MP.	IMP
Tri Djatmiko	PT. Ratah Timber
Dodit Agus Riyono	Forestry Service
Yhani Saktiawan	Betung Kerihun National Park
Ilyas	Danau Sentarum National Park
Darmawan	Kapuas Hulu District Tourism Service
Albertus Tjiu	WWF West Kalimantan Program
Hermas Rintik Maring	WWF West Kalimantan Program
Tri Agung Rooswiadji	WWF
Sri Jimmy Kustini	WWF West Kutai Program
Merzyta Septiyani	WWF
Beria Leimona	Independent PES consultant
Alan P.	LEI
Indra Setia Dewi	LEI
Iwan K. Permadi	APCS
Romain Pirard	IDDRI
Akhmad Fauzi	IPB
Sini Savilaakso	CIFOR
Michael Padmanaba	CIFOR
Wanggi Jaung	CIFOR
Louis Putzel	CIFOR
Ken Sugimura	CIFOR
Samuel McGlennon	CIFOR
Guillaume de Buren	CIFOR
Renaud Lapeyre	IDDRI

Nepal

Name	Organization
Sini Savilaakso	CIFOR
Parbat Gurung	HBTL
Shambhu Prasad Dangal	Environment Resource Institute
Dhan Bahadur Tamang	FECOFUN
Ganesh Karki	FECOFUN
Uddhab Pokharel	FECOFUN, Dolakha
Ganga Sagar Pant	TAAN
Dhan Bahadur Tamang	CF Member
Harihar Neupane	FECOFUN, Dolakha
Jagadish C. Baral	Independent Researcher
Deepak Kumar Singh	NTNC
Bijendra Basnyat	WTLCP
Madhu Ghimire	MoFSC
Lok Raj Pathak	FECOFUN, Dolakha
Pooja Mallick	WWF
Ugan Manandhar	WWF
Navaraj Pradhan	ICIMOD
Chandra Bahadur Thapa	District Forest Office, Dolakha
Mitra Jirel	District Forest Office, Dolakha
Kedar Nath Dahal	District Forest Office, Dolakha
Ramesh Basnet	Department of Plant Resources
Bhishma Prasad Subedi	ANSAB
Kalyan Gauli	ANSAB
Megh Dhoj Adhikari	ANSAB
Sagar Godar Chhetri	ANSAB
Basanti Subedi	ANSAB
Ravi Khatri	ANSAB
Sita KC	FECOFUN, Dolakha
Goliv Khatiwada	ANSAB

Kiran C Adhikary	ANSAB

Vietnam

Name	**Organisation**
Ho Sy Huy	DoF, DARD Quang Tri
Doan Viet Cong	DoF, DARD Quang Tri
Nguyen Quang Hai	Vinh Tu, Quang Tri
Le Van Phong	Vinh Tu, Quang Tri
Nguyen Huu Hien	Vinh Tu, Quang Tri
Tran Duc Phan	Vinh Tu, Quang Tri
Nguyen Van Phong	Vinh Tu, Quang Tri
Nguyen Thi Thu Hang	Forestry Protection Department, DARD Ha Tinh
Pham Nguyen Binh	Huong Son State Forest Company
Le Dinh Loi	Huong Son State Forest Company
Le Trong Hoai	Huong Son State Forest Company
Dau Van Sy	Huong Son State Forest Company
Duong Lien	Sustainable Forest management institute
Doan Diem	Sustainable Forest management institute
Dao Cong Khanh	Sustainable Forest management institute
Vu long	Sustainable Forest management institute
Pham Xuan Phuong	Sustainable Forest management institute
Pham Minh Sang	National Forest Science Institute
Tran Van Con	National Forest Science Institute
Nguyen Thi Thuy	National Forest Science Institute
Le Thuy Anh	WWF Vietnam
Vu Thanh Nam	VNFOREST, MARD
Ngo Sy Hoai	VIFOREST
Fabian Noeske	RECOFTC/FORINFO

Sini Savilaakso	CIFOR
Vu Thi Que Anh	SNV
Adrian Enright	SNV
Vu Thi Kieu Phuc	SNV

Appendix 2. The user or use categories identified for each ecosystem service at the workshops held in the pilot countries. Non-timber forest products were considered only in Nepal. Otherwise the countries are indicated in the tables.

Biodiversity

Users	**Chile**	**Indonesia**
Cosmetic companies	v	
Farmers	v	
Firewood collectors	v	
Fishermen	v	
Hunters	v	
Local community	v	v
Cultural use	v	v
NTFP gatherers	v	v
Pharmaceutical companies	v	v
Researchers	v	
Teachers and students	v	
Timber companies and other wood-based enterprises	v	v
Tourists	v	v

Carbon

User	**Indonesia**	**Nepal**	**Vietnam**
Carbon buyers		v	v
Companies purchasing forest products (timber mills, brick factories)			v
Forest-based enterprises	v	v	
Local community	v	v	v
Farmers			v
Households			v
NTFP gatherers	v		
Neighboring communities not directly involved in management	v		v
State-operated companies (forest owners)			v

Ecotourism

Users	Chile	Indonesia	Nepal	Vietnam
Artists (Painters, photographers)	v			
Arwana fishpond farmers		v		
Cultural/Ceremonial users		v	v	
Farmers (e.g. rice, agroforestry)		v		v
Fishermen		v		v
Government/local authority		v		v
Handicraft makers		v		
Honey collectors		v		
Hunters		v		
Local people/communities	v	v	v	v
Neighbor unions	v			
Parent organizations of school	v			
Coastal communities	v			
Local service providers	v		v	
Guides	v		v	
Porters			v	
NTFP users (Rubber)		v		
Oil palm planters		v		
Pilgrims			v	
Researchers/scientists	v			
Road travelers	v			
Special interest tourist	v	v	v	
Students	v			
Teachers	v			
Tour operators/tourist agencies	v			
Tourists	v	v	v	v

Hydrological services

Users	Chile	Indonesia	Nepal	Vietnam
Agriculture	v	v	v	v
Cattle owners	v			
Irrigation	v		v	
Land owners of the upstream	v			
Daily use; drinking water & sanitation	v	v	v	v
Fishermen	v		v	v
Hotels		v		
Industry				v
Car washing industry		v		
Hydropower			v	v
Lactolac milk company	v			
Mineral water industry		v		
Mining				v
Stream fisheries		v		
Water companies	v	v		
Water mill			v	
Microhydro		v		
People using watercourse as a firewood road	v			
Rafting, water activities			v	
Tourists		v	v	v
Certain tree species that use of lot of water	v			

Non-timber forest products

Use	User							
	Farmers	Enterprises	Local collectors	Local healers	Outsider collectors	Tourists	Town/city people	Traders
Adhesive	v		v					v
Aromatic		v	v	v				v
Dye	v		v					v
Edible	v		v		v		v	
Fiber	v	v	v		v			v
Fodder, litter	v							
Fuel	v	v	v				v	
Medicinal			v	v	v			v
Ornamental			v			v		v
Spices	v		v				v	

Appendix 3. Proposed indicators

Biodiversity