Local land use and river map in North Thailand
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CHAPTER 5

Monitoring for performance-based PES: contract compliance, learning and trust building

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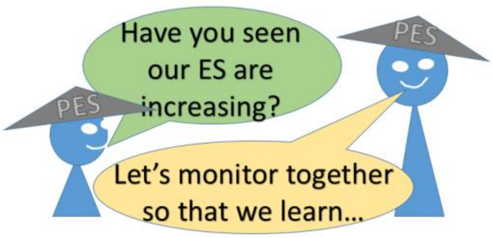
Highlights

- PES contracts need to specify how performance is to be monitored.
- Joint monitoring to support learning and trust building differs from contract compliance as such.
- Monitoring generally relies on readily observable 'proxies' for the targeted ES.
- Dealing with uncontrolled external variability (incl. extreme climatic events) remains a challenge.
- The Social-Ecological System with its internal learning loop is the ultimate target of monitoring.



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5.1 Introduction

An important part of PES contracts is the clarity that is needed on how 'performance' will be monitored and assessed[1]. With preceding chapters providing a typology of ES[2] and guidance on how to quantify services of various types, how to value them economically and how to assess tradeoffs[3], this chapter is focused on the monitoring of actual performance and ES change[4]. It starts by acknowledging that change in actual ES is not easy to quantify in space and time as it is part of wider patterns of change. It is certainly not easy to attribute any change in ES to specific actions of contract partners, without consideration of alternative explanations. Ecosystem services are produced in landscapes as social-ecological systems[5] that are subject to constant change with multiple learning loops for multiple actors, independent of each other or partly aligned. ES enhancement will nearly always include efforts to get the various stakeholders more aligned, and monitoring of progress will require such 'process' aspects, as well as actual changes in the landscape, ecosystem structure and function, and the services it provides.

Monitoring of ES has four main functions: a) learning, b) trust building, c) measuring contract compliance, and d) building evidence that the scheme causes ecological benefits worthy of support from higher levels of the polycentric governance system. The way a monitoring program is designed has to address these functions and the possible tradeoffs between them. In doing so, the chapter provides further discussion of proposition E1[1]:

> **E1**. Ecosystem service (ES) provision from agricultural landscapes is influenced by the existing combination of land use practices, how they are distributed spatially, how they interact with each other and how this changes over time.

Payments for ecosystems services (PES) schemes are designed to provide incentives (including access to land, credit facilities and information, or financial performance-based payments) that are not only aimed at increasing the amount, utility and value of ecosystem services (ES) that a landscape provides, but also that are, at least to some degree, conditional to 'performance'[6]. This 'performance-based' characteristic was weak in previous schemes such as the 'integrated conservation and development programs' (ICDP's) where inputs and money were provided with assumption or trust that land use change would be achieved, but with no explicit conditionality on actual ES outcomes[7]. This conditionality has implications for information needs – all contract partners need to know and agree on what is changing and by how much. If it becomes clear during negotiations of a PES mechanism that desirable changes in ES will be hard to quantify, it may be necessary to frame the contract on easier-to-measure 'proxies', accepting some risk that the relationship between the proxies and ES is changing with time.

This chapter explores the options and concerns around data and information for PES schemes that have at least some degree of conditionality, while aiming for turning the switch from degrading to restoring phases of landscape change (Figure 5.1). It is organized in four parts:

1. We analyse the concept and limitations of 'conditionality',
2. We present a framework for thinking about data and information requirements,
3. We use the 25 case studies of this volume to critique issues and concerns,
4. We propose a practical strategy and actions for designing data and information systems for an emerging PES arrangement.

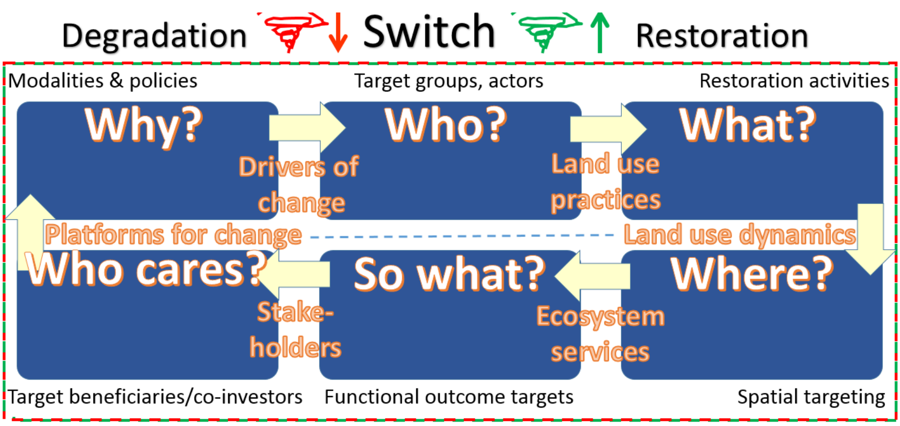

Figure 5.1. Key questions[4] that jointly shape an understanding of landscapes as social-ecological systems[5] and that may need to be monitored if the switch from degrading to restoring phases of a landscape is to be effectively turned in a PES arrangement

5.2 Conditionality in PES contracts as basis for monitoring

Five levels of 'conditionality' have been distinguished in the broad family of PES arrangements[8]:

- Actual change in ES (the 'so what' in Fig. 5.1),
- Change in ecosystem structure and land use that is expected to enhance the ES ('proxies') (the 'what' and 'where' in Fig. 5.1),
- Levels of effort and input (the 'who' in Fig. 5.1),
- Management plans and capacity to intervene as and when needed (the 'why' and 'who' in Fig. 5.1),
- Objectives (motivation) and priorities that guide the management (the 'who cares' and 'why' in Fig. 5.1).

The first two are generally discussed as 'outcome' measurements, while the latter three are seen as 'process' monitoring. Trust between contract partners can lead to a reliance on the management, objectives and motivation aspects in the process side, but trust has generally to be built up by an initial focus on tangible 'outcomes'. On the other side of the argument: clarity on desired outcomes can avoid 'micro-management' of the process, and allow innovative ways to achieve the desired outcomes to emerge. A risk of the latter is that if 'agreed outcomes' do not fully represent the underlying objectives, a focus on agreed metrics can side-track efforts to fulfilling contractual detail but not matching the intent of the contract partners. This is a common problem in performance management of any types of contractual agreements. The choice of 'key performance indicators' may be skewed towards what can be measured rather than what is important.

A major challenge is that PES partners bound by a contractual agreement may face is 'uncontrolled variability', or so called 'force majeur' in legal terms, or 'acts of god' (with apologies to religious feelings hurt, but this is a legal term in many countries)[9]. Extreme weather events, becoming more likely under global climate change, can cause major damage to vegetation, water flows (esp. floods), biodiversity (esp. droughts), built environmental infrastructure and human livelihoods. While ES may buffer (reduce vulnerability) for moderate events, there are limits to what can be buffered. This means that PES contracts need to consider where the limits of responsibility are, and how to monitor the external sources of variability most likely to disrupt the ES.

Information needs in a PES mechanism are thus much broader than changes in flows of ecosystem services, and must consider its monitoring scheme as it has social implications. Agreements of PES also seek to achieve voluntary participation, efficiency and fairness, which need to be demonstrated based on some level of evidence. Fairness or equity implies inclusiveness, balanced distribution of costs benefits and risks, decreasing the gap between the rich and poor as well as doing no harm to the poor[10,11]. Efficiency means than the PES scheme achieves its objectives of additional ecological benefits against a counterfactual or baseline at a lower cost than alternatives. Determining efficiency thus has information requirements not only about the PES scheme but also about a business-as-usual scenario and other feasible options. Similarly confirming that participation is, in practice, voluntary also has information implications. The Free and Prior Informed Consent (FPIC) literature has established good practice recommendations for such[12], but there usually remains debate on how inclusive any process and claim of 'consent' have actually been.

Monitoring involves costs, and the "value for money" of information is key to the design of a monitoring system. The benefits of monitoring can be broadly described as:

A. Learning about changes in the ES and the way they are influenced by land use and external factors;
B. Trust building between partners in a (prospective or actual) PES contract,
C. Compliance with terms of agreed PES contracts,
D. Building evidence that PES schemes contribute to ecological benefits.

The three PES paradigms introduced in the first chapter[1] have different requirements for monitoring: the commodification (CES) paradigm may focus on certifying actual delivery of ES as part of contracts (A and D), while trust building (B) is relevant in the compensation (COS) and co-investment (CIS) forms of PES, and an explicit focus on learning (C) is a major part of the co-investment paradigm (CIS).

5.3 Data and information framework

5.3.1 Measurements and the PES project cycle

Measurements are usually part of the process that leads to a PES scheme[2] project implementation or made by interested parties that seek to establish project effectiveness[13].The way monitoring is designed, often a combination of participatory (including project proponents) and 'expert' third-party assessments, has to balance between the four stated functions and the interests and perceptions of all contract partners. The global discussions on ways to reduce emissions from deforestation and (forest) degradation (REDD+) has made progress on the way 'Monitoring, Reporting and Verification (MRV)' has to be an integral part of any PES scheme. Although MRV has often been discussed as a single package, the three elements differ in character: the monitoring (M) can first of all serve the goal of learning about changes happening and their attribution to local actions and 'uncontrolled' external variability. The reporting (R) tends to have a qualitative (what is being learned) and a quantitative (what has been measured) part, geared towards the information requirements of external audiences. The verification (V) usually requires external, independent auditors to assess the quality (and possible biases) of the monitoring systems used. It may comment on the relation between project findings and experiences elsewhere, paying extra attention where results appear to be on the high or low end of the range that is seen as the 'norm'. In reality, however, there still are major challenges in how to implement MRV in a cost-effective way that reduces conflict[14]. In the context of REDD+, comparisons have been made between monitoring of trees by local communities versus professional technicians in three Southeast Asian countries and Tanzania[15]. Slightly lower precision in the first case could be compensated by increasing the number of replicates for approximately equal costs[16]. The cost structure of these two approaches is different, with additional costs for training in the first round of measurements paying back in the second measurement cycle[17]. Local monitoring increases transparency of the process, but will require additional checks and balances when incentives are directly linked to reports of the monitored change in forest condition. Local monitoring of water flows and stream quality, in combination with expert calibration of the methods used, has a strong track record[18].

5.3.2 Who needs what type of information?

PES schemes can involve numerous parties and interests that each has own information needs. At its most basic, there are buyers and sellers, but other groups are involved in most schemes and have their own needs, explicit or implicit. We recognize five groups according to their role (Figure 5.2).

1. Providers – land users/managers, individuals or communities whose decisions and actions influence (it is presumed) the flow of ES,
2. Beneficiaries/buyers –providing the payments (financial or otherwise),
3. Intermediaries – those who bring 1 and 2 together, facilitate and negotiate,
4. Other stakeholders – those with an interest in the PES scheme that is beyond roles 1, 2 and 3 (e.g. regulating or hoping for spin-off benefits of the scheme, but not paying) and who therefore try to influence 1, 2 or 3,
5. Researchers studying the process and learn from it.

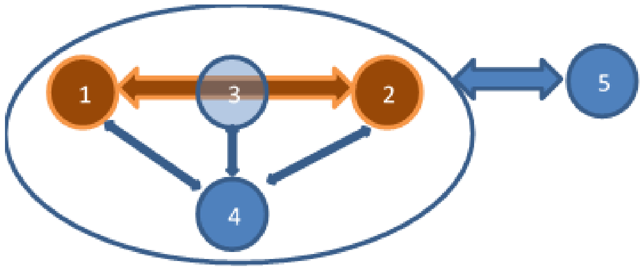

Figure 5.2. Stakeholders of PES schemes that are interested in and may take part in monitoring of performance

Referring to Figure 3.3[3], monitoring may have to involve many aspects of the PES scheme: 1. Actual change in ES, 2. Change in land use/land cover patterns that can be linked to ES, 3. The impacts of uncontrolled external variability (e.g. extreme rainfall events, droughts) that are beyond the spheres of influence and responsibility of the ES providers, but do impact on 1 and 2, 4. Efforts expanded in modifying land cover and direct costs involved (as basis for compensation), 5. Management plans for the land use decisions, 6. Shifts in objectives on the land user side, 7. Transaction costs involved in all steps to get the PES agreement going and to meet existing government regulations.

Where performance for a PES contract is defined relative to a 'baseline' expectation (e.g. continued degradation), it may be necessary to also collect data in 'control' sites, without PES intervention. This requires a good sense of comparability, in social, economic and ecological characteristics. It is likely to be open to contest if results differ from what was expected or hoped for. Overall this makes the monitoring of positive change ('restoration') easier than that of avoided damage. Specifically in the context of carbon (and other greenhouse gas) emissions, the concept of 'leakage' has been amply discussed. It relates to both positive and negative change outside a project area that is directly linked to project interventions (e.g. shifting demand for wood products elsewhere, if local forest protection is not linked to a decrease in demand for products). Especially for the external stakeholders, it may be relevant to collect data on the distribution of costs and benefits across households, and benefit of each intra-household member based on gender, to check that existing inequity is not enhanced. Where ES tend to be related to land, inequity in land ownership and tenure is prone to make PES benefits accessible mostly to those already better off. Gini coefficients for specific PES related income components have been successfully compared to those for pre-PES assets in this context[19].

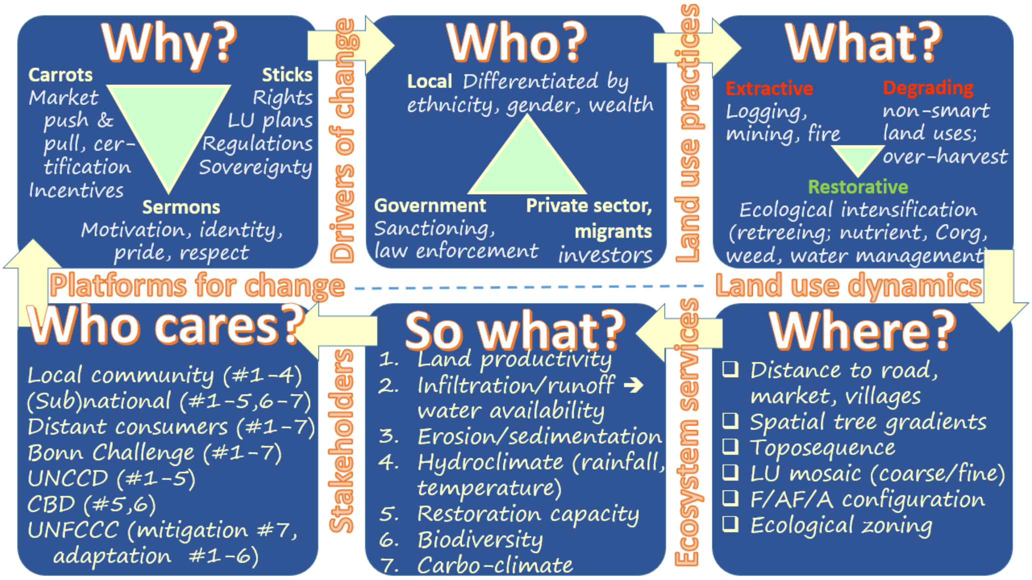

Figure 5.3. Further specification of Fig. 5.1 for aspects that may require monitoring attention in each of the six main questions for understanding a landscape as social-ecological system

5.3.3 How will data be collected and handled

For each of the types of information needed, an appropriate sampling frame is needed. This normally means that the boundaries of the system must be clear, so that the population of potentially measurable places is known, with appropriate stratification. Some properties need to be measured spatially (e.g. vegetation, soil carbon) and require a stratified sampling approach in which there is specific attention to the locations where high values can be expected. Other properties, such as river flow require specification of the points of measurement and observation[12]. Automatic data recording to data loggers, or for remote places where access for regular downloads is a problem, by telemetry[20] have become common for weather stations, river level records (to be converted to flow data), water temperature (and other physical and chemical characteristics for which sensors exist) and groundwater levels. Biodiversity data will usually rely on 'indicator species' (birds, trees[21]) or more advanced 'camera traps' for species not readily observed in day time and advanced analysis of spatial patterns, fragmentation and connectivity[22]. Local monitoring can include locally relevant dimensions of diversity[23]. Visitor numbers to places with recreational or landscape beauty value can be derived from GPS coordinates of Instagram (or similar) pictures uploaded to websites.

A key aspect of the design of any monitoring scheme is the transparency of the process, and easy access to quantitative results. Similar to the experience that public announcement of expenditure by (or on behalf of) local governments helps in reducing corruption, data obtained in PES monitoring should be open to public scrutiny. Various efforts to invite information on land cover change to be documented by photographs uploaded in a geographic information system (e.g. an overlay on Google Earth) are in development with positive results reported. Public involvement in monitoring of deforestation is progressing[24].

The costs of monitoring tend to go up when a higher precision (narrower confidence intervals of the estimates, to speak a technical language) is required. It is important here to distinguish between time series of stock estimates where errors tend to compensate (e.g. errors in tree biomass measurements), and direct flow measurements where error does not decrease with further effort. An important consideration is also the scale at which precision is needed. A study on a combination of remote sensing for land cover change and local C stock estimates of different land cover types, found that for an evaluation scale of 1 km^2 errors would be below 5%, while estimates at higher spatial resolution would require more costly methods and/or have a larger error associated with them[25]. C stock estimates for a large area tend to be accurate, while pixel level reliability is costly. This may have consequences for the way performance is remunerated. Frequency of measurement is another dimension of scale that depends on the level of precision desired given the rate and timing of occurrence or change in a situation, is a key consideration in monitoring biodiversity[26]. Not all measurements are needed throughout the scheme and focus of measurements may change as the scheme evolves.

Basic methods for monitoring the various aspects of a PES contract are described in Table 5.1. Examples of the way this is achieved in local context are provided in the next section.

Table 5.1 Examples of monitoring in the context of specific ES (based on Table 3.3) for PES contracts based on various types of conditionality; W, B, G, P stand for water, biodiversity, greenhouse gas (incl. C), and productivity based ecosystem services[2], respectively

ES	**Aspects to be monitored**	**Examples of methods** in NSS toolbox[4]
Actual change in Ecosystem Services delivery		
W (water)	Water quality[18], flow pattern[18], flow persistence as basis for flood risk assessments[27], indicators of full hydrological cycle[28,29]	PaWaMo
B (biodiversity)	Long-term monitoring plots (vegetation)[26], camera traps	QBSur, RABA
G (greenhouse gasses and carbon stocks)	Tree growth monitoring, emission factors for specified land use	RACSA, SEXi-FS
P (productivity)	Statistics on offtake, standing stocks, market prices, trade/export data	RAFT, LUPA, RMA
Change in ecosystem structure and land use that is expected to enhance the ES ('proxies')		
W	Vegetation pattern, filter zones for intercepting overland flow[30], fraction (and spatial distribution) of bare soil	RHA, CoolTree,
B	Buffer zones (gradients in human presence and impact), ecological corridors related to dispersal modes of key organisms	ECOR
G	C stock change inferred from land cover change[25]	ALUCT, REDD Abacus, REPeat
P	Remotely sensed land cover types combined with productivity data	DriLUC, LUCIA
Documenting and discounting for uncontrolled external variability ('force majeur')		
Rainfall	Calibrated weather stations + remote sensing rainfall data, hurricane/typhoon records	---
Seismic & volcanic	Earthquakes and associated landslides, changes of river courses, dam breaches, volcanic eruptions, deposits, tsunami's[31]	RALMA

ES	Aspects to be monitored	Examples of methods in NSS toolbox[4]
Hydroclimate	Relating space-time characteristics of water flow to rainfall via calibrated models[32] ; climatic effects of volcanic eruptions[33]	GenRiver
Fire	Remotely sensed hot spots, fire spread models	---
Levels of effort and input		
	Who, what, where, when records of level of effort	---
	Expenditures for external inputs	LUPA
	Volume of PES finance disbursed	---
	Success rates in tree planting, quality of work ratings	NotJustAnyTree, WhichTreeWhere
	Efforts and expenditure used in monitoring	---
	Opportunity costs: updating profitability estimates of options foregone	Con$erv, RESFA, REDD Abacus
Management plans and capacity to intervene as and when needed		
	Spatially explicit landscape management plans (zoning)	Polyscape, WNoTree
	Interactions with government authorities regarding access to land and land use rights,	RATA
	Interaction with government authorities regarding development and spatial planning and zoning at various scales	LUWES, LUMENS*
	Process used to deal with ecological, economic and social trade-offs	ASB-Matrix
	Involvement of multiple stakeholders	RPG
	Documentation of Free and Prior Informed Consent	AASSAPP
	Conflict settlement procedures	---
	Follow-up to local monitoring: evaluation, learning and adjustments	RISNA
Objectives (motivation) and priorities that guide the management		
	Landscape visioning exercises[34], explicitly involving female, male and youths	PALA, GroLUV
	Livelihood strategy, poverty and environment dynamic tools in Negotiation Support toolbox[4]	PaPold, G-TreeFarm
	Sustainable Development Goal analysis and performance indicators	TreeSilience, CoolTree
Transaction costs		
	Cost of participating in PES scheme: time spent, meetings, travel, social capital, reputational risks	RISNA, MuScaPes
Co-benefits		
	Changes in livelihoods and ES that are not the target of the PES scheme	PaPold
	Effects on skills, attitudes, knowledge as part of capacity development	CaSAVA

ES	Aspects to be monitored	Examples of methods in NSS toolbox[4]
Distributional effects (gender, poverty)		
	Gini coefficients (gender specific) of assets, costs and benefits[35]	GroLUV
	Perceived equity and fairness e.g. documented from focus group discussions	FERVA

Researchers and villagers interacting on a local water quality and land use change monitoring scheme in N. Thailand. Photo: World Agroforestry Centre/Meine van Noordwijk

5.4 Examples of how monitoring is achieved in PES cases discussed in this book

The various case studies throughout the book provide contextualized detail on how monitoring was approached, both regarding the specific ES involved, and regarding the more process aspects of a PES (co-investment) relationship between contract partners. A few highlights are compiled here for the three main types of ES targeted by the PES schemes: water, biodiversity and carbon.

5.4.1 Water focussed landscapes

The largest share of PES examples discussed in this book, reflecting current reality in the developing world, is focussed on aspects of watershed management (Table 5.2), and makes use of direct measurement of rivers and/or proxies of land cover that are considered risky or benign.

Table 5.2 Examples of monitoring in water-focused landscapes (specific ES based on Table 3 of chapter 2)

Case study	ES*	Monitoring actual ES	Monitoring process, proxies
Sasumua[36] – potential scheme between Smallholder farmers in a Water Resource User Association and Nairobi Water and Sewerage Company – Chapter 8[39]	W4	o Erosion problem analysis through questionnaire surveys and infrared spectroscopy.	- WTP and WTA determined through surveys with participatory GIS, - Changes in sediment flow, surface runoff, base flow and water yield using SWAT Model with samples from reservoir inlet points and past climate data.
Naivasha (smallholder farmers in uplands in Upper Turasha-Kinja and Wanjohi Water Resource Users Associations (WRUAs) and Lake Naivasha Water Resource Users Association (LANAWRUA) – Chapter 8[39]	W4	o Soil deposition at the grass strips; water quality using turbidity meters, o Water quantity from regular gauge readings.	- Land cover change using GIS and remote sensing, - Seller livelihood analysis and capacity assessment using surveys.
Uluguru (Tanzania)[37,38] – between smallholder farmers in subwatershed of Mfizigo river and DAWASCO and Coca-cola Kwanza Limited – Chapter 8[39]	W1, W2, W3, W4, W6	o River water level using staff meter and automatic data logger, o Water discharge using current meter, o Sediment flow using sediment sampler and laboratory testing.	- Land cover change using GIS and remote sensing, - Livelihood change analysis using questionnaires, field observation, focus discussion and farm visits.
Asian Highlands, chapter 18[40]	W1, W2, W3	o Retention, recharge and reuse of rain water.	- Socially inclusive community forums - National Water Use Master Plans (WUMP)
Lantapan (Philippines), chapter 19	W2, W3, W4	o Survival rate of the trees planted (90% threshold), o Not planting seedlings under the power transmission lines.	- Develop tree-based or agroforestry farms, - Maintain and protect the planted trees until the age of maturity, - Are responsible for possible intruders (e.g. illegal occupants, incendiarism or intentional burning).
Sloping land conversion (China), chapter 27[41]	W2, W3, W5	o Tree planting, absence of annual crops (with biennial medicinals as borderline case).	- Voluntary contracts at standard compensation, - Motivational match with local notions of justice.
Cidanau (Indonesia), chapter 35[42]	W3	o Manual, ground check and verification on the farmers' contracted land, o FKDC in collaboration with ICRAF start to	- Maintain and replant 500 trees/ha, - Cutting and thinning trees is allowed in some cases, - Specific plan on land management for soil

Case study	ES*	Monitoring actual ES	Monitoring process, proxies
		develop methodology to measure the performance of PES in Cidanau using canopy density and remote sensing.	conservation and benefit sharing must be stated in the selection proposal.
Sumberjaya (Indonesia), chapter 36[43], chapter 26[44], Box 2.1[2]	W4, W6	○ Externally verified changes in sediment loads of the river based on turbidity under specified flow conditions.	- Participatory water monitoring (PaWaMo)[4,18]

W1 Water transmission; **W2** Buffering peak flows; **W3** Gradual release of stored water supporting dry-season flows; **W4** Maintaining water quality (relative to that of rainfall), sediment and pollutants per unit volume of water, biological water quality indicators; **W5** Stability of slopes; **W6** Tolerable intensities of net soil loss by erosion; WTP = willingness to pay; WTA = willingness to accept.

5.4.2 Biodiversity-focused landscapes

Only one case study focussed on biodiversity is described in this book, although biodiversity 1s often mentioned as secondary objective in watershed management efforts.

Table 5.3 Examples of monitoring in biodiversity-focused landscapes (specific ES based on Table 3 of chapter 2)

Case study	ES*	Monitoring actual ES	Monitoring process, proxies
East Africa wildlife conservation payments – between local land owners for setting grazing land aside (leaving it unfenced) for wildlife conservation and tourist operators or conservancy owners, chapter 9[45]	B1, B3	Rate of change in wildlife and livestock biomass using aerial surveys	Conservancy management plan. % of land under co-managed for wildlife conservation determined through surveys of key public contacts, Change in pastoralists incomes using household surveys and interviews.
Human-elephant conflict (HEC) in Thailand as government's policy to expand export-oriented agricultural sector[46]	B1, B6	Annual HEC incidents, Annual HEC damage costs, Annual HEC protection costs by households, Land cover change intensity, Number and area of breeding and foraging sites, Number of threatened species.	Increase water supply available for wildlife, Convert alien invasive shrub and tree species into grassland, Create mineral saltlicks as a contraceptive for female elephants, Source of food for wildlife, Plant food for elephants within the sanctuary, Fence part of the sanctuary.

* **B1** Integrity of conservation areas by preventing loss of habitat and threats at population level around core protection sites; **B3** Connectivity between protected areas via corridors; **B6** Opportunities for active recreation (ecotourism)

5.4.3 Climate-smart landscapes

The climate-smart concept addresses both 'mitigation' and 'adaptation' and has rapidly been adopted in the development community. Examples here generally use the idea that mitigation can generate income that pays for locally relevant adaptation measures.

Table 5.4 Examples of monitoring in climate smart landscapes (specific ES based on Table 3 of chapter 2)

Case study	ES*	Monitoring actual ES	Monitoring process, proxies
Bac Khan (Vietnam), Chapter 6[47]	G1, G3	Volume of carbon sequestered monitored locally.	Forest patrolling, tree planting inside and outside forest.
Mount Elgon (Uganda) between Uganda Wildlife Authority (sellers) and FACE Foundation(buyers), chapter28[48]	G1, G3	Volume of carbon sequestered verified by third party.	Management plan including removal of encroachers and sharing of responsibilities and benefits from the scheme with adjacent villages, Area of land cleared of encroachers and reforested.
MERECP between Norway & Sweden and local communities in Mt Elgon area in Kenya and Uganda, chapter 7[49]	G1, G3	Volume of carbon sequestered verified by third party.	Management plan for restoring degraded forest, Area of degraded forest reforested.
Lake Singkarak (Indonesia), chapter 29[50]	G2, G3	Volume of carbon sequestered monitored locally.	Voluntary participation in private agroforest establishment on land legally controlled by the community.
Trees for global benefits – between agroforestry farmers adjacent to protected natural forests and voluntary carbon buyers[51]	G1, G2, G3	Volume of carbon sequestered estimated from technical specifications of different farming systems based on tree growth (Mean Annual Increment and Current Annual Increment) and allometric equations	Farm investment plan, Enhancing tree cover while ensuring food and livelihood security, Area of farmland with trees, Area of protected forest managed.
Kenya Agricultural Carbon Project (KACP) between farmer groups and voluntary carbon offsetters via World Bank Biocarbon Fund	G2, G3	Volume of carbon sequestered using Verified carbon standard methodology VM0017[52], Change in soil carbon using the Roth-C Model[53].	Activity baseline and monitoring survey using farm-level interviews.

* **G1** Protecting carbon stocks in natural forest areas, peat soils and other carbon storage areas: Area protected; vegetation cover, carbon stocks; **G2** Protecting above- and/or belowground carbon stocks in areas used for (agro)forestry and/or agriculture: Land cover change intensity, time-averaged carbon stocks; **G3** Restocking carbon with Increase in tree cover by area Increase tree cover by density

5.5 Conclusions: Stepwise planning for monitoring PES schemes

As the examples show, the specific details of how monitoring is integrated with PES designs and implementation phases differs with context. From the experience in the case studies, we suggest a number of steps to be followed:

1. Clarify early on what the information needs to the various stakeholders (Figure 5.2) in the emerging PES scheme are likely to be,
2. Agree on who needs information that should be provided as part of the core scheme (rather than as an add-on activity with separate resources) and get them around the planning table,
3. Agree on each type of information need and design a protocol, paying attention to costs, scale, reliability (calibration by experts) and transparency. Indicators in the protocol can consider indicators of various global initiatives contextualized to the local conditions,
4. Estimate the overall costs (quantitatively or qualitatively) and confirm it is viable. Go back to Step 1 if not (only going back to 2 or 3 will lead to problems later…),
5. Get on with the work,
6. Evaluate lessons learnt and publicise them, particularly if you failed in some aspects and hope others might avoid the same mistake.

Monitoring aimed at continuous learning may at times be at odds with the strategic behaviour of contract partners where 'compliance' is the issue. Restricting the scope for 'performance-based' contracts and favouring a more holistic co-investment paradigm, is often more feasible, given the complexity of attribution in multifunctional, multistakeholder landscapes.

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