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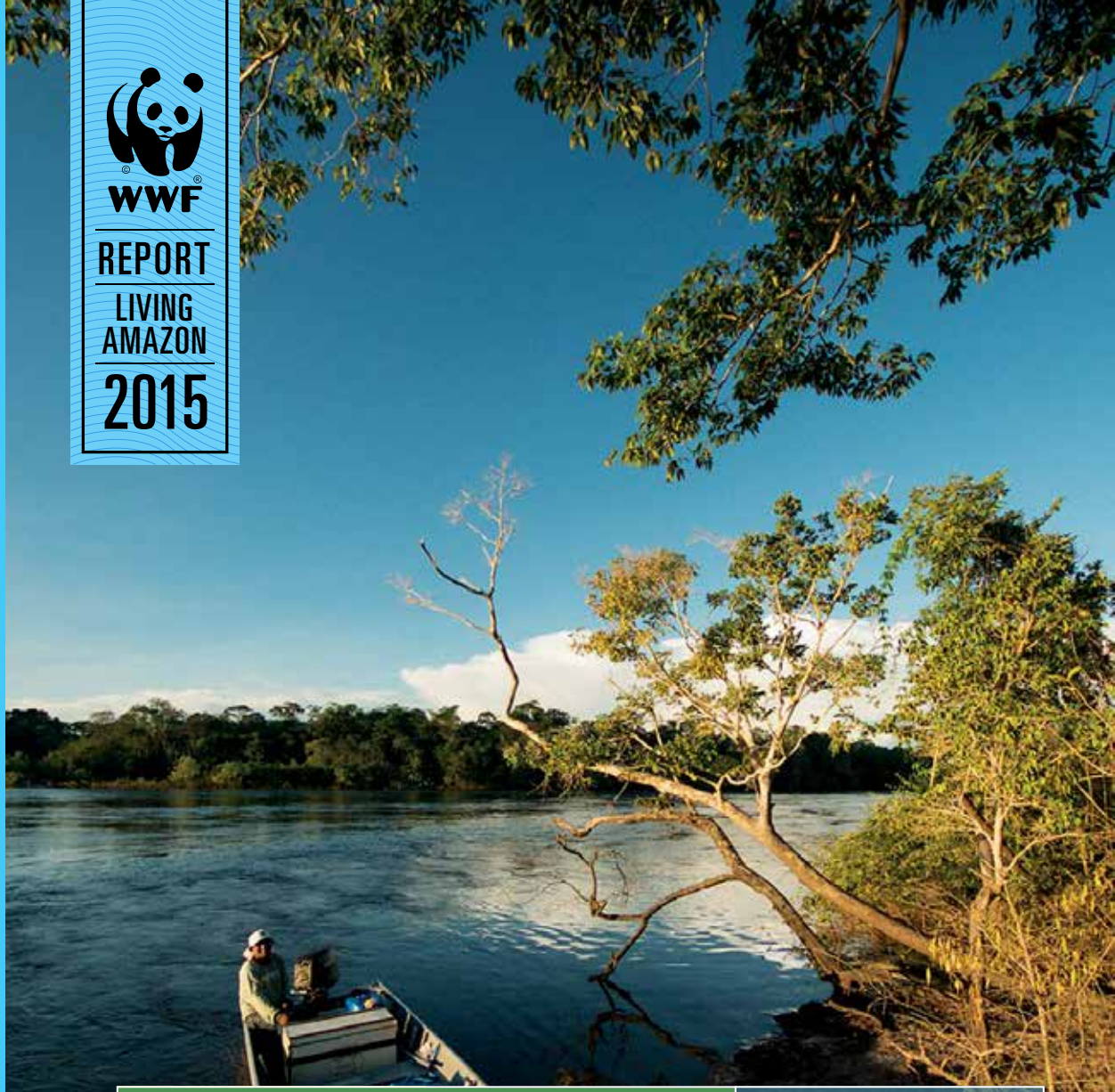
REPORT

LIVING AMAZON

2015



LIVING AMAZON INITIATIVE | ECOSYSTEM SERVICES

SUSTAINABILITY

Ecosystem services valuation as a decision-making tool

Conceptual bases and lessons learned in the Amazon region

MARÍA JOSÉ PACHA
For the Living Amazon Initiative

LIVING AMAZON INITIATIVE | ECOSYSTEM SERVICES | SUSTAINABILITY

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CONTENTS

LIST OF ACRONYMS

NPA	Natural Protected Area
BES	Biodiversity and Ecosystem Services
SEA	Strategic Environmental Assessment
CAC	*Conversatorio de Acción* Ciudadana (Citizen Action Dialogue)
GHG	Greenhouse Gases
GCP	Global Canopy Programme
GOREMAD	Government of Madre de Dios
InVest	Integrated Valuation of Ecosystem Services and Tradeoffs
ISI	International Sustainability Institute
MDD	Madre de Dios (Peru)
NatCap	Natural Capital Project
SAP	Sustainable Amazon Plan (Brazil)
NCCP	National Climate Change Plan (Brazil)
PPCDAM (Brazil)	Action Plan for Prevention and Control of Amazon Deforestation
PES	Payments for Ecosystem Services
PWS	Payments for Water Services
REDD	Reducing Emissions from Deforestation and Forest Degradation
SINANPE	National System of Natural Areas Protected by the Peruvian State
TEEB	The Economics of Ecosystems and Biodiversity
WWF	Worldwide Fund for Nature

Butterflies / Indigenous Community of Palma Real

EXECUTIVE SUMMARY

Human wellbeing and most economic activities depend on a healthy environment. A land-use policy approach focused on the benefits provided by nature - ecosystem services - allows us to identify the direct and indirect ways in which we depend on the environment. This approach, based on valuation of ecosystem services, can help significantly to generate relevant policies at both central and local government levels by providing a complete picture of the costs and benefits of the various choices associated with land use management, and highlighting the best local strategies for improving economic sustainability and wellbeing.

This guide seeks to show how the concept of ecosystem services can be applied to land management decision-making for preserving these services and enhancing human wellbeing.

To do this we explore in detail three cases where the InVest tool has been used to identify, assess and 'put a price on' ecosystem services. Firstly in Madre de Dios (Peru), where InVest was used to support a land use planning process undertaken by the regional government. Secondly, in a complex triple-border nature preservation area in Peru, Colombia and Ecuador where the tool was used to support the management of this protected area, with major participatory input by local stakeholders. Finally, we examine the case of the State of Acre (Brazil), where InVest was used in connection with the economic valuation of land use options in an area where major public policies already ensure the supply and maintenance of ecosystem services.

The InVest tool for valuing ecosystem services has been generally accepted by decision-makers and their staffs as being a flexible, affordable, tool that is relatively easy to apply and that produces easy-to-understand visible results. Nevertheless, major challenges remain for it to be used more widely for informing technical, social and political decisions.

The key lessons learned from the above cases include the need to (1) involve decision-makers at an early stage of the process to ensure their appropriation of the InVest tool; (2) ensure that the social dimension is reflected in all the technical analyses so that local communities can validate results; and (3) develop a flexible process where information can be adapted, improved and updated depending on circumstances. A review of the application of InVest in 20 countries shows that it is particularly important to build up trust with decision-makers, work closely with the local stakeholders who will use the outputs of the process, and train local experts to serve as reliable partners.

We conclude that a valuation of ecosystem services helps people to make informed decisions about land use management aimed at promoting effective development and conservation. It is important to emphasise, however, that this is not a straightforward technical exercise, but one that must also take into account social and political dimensions to ensure that local communities can play a role in decision-making inspired by the ecosystem services approach and thus assure their ownership of the process.

INTRODUCTION

Human wellbeing and most economic activities depend on a healthy environment. A policy approach focused on the benefits provided by nature - ecosystem services - allows us to see the direct and indirect ways in which we depend on the natural environment. Based on a valuation of ecosystem services, this approach can help significantly to generate relevant policies at both central and local government local levels.[1]

HUMAN WELLBEING AND MOST ECONOMIC ACTIVITIES DEPEND ON A HEALTHY ENVIRONMENT.

The many benefits of nature sustain our livelihoods. These include our food and water, materials such as wood, wool and cotton, and many of our medicines. Other less obvious, but equally important benefits include climate regulation. For example, the forests of the Amazon produce most of South America´s rain clouds. Intact wetlands or dune belts ('ecological infrastructure'), protect us against the impacts of floods, storms and other natural hazards. The diversity of vegetation ensures natural groundwater recharge and reduces soil erosion and dam siltation. Nature is also a significant source of recreation, cultural inspiration and spiritual fulfillment. Finally, robust natural systems containing a wide range of plant and animal species make an invaluable contribution to climate change mitigation and adaptation.

Nature´s benefits often provide the most cost-effective and sustainable solutions to meet human needs. Ensuring that ecosystem services are incorporated in land management policy-making can boost local economies, save money for town councils, create jobs and improve quality of life. This approach also helps tackle poverty by highlighting how scarce, essential resources and services are distributed.

Investing in a functioning environment is often considered a luxury rather than as a kind of life insurance. This is because ecosystem services are relatively inconspicuous and generally regarded as cost-free in our modern economies. Many people also tend to assume, mistakenly, that ecosystem services have an unlimited shelf-life and that other, more pressing, day-to-day issues must take priority. Hence many key decisions are taken with no appreciation of their environmental impacts. In reality,

1 TEEB (2010) *La economía de los ecosistemas y la biodiversidad para las autoridades regionales y locales* (A quick guide to the Economics of Ecosystems and Biodiversity for Local and Regional Policy Makers)

the excessive exploitation of limited resources leads to the loss of our natural capital: ecosystems have limits to the amount of strain they can bear, and when these limits are reached the damage is difficult to repair and the search for suitable alternatives requires a substantial amount of time, money and effort.

While many of the threats to the ecosystem are external to the local level, local policy makers nevertheless have to face the dire consequences of continued neglect. Economic analyses have shown that maintaining functioning ecosystems is often the least expensive option.

We all need to identify, appraise and work with the many benefits that originate in nature. Placing a value on ecosystem services can enable us to more accurately define the costs and benefits of different policy options and to identify the optimum strategies for improving economic sustainability and human wellbeing.

Knowledge of the benefits of ecosystem services can help decision-makers to face multiple challenges, to review and fine-tune regulations and influence forms of local supply and production, as well as helping to create market instruments and other incentives for improving water supply and other important amenities.

Glossary

Ecosystem services are the direct benefits that humans receive from the ecosystems.

The Natural Capital Project

© Simon Rawles

RURAL DEVELOPMENT OFTEN PROMOTES ECOSYSTEM SERVICES WITH HIGH MARKET VALUE, TO THE DETRIMENT OF EQUALLY IMPORTANT BUT LESS OBVIOUS REGULATORY SERVICES.

Examples

Some examples of the use of the ecosystem services concept in Latin America.

Ecosystem Services in Public and Urban Management

Cities depend on nature, and ecosystem services can provide cost-effective local services. For example in Quito (Ecuador) the local authorities spend money on watershed conservation to ensure a good supply of drinking water. In Curitiba (Brazil) the local government has achieved cost-effective improvements in flood regulation by setting aside green spaces for rainwater runoff.

Ecosystem Services in the Management of Rural Areas and Natural Resources

Rural development often promotes high-value ecosystem services at the expense of equally important although less obvious regulatory services. There is no need to continue this type of approach. In Nicaragua, Costa Rica and Colombia, for example, pasture management has been improved by sowing different varieties of grasses, bushes and trees to generate additional environmental benefits. This has produced improvements in habitat quality and reduced soil degradation, thereby enabling ranchers to keep cattle in the same areas for longer, avoiding further encroachment of the 'agricultural frontier' and reducing pressure on nearby forests.

Ecosystem Services in Land Use Planning and Environmental Assessments

Planning frameworks and environmental impact assessments can include a proactive approach to ecosystem services, demonstrating for example how planned infrastructure development such as dams and roads can affect local populations and society as a whole. At the same time it allows for the identification of the potential economic advantages (not just constraints) to be derived from safeguarding and maintaining these services.

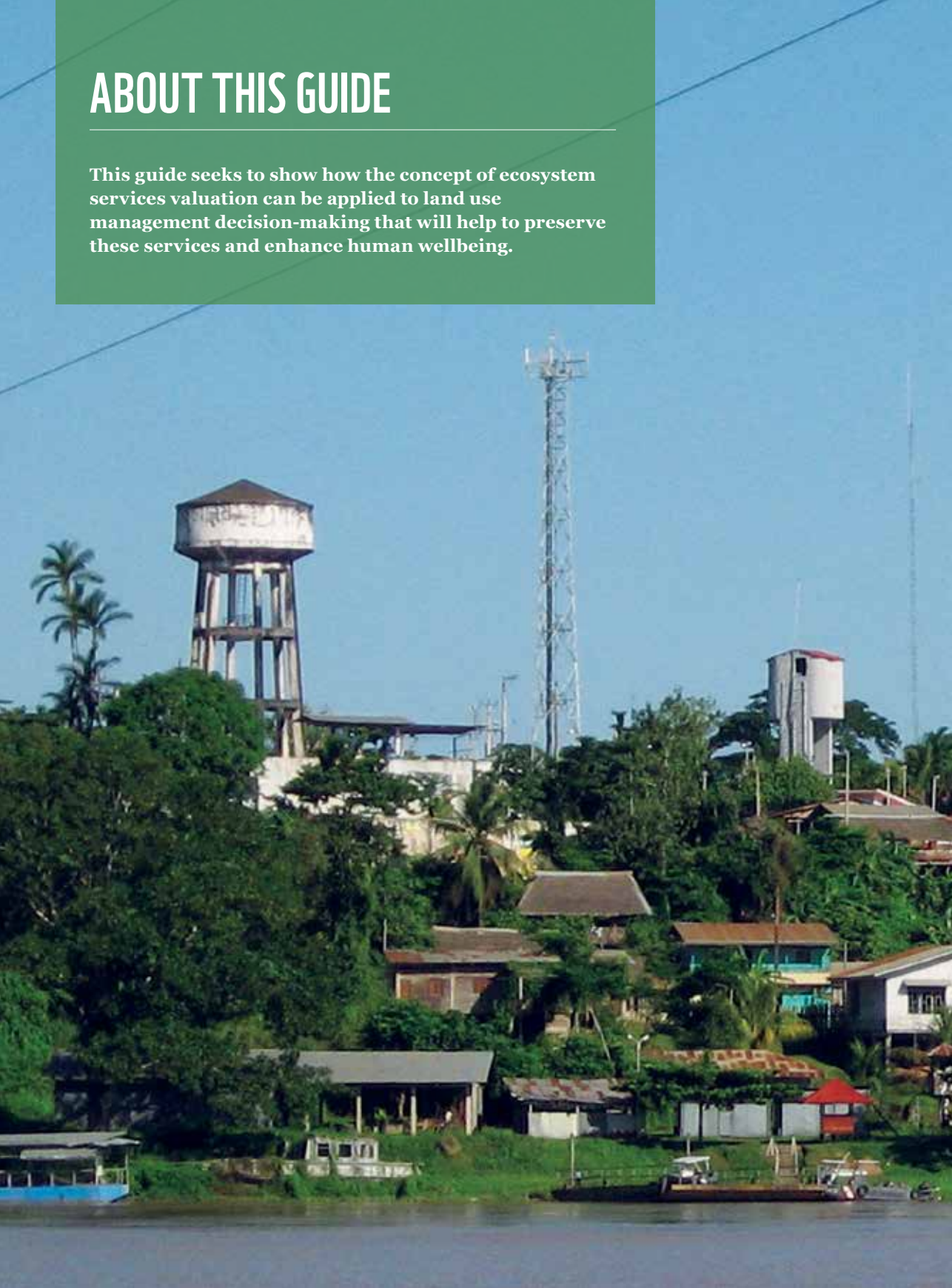
Ecosystem Services in Payment Schemes and Market Instruments

Payment mechanisms for ecosystem services (PES), adapted to local conditions, together with certification and eco-labelling schemes, provide incentives to reward good stewardship of natural capital. In Moyobamba (Peru), a study of users´ 'willingness to pay' for improved water supply has led to additional water charges being levied on them in order to compensate upstream farmers for conserving the watershed.

The carbon market also presents economic and conservation opportunities. Indigenous people in the Talamanca Reserve (Costa Rica) rehabilitated cocoa plantations with regional carbon and biodiversity funds, resulting in higher cocoa yields.

ABOUT THIS GUIDE

This guide seeks to show how the concept of ecosystem services valuation can be applied to land use management decision-making that will help to preserve these services and enhance human wellbeing.



In Chapter 2 we explore how the concept of ecosystem services can be useful in decision- making by identifying 'why and how', and highlighting the public policy areas where ecosystem services and their values can be identified. Given that adopting an approach based on ecosystem services is a challenge, people need to be aware of how to successfully implement the process. Once a decision has been taken to adopt the approach, a number of incremental steps are required, as described in this chapter, from the beginning of the process (collection of key information) through the 'action' phase, and up to the stage where concrete outcomes can ensure the continued provision of ecosystem services.

Chapter 3 lists and reports specific experiences where the identification and valuation of ecosystem services has been employed for different purposes and in different settings in Peru, Colombia and Brazil, involving WWF and local partners. In all these cases we used the *Integrated Valuation of Ecosystem Services and Tradeoffs* (InVest) tool. In addition to comparing the different case studies, details are provided in this chapter of the various challenges faced by decision-makers in the use of InVest, and the results achieved.

THE MAIN INPUT FOR IDENTIFYING CHALLENGES AND LESSONS LEARNED WAS THE MATERIAL GATHERED FROM THE REGIONAL WORKSHOP.

In Chapter 4 we record details of the abovementioned challenges by decision-makers which were discussed at a workshop held in Lima in 2013. These are grouped according to the technical, social and political difficulties encountered in the implementation of the InVest tool in governance processes.

Chapter 5 describes the lessons learned from our experiences with ecosystem services valuation, based on interviews, workshops and review of the relevant literature.

Key messages

The identification of environmental services in a participatory manner can assist in the making of responsible decisions based on prior knowledge of the likely impacts on natural capital and social wellbeing.

This guide is intended for decision-makers responsible for matters related to land use management and for project managers who are beginning to work with ecosystem services in the Amazon.

We hope that the above can benefit from the various experiences where InVest has been used in the Amazon region. We hope especially that practitioners will be able to identify the key factors potentially leading to the successful use of the ES approach for informing land use decisions, so that decision-makers will be in a better position to formulate public policies that ensure the continued supply and retention of the services.

The main input for identifying the challenges faced and the lessons learned was the material collected in the course of the regional workshop held in Lima (Peru) on May 27-31, 2013: *Mapping Ecosystem Services with InVest for the decision-making process: an approach based on case studies in the Amazon*, developed by WWF and partners. Useful material also came from interviews with key players and a review of the literature.

Points of interest

This guide also contains a number of features designed to help readers learn more about the topics addressed:

Glossary	Explanation of words used
Technical results	Main outcomes of the application of InVest in the different experiences
Key messages	Main ideas of each section in summary form
Comments	Extracts of comments by participants in the different experiences
Overview and Experiences	Summary of general aspects of the case studies

ECOSYSTEM SERVICES AS INPUTS FOR DECISION-MAKING

It is vital for decision-makers to possess tools that enable them to identify, appraise and value ecosystem elements on which the success of their actions may depend. They also need to have information about the possible impacts of their own actions on ecosystems.

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Ecosystem services can be defined as the direct benefits that humans receive from ecosystems. An approach to conservation and sustainable development based on ecosystem services therefore presents an opportunity to achieve conservation goals in places where traditional approaches do not work. This approach seeks to integrate ecosystem services in decision-making by:

a) Using scientific assessment tools in order to understand people´s dependence on ecosystem services and the impact of these services on them; and

b) Applying mechanisms that feed the values of ecosystem services into policy decisions made by governments, business, NGOs and individuals.

An ecosystem services approach can encourage conservation strategies by affording access to new sources of longterm financing, boosting the impact of the strategies over a larger area and encouraging conservation awareness in institutions that have traditionally not taken the environment into consideration in their decision-making processes.

How useful are Ecosystem Services for decision-making?

It is vital for decision-makers in public management and other areas to possess tools that enable them to identify, appraise and value ecosystem elements on which the success of their actions may depend. They also need to have information about the possible impacts of their own actions on ecosystems. They need therefore to first understand ecosystem services trends, e.g. the water available for agriculture irrigation purposes in places where infrastructure is to be built for hydropower generation.

Given the complexity and interaction of many natural and social processes, future scenarios need to be constructed for defining the positive or negative effects and impacts on different ecosystem components and economic systems. One example would be to decide whether it is advantageous or not to promote road construction in tropical forests in order to release more land for agriculture, using factors such as the level of climate change or the consolidation (or not) of carbon markets, or introducing (or not) more efficient institutional methods for preventing accidental forest fires, etc.

Numerous efforts and tools currently exist for operationalising the concept of ecosystem services for decision-making in the area of land and natural resource management.

The main initiatives are:

- *The Economics of Ecosystems and Biodiversity*[2] - a global initiative aimed at drawing attention to the economic benefits of biodiversity, including the incremental costs of biodiversity loss and ecosystem degradation. This initiative represents an approach that can help decision-makers recognize, demonstrate and capture the value of ecosystem services and biodiversity.

- Created in 2012, the *Intergovernmental Science Policy Platform on Biodiversity and Ecosystem Services*[3] has been providing an interface between the scientific community and decision-makers aimed at building capacity for strengthening scientific expertise in ecosystem services and using scientific appraisals to aid decision-making.

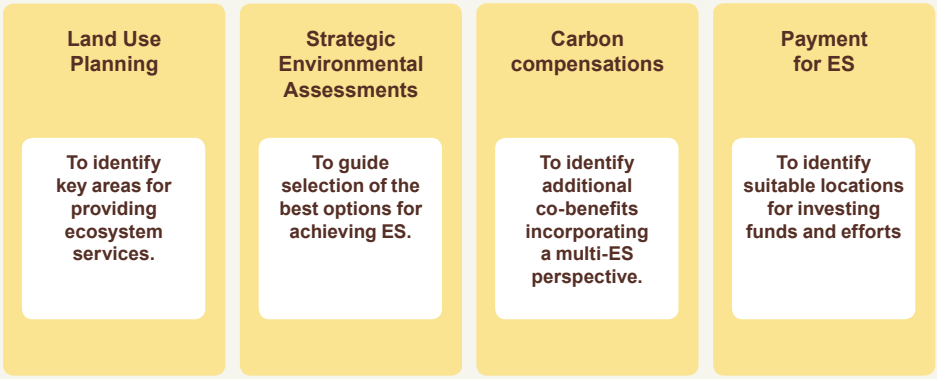
- National governments are increasingly conducting assessments of biodiversity and ecosystem services. China, Mexico and the United Kingdom, for example, are developing techniques for working with available data and identifying indicators and other ways to communicate the results to the general public.

Assessing ecosystem services can help to ensure informed decisions are made in various areas such as land use planning, strategic environmental assessments, carbon offsets and PES (Fig. 1).

2 The Economics of Ecosystems and Biodiversity (TEEB)

3 www.ipbes.net

Figure 1: Different uses of the ecosystem services approach for decision-making in land management.



How can ES be incorporated in local and regional policies?

The *Economics of Ecosystems and Biodiversity Programme* (TEEB) proposes six steps to serve as a guide for designing specific processes for evaluating and appraising the benefits of nature. This stepwise approach helps policy makers to navigate through the different assessment options available. The relative weight of each step depends on the specific situation: it is not a fixed recipe. These steps are:

1. Specify and agree on the policy issues with stakeholders.
2. Identify the most relevant ecosystem services.
3. Define information needs and select the most appropriate methods.
4. Assess ecosystem services.
5. Identify and appraise policy options.
6. Assess how impacts are distributed.

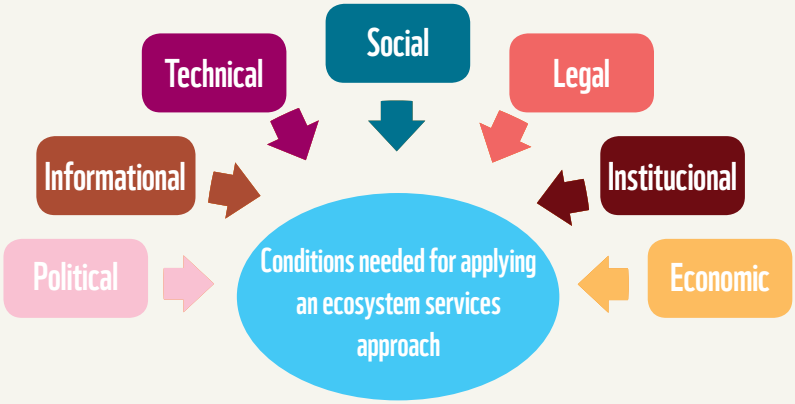
For further details on each step consult the guide on the TEEB web site. [4]

4 http://www.teebweb.org/our-publications/teeb-study-reports/local-and-regional-policy-makers/

What conditions are required for applying the ecosystem approach?

Despite its considerable benefits, the ES approach may not be the best option for achieving natural resources conservation. Success depends on several factors, primarily an enabling environment and an effective project design. It is therefore crucial to perform a preliminary assessment to determine whether the key elements exist for using this approach. This assessment can help to define key strengths and weaknesses and identify information gaps that need addressing if the approach is to be taken up. We suggest that the following points should be considered (Fig. 2):

Figure 2: Requirements for applying an ES approach to informing decision-making.



1. **Political aspects.** Does sufficient political will exist to enable natural resource-related decision-making that draws on the information presented and is not a result of pressure exerted by different sectors? It is necessary to identify whether willingness exists to accept the ideological concept of the ecosystem approach and whether this is part of a process or requires a paradigmatic shift to achieve its successful implementation. A favorable political envronment is a vital requirement when applying an ES approach given that it can have important repercussions on a number of other areas (human, financial and institutional resources, access to information, etc).

2. **Informational Situation.** Is information available, accessible, of good quality and in the amount required?

3. **Technical Conditions.** Is there sufficient technical capacity to understand the tool and its results? Stakeholders should have the minimum amount of knowledge to learn and apply InVest**.**

4. **Social Context.** Do opportunities exist for fully informed participation of stakeholders? Full and effective participation is required to enable stakeholders to provide their own information and other data and to understand and substantiate the outputs.

5. **Legal Aspect.** Does a legal framework exist to support and regulate the concept of ecosystem services, to ensure community participation and trade-offs?

6. **Institutional Situation.** Do institutions exist that have the mandate, resources and skills needed for underpinning decision-making on environmental management with information on the value of natural capital and on the positive and negative impacts?

7. **Economic Situation.** Do human and financial resources exist for implementing a ecosystem-based approach? It is a process that takes time and absorbs resources. Before commencing, it is necessary to clarify whether both are available and for how long.

If most of the answers to the above are positive, it means that the environment is conducive to using an ecosystem services approach. If most of the answers are negative, it is not advisable to apply an ecosystem services approach to the proposed conservation project. Even in the latter case, however, this Guide can be used to develop or strengthen the missing elements so that the approach can be used at some future date.

What tools exist to identify Ecosystem Services?

Tools for identifying ES are available which show the scope and characteristics of the various ecosystem services on spatially accurate maps and which create and evaluate usage scenarios. One such scenario is described below.

The Natural Capital Project (NATCAP) was introduced in 2006 with the premise that information about ES can be used to inform decision-making and improve both the natural environment and people´s wellbeing. NATCAP is an association of universities and global NGOs such as Stanford and Minnesota Universities, the Nature Conservancy and WWF that are developing tools, concepts and practices in ecosystem services and applying them in a number of areas around the world, with the aim of encouraging influential leaders to adopt the ES approach to decision-making on land use management. The main objective is to transform decisions affecting the environment and human wellbeing by providing clear and reliable information on ecosystem services.[5]

To support this goal, a set of standardised ecosystem services assessment tools is available on an open source and cost free platform known as InVest (*Integrated Valuation of Ecosystem Services and Tradeoffs*)[6]. InVest is a group of models that can be applied to land, marine and freshwater environments using functions to estimate changes in biodiversity and ecosystem services under different demographic, land-use change and climatic conditions. While InVest provides a basic framework designed to be used anywhere, it focuses on co-developing specific applications with decision-makers to ensure that the results apply to local needs and reflect available data, and that the metrics and the knowledge production processes are credible, relevant and approved by the various practitioners (Ruckelshaus et al. , 2013).

5 More information at www.naturalcapitalproject.org

6 In Spanish: *Valuacion Integrada de Servicios Ecosistémicos y Compensaciones*

InVest possesses a number of advantages that make it a suitable tool for the Amazon countries, which share various characteristics in terms of their capacities, institutions and data availability that are relevant to these tasks. The main advantage is that the programme is free and the software requires no license. The new versions promise high functionality. Accessing more sophisticated and expensive platforms such as ArcGIS is not necessary. The second advantage is the programme´s relative ease of use and effective knowledge-transfer package. The increasing use by practitioners worldwide (Belize, Indonesia, Hawaii, Canada) means that the tool is achieving the necessary critical mass of users for its further development and consolidation.

In land-based and freshwater ecosystems, InVest enables modelling of:

- Habitat quality
- The benefits of carbon sequestration
- Annual production of water for hydropower
- Water purification through nutrient retention
- Erosion control
- Crop pollination
- Production of woodr and non-wood forest products

In marine and coastal systems, InVest addresses:

- Benefits of fisheries
- Aquaculture food
- Coastal protection
- Wave energy
- Generation of landscapes for aesthetic and recreational purposes

IT OFTEN TAKES YEARS OR EVEN DECADES FOR A WINDOW OF POLITICAL OPPORTUNITY TO OPEN THAT ENABLES NEW TECHNICAL INFORMATION TO INFLUENCE DECISION MAKING.

InVest models are spatially accurate, allowing maps to be designed indicating where ecosystem services are produced and consumed. To learn more about this tool we suggest a visit to the Natural Capital Project website.

Different ways to make an impact on decision-making

It often takes years, even decades, for a policy window to open that enables new technical information to influence decision-making. In the course of this long journey the groups involved in trying to change or improve land management policies may become discouraged by the slow progress. However, specific and measurable ways exist of assessing whether they are on the right track and to define the missing elements needed for informing decision-making processes. In this respect 'milestones' marking progress do exist to provide encouragement for driving the process towards the goal of effectively implementing policies to protect biodiversity, ecosystem services and human wellbeing .

Figure 3[7] represents a framework for detailing the ways through which ES information can successfully inform decisions and create public policy changes. Each of the four columns represents a different 'pathway' constituting some form of success in incorporating ES information into decisions and outcomes. Stronger impacts are achieved as the process evolves from top to bottom down each pathway, and from left to right between the four pathways. Each science-policy engagement will traverse these pathways to a different extent, and the stages can be used to track progress which is not always linear. In some cases, interaction among pathways allows progress to build on work sequentially along them.

Pathway 1 represents a process in which scientists, local experts, stakeholders and decision-makers jointly provide data and information and produce, analyze and disseminate results as a collective knowledge construct. Change indicators are simple and include numbers of publications or communications about new ways in which knowledge and information on ES is disseminated. Progress on Pathway 1 may cause an impact on Pathway 2 since research constitutes the introduction of new knowledge, understanding and awareness of ES shared by stakeholders and decision-makers alike.

7 Framework prepared by the Natural Capital Project team based on a bibliographical review of the joint production of knowledge on public policies, observations and experiences in the application of InVest in over 20 countries (Ruckelshaus et al. 2013).

Pathway 2 represents impacts of ES information on the attitudes, beliefs, awareness and understanding of stakeholders and decision-makers. Measures of change in stakeholder perspectives can come from documented shifts in written or oral language and the ways in which objectives or positions are articulated.

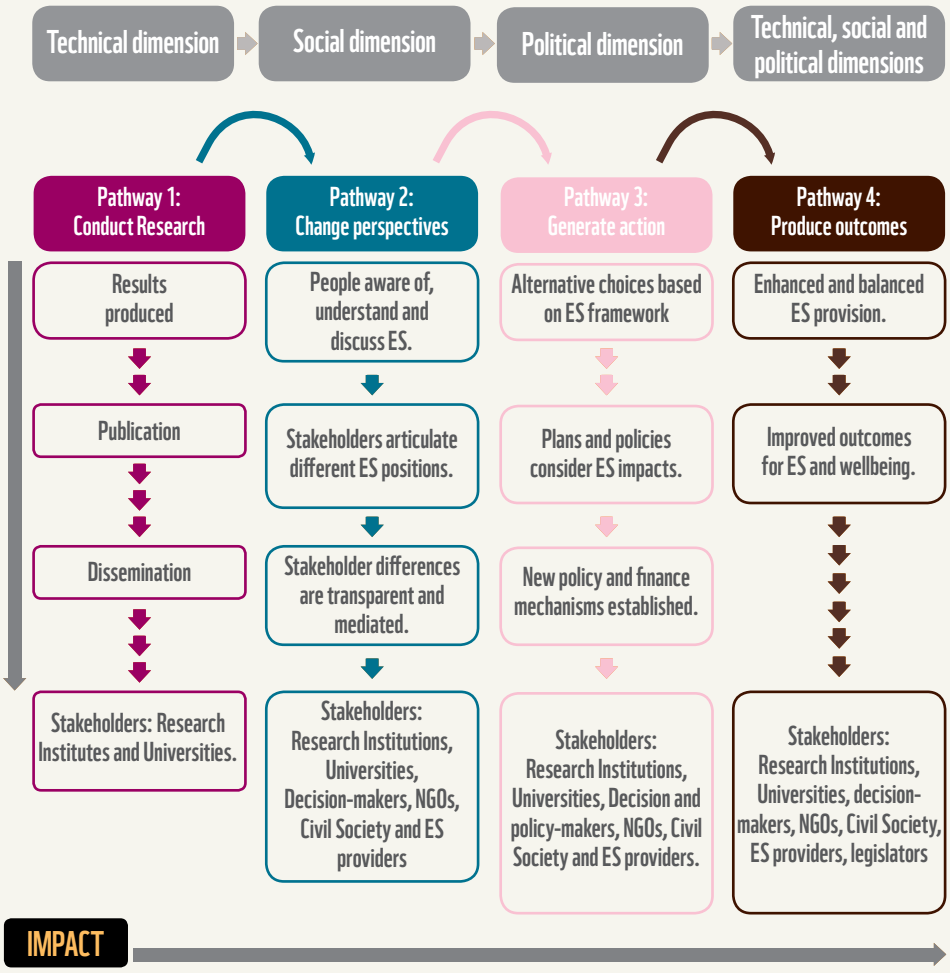
Progress along Pathway 2 can lead to Pathway 3 as new ways of thinking about ES cause the stakeholders and decision-makers to make different choices and design new policy mechanisms, taking explicit account of ES and tradeoffs[8] in investment decisions or planning and policy processes. Pathway 3 represents the impact of ES information on specific projects and on the behaviour of decision-makers, which may result in commitments, procedural changes or a specific decision on the financing, continuation, expansion or completion of a project, programme or policy.

Progress on Pathway 3 can spill over into 4 since the implementation of new ES-related policies and financing mechanisms generate concrete results and lead to measurable improvements in the provision of ecosystem services, biodiversity and other dimensions of human wellbeing.

Examples exist in several countries of initiatives that are represented on one of these four pathways. Decision-makers involved in land use management and spatial planning schemes and PES in water funds in Latin America were the first to develop this approach and test InVest tools. The models have been applied iteratively in a number of similar situations, producing beneficial impacts on ES knowledge construction related to spatial planning, PES decisions and actions (Goldman-Benner, et al., 2012).

8 Compensación" in Spanish.

Figure 3: Pathways and impact levels of Ecosystem Services on land use management decisions (adapted from Rucklshauss et al., 2013)



Information on ES has penetrated deeply into Pathway 4 within relatively short-term engagements over 1–2 years, such as the development of a coastal zone management plan in Belize with a well-defined and executed planning process carried out by Belize government partners (CZMAI 2012).

Key Message

Information about ecosystem services is more quickly incorporated into decision-making contexts where ES models have already been developed and where interest and decision-making processes are well-defined.

Embedded in this framework of possible pathways and impact levels are three aspects that are necessary for ensuring success in incorporating ES in decision-making: technical, social and political aspects. Firstly, the **technical** dimension relates to Pathway 1, where data and technical skills are needed to run the models and thereby obtain information on the situation and distribution of ES.

The **social** dimension is more fully developed in Pathway 2, where full and effective local participation is a precondition for achieving major community changes. Finally, the **political** dimension is more related to Pathways 3 and 4 in which specific policies are developed to retain and increase the supply of ES and human wellbeing.

The framework described above aims to boost understanding of the many different situations in which information about ES can influence decision-making. Note however that each case involving the assessment of ES is unique and depends on the political, social and economic context in which it is developed. Similarities and differences between contexts can be found, but the main advantages from using the framework are the recommendations and lessons learned, which can be used in other situations.

We focus on a number of case studies in the next chapter: Madre de Dios (Peru) , the Triple Border National Protected Areas (Colombia, Ecuador and Peru) known as the 'Tri-National Corridor', and the case of the State of Acre (Brazil). All these places are at different points on the pathways towards valuation of ecosystem services.

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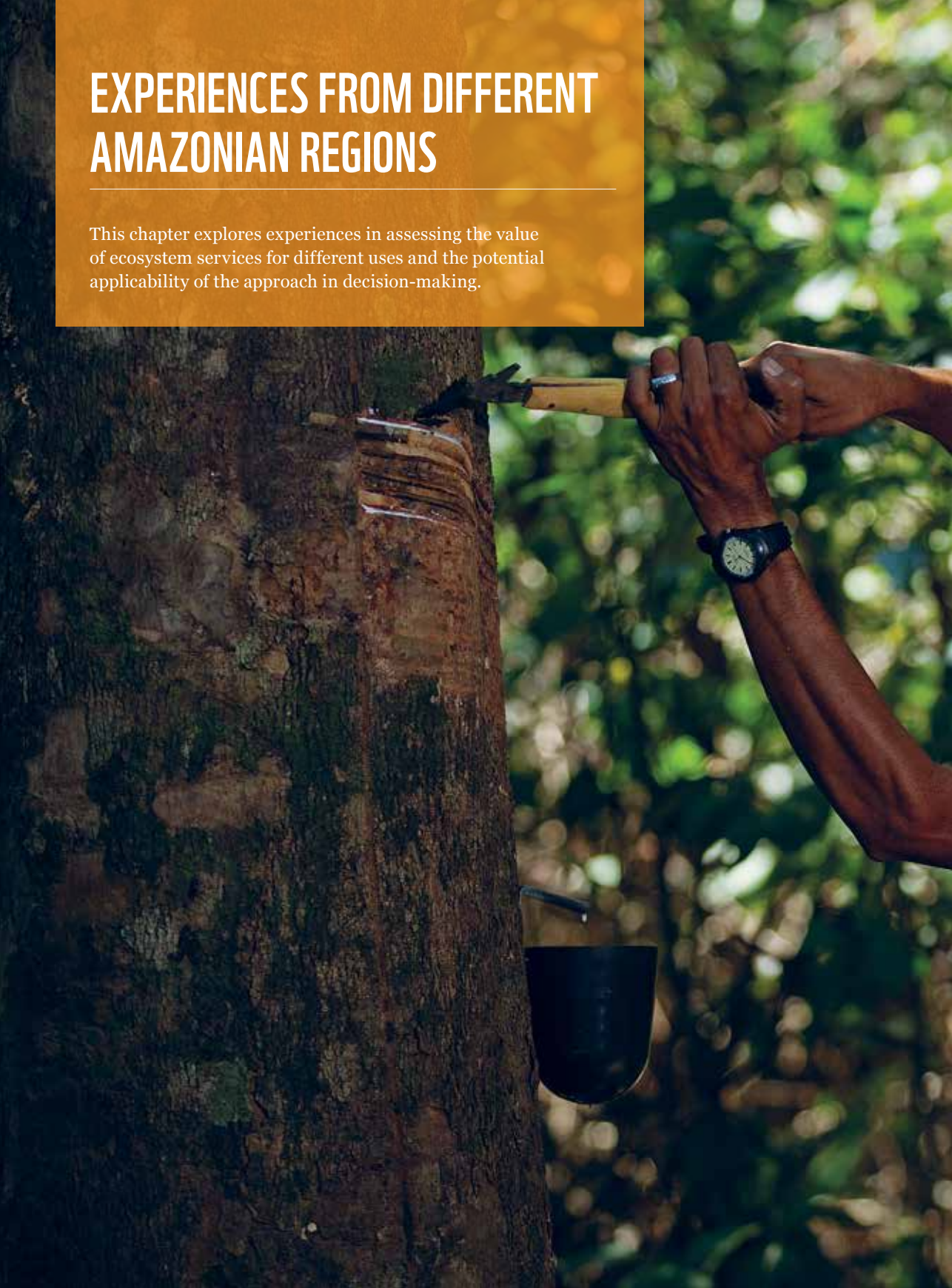
Rubber Tree Forest / Tahuamanu Province

EXPERIENCES FROM DIFFERENT AMAZONIAN REGIONS

This chapter explores experiences in assessing the value of ecosystem services for different uses and the potential applicability of the approach in decision-making.



Case studies in Madre de Dios (Peru), the Tri-National Protected Areas Corridor between Colombia, Ecuador and Peru and, finally, in the state of Acre (Brazil), are discussed. The valuation of ES involved application of the InVest tool.

Table 1: Summary of key aspects of Ecosystem Services Valuation in Madre de Dios (Peru) , the Tri-National Corridor (Colombia , Ecuador and Peru) and Acre (Brazil).

	Madre de Dios, Peru	Tri-National Corridor (Colombia, Ecuador, Peru)	Acre (Brazil)
Study area	Department of Madre de Dios, Peru	Protected areas in the Tri-National Corridor: La Paya (Colombia), Cuyabeno (Ecuador), Gueppi (Peru)	State of Acre, Brazil
Land area	8.2 million ha.	4 million ha.	17 million ha.
Ecosystem services targeted for valuation	Carbon storage; water production; sediment retention; biodiversity	Carbon storage and flows; biodiversity	Climate change mitigated; siltation avoided; nutrient removal avoided; water quality; biodiversity; local pollution control
Threats	Land use change, roads, mining	Logging; illegal crops; infrastructure projects; expansion of agricultural frontier; hydrocarbons	Expansion of pasture, infrastructure (roads), encroachment of agricultural and cattle-raising frontier
Data and information	Carbon in biomass and forest inventory data on the Amazon; IPCC bibliography	Preparation of a new coverage/ land use map and bibliographical data on carbon.	Datos ya existentes de distintas publicaciones
Future scenarios	2025	2020 and 2030	2025
Use	Land use planning and identification of priority zones for REDD+	Ordenamiento Territorial	Fortalecer el esquema de Pagos por Servicios Ecosistémicos
Social dimension	Preparing scenarios using participatory appraisal methods with variety of stakeholders	Validation of maps; identification of threats and extent of impacts; scenario development, with participation of with local inhabitants	Application of InVest did not involve the social dimension
Political dimension	Outcomes need to be submitted to decision-makers.	Outcomes submitted to decision-makers and key stakeholders (environmental authority and local municipal government) in the protected areas	Outcomes submitted to decision-makers in the regional government

Madre de Dios

Summary

The identification of ecosystem services in Madre de Dios is closely linked to the need of the regional government (GOREMAD) to complete its land use planning process. This exercise enabled us to identify priority sub-watersheds for implementing forest carbon projects. We were also able to identify ecosystem services and create land use scenarios for 2030 with the participation of local stakeholders.

The **first objective** was to determine the precise ES situation in Madre de Dios in terms of its ability to support the regional government´s land use planning process and then to identify priority sub-watersheds for forest carbon projects.

Overview

What?
Identification and quantification of Ecosystem Services for land-use planning

Who?
WWF- Peru
Madre de Dios Regional Government (GOREMAD)
Universidad Nacional Amazónica de Madre de Dios (UNAMAD)
Environmental Services and REDD+ Roundtable (MSAR)
Forest Users (farmers, nut-gatherers, miners, loggers and rubber-tappers)
Rural and indigenous communities

Where?
Madre de Dios, Peru

Ecosystem Services

x	Carbon
x	Biodiversity
x	Sediment Retention
x	Water production

Pathways and impact levels of Ecosystem Services information on decisions

Project Team

Elizabeth Ochoa Torres, Nelson Gutierrez, Juan Carlos Riveros, Cecilia Alvarez WWF- Peru

Context

The Department of Madre de Dios covers an area of 85,182.63 km², representing 6.6 % of Peru´s territory and 15.3 % of its forested region. Given that is one of Peru´s departments with the largest area of primary forest and other areas of natural significance, 44.78% of the department is protected by the National System of State-Protected Natural Areas (SINANPE).

Causes of deforestation and degradation of the Amazon Forest. Landscape changes and the destruction of forest areas result from the encroachment of agriculture, ranching, mining activities, roads and human settlements. The main threats to the region are the lack of land use planning, informal gold mining and the proliferation of agricultural holdings in the

protected areas. The current annual rate of deforestation in Madre de Dios is 0.03 %,[9] having tripled since 2008 due to the rapid spread of illegal mining spurred by high international gold prices.[10] Mining activities quadrupled from 1999 to 2012.

Social dimension. According to the latest census (2007), the department contained 112,814 inhabitants, 40% of whom were immigrants from other departments in Peru. Population growth in this formerly sparsely populated region has increased by 290% since 1981[11] largely due to the availability of work opportunities, including legal and illegal gold mining. A high percentage of the population however continues to live in poverty, with low education and non-formal employment. The department is being transformed by a process of decentralization and continuing migration facilitated by road development and given an extra impetus by the gold rush.

Political and institutional dimension. Frequent changes of government in Madre de Dios have impeded development and undermined planned programmes. A major land use initiative driven by the departmental government is at present being appraised by different districts and stakeholders. While this plan contains two deforestation and sustainable development scenarios conceived in very general and non-spatially explicit terms, an opportunity nevertheless exists for identifying ecosystem services which could make a valuable contribution to the land use process already underway.

At the national level, a Directorate General of Evaluation, Valuation and Financing of the Natural Heritage exists within Peru´s Environment Ministry (MINAM). The fact that this DG exists shows awareness of the importance of having tools for achieving the valuation of ecosystem services.

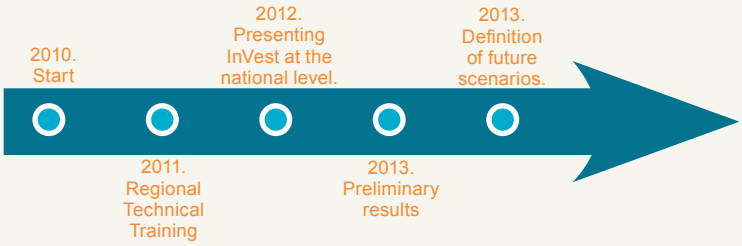
9 Cecilia Alvarez: personal observation based on data published by AIDER.

10 Asner, GP et al (2013) *Elevated rates of goldmining in the Amazon revealed through high-resolution monitoring*. Proceedings of the National Academy of Sciences. Vol. 110, N 46. Available at http://www.pnas.org/content/110/46/18454.full.pdf+html?sid=6cd5dfe1-834b-48c8-9c0c-cfab2d1f2780

11 Madre de Dios Regional Population Programme, 2013-2017 (GOREMAD).

Need: To provide technical support to the land use planning process driven by the Madre de Dios government by encouraging interest in ecosystem services and at the same time assisting in the identification of key areas where these could be implanted on a sustainable basis.

Intervention process



- 2010. **First step.** The "*Progress on Forest Carbon in Peru*" project contains a component relating to the identification of key ecosystem services for Madre de Dios.
- 2011. **Training of technical team**. The WWF-Peru Conservation Sciences team was given training on ecosystem services and the InVest tool. The tool was subsequently acknowledged by the departmental government and civil society as a valid component of the Environmental Management Diploma. Other models were then identified which were deemed to be a priority for our future evaluation: water production, sediment retention and habitat quality.
- 2012. **Presentation of InVest to national decision-makers**. The tool was explained to the above-mentioned Directorate General of Evaluation, Valuation and Financing of the Natural Heritage, and an introductory course on InVest was organised for local policy and technical staff.

- 2013. **Preliminary results**. The data were updated on the basis of information secured from the Madre de Dios Ecological Economic Zoning Plan and a variety of field studies. After due analysis of the available information we produced a first report entitled "*Mapping and Evaluation of Ecosystem Services in Madre de Dios*". This report is currently being revised.

- 2013. **Definition of future scenarios**. In July 2013, three workshops to plot future development scenarios for Madre de Dios were organised with the support of GOREMAD. These workshops made it possible to assess the preliminary results and demonstrate the changes in the provision of ecosystem services that had been mapped and quantified in the first evaluation. The 2030 scenarios were developed taking account of two contrasting outlooks: the future development of land use in the region reflecting the perceptions of key stakeholders versus the 'business as usual' brigade. Later a meeting was held with the support of the departmental government, the ES and REDD+ Steering Group, attended by farmers, miners, nut-gatherers, indigenous community representatives and other forest users, plus some decision-makers and civil society representatives.

Achievements

Technical Dimension

- **Priority areas for investment in forest carbon projects were identified.** The sub-basins were classified according to their forest carbon content and risk of conversion. Results of the carbon content at district level and for different categories of forest holdings were obtained: Protected Areas, Indigenous Communities and Indigenous Lands.

- **Areas providing a range of environmental services defined.** Locations assessed as ideal for implementing biodiversity support programmes were identified: sub-basins at increased risk of deforestation but possessing good quality habitat levels where carbon sequestration protection would benefit biodiversity and habitat quality; and micro-watersheds capable of providing multiple benefits in terms of carbon storage and water services.

- **Strengthening of forest carbon models.** The carbon model was based on analysis of satellite imagery and field verification of existing plots throughout the region. This served to reinforce the credibility of the model for use in future projects.

Social dimension

- **Stakeholder participation.** Definition of the scenarios for 2025 was conducted in a participatory manner. The views of the main stakeholders, decision-makers and representatives of civil society were complemented by those of individuals who do not normally participate in these events (ordinary farmers, nut-gatherers, indigenous community representatives and other forest users).

- **Knowledge and awareness of the Ecosystem Services concept increased.** Communities generally used to associate ES with carbon and REDD+ issues, but thanks to the scenario identification workshops, participants were able to learn about the ES concept and reflect more broadly on the value of using other ecosystem services in their particular settings.

Political Dimension

- **The ES approach was incorporated in concrete form by matching the needs of local government**. This exercise is in tune with ongoing processes such as the land use plan for the Madre de Dios department. Some decision-makers were present at the various workshops, and it is expected that the contribution of InVest as a key tool to the land use plan will be mirrored in their future decisions based on the information presented and confirmed by different stakeholders.

Technical Results

- **Carbon.** The highest values found were 193 tons of carbon per hectare. Thus the total amount of carbon stored in the department was estimated to be 1,314 megatons. The highest densities are located in the west of the region where large well-protected tracts of forest exist.
- **Protected Natural Areas retain the highest amounts of carbon.** The Manu National Park possesses the highest density of carbon, with an average 162 tons per ha and a total of 253 megatons.
- **Four sub-basins were prioritized based on their carbon content and risk of deforestation.** Other sub-basins under forest tenure or subject to land rights were identified where human activities and opportunities for sustainable use and conservation could be encouraged.
- **Madre de Dios has the highest water production in Peru.** The highest level of water production is the Madre de Dios district, followed by the Manu and Fitzcarrald districts which contain ten major basins and 442 sub-basins (micro-watersheds). The total largest annual production of water (in m^3) is in the basin of the Alto Madre de Dios River, followed by the Las Piedras River basin.
- **Deforestation and high levels of sediment transported.** The Madre de Dios River has the highest water production of all the 10 basins surveyed, and also produces the highest levels of sediment. This is due to extensive deforestation mainly in the Andean foothills. Siltation rates are accelerating throughout the Amazon basin, interfering with the dynamics of the rivers (e.g. increasing turbidity, flooding, course alterations, etc)**.**
- **High quality habitat for preserving the jaguar.** In 2009 the central and northern areas of the department provided a high quality habitat for jaguars, but this was not the case in the south where a high level of degradation was observed mainly in the mining area running along the deforested area (inter-oceanic highway).

Problems and challenges

- **Familiarisation with the tool was not an easy task**. It is imperative to form a strong technical team to induce different people to undertake the process without delay. Capacity building is essential for using InVest effectively.

- **Data collection** on Madre de Dios has been difficult. Local hydrological and edaphological information was hard to obtain and our models had to depend on published global and national data and information from research institutes, etc. Detailed calibration of the models based on the collected field data still has to be done in order to improve the results.

- **Discontinuity of management and substantial political instability,** leading to frequent changes in the local government authorities, have made it difficult to sustain progress and have negatively affected the programmes. The involvement of potential decision-makers has been ineffective, not due to lack of good intentions but rather to the institutional weaknesses of the regional government. Staff members were trained to 'diploma' level, for example, but most individuals have now left the regional government. The most fruitful exchanges were with the academic sector (UNAMAD) and organised civil society, represented by the Environmental Services and REDD+ Steering Group.

Next Steps

- The results of the 'scenario workshops' need to be submitted to GOREMAD and incorporated in its land management plan.

- The models need to be calibrated using the field data obtained.

- An economic valuation of environmental services is needed. InVest has a module for valuation, but the methodologies are crude and require fine-tuning. We are analysing the various ES methodologies and preparing a manual to help with this.

What more is required for ES valuation to be used in decision-making?

This question is not yet of major interest to Peru´s national authorities and is not a priority on their management agenda. Nevertheless, interest in ES was aroused, at least at the regional level (in Madre de Dios), as the result of the relationship of trust built with the team working for the local authorities, which greatly facilitated the process.

"WE ARE AT THE STAGE OF CONSTRUCTING THIS PROCESS TOGETHER WITH THE REGIONAL GOVERNMENT, CALLING ON DECISION MAKERS TO INCORPORATE ECOSYSTEM SERVICES INTO LAND USE PLANNING". CECILIA ÁLVAREZ - WWF PERU.

© WWF/Alonso Córdova - 2007

Brazil nut tree / Tahuamanu

Tri-National Protected Areas Corridor (Colombia, Ecuador and Peru)

Summary

An assessment of the value of ecosystem services was conducted in the basin of the Upper Putumayo river in the Amazon border area between Ecuador, Colombia and Peru, where three Protected Areas (NPAs) meet: the La Paya National Park (Colombia), the Cuyabeno Wildlife Reserve (Ecuador) and the Gueppi Sekime National Park (Peru). All three are subjected to pressures associated with human activities and encroachment which are rapidly increasing degradation and undermining habitat quality. It follows that urgent coordinated action is needed by the parties operating in the areas and by decision-makers responsible for mitigating or managing the threats that have been identified.

ES valuation as a tool for managing natural resources and land use planning was applied to the Corridor. The 'social dimension' was also included in the exercise for the first time. This helped to enhance the technical dimension by involving indigenous and other local people in the identification of ecosystem services and the threats to such services. The approach also aided their understanding of future scenario changes and showed how local knowledge, combined with scientific expertise and development perceptions and interests, can be a powerful tool, reflecting a variety of viewpoints on the planning and management of natural resources.

The initial objective was to assess the value of the environmental services provided by the three NPAs, define their conservation status and the pressures and threats they are subjected to. The main idea was to obtain the best information available for presenting to the parties involved in management and administation of this Amazon territory, in the expectation that they would incorporate the results in their development plans. In this way communities would be able to support their own proposals for addressing their needs and problems based on information which had the legal backing of authorities and institutions.

IN THIS PRACTICE ECOSYSTEM VALUATION IS USED AS A NATURAL RESOURCE MANAGEMENT AND LAND USE PLANNING TOOL.

Overview

What?
Identification of Ecosystem Services for managing natural resources within and outside the three protected areas of the Tri-National Corridor.

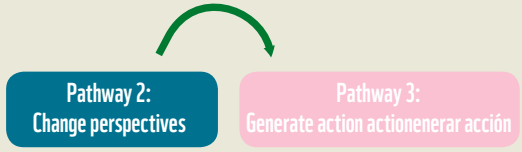
Who ?
WWF-Colombia and WWF-Peru
Protected areas systems of Colombia, Peru and Ecuador
Forest users (farmers, ranchers)
Rural and indigenous communities

Where?
La Paya National Park (Colombia), Cuyabeno Wildlife Reserve (Ecuador) and the Gueppi Sekime National Park (Peru).

Ecosystem Services

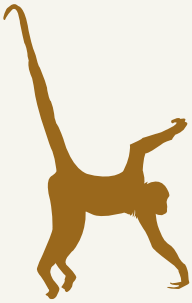
x	Carbon
x	Biodiversity (habitat quality)

Pathways and levels of impact of the ES information on decisions



Project team

Camilo Ortega, Cesar Fredy Suarez and Carmen Candelo Reina
WWF-Colombia
WWF Peru



Context

The Amazon region covers a large part of the territories of Colombia, Peru and Ecuador (23.3% of Colombia, 48% of Ecuador and 60% of Peru[12]), amounting to an area of around half a million square kilometres. The predominant ecosystem consists of rainforests bathed by large water systems of major importance for the region. This area also plays host to emblematic species such as the jaguar, manatee, the black caiman and the blue-billed curassow. It is rich in natural resources and petroleum and possesses substantial ecotourism potential. The Colombia-Ecuador-Peru Tri-National Corridor was established five years ago and comprises three national Natural Protected Areas (NPAs): the La Paya National Park (Colombia), the Cuyabeno Wildlife Reserve (Ecuador) and the Gueppi Sekime National Park (Peru).

Causes of deforestation and degradation of the Amazon Forest. The main pressures threatening the Amazon forest are deforestation and changing land use patterns. Pressures of lesser intensity include hunting, overfishing, all kinds of illegal trafficking, illegal crops and mining (the latter producing chemical pollution and siltation in the river systems). In addition, the region is threatened by large-scale internal and cross-border road construction. The Tri-National Corridor is also located in a strategic area for hydrocarbon exploitation by the three countries. This activity has its own vast economic dynamics and is a source of overlapping territorial disputes, as well as an ever-present danger to the survival of the protected areas.

Over the past 20 years, human activities in the protected areas have increased 206%, reducing the areas from 72,730 ha to a total of 35,139 ha and leading to a 6% loss of natural vegetation cover. In Ecuador for example, the Cuyabeno Reserve and its area of influence decreased between 1986 and 2001 by more than 180,000 ha (22.5%). Average annual logging within the reserve of 2,000 ha per year has produced a total loss of 28,528 ha of primary forest. On the other hand, the protected area in Peru has remained relatively immune from human incursion given the difficulty of access. Data on deforestation in the latter area is not available.[13]

12 Data from WWF-Colombia technical reports

13 Data from WWF-Colombia technical reports

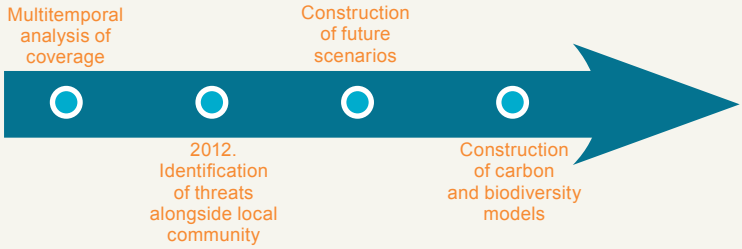
Social dimension. The Amazon regions of the three countries contain numerous indigenous groups. These nominally control large tracts of land as communal, autonomously-governed reserves with their own jurisdictions. Nine of these reserves exist in the La Paya National Park in Colombia, while the Gueppi Sekime Park in Peru, together with its area of influence, hosts around 2,312 Kichwas, Secoyas and Huitotos. In the Cuyabeno reserve in Ecuador, there are eight communities representing five ethnic groups: Siona, Secoya, Cofan, Shuary and Kichwa.

Political and institutional dimension. This border area covers approximately 4 million hectares with its own specific features. The border of Ecuador and Colombia has witnessed an increase in crime, illegal activities and resource exploitation, all of which have forced the authorities of both countries to step up joint security in the area. In the Peruvian sector population density is low and the area is very isolated (only accessible by air) and subject to fewer pressures. In general, the presence of the State in this isolated and remote corridor is virtually non-existent, which means that the reserves and parks themselves are the only true 'representatives' of the national governments in the area. This, paradoxically, makes it easier to generate working arrangements and specific actions locally to promote and benefit conservation and sustainable development.

The Tri-National Corridor Project led by WWF-Colombia is one of the key strategies for the conservation of the biodiversity of 4 million hectares of Amazon rainforest and subtropical wetlands. In 2011 a memorandum of understanding was signed by the three countries aimed at creating a regional management model for the sustainable development and conservation of the protected areas and their surrounding 'zones of influence', and of strengthening institutional capacities therein.

Need: To generate more regional awareness of the value of standing forests in the Amazon by employing the concept of ecosystem services and convincing people of the usefulness of such services.

Intervention process



1. **2011. Multitemporal analysis of cover.** Given the shortage of accurate data on homogeneous vegetation cover we found it necessary to map deforestation trends by employing a multitemporal evaluation of the entire Corridor area with satellite images for three different years (1990, 2000 and 2010). This analysis was evaluated by the residents of Puerto Leguizamo with a view to helping to define its accuracy.

2. **July 2012. Identification of pressures and strengthening local communities.** A review of the appropriate literature (technical, scientific and governmental) was conducted to identify the pressures on the Corridor area. Expert meetings were also attended by specialists from the three countries concerned with the Tri-National project and, finally, a consultation process was undertaken in Colombia with the residents of the area, using the *Citizen Action Conservatorio* (CAC) methodology within the framework of a capacity building programme (see box) .

Glossary

What is a Citizen Action 'Conservatorio' ?

The CAC is a participatory discussion or dialogue mechanism enshrined in Colombian law and materialized through a process of capacity building that seeks to improve opportunities for contact between communities and public and private institutions with a view to resolving problems. The CAC in other words is a conflict resolution mechanism which helps to protect civil rights through collective action and constructive negotiation. It involves three stages: preparation, negotiation and monitoring .

The CAC is used as as an aid to working with community leaders to identify the needs of the area and to empower leaders so that the knowledge and tools acquired can be subsequently used by the latter to participate actively in discussions (and to generate agreements) with the local, regional and national authorities. This main dialogue with the authorities took place in April 2013 in Putumayo Department (Colombia).

How was this process? The various parties (including community leaders) who participated in this exercise were identified over a period of one year by members of the project team. The participants included representatives of the Siona, Murui, Muinane, Kichwa and Coreguaje indigenous communities and a number of other ethnic minorities. Amazon farmers and black representatives from the Putumayo department were also selected. All the leaders were initially selected by their own communities after project leaders had explained the process to them, and then trained over a period of one year by the Putumayo 'Tres Fronteras' team. Only those who were interested in actively participating in the process were finally selected.

As part of the preparatory work for the CAC we worked with all the leaders in three workshops to help them identify and determine the value of the goods and services existing in the region, highlight the pressures and threats affecting them, and to form a clear understanding of how these were reflected in the development of the town of Puerto Leguizamo (Colombia).

As for the goods and services provided by ecosystems, three activities were undertaken to obtain inputs for the models. Firstly, goods and services related to livelihoods, education, health, housing, food, transportation, roads, the economy, local crafts, culture and work were identified by the participants. Next, participants were detailed to report the pressures that these goods and services were subjected to, and their overall impact was measured and recorded for use as inputs for habitat quality models. Finally, an exercise was conducted to locate and understand the distribution and trend of these pressures over recent years. The information collected, geographic and otherwise, throughout this process, was the result of helpful participatory engagement by local stakeholders.

3. **2013. Building future scenarios.** Potential deforestation scenarios were constructed for the years 2020 and 2030 in order to show future trends and change-processes involving the forest.

4. **2013. Modelling of ecosystem goods and services.** The use of different methodologies involving geographical analysis as well as the evaluations made by the communities living in La Paya made it possible to assess the value of ecosystem goods and services by using InVest models. To assess biodiversity, the 'Quality and Habitat Rarity and Habitat Risk Assessment' models were employed drawing on data produced by the community discussions described above on the level and occurrence of threats. Finally, information obtained from the literature and the 'Carbon Sequestration Model' were used to calculate the ES carbon situation and assess the vulnerability of ecosystems.

Achievements

Technical Dimension

1. **The condition of the forest in the Corridor was evaluated for the first time.** The results showed for the first time the loss of forest over the last few decades throughout the entire Tri-National Corridor and the probability of these losses continuing up to 2040 if usage continues as at present.

2. **A technical product was enhanced thanks to the involvement of local people.** Building scenarios and identifying threats to the population improved the technical product and conferred a degree of legitimacy on it. By encouraging social participation and participatory appraisal methods in the identification and evaluation of such threats, the technical exercise benefited from the kind of reliable and concrete information that is not usually found in secondary sources. The construction of scenarios and assessment of threats with the cooperation of local people will undoubtedly further enhance the technical product once the field data is confirmed with satellite information.

Social dimension

1. **Empowerment was achieved and the needs of various sectors identified.** The basic requirements of the territory were identified and the leaders of local and indigenous communities were able to absorb knowledge and become familiar with tools which they subsequently used to actively participate in the dialogue with Colombian authorities regarding the legal or illegal status of their lands, problems of land management and land-use certification, etc. The process facilitated the dialogue between the communities themselves and the decision-makers. The various discussions also enabled local people to acquire information and to reflect upon and take their own decisions regarding the use of natural resources.

2. **Understanding socioeconomic processes and resource uses.** Estimating and understanding how socioeconomic processes and migratory dynamics impact on natural resource trends in the municipality was a successful outcome of the exercise. It was abundantly clear from our contacts that the largest rivers in the area (Caquetá and Putumayo) were the main drivers of migratory flows.

Political Dimension

1. **Information for managing protected natural areas.** Decision-makers in the three NPAs now have information that has been substantiated by the population and on which they can base decisions regarding land use and management.

2. **The technical information generated in these exercises was invaluable** for enabling the authorities to

Technical Results

- **Increased deforestation in the Tri-National Corridor over the past 20 years.** The loss of forest cover in the corridor increased by 170%, from 186, 080 hectares in 1990 to 316,744 hectares in 2010. The rate of deforestation was highest in La Paya (0.18%) partly due to the existence in the area of road and river transport routes increasingly used by local communities and others to encroach on the forest.
- **Past, present and future degradation.** The analyses made in 1990, 2000 and 2010 clearly show that expanded degradation led to sites with extremely low habitat quality, especially in the western part of the Cuyabeno Reserve in Ecuador, in the La Paya National Park in Colombia and along riverbanks, especially of the River Putumayo.
- **Future scenarios.** Based on the pressures that have been identified, and if the same drivers of change persist, it is estimated that by 2020 the areas not covered by trees will amount to 481,548 hectares (11.79 % of the total area), and by 2030 this will be 647,704 acres (15.86%). La Paya will be the area most affected, followed by the Cuyabeno. Release of carbon stocks is likely to increase in both areas as a result.

assess and address the various pressures on the environment and to commit themselves to taking action on change within their legal powers.[14]

Problems and challenges

- **Information needed to apply the models in remote areas with high biodiversity levels is inconsistent between the three countries or can only be accessed with difficulty.** Little data was available on the protected areas in the Tri-National Corridor. Moreover, much of the information available was incompatible between the three countries given that each government has conducted spatial analyses using different methodologies. This made it difficult to identify trends and build future scenarios. New multitemporal classifications of the territory will have to be undertaken using bibliographical data, which could be unreliable. This was the case, for example, of the carbon and habitat quality models where the dynamics modelled probably fail to reflect adequately the reality on the ground, and require revising since they do not allow appropriate definition of the dynamics of gradual changes.

- **Problems were encountered in managing data and information** in a context involving three different countries and three different official information management systems. Acquiring inputs which would be accepted by the governments of Colombia, Peru and Ecuador, was a major challenge. For example, each of the three countries possesses a 'protocol' for generating information for land use maps so that they are difficult to harmonise. It is to be hoped that the maps made by NGOs and the information provided on the various ecosystems will be used by decision-makers. However the maps will still have to be examined and approved by each country where data, methodologies and mandates are entirely different. This kind of drawback has created uncertainty and impeded progress.

- **Local participation was very low in Ecuador and Peru.** In Colombia on the other hand it was easier to involve communities in defining threats because ES identification was a key part of the

14 Conservation of biological diversity and certain ecosystem services are generally regulated by norms that favour their conservation, e.g. some of the principles enshrined in the Political Constitution of Colombia, Law 99 of 1993, the Covenant on Biological Diversity, and Law 21 of 1991(ratifying ILO Convenant 169).

capacity building process that already existed in the region. This was not the case in Ecuador and Peru where a similar process failed to take off, and special efforts would have had to be made requiring the approval of the Technical Management Committee of the Tri-National Project, as well as additional funding**.**

- **Analysis of some pressures was only partial.** With respect to ranching, logging, hunting, illicit crops and solid waste pollution, only in the Colombian protected area was it possible to acquire information generated by discussions with local stakeholders and communities during the CACs that took place in 2012-2013. Unfortunately there was little participation in them by official State representatives.

Next Steps

- To conduct a capacity building exercise similar to the ones in Ecuador and Peru with a view to identifying the scale of the various pressures and to generate appropriation of the process by the communities and decision-makers by involving both public and private stakeholders from the region.
- To undertake a more specific classification of tree coverage in forested areas and in non-forested areas where different types of vegetation can be identified as natural cover.
- To ensure that information on pressures exerted by hydrocarbons, mining, roads, population centres and forest changes is harmonized.
- To strengthen monitoring of the *Citizen Action Convocatorio* groups in Colombia on the basis of an action plan.

What is required for using ES valuation in decision-making?

Once the results have been obtained from the project it is vital to begin a process to disseminate them. Information should not be confined to the managers of the NPAs. The overall objective should be to strengthen governance, improve ecosystem management and upgrade decision-making with regard to managing the various threats faced by the Tri-National Corridor.

Remarks

"Information generated about the ES is valuable providing that appropriate mechanisms are established for the information to reach decision-makers, and especially that they acknowledge the importance of information, understand it thoroughly, and take action accordingly".
Camilo Ortega WWF-Colombia

"Access to information will also be of social and community benefit. This type of information facilitates dialogue between communities and decision-makers and enables ordinary people to absorb the information, reflect on it and make their own decisions regarding the use of natural resources".
César Suarez WWF-Colombia

"If local people understand and manage information about ES within the context of their rights, a basis will be created in support of their demands and proposals, thus providing opportunities for a more equitable dialogue between communities and institutional decision-makers and leading to the latter addressing people's needs".
Carmen Candelo Reina WWF-Colombia

Acre (Brazil)

Summary

The state of Acre in Brazil is one of the pioneers in creating mechanisms for reducing deforestation and degradation in the Amazon. The bold decision by the regional government to establish public policies to conserve the forest and at the same time enable sustainable development to take place led to the creation of the *Environmental Services Incentives System* in 2010. The system encompasses the different ecosystem services provided by the forest and is focused on developing financial mechanisms to ensure the conservation and retention of such services.

Identifying ecosystem services was done by using InVest to define the impact of changing land use on watersheds in two scenarios: the first examines current trends, and the second is based upon sustainable management of the ecosystem over a period of 15 years (from 2012 to

Overview

What?
Identification of ecosystem services in two land-use scenarios and economic valuation of these alternatives

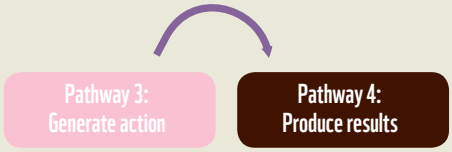
Who?
WWF-Brazil
Government of Acre
Climate Change Institute of Acre Government
International Sustainability Institute
Global Canopy Program

Where?
Acre, Brazil

Ecosystem services

x	Carbon
x	Biodiversity (habitat quality)
x	Avoided siltation
x	Nutrient removal
x	Water production
x	Local pollution control

Pathways and impact levels of ES information on decision-making



Project team

Alberto Tavarez - WWF- Brazil
WWF-UK

2025). Note that this novel approach incorporates monetary valuation of the two scenarios, as well as taking into account the consequences of deforestation and expansion of areas for cattle raising.

Context

Acre has a total area of 164,000 square kilometers. 2012 figures show that 13.6 % of the state has been deforested,[15] and 86% of the territory is still covered by rainforest of which 45% is protected.

Causes of deforestation and degradation of the Amazon Forest. Government data from 2007 show the powerful influence of roads and access routes in the deforestation process. For example, 68% of all the deforested areas lie within 50 km of the two highways that cross the state (BR-317 and BR-364). The main driver of deforestation however is cattle ranching, with 85% of all the deforested area converted into pasture. Moreover, 'secondary' forests now cover 10.4% of previously deforested areas, with agriculture occupying only 4% of these areas. Between 1996 and 2005 the average rate of deforestation in Acre was 602 square kilometers per year. However, between 2003 and 2012, the deforestation rate fell by 71 %, the lowest rate since records began in 1988[16].

Social dimension: The state has 730,000 inhabitants and is one of the poorest and most isolated states in Brazil.[17]

In the 1970s and 80s a rubber tappers/indigenous social movement existed whose main purpose was to reclaim land rights, rights to rubber and nut extraction and to combat the huge amount of deforestation caused by intensive speculation and expansion of the cattle-ranching industry largely as a result of the new section of Federal Highway BR-364 built through the state.This movement culminated in the murder in 1988 of the main opponent of deforestation, the popular rubber tappers' leader, Chico Mendes. This caused national and global outrage and was the critical point effectively marking the beginning of the environmental movement in the Brazilian Amazon. The event also impelled the Brazilian government to recognize and create the first official extractive reserve (RESEX). These reserves are a special category of protected area designed specifically to protect the property rights of people who depend on the extraction of natural resources such as rubber and Brazil nuts, to encourage the sustainable use and conservation

15 Programme to Calculate Amazon Deforestation (PRODES),

16 WWF (2013) Environmental Services Incentives System in the State of Acre, Brazil

17 IBGE (2012) Demographic Census 2010.

of the environment, while at the same time recognizing and valuing the traditional knowledge inherited by these people. Imitating the Acre model, by 2010 a total of 65 RESEX had been established in the Brazilian Amazon, covering an area of 133,000 km^2 .

Political and institutional dimension. From 1999 onwards Acre was the first state of the 8 states that comprise the Brazilian Amazon to embark on policies designed to promote sustainable development and reduce deforestation. This explains why deforestation has declined in Acre faster than in any other part of the country.

Since 1999 the State of Acre has been governed by a progressive political party that has implemented a series of policies designed to generate a model of sustainable development based on the principles of environmental protection, rational use of natural resources, poverty reduction and the strengthening of a forest-based economy.

As for ecosystem services, Acre has instituted a pioneering system (SISA) as part of a wideranging policy to increase the value of the state´s natural capital. According to the Acre government[18] these policies include:

- Incentives for environmental services
- Regularization of environmental liabilities
- Certification of sustainable rural land tenure
- Public and private forest management
- Reforestation
- Restoration of degraded areas.

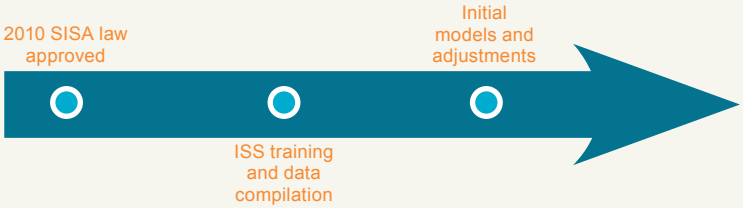
SISA was established to evaluate and foster the state´s provision of ecosystem services, especially with regard to carbon, biodiversity, fresh water, climate regulation and fostering local culture and traditions.

18 Acre, 2011b

These policies also reflect Brazil´s federal policies such as those contained in the Sustainable Amazon Plan (PAS), the Plan for Prevention and Control of Deforestation in the Amazon (PPCDAM) and the National Climate Change Plan (PNMC).

Need: To undertake an economic (monetary) valuation of ecosystem services of Acre´s Amazon rainforest and to compare the consequences of current deforestation trends with a future sustainable management scenario.

Intervention process



1. **Law 2.308/2010** is approved establishing the Acre State Environmental Services Incentives System (SISA).

2. **Training and data collection.** The NGO *Global Canopy Programme* (GCP) showed interest and contracted the International Sustainability Institute (ISI) to undertake an analysis of ecosystem services in the state. The ISI team was trained in the use of the InVest tool in Rio de Janeiro. During the first stage the analysis was carried out remotely without visiting Acre, but included contact by telephone and teleconference.

3. **Initial models and adjustments.** After completion of the first phase, WWF and GCP reviewed the results. It was clear that the initial scenarios based on the projections provided to ISI were not suitable and it was decided to repeat the process using two alternative scenarios.

Achievements

Technical Dimension

- **Deforestation is determined using two scenarios.** If current trends continue (the 'Business as Usual' scenario) 782,000 hectares will be deforested between 2012 and 2025, equivalent to an annual deforestation rate of 56,000 hectares. However, in the second scenario involving sustainable management, 188,000 hectares will be deforested between 2012 and 2025 at an annual rate of 14,500 hectares - a reduction of 76% over the first scenario.

LOWER DEFORESTATION RATES REDUCE ECONOMIC LOSSES IN 80% OF ACRE, SO THE STATE WILL SAVE FROM 1.4 TO 2.8 BILLION DOLLARS BY THE YEAR 2025.

Political Dimension

- The government of Acre can put an economic value on their land use decisions.

Technical Results

- Under the first ('Business as Usual') scenario involving traditional economic management, the total loss in terms of the value of ecosystem services due to deforestation will amount to between US$2.3 billion and US$ 4.5 billion in 2012-2025. On an annual basis this amounts to losses of between US$178 million and US$346 million, with an annual deforestation rate of 56,000 hectares.

- However, the sustainable ES management scenario would involve annual losses of US$35 -US$70 million - a significant reduction resulting from cutting the deforestation rate by 76 % compared to the first scenario. It is clear that reducing deforestation would reduce economic losses by 80%, thereby saving the state of Acre US$1.8-US$3.6 billion by 2025.

Problems and challenges

- Given that the initial results were not satisfactory it was necessary to undertake the technical exercise again. This additional effort was not taken into account in the initial plan or in the budget or timeframe. We conclude that considerable care is needed in the first stages of developing projects with all the stakeholders, preferably by organising discussion workshops on the lines described above.

- Substantial effort needs to be applied to some of the models in order to learn and understand how the tool works. A number of difficulties were encountered in certain cases regarding operationalization of the model, which often took days to resolve. Nevertheless, once these obstacles were overcome, InVest proved to be extremely easy to use, with its main strength being its capacity to generate visible results.

- Putting a general and monetary value on biodiversity is a very sensitive undertaking.

- It is not entirely clear how to incorporate traditional knowledge into identifying ecosystem services. It is particularly difficult to assess the amount of knowledge that communities genuinely possess about the forest. A key point: discussions must include other less prominent population sectors such as riverside dwellers and people engaged in extractivist activities.

Next Steps

- To provide participatory spaces for people in the Acre communities to assess and better understand and digest the technical results of the exercise.

What is required for ES valuation to be used in decision-making?

This was a technical exercise undertaken within the framework of a broader governmental programme which was already using the ES concept to generate public policies favouring the preservation and continuation of such services. It is to be hoped that the information output can be used for decision-making on establishing priority areas and to direct investments to ensure that ecosystem services remain of benefit to decision-makers.

Remarks

"*From the government´s viewpoint, the question of ecosystem services is important for Amazon countries because we possess an enormous natural wealth and capital which is not valued in terms of the public accounts or in terms of the benefits that could arise for the communities which depend on the services*".

Eufran do Amaral
Institute for Climate Change - State of Acre, Brazil

Comparisons

By comparing three studies in different Amazon countries we can evaluate the applicability and utility of ES valuation in terms of its goal to contribute to land use and natural resources management decisions.

As explained in Chapter 2, conditions need to exist for applying the ecosystem approach to decision-making which relate closely to policy-sensitive conditions. These conditions include having access to key information, ensuring the existence of technical skills, encouraging participation, and having legal and institutional support, as well being able to count on willingness to finance this approach to ecosystem services. In most cases these conditions do not initially exist. A preliminary analysis can help to prepare a roadmap for developing at least some of the above conditions needed for using the ES approach to impact on decision-making and land use management.

ANY PROGRESS IS A SMALL SUCCESS AND THERE IS NO NEED TO WAIT FOR ALL THE CONDITIONS TO BE MET TO START DEVELOPING AN ES APPROACH.

However it is important to note that any progress made towards the desired goal constitutes a small success, and that it is not worth waiting for all the conditions to be complied with before developing an ES approach. As explained in Chapter 2, a number of ways exist to achieve some form of impact on decision-making and intermediate, smaller successful events on the various 'pathways' should be welcomed as signs of progress.

By starting to generate information on Pathway 1, for example, the community, government and stakeholders will be in a position to gradually internalize the ES concept, pending its eventual impact on attitudes, beliefs, awareness and understanding (Pathway 2). Once the basic concepts and information are internalized, Pathway 3 is reached where new forms of thinking about ES can encourage

decision-makers to move towards undertaking actions and designing new mechanisms for preserving ecosystem services for the benefit of the community (Pathway 4).

In the context of the three study cases, each of them can be found on one of these 4 pathways (Table 2). Madre de Dios has completed Pathway 1 and is about to enter Pathway 2. After compiling the data and generating new layers of information on the results obtained with the of the different ecosystem services, the project team is now focusing its attention on Pathway 2 in Madre de Dios in an effort to change the views of a range of different stakeholders, by raising their awareness of the value of all the ecosystem services (in addition to carbon), and in the hope that they will understand the impacts of current decisions, particularly when they realise that they can be adversely affected by their decisions in the near future.

Table 2: Comparison of case studies indicating the conditions that existed for implementing an ES approach, and the stage reached towards achieving impacts on decision-making.

Conditions	Pathway 1: undertake research	Pathway 2: change perspectives	Pathway 3: generate action	Pathway 4: produce outcomes
Political		x	x	x
Informational	x	x	x	x
Technical	x	x	x	x
Social		x	x	x
Legal			x	x
Institutional			x	x
Economic			x	x
	Madre de Dios	Tri-National Corridor	Acre	Acre

In the case of the Tri-National Corridor, the team has made considerable progress by incorporating the social dimension into the technical dimension and has transited along Pathway 2 in terms of changing the views of the key stakeholders by involving local inhabitants and indigenous groups to participate in the definition of ecosystem services and the threats posed by them. The political decision on the importance of jointly managing the areas between

Colombia, Ecuador and Peru was a major factor right from the beginning and the ES approach was used extensively to generate actions aimed at preserving them. Currently the team is focused on Pathway 3, in the expectation of generating concrete actions to preserve the ecosystem services both inside and outside the protected areas.

In the case of Acre, the State has a long history of public policies focused on developing mechanisms to promote forest conservation and sustainable development through the ES valuation concept. As already explained, the Environmental Services Incentive System (SISA) was established in 2010. This initiative shows that the state is now on Pathway 3 and is undertaking concrete actions and instituting financial mechanisms to preserve ecosystem services and produce practical results for reducing deforestation, as shown in recent statistics (Pathway 4)[19]. These results have emerged independently from the application of InVest, which has been used to guide future decisions based upon quantitative and economic valuation of environmental services as well as of outcomes emerging from different usage scenarios. In short, the ecosystem services approach is already perceived as an invaluable tool to be used alongside government policies. No paradigmatic change is needed to understand, apply and use it for decision-making.

Similarities[20]

Despite the political, social, economic, environmental and technical differences that we have explored in the above three cases, a number of common elements also exist such as deforestation and the emphasis on carbon.

Deforestation is the clearest example of existing threats to the environment. Indeed, threats to forests and other Amazon ecosystems are multiple. They interact and have cumulative effects and assessing and understanding these threats is a complex undertaking. However, deforestation detected by satellites has traditionally been used as the universal indicator of impacts on forests given that large areas can be evaluated in a relatively accurate and economic manner.

19 Statistics produced by the PRODES project, *Satellite monitoring of the Brazilian Amazon Forest*, reveals an annual reduction of 35% in deforestation (km²/yr) from 2012-2013.

20 Adapted from Valqui & Lopez (2013) *Sistematization of three cases of the application of the InVest tool in the Western Amazon*. WWF Peru

It is important to note that deforestation is only one of the more extreme and conspicuous manifestations of human encroachment on the natural world. It is is also worth noting that that satellite images showing the amount of deforestation are often the culmination of a process which began years ago with the hunting of animals for human consumption, continued thereafter by commercial logging of the largest tree species, opening forest roads and the exploitation of palm leaves and other non-timber forest products. In addition there may be pollution of waterways with hydrocarbons and other contaminants, overfishing, siltation, etc.

Many of these impacts can be modelled by a combination of figures related to population density, accessibility, prevailing economic activities, years of human occupation, official land use, levels of environmental compliance, etc.

However, unlike the deforestation that is easily identified through satellite images, a large amount of degradation escapes detection by being virtually invisible under the tree canopy, and therefore goes unrecorded. Given that degradation is widespread and has negative effects on the environment, more research is needed to more correctly estimate the amount of lost natural capital (i.e. in monetary terms). This requires considerable field effort, like that being made by the WWF-Colombia team in the 'Three Borders' project where, based upon the experience of local people, the team was able to firstly assess the degree of impact according to the distance from the source and then integrate this information with available data obtained from satellite imagery. This methodology deserves to be evaluated and substantiated in other areas.

As an integrative tool, InVest cannot solve the underlying problem of deforestation, but it can help to deflect attention away from deforestation as being the sole cause of degradation. For example, in the Madre de Dios study, areas of high water production and therefore with higher risk of erosion were identified. In other words, it is worth looking closely at other aspects of degradation, whether deforestation risks are involved or not.

The emphasis on carbon. In the three studies, carbon sequestration and storage, highlighted as an ecosystem service, coincides with the emphasis that most of initiatives in the region place on obtaining carbon-related data for use in REDD + projects and programmes.

This type of approach, focused on carbon as a core theme at the expense of other services that may be just as important (or more so), has many critics among the local communities and indigenous peoples who depend on the forest for their livelihood.

On the other hand, while it is important to continue discussing the relative importance of carbon, this emphasis is justified for several reasons:

i. Of all the ecosystem services related to the Amazon forests, carbon sequestration and storage as a factor in global climate control is probably the best established concept. It is undoubtedly the best developed from a methodological point of view in terms of management, measurement and ease of market access. In contrast, it is more difficult to put an accurate price on the market value of potentially important biodiversity.

ii. In the Amazon region carbon content correlates significantly, although perhaps less obviously, with biodiversity, water production and most of the services described in the three studies. The exceptions are primarily associated with montane ecosystems and wetlands, where endemic species or other plant communities are not necessarily related to tree biomass.

iii. The aforementioned ease with which appropriate data on carbon can be obtained is a decisive advantage over many other ecosystem services, the study of which is likely to involve very high costs.

iv. The results of the Acre study are ample justification for the attention paid to carbon since it represents 61 % of the monetary value of ecosystem services that could be valued - avoided sedimentation, nutrient removal, water quality, local pollution control, etc.

It follows that, in the context of the Amazon, carbon will continue to play an important role in incorporating ES in informing land use and natural resource decisions. However it is also advisable that attention be paid to the origin of the REDD+ concept as part of a strategy for valuing ecosystem services, as well as forming part of an overall strategy that can be exploited (or not) to make it useful for meeting goals of a more local nature.

A further similarity is that the ES approach applied in the 3 exercises demonstrates that standing forest is a more valuable asset than another type of land use. While different approaches, capacities and conditions have produced a range of different products, the core proposal has been to identify and assess the value of ecosystem services provided by the forest.

Differences

Differences exist in the availability of information, institutional and stakeholder participation and in the level of progress and utilization of results by decision-makers.

Availability, accessibility and quality of information. The issue of availability and accessibility of information is, on the one hand, the key to properly applying the InVest tool, given that this requires information of an appropriate amount and quality. On the other hand, InVest can help to launch a project agenda leading to the construction and maintenance of databases containing such information. In other words, the tool can catalyze a process that helps to generate the required information.

Availability, accessibility and quality of information is different in each of the three countries analysed. A long tradition of collecting information on deforestation and other ecosystem services exists in the state of Acre. The database for most of the variables in Acre was provided by the Government of Acre Institute for Climate Change and Regulation of Environmental Services (BMI). That proved to be an advantage for an InVest-type analysis and, more generally, for informing decision-making.

In the case of Peru, despite the efforts of various governmental and non-governmental organizations, there are no recent official figures on deforestation rates. In Madre de Dios, where most REDD + initiatives exist, a number of different estimates of carbon stocks have been made. Each REDD + project has its own estimate of deforestation rates and future trends. Meanwhile, no complete, up-to-date databases exist for the other services. The same situation can be found in most of the regions of the Peruvian Amazon. Information needs to be compiled in a database and specifically generated for a particular project. It follows that achieving the use of InVest and other spatial tools to aid decision-making will require significantly greater effort.

In the Tri-National Corridor, Colombia, Ecuador and Peru have marked differences in the quality of their spatial databases. This is also the case for methodologies, processes and scales of analysis for the different variables. Furthermore, the logistical difficulties of obtaining information were made worse by the incompatibility of data, all of which called for substantial efforts to standardize and harmonize available information. The exercise is currently progressing best in Colombia, where official spatial information has been suitably complemented with inputs from local populations.

Participation, institutionality and use of results by stakeholders. In Acre the use of the InVest tool has been substantiated and accepted by official decision-makers without, however, a social input ('social validation') by forest users.

The information serves to justify economically and conceptually the Acre government´s environmental policies, which have effectively replaced traditional development, based on deforestation activities to provide pasture for livestock, by focussing on improving the protection, conservation and use of standing forest.

While the Tri-National Corridor study was approved by the three countries´ authorities responsible for protected natural areas, it has not yet been sanctioned by the local municipal authorities - a pending task for the next phases of the process.

In the Colombian sector, information was collected, analysed and disseminated about the pressures arising from human activities. This data was based on local experience. The results of analysis, concepts of land use and other learning outcomes were then employed as tools to explain, justify and negotiate agreements and concessions in the *Citizen Action Dialogue* (CAC), where local stakeholders were able to address illegal land occupation issues, the need for new protected areas, etc. The InVest process effectively inspired these people to match their territorial aspirations to the scenarios presented.

Given the difficulties inherent to obtaining the necessary information, the validation process is likely to take time since it involves a substantial degree of coordination to achieve a successful outcome.

Finally, **employing the results of ecosystem services valuation assessments for decision-making** will depend on several factors that may run different courses in the three countries. In Colombia and Peru, for example, the concept of economic valuation is unlikely to face many ideological problems, while in Ecuador it is possible that the government and indigenous organizations may continue to question the whole concept of placing a value on ecosystem services. Decision-making will also depend on the degree of centralization or decentralization in each country and whether, for example, current mandates exist for granting rights to land and natural resources.

In Madre de Dios the study (for detecting decision-maker willingness to participate) has proved to be somewhat ineffective, not because of any lack of good intentions but because of the regional government´s institutional weaknesses and high staff turnover. Although staff members were trained to 'diploma' level, most of them have since left regional government service. Interaction was most fruitful with the academic sector (UNAMAD) and civil society organizations involved in the Environmental Services and REDD + Steering Group. The project has to date progressed only to the first stage of introduction of the InVest tool and little involvement and support has been forthcoming. In the immediate future the plan is to train staff, develop future development scenarios and seek validation of the ES approach.

The greatest difficulty in using the tool in Madre de Dios has been the lack of adequate institutional arrangements and capacities. The decentralization process has been managed very irregularly. It has not, for example, been completed in several sectors, with staff often reassigned without clear remits or necessary resources.

As for the InVest tool, the suggestion in Acre´s case for broadening its scope with other tools is in direct contrast with the more basic need in the other two cases to improve the quality and availability of information. In general, Brazil has made most progress towards informed natural resource management.

CHALLENGES AND NEEDS FOR DECISION-MAKING

The tool can be used as a lever for introducing changes. It can also be regarded not simply as a device for identifying conditions but also for pointing to ways of enhancing those conditions.

ES valuation with the use of the InVest tool has generally been accepted by decision-makers and technical staff as a flexible, relatively simple, affordable tool capable of displaying easily understood visible results. The tool can be used as a lever for introducing changes. It can also be regarded not simply as a device for identifying conditions but also for pointing to ways of enhancing those conditions.

With inputs from interviews and the results of the policy workshop held in Lima in 2013 on "*Mapping Ecosystem Services with InVest for the decision-making process: an approach based on case studies in the Amazon*"[21] a definition was reached of the political, social and technical challenges faced by decision-makers regarding the ES approach.

The political dimension

1. **Conservation and development.** The entire logic of the concept of ecosystem services revolves around not only solving conservation problems but also addressing development issues in order to make the approach more attractive to decision-makers and communities.

2. **Legal framework.** We need to develop a regulatory framework that includes clear rules for ecosystem services valuation that (i) avoid troublesome subsidies, (ii) reduce asymmetries in decision-making powers, (iii) ensure access to information and (iv) are transparent .

3. **Appropriate institutions.** Public institutions need to be encouraged to adopt clear rules at regional and local levels and incorporate the information necessary for decision-making**.**

4. **Promoting changes.** The entire process involved in assessing ES provision and valuation can mainstream ideas for improving public institutions on the basis of better informed decisions resulting in change.

21 Report available on the WWF Peru page in the publications section: http://peru.panda.org/informate/publicaciones/?214850/tallerregionaldemapeodeserviciosecosistemicosconinvest

5. **Promoting political will.** It is essential for targeted parties to have the political will to use the ecosystem approach to decision-making since it involves changing the logic of information and the variables employed to inform appropriate decisions.

6. **Non-monetary valuation.** Payment and/or compensation mechanisms that are being promoted in the ES process should not be based exclusively on monetary values, and non-monetary incentives should be encouraged.

7. **Applicability.** In addition to information availability, three important things need to be considered when applying the ecosystem approach to public policies: the approach must be participatory, it must have its own institutional frameworks, and its incorporation in political processes on a wider scale must be ensured. The tool is a lever to start generating changes, not only for identifying preconditions but also for highlighting ways of enhancing those conditions**.**

8. **Inclusion of the concept in public policies.** The assessment of ecosystem services must be included in land management plans, programmes and projects, while also taking into account the economic environment and a government´s own long-term view.

9. **Institutional liaison.** Good coordination is needed among national, regional and local governments to highlight the ability of ecosystem services to influence public policies. A coordinated approach would ensure, for example, the generation of land use plans at different levels of government by incorporating ecosystem services while retaining sustainable economic activities**.**

Technical dimension

1. **Generating reliable information.** Starting from the premise that "you cannot manage what you cannot measure", investment in economic and human capital is needed to promote research in government institutions and ensure the availability and accessibility of the information generated.

2. **Simple and cheap information.** Information must be available at least partially and it must be acceptable and understandable for all stakeholders. Obtaining such information must not be prohibitively costly.

3. **Raise all technical levels.** It is necessary to raise technical levels in regional, local governments and civil society organizations in order to form a critical mass of users that will facilitate deeper understanding of the potential ES impact on decision-making processes.

4. **Merge tools.** Use a variety of tools to operationalise the ES approach.

5. **Information sharing.** Research institutions and local and national universities possess information which is frequently not shared outside the scientific community but which can provide an invaluable input to ES assessments.

6. **Greater understanding of ES.** Wider understanding of the principles, scope and interactions of ecosystem services is necessary. For example, assessments of hydrological ecosystem services and payment mechanisms are associated with the provision of water for human consumption rather than with the fundamental role of water in the functioning of ecosystems and its role in regulating climate**.**

7. **Incorporate local realities into the general models.** InVest models are all-encompassing and often incorporate very general information and results that are not useful on a local scale. It is necessary therefore to develop an iterative process whereby overarching global models can be adapted to local realities.

8. **Scenarios.** To make assessments of different future scenarios, a coverage and usage map is needed as a basis for evaluating conditions in future years.

The social dimension

1. **Validation of models by stakeholders.** The results of the evaluation of ES provision and valuation must be substantiated by the relevant stakeholders. This means that they should be presented with reliable information and that the outcomes should not be biased for example by the interventions of more outspoken stakeholders or by those who have privileged access to information or tools.

2. **Fostering effective participation.** Participation by stakeholders must be effective. This requires strategies for making them aware of the logic of ecosystem services, their assessment and valuation, and the monetary and non-monetary rewards involved. The stakeholders must have a full understanding of the entire process. This requires a degree of skill and transparency on the part of project leaders to enable understandable information to be appropriately conveyed.

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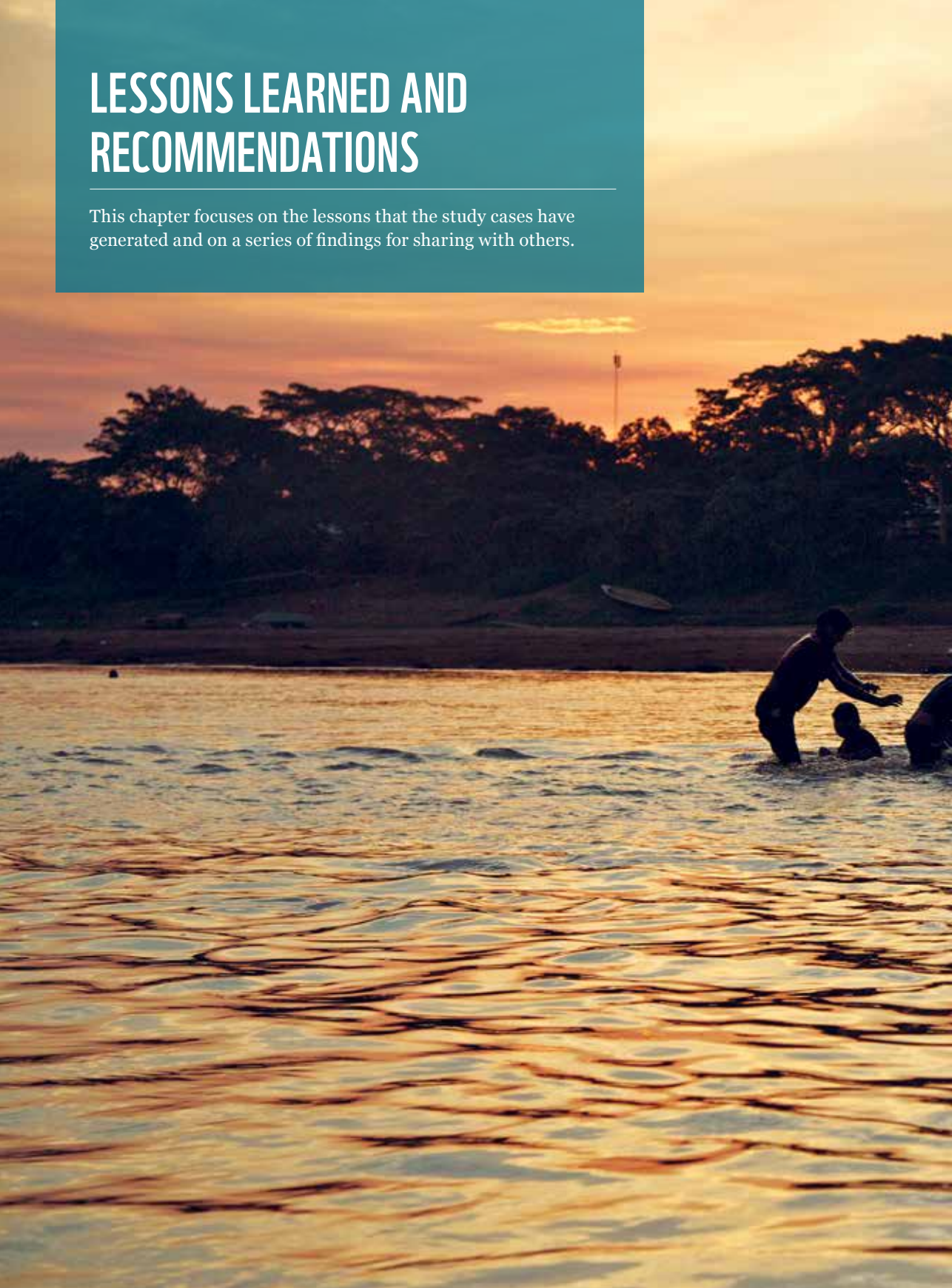
LESSONS LEARNED AND RECOMMENDATIONS

This chapter focuses on the lessons that the study cases have generated and on a series of findings for sharing with others.



The lessons learned are the key for sharing practices with others and include recommendations for applying them in other places and projects. The lessons and recommendations result from the knowledge acquired in the course of analysis and experience[22], unlike the practices and case studies which are limited to the specific (albeit indispensable) political, economic, social and institutional contexts.

Glossary

Lesson learned

A generalization that reflects learning based upon concrete practice.
Conclusions are those obtained from evaluating the completed task and comparing the outcomes obtained with the goals sought and the time and effort invested.
Recommendations are provided for those who are interested in developing a similar project.

LESSONS LEARNED ARE THE KEY TO SHARING PRACTICES WITH OTHERS AND ARE THE ONLY RECOMMENDATIONS THAT CAN BE CONSIDERED FOR APPLICATION IN OTHER PLACES AND PROJECTS.

Lessons learned from the process of identifying ecosystem services to inform decision-making are presented according to the case studies and have been assembled on the basis of an extensive review of the literature, interviews and scientific publications. This analysis also includes the lessons learned from the application of the InVest tool in over 20 countries throughout the world and in a variety of environmental, social, political and technical settings[23]. The lessons presented here are those that are considered of interest in the Amazonian context.

These lessons can serve as recommendations for others who wish to embark on a similar process in the Amazon and to use ecosystem services approaches to inform land management decisions.

22 Acosta, L (2005) *Guía práctica para la sistematización de proyectos y programas de cooperación técnica.* FAO Regional Office for Latin America and the Caribbean.

23 Extracted, adapted and translated from the article by Ruckelshaus, M., et al. *Notes from the field: Lessons learned from using ecosystem service approaches to inform real-world decisions.* Ecological Economics (2013).

Key Messages

The main recommendations for using the ecosystem approach to provide information for decision-making:

- It is important to **build trust among the different stakeholders.**
- It is necessary to produce results in conjunction with the local partners who are going to use them.
- It is important to **train credible local experts and collaborators** to appropriate the scientific aspects related to the generation of data and models for their own use.

Political dimension

The political dimension in the ecosystem services approach relates to the public policy issues and governmental processes that are necessary for ensuring that the relevant information is used for informing land management decisions.

For the ES approach to apply to regional natural resources management policies and strategies it is necessary that:

1. **Governments are involved in the process from the beginning**. Unless this relationship is established from the beginning of the process, and unless governments collaborate by providing data and joint work schedules, it is very difficult for them to achieve ownership of the process and in due course accept the information that has been submitted to them. Furthermore, the outputs must be substantiated and accepted by the technical bodies which rely on decisions made at a higher level.

   In the early stages of the Madre de Dios project, greater interaction should have been encouraged with the departmental authorities and other institutions familiar with the subject and possessing more information. In Colombia, government participation in the community processes has been weak, and a strategy needs to be developed involving training, ownership, understanding

and joint effort directed at the technical teams. In Acre, the GCP organization ensured participation by the State government, which reacted positively to the outcomes.

2. **Ecosystem services and biodiversity need to be related to changes in livelihoods and other aspects of human wellbeing**. It is necessary to track how the consequences of ecosystemic change can affect human wellbeing. For example, maintaining local means of subsistence beyond simply recording incomes was included in the list of desirable goals in examples from around the world.

3. **ES valuation is not always about money**. An ecosystem services approach for informing decision-makers is not always only about attributing monetary values to environmental benefits. It is necessary to possess skills for ensuring that biophysical estimates on environmental services precede any economic assessment. This has proved to be an important conceptual step which has opened the way for many decision-makers to discuss issues which previously they had disregarded. Overall, in most cases, valuation models and providing estimates of monetary benefits have proved to be less important.

Technical dimension

The technical dimension contained in the ES approach refers to aspects which emerge from the generation of biophysical data, information analysis, preparation of models and the assessment of ecosystem services provision to ensure that the information is used in decision-making.

To ensure that the ES approach is applicable to regional natural resource management strategies and policies it is necessary to:

1. **Include information on ES as part of an iterative scientific and political process.** The process by which information on ecosystem services involves decision-makers and other stakeholders is as important as the scientific tools used and the outcomes

AT THE GLOBAL LEVEL IT HAS BEEN PROVED THAT SUCH LOCAL LEADERSHIP IS THE KEY TO ENSURING THAT INFORMATION ON ES LEADS TO THE BEST RESULTS IN IMPROVING HUMAN AND ENVIRONMENTAL WELLBEING.

obtained from them. The iterative and interactive approach for defining when and what type of information about ecosystem services is necessary is a vital key for creating awareness of what is useful and credible, and for fostering changes in the processes involved in making decisions and generating results.
The iterative nature of the process for developing alternative scenarios, assembling information and data for the assessment tools, interpreting initial results and repeating the process as necessary, is invaluable for building confidence among scientists, stakeholders and decision-makers. Moreover, it is important to foster mutual understanding of problems and define how to use the results for informing decisions. Furthermore, it is crucial to ensure there isnegotiation and a structured and guided process for repeating data input, regularly improving and updating information. These can lead to agreements on a plan or specific policies which, although time-consuming, can produce additional benefits.

2. **Establish teams of local experts with the technical tools to ensure a continuous learning process.** InVest is a simple and accessible tool which can help to facilitate an iterative process, given that local experts can be trained in its use, can assume authorship of it and can learn how to deal with the ongoing requirements for technical support. In cases where the local scientists are prepared to lead on data collection and the interpretation of results, this increases the credibility of the ES information for decision-makers. In this way it is more likely that the results (Pathway 1) will stand a chance of changing perspectives (Pathway 2) and generating suitable actions (Pathway 3). Local experts also have a greater understanding of local biophysical and socioeconomic conditions and relations with decision-makers and are in an ideal position to transfer these perceptions to the modelling exercise, thereby ensuring that the analyses are in tune with local themes. It has been proved that local leadership of this type is the key for information on ecosystem services to achieve the desired result for enhancing human wellbeing and improving the environment (Pathway 4).

3. **Create synergies with other researchers in order to drive home the concept of assessing the provision and value of ecosystem services.** In Peru for example the interaction with UNAMAD was a key element for ensuring validation and continuity of the process. It would be interesting also to foster research projects as an additional support mechanism for generating the information needed for modelling.

4. **Construct models with the best information available.** The absence of best data should not halt the process of analysis, especially when data gaps exist as occurred in Peru and in the Tri- National Corridor. However, the initial ES assessment can help to define data requirements as well as providing an overview and the current status of ecosystem services.

5. **Keep ES assessments simple at the outset.** It matters little that the interdisciplinary scientists complain of having to oversimplify biophysical and socioeconomic processes. Government representatives normally require decision-making tools that are simple, understandable and easy to use, and which can be rapidly incorporated into scientific and policymaking processes. In NatCap´s global experience, even the simplest tools have proved to be very complicated for parameterizing and interpreting ES information. In order to be of use for most decision-makers, the tools must be capable of estimating how changes in decisions also lead to changes in the ecosystem services, and how the latter can be of value in terms of environmental and human wellbeing.

6. **Generate information on ecosystem services that matches local realities.** InVest models are dependable but too generalised and may overlook key differences. In Colombia, for example, it was necessary to make adjustments to ensure that the outcomes reflected the local and regional context.

7. **Report degrees of uncertainty clearly and honestly.** Applying InVest and similar models for evaluating ecosystem services entails a range of assumptions, and the outputs of the models normally reveal different degrees of uncertainty. When demonstrating the application of

the tool we need to explain its usefulness and discuss the limitations of our models and the implications of these on decisions regarding, for example, which biophysical and social processes can or cannot be represented.

Social dimension

The social dimension in the ES approach refers to the opportunities for forest users to participate effectively, fully and in an informed way in land use decision-making.

- **The social dimension needs to be incorporated into technical analyses in order to enable local communities to appropriate the process and substantiate the results.** Participation by local communities and indigenous groups in Colombia through the CAC process was essential for identifying threats, especially when information such as this is not readily available and forms of land use are not well organized. This process also helps social empowerment and expands opportunities for incorporating the results into spatial planning decisions.

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CONCLUSIONS

In the Amazon and other regions where forests are of international importance, tools are needed so that decisions taken by governments about natural resource use and the preservation of ecosystem services are based on the best available information, approved and substantiated by key stakeholders.

In the Amazon and other regions where forests are of international importance, tools are needed so that decisions taken by governments about natural resource use and the preservation of ecosystem services are based on the best available information, approved and substantiated by key stakeholders.

It has been noted that the ES approach is appropriate in situations where different environmental, social, political and economic contexts exist, given that it can assist in the decision-making process pragmatically and quantifiably by enabling the costs of services to be clearly explained. Nevertheless, a number of conditions need to be taken into account to ensure the success of this approach, and they should be used as a guide to undertaking the initial assessment to help define gaps.

InVest is s a tool which is easy-to-use and versatile. It can be applied for a number of different purposes. No recipe exists for applying the tool; it needs to be adapted to the local context and used as a device for generating interaction with key stakeholders. Furthermore, it is worth noting that various success points can be identified ranging from from the generation of information through to achieving concrete action on the part of decision-makers. Indeed, InVest can serve to boost this entire process.

The analyses of the application of InVest in Madre de Dios, the Tri-Nnational Corridor and the state of Acre reveal a wide variety of initial situations, innovation processes, achievements and challenges that have taken different directions with respect to ES information informing decisions. Each situation has been unique and none have been free from drawbacks. Those interested in launching their own process could well learn from this experience of applying InVest in order to avoid making similar mistakes. Different challenges have been noted from the technical, social and political point of view which should be taken into account before setting out on this journey.

Other colleagues familiar with the subject have indicated some interesting points for consideration (Valqui and Lopez, 2013) :

Using technical information for decision-making. InVest assumes that assessments of the value of natural resources contributes to making rational decisions based on information and on weighing options. In a society where powerful sectors force their decisions on the State, or where the State prioritizes certain activities, it will be difficult for the results generated by InVest to show immediate returns. However, less-favoured stakeholders will in due course be in a better position to justify questioning decisions

that cause impacts that previously could not be quantified. In short, InVest explicitly helps to internalize costs.

The use or misuse of information. At best, a positive feedback cycle develops between the greater availability and management of information, better institutions (institutions with resources and capabilities), better stakeholder participation, and better decision-making, all of which increases confidence in the processes and outcomes.

But, at worst, the information can be used by decision-makers to justify decisions based on other considerations or to detect new ways for increasing their control over funds. For this reason several indigenous organizations have opposed the concept of ecosystem services, suspecting that the approach is simply a device for justifying decisions by the State and big business (e.g. REDD).

The limits of participation in the Amazon. Democratization of the decision-making process includes better access to, and use of, information. This presupposes and requires stakeholders to be able and available to participate in the process. The extent and number of changes, cultural differences and the physical isolation of many of the population groups are often an unsurmountable barrier to participation. The InVest process, together with other participatory processes, needs to find a balance between the costs and benefits of participation. Finally, as highlighted by the authors of the Tri-National Corridor study, participation is an opportunity for creating and maintaining an atmosphere of mutual trust among stakeholders. This degree of trust can later allay doubts and reduce many problems which can arise from increases in the cost of the processes, for example, or even cause them to be halted altogether.

The quality of information and models. It is obviously desirable for information to be of the best possible quality, but a balance has to be achieved between costs and benefits. In the case of carbon storage, data needs to be obtained to estimate the biomass of the different types of forest, as well as baseline data on expected deforestation in order to compare different policies. In Brazil, for example one or more methods has been established and accepted so it was possible to apply InVest to information that had already been generated by IPAM. In contrast, official discussions are still underway within the Environment Ministry (MINAM) in Peru on the question of which method should be used to estimate carbon stocks and deforestation. As a result no official deforestation or carbon storage rates exist on which InVest exercises can be based.

Duration of the exercise. In all three cases the exercise lasted longer than planned. In Brazil it lasted for two years, regardless of the fact that basic information did not need to be generated. In the Tri-National Corridor and Madre de Dios the process is much less advanced and has already taken over three years. The problem in both places is that data need to be generated specifically for the application of InVest. In these cases it is probably worth examining whether it would be worth considering replacing an exercise such as this (maximum accuracy and long timeframe, running the risk of stakeholders probably losing interest) or a shorter, simpler exercise using information which is already available, although not particularly accurate, but that is acceptable to the stakeholders involved. If this approach were accepted, an opportunity for applying more accurate tools could probably be left until institutional and information conditions improve. Exercises conducted over a longer timeframe would probably eventually lead to improvements in the quality of information, institutions, models and decisions.

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ECOSYSTEM SERVICES VALUATION AS A DECISION-MAKING TOOL

CONCEPTUAL BASES AND LESSONS LEARNED IN THE AMAZON REGION

3 CASE STUDIES

Madre de Dios (Peru); Tri-national corridor (Colombia, Ecuador and Peru); Acre (Brazil)

29 MILLION

hectares of the Amazon in which ecosystem services can help land use management are covered by protected trans-frontier forests but they could be better managed

86% OF ACRE

Is still covered by forest

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