Business and Biodiversity Offsets Programme (BBOP)

Biodiversity Offset Cost-Benefit Handbook

BBOP
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Forest Trends, Conservation International and the Wildlife Conservation Society provided the Secretariat for BBOP during the first phase of the programme's work (2004 - 2008).

Publication Data

Business and Biodiversity Offsets Programme (BBOP). 2009. *Biodiversity Offset Cost-Benefit Handbook*. BBOP, Washington, D.C.

Available from: **www.forest-trends.org/biodiversityoffsetprogram/guidelines/cbh.pdf**

ISBN 978-1-932928-33-4 (PDF)

Cover and graphic design by Rima Design.

About this document

The Principles on Biodiversity Offsets and accompanying supporting materials[1] such as this Biodiversity Offset Cost-Benefit Handbook[2] have been prepared by the Business and Biodiversity Offsets Programme (BBOP) to help developers, conservation groups, communities, governments and financial institutions that wish to consider and develop best practice related to biodiversity offsets. They were developed by members of the BBOP Secretariat and Advisory Committee[3] during the first phase of the programme's work (2004 – 2008), and have benefited from contributions and suggestions from many of the 200 people who registered on the BBOP consultation site and numerous others who have joined us for discussions in meetings.

The Advisory Committee members support the Principles and commend the other working documents to readers as a source of interim guidance on which to draw when considering, designing and implementing biodiversity offsets. Best practice in biodiversity offsets is still in its infancy, and the concepts and methodologies presented here need to be further discussed, developed, tested and refined based on more practical experience and broad debate within society.

All those involved in BBOP are grateful to the companies who volunteered pilot projects in this first phase of our work and for the support of the donors listed overleaf, who have enabled the Secretariat and Advisory Committee to prepare these documents.

BBOP is embarking on the next phase of its work, during which we hope to collaborate with more individuals and organisations around the world, to test and develop these and other approaches to biodiversity offsets more widely geographically and in more industry sectors. BBOP is a collaborative programme, and we welcome your involvement. To learn more about the programme and how to get involved please:

See: **www.forest-trends.org/biodiversityoffsetprogram/**

Contact: **bbop@forest-trends.org**

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1 The BBOP Principles, interim guidance and resource documents, including a glossary, can be found at: **www.forest-trends.org/biodiversityoffsetprogram/guidelines/**. To assist readers, a selection of terms with an entry in the BBOP Glossary has been highlighted thus: BIODIVERSITY OFFSETS. Users of the Web or CD-ROM version of this document can move their cursors over a glossary term to see the definition.

2 This paper was prepared by Maryanne Grieg-Gran and Kerry ten Kate, with contributions by Michael Bennett and reflecting comments received during the public consultation period.

3 The BBOP Advisory Committee currently comprises representatives from: Anglo American; Biodiversity Neutral Initiative; BirdLife International; Botanical Society of South Africa; Brazilian Biodiversity Fund (FUNBIO); Centre for Research-Information-Action for Development in Africa; City of Bainbridge Island, Washington; Conservation International; Department of Conservation New Zealand; Department of Sustainability & Environment, Government of Victoria, Australia; Ecoagriculture Partners; Fauna and Flora International; Forest Trends; Insight Investment; International Finance Corporation; International Institute of Environment and Development; IUCN, The International Union for the Conservation of Nature; KfW Bankengruppe; Ministry of Ecology, Energy, Sustainable Development, and Spatial Planning, France; Ministry of Housing, Spatial Planning and the Environment, The Netherlands; National Ecology Institute, Mexico; National Environmental Management Authority, Uganda; Newmont Mining Corporation; Private Agencies Collaborating Together (Pact); Rio Tinto; Royal Botanic Gardens, Kew; Shell International; Sherritt International Corporation; Sierra Gorda Biosphere Reserve, Mexico; Solid Energy, New Zealand; South African National Biodiversity Institute; Southern Rift Landowners Association, Kenya; The Nature Conservancy; Tulalip Tribes; United Nations Development Programme (Footprint Neutral Initiative); United States Fish and Wildlife Service; Wildlife Conservation Society; Wildlands, Inc.; WWF; Zoological Society of London; and the following independent consultants: Susie Brownlie; Jonathan Ekstrom; David Richards; Marc Stalmans; and Jo Treweek.

During Phase 1 of BBOP, the BBOP Secretariat was served by Forest Trends, Conservation International and the Wildlife Conservation Society.

We thank those organisations that have provided financial support for BBOP's work[4]: the Alcoa Foundation; Anglo American; City of Bainbridge Island, Washington, USA; Conservation International; Department for International Development, United Kingdom; Department of the Environment, Water, Heritage and the Arts, Australia; Forest Trends; International Finance Corporation; KfW Bankengruppe; Ministry of Housing, Spatial Planning and the Environment, The Netherlands; Newmont Mining Corporation; the Richard and Rhoda Goldman Fund; Rio Tinto; Shell International; Sherritt International Corporation; Solid Energy New Zealand; the Surdna Foundation; the United Nations Development Programme/Global Environment Facility; United States Agency for International Development[5]; and Wildlife Conservation Society.

4 Endorsement of some or all of the BBOP documents is not implied by financial support for BBOP's work.

5 This document is made possible in part by the generous support of the American people through the United States Agency for International Development (USAID). The contents are the responsibility of Forest Trends, Conservation International and the Wildlife Conservation Society and do not necessarily reflect the views of USAID or the United States Government.

Contents

To be successful, biodiversity offsets should compensate indigenous peoples, local communities and other local stakeholders for any RESIDUAL IMPACTS of the project on their biodiversity based LIVELIHOODS and AMENITY. They also need to deliver the required conservation gains without making local people worse off, for example due to land and resource use restrictions created by the biodiversity offset. This requires a cost-benefit comparison between the benefits of the offset and the costs to local people of the residual biodiversity related impacts of the project and of the offsets.

The purpose of this Handbook is to provide guidance on how to use economic tools of valuation and cost-benefit analysis to address these challenges. The steps in the Handbook are designed to help OFFSET PLANNERS do their best to ensure that:

- Local people are no worse off through the presence of the project in terms of its impact on biodiversity related livelihoods;
- Local people at the offset site are no worse off as result of the biodiversity offsets, as appropriate and equivalent benefits are built into the offset to compensate for any negative impacts they cause; and
- Calculations of the conservation gain of the biodiversity offset activities are realistic in the assumptions made about how local people will become involved in the offsetting activities.

Activity 1 identifies a project's residual impacts on the use and enjoyment of biodiversity by indigenous peoples, local communities and other local stakeholders that have not already been addressed by the developer's social engagement programmes. Activity 2 identifies the impacts of proposed biodiversity offset activities on these local stakeholders. Activity 3 applies economic tools of valuation to estimate the costs and benefits to local stakeholders of the project and offset impacts. Activity 4 brings together all the cost-benefit information generated to make the final offset recommendations.

Table of contents

Using the ‘click-through’ feature in this PDF document

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You can click on text that is blue and underlined (hypertext) to navigate within and between sections (e.g. from summary text to detailed text). And then you can return to your original place. You can also click on links to access material on external websites.

To jump back to the hypertext link where you clicked from, check the ‘Previous View’ and ‘Next View’ arrows are showing on your toolbar. If they are not, go to the ‘View’ drop down menu at the top of your screen and select ‘Toolbars.’ Make sure the ‘Web’ or ‘Navigation’ toolbar is selected, or ‘Customise’ and pick:

Introduction

The Business and Biodiversity Offsets Programme

Biodiversity offsets are measurable CONSERVATION OUTCOMES resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development[6] after appropriate prevention and MITIGATION measures have been taken. The goal of biodiversity offsets is to achieve NO NET LOSS and preferably a NET GAIN of biodiversity on the ground with respect to species composition, HABITAT STRUCTURE, ECOSYSTEM FUNCTION and people's use and CULTURAL VALUES associated with biodiversity.

The Business and Biodiversity Offsets Programme (BBOP) is a partnership between companies, governments, conservation experts and financial institutions that aim to explore whether, in the right circumstances, biodiversity offsets can help achieve better and more cost effective conservation outcomes than normally occur in infrastructure development, while at the same time helping companies manage their risks, liabilities and costs. BBOP has been researching and developing best practice on biodiversity offsets and beginning to test it through a portfolio of pilot projects in a range of contexts and industry sectors, aiming to demonstrate improved and additional conservation and business outcomes. BBOP's expectation is that biodiversity offsets will become a standard part of the development process when projects have a significant residual impact on biodiversity, resulting in long term and globally significant conservation outcomes.

The Principles on Biodiversity Offsets and accompanying supporting materials such as this Cost-Benefit Handbook have been prepared by BBOP to help developers, conservation groups, communities, governments and financial institutions that wish to consider and develop best practice biodiversity offsets.

They were developed by members of the BBOP Secretariat and Advisory Committee during the first phase of the programme's work (from November 2004 – December 2008). They reflect discussion by members of the BBOP Advisory Committee, some practical experience through trials at the BBOP PILOT PROJECT sites, and have also benefited from contributions and suggestions from the many people who registered on the BBOP consultation website and numerous others who have participated in workshops and meetings. Since 2006, potential elements of principles for biodiversity offsets and methods following the basic steps outlined in this Handbook have been evolving in parallel with early progress at the pilot projects, but the set of principles laid out in Part 1 of this document was only prepared in February 2008, since when it has been the basis for consultation culminating in final text in December 2008. Consequently, the methodologies described here were not available in their entirety to the pilot projects when they started work on the design of their offsets, nor were the underlying principles.

Some of the pilot projects joined BBOP comparatively recently (e.g. Solid Energy New Zealand only joined with its Strongman project in October 2007) and, for others, project authorisation has taken longer than initially anticipated, which has slowed the process of offset design. None of the companies has yet worked through all the steps described in this Handbook. It is also important to bear in mind that Phase 1 of BBOP involved just five pilot projects with large companies (Shell, Newmont, Anglo American, Sherritt, Solid Energy New Zealand), and a sixth involving local government (the City of Bainbridge, USA) working with a small real estate

6 While biodiversity offsets are defined here in terms of specific development projects (such as a road or a mine), they could also be used to compensate for the broader effects of programmes and plans.

developer. Best practice on voluntary biodiversity offsets is best described as experimental and evolving. Many of the approaches described and offered here as options have not yet been robustly tested in the context of voluntary biodiversity offsets and may not be the most useful or appropriate approach in some specific contexts. They should therefore be viewed as a ‘work in progress’, to be used with judgment, acknowledging their limitations. Once they have been adapted and more widely used in practice, it will be possible to revise and improve the guidance in this Handbook based on experience.

The BBOP Principles on Biodiversity Offsets

At the heart of BBOP's approach to biodiversity offsets is a set of principles (Box 1).

Box 1: Principles on Biodiversity Offsets supported by the BBOP Advisory Committee

Biodiversity offsets are measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development after appropriate prevention and mitigation measures have been taken. The goal of biodiversity offsets is to achieve no net loss and preferably a net gain of biodiversity on the ground with respect to species composition, habitat structure, ecosystem function and people's use and cultural values associated with biodiversity.

These principles establish a framework for designing and implementing biodiversity offsets and verifying their success. Biodiversity offsets should be designed to comply with all relevant national and international law, and planned and implemented in accordance with the Convention on Biological Diversity and its ecosystem approach, as articulated in National Biodiversity Strategies and Action Plans.

1. **No net loss:** A biodiversity offset should be designed and implemented to achieve in situ, measurable conservation outcomes that can reasonably be expected to result in no net loss and preferably a net gain of biodiversity.
2. **Additional conservation outcomes:** A biodiversity offset should achieve conservation outcomes above and beyond results that would have occurred if the offset had not taken place. Offset design and implementation should avoid displacing activities harmful to biodiversity to other locations.
3. **Adherence to the mitigation hierarchy:** A biodiversity offset is a commitment to compensate for significant residual adverse impacts on biodiversity identified after appropriate AVOIDANCE, minimisation and on-site rehabilitation measures have been taken according to the mitigation hierarchy.
4. **Limits to what can be offset:** There are situations where residual impacts cannot be fully compensated for by a biodiversity offset because of the irreplaceability or vulnerability of the biodiversity affected.
5. **Landscape context:** A biodiversity offset should be designed and implemented in a landscape context to achieve the expected measurable conservation outcomes taking into account available information on the full range of biological, social and cultural values of biodiversity and supporting an ecosystem approach.
6. **Stakeholder participation:** In areas affected by the project and by the biodiversity offset, the effective participation of stakeholders should be ensured in decision-making about biodiversity offsets, including their evaluation, selection, design, implementation and monitoring.
7. **Equity:** A biodiversity offset should be designed and implemented in an equitable manner, which means the sharing among stakeholders of the rights and responsibilities, risks and rewards associated with a project and offset in a fair and balanced way, respecting legal and customary arrangements. Special consideration should be given to respecting both internationally and nationally recognised rights of indigenous peoples and local communities.
8. **Long-term outcomes:** The design and implementation of a biodiversity offset should be based on an ADAPTIVE MANAGEMENT approach, incorporating monitoring and evaluation, with the objective of securing outcomes that last at least as long as the project's impacts and preferably in perpetuity.
9. **Transparency:** The design and implementation of a biodiversity offset, and communication of its results to the public, should be undertaken in a transparent and timely manner.
10. **Science and traditional knowledge:** The design and implementation of a biodiversity offset should be a documented process informed by sound science, including an appropriate consideration of traditional knowledge.

The Principles provide a framework for offset design and implementation but there are many ways of working within this framework. This Biodiversity Offset Cost-Benefit Handbook is one of three principal elements of the emerging BBOP toolkit designed to help offset planners implement offsets in accordance with the principles. The others are the Biodiversity Offset Design Handbook (see **www.forest-trends.org/biodiversityoffsetprogram/guidelines/odh.pdf**) and the subsequent Biodiversity Offset Implementation Handbook (see **www.forest-trends.org/biodiversityoffsetprogram/guidelines/oih.pdf**). Figure 1 illustrates the scope of the three Handbooks.

Figure 1: The scope of the Biodiversity Offset Design, Cost-Benefit and Implementation Handbooks

Biodiversity Offset Design Handbook

Step 1
Review project **scope** and **activities**

Step 2
Review the **legal framework** and / or **policy context** for a biodiversity offset

Step 3
Initiate a **stakeholder participation** process

Step 4
Determine the need for an offset based on **residual adverse effects**

Step 5
Choose methods to calculate **loss** / **gain** and quantify **residual losses**

Step 6
Review potential **offset locations** and **activities** and assess the biodiversity **gains** which could be achieved at each

Step 7
Calculate offset gains and **select** appropriate offset locations and activities

Step 8
Record the offset design and enter the offset **implementation process**

Biodiversity Offset Cost-Benefit Handbook

Activity 1
Identify the **project's** direct and indirect residual impacts on local use and enjoyment of biodiversity

Step 1
Determine the project's **direct** and **indirect** residual impacts on **local use** & **enjoyment** of biodiversity

Activity 2
Identify the impacts of proposed **offset** activities on local stakeholders

Step 2
Identify **potential offset activities**

Step 3
Identify **impacts** of proposed offset activities on **local stakeholders** at the **project** and **offset sites**

Activity 3
Estimate the **costs and benefits** to local stakeholders of project residual impacts and offset options

Step 4
Scoping of cost-benefit comparisons for **affected stakeholders**

Step 5
Estimate **costs** and **benefits**

Activity 4
Specify a fair and effective offset **package**

Step 6
Check that **preliminary offset recommendations** meet **cost-benefit** requirements

Step 7
If necessary, **revisit** the design of the **offsets** to bring costs and benefits into balance and address distributional concerns

Step 8
Make the **final recommendations** of socioeconomic offsetting activities and **quantify** the associated conservation gain

Biodiversity Offset Implementation Handbook

Activity 1
What are the biodiversity offsetting **activities** and where will they be carried out?

Activity 2
How will the biodiversity offset **operate** and be **managed**?

- **2.1** What are the **roles** and **responsibilities** and potential stakeholders in biodiversity offset implementation?
- **2.2** What are the **legal aspects** of establishing an offset?
- **2.3** What are the **institutional aspects** of establishing an offset?
- **2.4** How should a biodiversity offset **management plan** be developed?

Activity 3
How will the biodiversity offset be **financed** over the long-term?

- **3.1** How will the short- and long-term **costs** of implementing the biodiversity offset be calculated?
- **3.2** What are the potential conservation **trust fund** options?
- **3.3** What are the potential **non-trust fund** options?
- **3.4** How can sustainability be built or enhanced through **additional revenue options**?

Activity 4
How will the offset be **monitored** and **evaluated**?

- **4.1** How will an offset be **monitored** and **evaluated**?
- **4.2** **Implementation** performance
- **4.3** **Impact** performance
- **4.4** Linking **implementation** and **impact** performance
- **4.5** How will monitoring and evaluation data analysis results be used to **assess** and **improve** project performance?
- **4.6** **Certification** and **verification**

Activity 5
Launching the offset

Purpose and scope of the Handbook

The purpose of this Cost-Benefit Handbook is to provide guidance on addressing the livelihood aspects of biodiversity offsets for local stakeholders. It is intended to supplement the Offset Design Handbook which, in line with most existing policy and practice on biodiversity offsets, presents a direct measurement approach, quantifying BIODIVERSITY LOSSES and offset GAINS using measures such as habitat quality and area and species' populations. The Cost-Benefit Handbook explains how to use economic tools to analyse the biodiversity related impacts of the project on indigenous peoples, local communities and other local stakeholders ('local stakeholders') and compare them with the costs and benefits to these local stakeholders of the potential biodiversity offset packages.

Why focus on local stakeholders?

There may be many different individuals and groups whose involvement in the design and implementation of a biodiversity offset will be important to ensure its fairness and success, but this Handbook focuses in particular on people living in and around the project and POTENTIAL OFFSET SITES. They may be indigenous peoples, local communities and / or rural dwellers, who are pursuing LIVELIHOODS based on farming, fisheries, ECOTOURISM or other biodiversity related activities, or who have particular cultural associations with biodiversity (whether aesthetic, spiritual or religious values). For the purposes of this Handbook, all these groups are embraced by the term 'stakeholders' and 'communities', although more specific language is used where necessary.

It is important to give special attention to local stakeholders for the following reasons:

- A project may have a negative impact on the biodiversity based livelihoods and amenities (i.e. recreational, aesthetic and spiritual values) of local populations. This needs to be compensated and restored in order to achieve the goal of biodiversity offsets: no net loss, or a net gain, of biodiversity.
- The offset will need to address the underlying causes of biodiversity loss at the offset site, which may be linked to unsustainable resource use practices by local stakeholders. Offering local stakeholders a viable and attractive sustainable use alternative will be key to ensuring their willing involvement and to achieving successful long-term conservation outcomes.
- An important motivation for companies to undertake voluntary biodiversity offsets is to secure a 'social license to operate' and good relations with stakeholders, avoiding conflict or resentment in communities. For this, it is important that local livelihoods and AMENITY are not negatively impacted, and preferably enhanced, by the biodiversity offset.

This is not to deny the importance of biodiversity losses and gains for non-local stakeholders but these global values are complex and controversial to estimate in monetary terms and arguably are addressed adequately by the direct measurement approach.

Why use economic tools? How Cost-Benefit Analysis is relevant to biodiversity offsets

Biodiversity offsets will have a greater chance of success if they fully compensate local stakeholders for any residual impacts of the development project, and provide incentives to local people to participate in delivery of the required CONSERVATION GAINS. This means that local stakeholders need to perceive benefits from the offset package even if the offset activities may mean some land and resource use restrictions. This is essentially a cost-benefit comparison between the benefits to local people of the offset and the costs to local people of the residual biodiversity related impacts of the project and of the offsets.

The benefits of the offset to local people may involve the provision of alternative sources of biodiversity resources to replace those affected by the project or to reduce pressure on areas considered of important conservation value. The benefits from the offset package can also include incentive measures such as payments for environmental services.

The relative importance of the two cost elements (project-related and offset-related) will vary. In some cases, the offset itself might not involve costs for the local stakeholders and it is the project's residual impacts that are of most concern. In other cases, the development project might have no residual impacts on communities' use and enjoyment of biodiversity because of extensive social engagement programmes. However, the offset package might involve working with local stakeholders to reduce threats to biodiversity through, for example, curtailing use of fuelwood from natural forests, or actively protecting forests from outside incursions. In these situations, it will be important to examine the costs to these stakeholders of the offset package and compare these with the benefits. Similarly, the offset package may involve working with some stakeholders that are more distant from the project and are therefore not affected by it. The key question in such cases is whether the benefits provided to them by the offset are greater than the costs implied by the offset:

$$Bo \geq Cp + Co$$

Where Bo = benefits of the biodiversity offset to the local stakeholders

Cp = costs to local stakeholders of the residual biodiversity related impacts of the project

Co = costs to local stakeholders of the biodiversity offset

The appropriate methods for determining and comparing costs and benefits depend very much on the scale of the project, the nature and scale of the residual impacts and the context. Rigorous estimates of costs and benefits count for little if local stakeholders do not accept them or find them credible. In some circumstances, rough estimates based on biodiversity proxies to determine no net loss will be sufficient basis for stakeholder discussion and agreement. In other cases, where more is at stake or there are complex trade offs between different kinds of impact and between different local stakeholders, it may be necessary to make more detailed estimates, converting to monetary terms as much as possible.

This Handbook sets out an approach which can be used with varying degrees of precision, to match the circumstances.

Working with local stakeholders

Working with local stakeholders such as indigenous and local communities on planning and implementing biodiversity offsets raises some key challenges. Some of these are specifically related to offsets, such as determining the significance of the project's impacts on community use and enjoyment of biodiversity from the community perspective; designing an offset so that it fully compensates communities for these impacts, for example determining how large a woodlot area would need to be; and formulating an offset package that is considered fair by different groups within the community. Others are challenges inherent in establishing a fair and equitable relationship with local stakeholders such as indigenous peoples and local communities for any collaboration, whether it is a biodiversity offset, an ecotourism project, a bioprospecting agreement or indeed any other project. The different groups are likely to have a range of varying rights and interests in the land and resources in and around the project site and the biodiversity offset site, so they may need to be treated distinctly at certain stages in the process. That is a matter that will need careful consideration in each individual setting. For further information on some of these distinctions and on best practice in PARTICIPATION, please see the accompanying Resource Paper on Biodiversity Offsets and Stakeholder Participation (**www.forest-trends.org/biodiversityoffsetprogram/guidelines/participation.pdf**).

Applying the tools set out in this Handbook may involve eliciting information on issues that could be considered sensitive. It may include studying people's income from biodiversity related activities, or their use of medicinal plants and traditional knowledge on the medicinal properties of local plant species, or details of their cultural practices. It may also involve supporting them as their community, or some householders' homes, are relocated because of the development project for which the offset is being designed. This raises legal and ethical issues about the manner in which information is acquired and used, and more broadly about people's consent. It is important for developers and their consultants and advisers to follow recognised international and national law and best practice on this. There are a number of relevant treaties, codes of practice, standards and guidelines on topics ranging from the rights of indigenous and local communities to scientific research to genetic resources and traditional knowledge. Discussion with the stakeholders themselves and experts familiar with the full range of stakeholder participation processes should guide the selection of the most appropriate methods and approaches to use in particular circumstances. Some sources of further guidance on law, policy and best practice related to working with stakeholders can be found in the Resource Paper on Biodiversity Offsets and Stakeholder Participation (**www.forest-trends.org/biodiversityoffsetprogram/guidelines/participation.pdf**).

Who decides whether an offset 'package' is satisfactory?

Some of the issues discussed in this Handbook (for instance, social and environmental impact assessments) are the subject of regulation. In some countries, biodiversity offsets are also regulatory requirements. In such cases, it is the regulator who will decide whether the developer's proposed activities are satisfactory. However, this Handbook has been prepared with a very common situation in mind, namely when the regulatory process determines the main parameters of the project and some mitigation measures, but does not require the developer to carry out a biodiversity offset to achieve 'NO NET LOSS'. In this case, the biodiversity offset is purely voluntary and it is thus for the developer itself to decide upon the offset package. However, the developer cannot do this alone. The most common motivation for a company to undertake a voluntary biodiversity offset is to secure good relationships with its stakeholders, particularly communities. As described above, this is only likely if local stakeholders feel the project and offset are beneficial for them. Thus it will be important for them to be involved with the developer in designing the offset to their mutual satisfaction.

Using the Handbook

Target audiences for this Handbook

Applying economic tools such as those described here can generate useful information to support discussion with local stakeholders on the design of a satisfactory biodiversity offset or set of biodiversity offsets. The Handbook is intended primarily for use by:

- Project developers, who need an overview of what is involved in cost-benefit analysis and how it could be useful in biodiversity offset design. They may commission economic consultants to undertake the analysis (see Appendix 1); and
- Economic consultants commissioned to carry out the cost-benefit analysis for the purposes of biodiversity offset design, who need to know what is expected of them and what needs to be covered in the valuation exercise.

Box 2 shows how these different audiences can use this Handbook.

Project developers may choose to establish a small group of staff, consultants, local stakeholders and other experts to assist them in the design of the biodiversity offset. All these people, termed 'offset planners' in this Handbook, may have recourse to the materials presented here. In addition, the Handbook may also be useful for other audiences such as individuals and organisations working with communities, who may be involved in biodiversity offsets.

Box 2: How to use this Handbook

This Handbook is intended for several audiences with varying needs. Before reading the document it may help to bear in mind the following:

- **Project developers** seeking an overview of the issues and who may contract consultants to carry out an offset cost-benefit analysis on their behalf should read the Introduction and Part 1 for a rapid overview of the steps. The model terms of reference provided at the end of the Handbook may also help in recruiting and guiding an economic consultant to undertake the analysis.
- **Economic consultants hired to undertake the analysis and project developers who will do this for themselves** may prefer to read the Introduction and then go straight to Part 3 for a more comprehensive explanation of the steps. It may help to consult Part 2 of the Handbook, which offers a series of potential templates and checklists for working through the steps and presenting the results.

How to use in parallel with the Biodiversity Offset Design Handbook

The Biodiversity Offset Cost-Benefit Handbook is designed to be used in parallel with the Biodiversity Offset Design Handbook. The results of applying this Handbook contribute to the final decision on the location and nature of the biodiversity offset activities which is the outcome of using the Biodiversity Offset Design Handbook. But there are other points of intersection between the steps in the two Handbooks as discussed in Box 3 and shown in Figure 2.

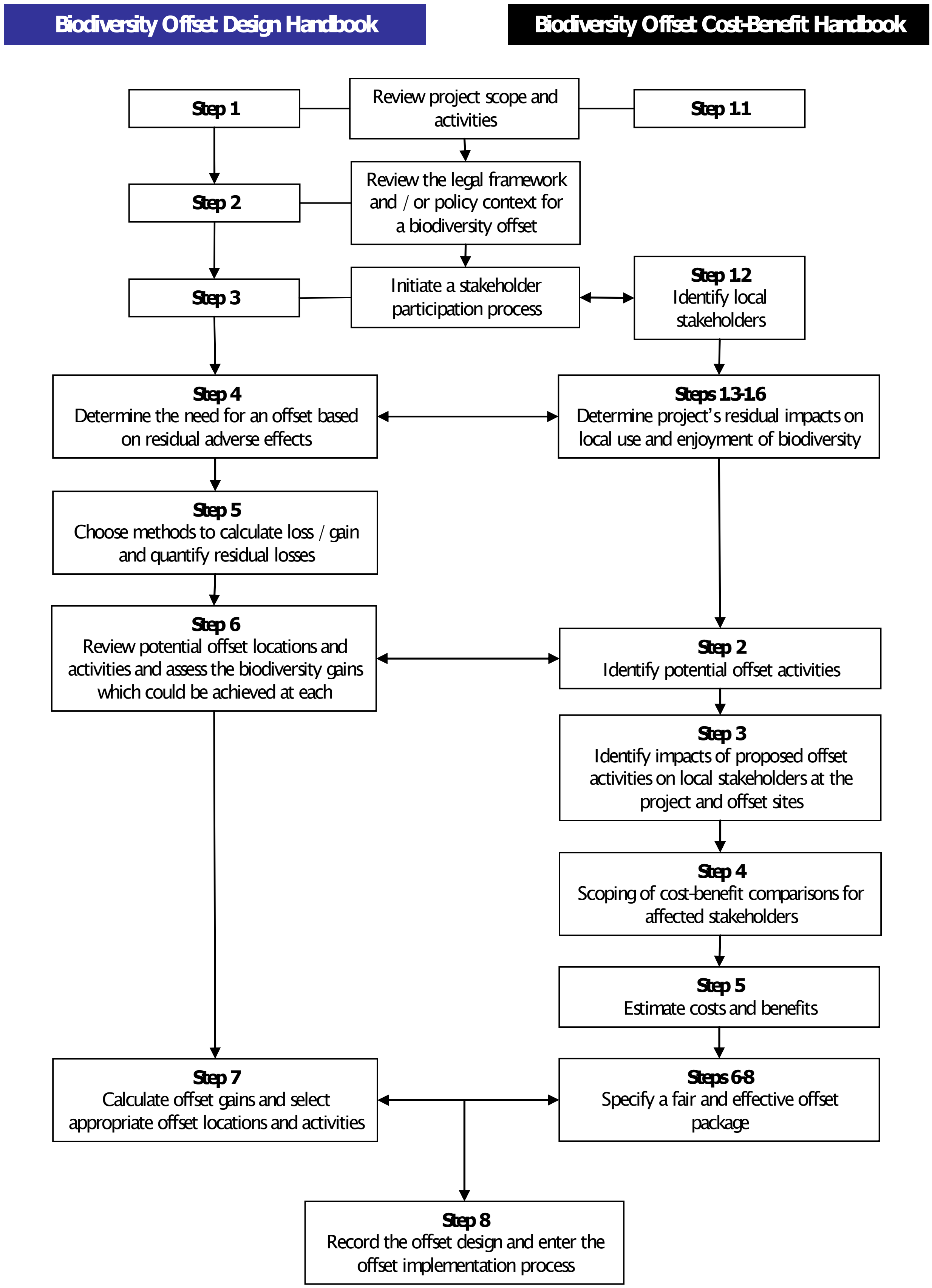
Box 3: The links between the Offset Design Handbook and the Cost-Benefit Handbook

The Offset Design Handbook offers a process for defining whether a biodiversity offset is an appropriate approach, and, if so, for defining the nature, scope and location(s) of all the necessary offset activities. The Cost-Benefit Handbook focuses on local stakeholders' use and cultural values associated with biodiversity and feeds in to final offset design in the Offset Design Handbook, helping ensure a fair and effective offset package. They start using the same information (about the nature of the development project and the stakeholders involved), then use different methods to focus on different aspects of offsets, before coming together on the final selection of offset sites and activities.

Initially, the project activities are identified in the Offset Design Handbook, and this can be used to inform the first step of the Cost-Benefit Handbook In the identification of stakeholders, The Cost-Benefit Handbook can provide detailed information on the local stakeholders and their uses and cultural values of biodiversity that is useful in the Design Handbook. Both Handbooks identify residual impacts of the project on biodiversity, but the Cost-Benefit Handbook emphasises impacts on local use and enjoyment of biodiversity. The two Handbooks then diverge. The Offset Design Handbook quantifies impact losses using biodiversity measures and focusing more on its INTRINSIC VALUES, while the Cost-Benefit Handbook uses economic valuation and focuses more on local cultural and USE VALUES. The methodology of the Cost-Benefit Handbook compares a package of costs and benefits, so quantification is best done after all the offset activities and their impacts have been identified.

The Cost-Benefit Handbook compiles potential offset activities drawing from Step 6 in the Offset Design Handbook and identifies their likely impacts on local stakeholders. It then quantifies and compares the costs of the project impacts and the costs and benefits of the offset activities for local stakeholders. The results contribute to the selection and evaluation of offset sites and activities in Steps 6 and 7 of the Offset Design Handbook. The final step of the Cost-Benefit Handbook pulls together all the findings to specify an offset package that is both fair from the point of view of local stakeholders and effective in terms of delivering sustained conservation gains. This feeds into the final decision on the location and nature of the biodiversity offset activities in the Offset Design Handbook.

Figure 2: The relationship between the Biodiversity Offset Design and Cost-Benefit Handbooks



Part 1: Overview of the Steps

Activity 1: Identify the project's direct and indirect residual impacts on local use and enjoyment of biodiversity

The Handbook begins with an identification of the project's direct and indirect RESIDUAL IMPACTS on local use and enjoyment of biodiversity. Much of this analysis may already have been done in project design documents and the Environmental and Social Impact Assessment and some of the biodiversity related impacts may have been addressed in COMPENSATION measures as part of social engagement programmes. The aim of this activity is to identify biodiversity related impacts on local stakeholders that may have been missed in the project design and appraisal process or not addressed adequately. After examining the scope for avoiding or reducing these impacts according to the MITIGATION HIERARCHY and considering whether any of the remaining impacts are non-offsettable for social or cultural reasons, the OFFSET PLANNER will have identified a set of residual impacts that can be offset.

Step 1: Determine the project's direct and indirect residual impacts on local use and enjoyment of biodiversity

Objective

Identify a set of residual impacts on biodiversity based livelihoods and AMENITY that need to be offset in each affected community or local stakeholder group, taking account of current and future trends in biodiversity use in the 'without project' situation. Key stages are to:

1.1 Define the components of the project […more details]

1.2 Identify the affected local stakeholders […more details]

1.3 Define the 'without project' BASELINE, for instance, completing a 'Key Biodiversity Components Matrix' […more details]

1.4 Identify impacts […more details]

1.5 Define compensation measures already included in project design and ESIA […more details]

1.6 Identify residual Impacts […more details]

Activity 2: Identify the impacts of proposed offset activities on local stakeholders

This part of the Handbook explores how conservation activities that may impact indigenous and local communities at the offset site (e.g. reduced livestock levels) can be compensated. It will also suggest that socioeconomic activities that result in conservation gains should be identified and included, where appropriate, as potential components of the biodiversity offset. It discusses how offset planners can work with communities to identify and assess the package of benefits (delivered through mechanisms such as conservation agreements and payment schemes) that have the potential to secure the agreed conservation activities by the communities.

Step 2: Identify potential offset activities

Objective

Identify the full range of offset activities under consideration, including the offset activities needed to address the project's residual impacts on local stakeholders' use and enjoyment of biodiversity (as identified in Activity 1 of this Handbook) and the offset activities identified in Step 6 of the Biodiversity Offset Design Handbook. Key issues covered include:

- How can LEAKAGE be prevented? […more details]
- Are OUT-OF-KIND offsets acceptable? […more details]

Step 3: Identify impacts of proposed offset activities on local stakeholders at the project and offset sites

Objective

Identify any socioeconomic and cultural implications of the offset activities for the various communities and other stakeholders concerned. Key stages are to:

3.1 Identify the local stakeholders affected by the proposed offset activities […more details]

3.2 Conduct rapid assessment of baseline stakeholder use of biodiversity at offset sites […more details]

3.3 Determine impact of proposed offset activities on the use and enjoyment of biodiversity by local stakeholders […more details]

Activity 3: Estimate the costs and benefits to local stakeholders of project residual impacts and offset options

After completing Activities 1 and 2, the offset planner will have identified the various indigenous peoples and local communities and other local stakeholders affected by the project's residual biodiversity related impacts and those that are likely to be affected positively and negatively by the proposed offset activities. The challenge is to design the offset options so that they fully compensate for the residual impacts of the project, where relevant, and leave the affected local people no worse off. This Activity involves assessment of the value to the community of project impacts and of offset costs, in terms that can be compared with the benefits of biodiversity offsets. In some cases, physical units, components of biodiversity will suffice as the CURRENCY for these comparisons. In others, the complex range of impacts from the project and offset activities may require the use of valuation techniques to convert to monetary terms.

Step 4: Scoping of cost-benefit comparisons for affected stakeholders

Objective

Draw together the cost-benefit comparisons for each affected community and local stakeholder group making decisions about the sub-groups within local stakeholder groups that need special attention, the timeframe over which comparisons will be made and the approach to take in the case of illegal or unsustainable use of biodiversity. Key issues covered include:

- Examining intra-community differences in costs and benefits […more details]
- How to compare different patterns of costs and benefits over time […more details]
- How to make estimates in circumstances where community resource use is illegal or unsustainable […more details]

Step 5: Estimate costs and benefits

Objective

Estimate the costs and benefits to an affected community (or other local stakeholder group) of project residual impacts and of offset options in terms that can be compared. Key stages are to:

5.1 Identify types of value involved […more details]

5.2 Gather information on biodiversity proxies as the starting point for cost-benefit analysis and decide whether it is appropriate to base cost-benefit comparisons solely on these […more details]

Then, estimate costs and benefits using an appropriate method:

5.3 When to use the MARKET PRICE METHOD […more details]

5.4 When to use surrogate market approaches […more details]

5.5 When to use the PRODUCTION FUNCTION METHOD […more details]

5.6 When to use the REPLACEMENT COST METHOD […more details]

5.7 When to use STATED PREFERENCE approaches […more details]

Activity 4: Specify a fair and effective offset package

The final Activity is to bring together all the cost and benefit estimates relating to a preliminary set of offset options, to examine the implications for local stakeholder groups, and define a final offset package that leaves local stakeholders no worse off, fully compensates them for any residual project impacts on their use and enjoyment of biodiversity and deliver the required conservation gain.

Step 6: Check that preliminary offset recommendations meet cost-benefit requirements

Objective

Check the preliminary set of offset recommendations and associated costs and benefits to ensure they meet the conditions required for acceptability to local stakeholders and long term success.

Step 7: If necessary, revisit the design of the offset to bring costs and benefits into balance and address distributional issues

Objective

Adjust the design of the offset if the benefits do not yet fully compensate communities for the project residual impacts or for costs associated with the offsets, or if there are concerns about the distribution of costs and benefits.

Step 8: Make the final recommendations of socioeconomic offsetting activities and quantify the associated conservation gain

Objective

Pull together the results of the cost-benefit comparisons and make final recommendations on offset options that will satisfy stakeholders and deliver no net loss of biodiversity.

Part 2: Tool Section

Table 1: List of tools in the Biodiversity Offset Cost-Benefit Handbook

Tool title	Stage of Handbook to which tool is relevant	Purpose of tool
Project Activities, Offset Activities and the Communities Affected	Steps 1.1, 1.2, 2.1, 3.1 and 4.1	In this table, the offset planner starts by listing the components of the development project being planned (e.g. mine site, tailings dam, new access road etc), and subsequently lists all the potential offset activities. Then the offset planner identifies the communities affected by each activity, including any groups particularly affected within the community.
Identification of Communities Affected	Steps 1.1, 1.2, 2.1, 2.2 and 4.1	The basis for analysis in this Handbook is the community (and lower levels of organisation, such as households, where appropriate). The first table started by identifying the activities and, from those, identifying the communities that would be affected by them. This table reorganises that information by community, as this will be the basis for the subsequent offset design and valuation exercises. It encourages the offset planner to record the different communities affected and provide a brief description of each, including the location and size of the community, and which project activities will affect them, as well as any groups within each community (e.g. women, landless families, elders, shamans) who will be particularly affected by the project activities.
Current Community Use and Enjoyment of Biodiversity in Area of Project Activities	Steps 1.3 and 5.1	This table provides a background on community use of biodiversity, as the basis for analysis of the offsets needed to compensate the effects of the project on local communities. It provides a place to record a summary of the different communities' current direct uses of biodiversity (in terrestrial, marine and aquatic ecosystems), and a similar place to record their present non-consumptive USE VALUES and then cultural or NON-USE VALUES in the same areas. Finally, one column allows offset planners to record the 'without project' scenario for the communities' different uses. This changing baseline is an important consideration when deciding how much impact the project itself is responsible for, and when considering the chances of success of offset activities intended to increase biodiversity values. Communities' present uses are considered within both the DIRECT AREA OF INFLUENCE, and the INDIRECT AREA OF INFLUENCE. The latter would cover effects on communities that are more distant from the project site (e.g. loss of LIVELIHOOD from impacts on fisheries caused by upstream activities).
Current Community Use and Enjoyment of Biodiversity in Area of Potential Offset Activities	Steps 3.2 and 5.1	This table is the mirror of the preceding table. It provides a framework for analysis of the present uses of biodiversity by local communities at the sites where biodiversity offset activities may be undertaken in the future. It thus lays the ground for assessing the likely impact on those uses that may be caused by the presence of the offset.
Impacts of Project on Community Use, and Handling	Steps 1.4, 1.5, 1.6 and 4.1	This table enables offset planners to build on the analysis in the 'Current Community Use and Enjoyment of Biodiversity in Area of Project Activities' table, in which the 'without project' current uses and prognosis for future uses

Tool title	Stage of Handbook to which tool is relevant	Purpose of tool
Residual Impacts		of biodiversity by communities were recorded. Here, the impact on those uses of the project is recorded and analysed. Offset planners start by recording the impacts of the project on the uses of biodiversity by particular communities, as identified in the preceding table. They are then encouraged to consider and record the compensation measures already planned in project design, and whether these are adequate, and thus the impacts fully compensated. If the impacts are already fully dealt with, the offset planners can move straight to Activity 2. If the impacts are not fully dealt with, the offset planner would record which impacts still need addressing, and determine whether these uncompensated impacts can be avoided altogether and reduced. If there will be a residual impact, the planner records this and considers whether the impact is capable of being offset, and thus whether a biodiversity offset is needed to address the project's impacts on each community. As with most of the tables the planner is asked to record the basis and rationale for the views and decisions captured in the table.
Impacts of Potential Offset Activities on Community Use	Steps 2.1, 3.3 and 4.1	This is analogous to the preceding table, in that it similarly builds on the analysis whereby the offset planner lists the potential impacts on each community that will be caused by the presence of the offset activities.
Defining and Applying Valuation Methods, Results	Step 5	This table captures the decision of the offset planner (or their economist consultant) on the type of value to be assessed (e.g. DIRECT USE VALUES, INDIRECT USE VALUES and non-use values) the appropriate valuation method to use for each value, the rationale for this decision, the results (e.g. an assessment of amount of biodiversity benefit of dollars needed to compensate the community for the impact), the approach taken and record any key assumptions. This assessment is made community by community, including those in the direct and indirect areas of influence.
Final Results: Compensation to Communities, by Community	Activity 4	This table takes the valuation results and records the offset planner's final decision on the mixture of biodiversity offset activities and the necessary compensation. For each community, the compensation needed for all activities affecting them (whether project activities or offset activities) are brought together, so the offset planner can establish the total amount of compensation needed for each community group, to ensure they are no worse off as a result of the presence of the project and offset, and will support the offset activities.
Final Results: Compensation to Communities, by Project and Offset Activities.	Activity 4	This table takes the results of the preceding table which records the valuation results and the offset planner's final decision on the mixture of biodiversity offset activities and the necessary compensation. In addition to compensating communities, which will be facilitated by the preceding table (organised by community), the offset planner may need to list the compensation (to a variety of communities) activity by activity. This could help the planner decide between different activity options and also enable the results of this Handbook to be included in the overall offset design captured in the Offset Design Handbook's 'Biodiversity Offset Design Summary', and later in the Offset Implementation Handbook's 'Template for a Biodiversity Offset Management Plan'.

Project Activities, Offset Activities and the Communities Affected *(Steps 1.1, 1.2, 2.1, 3.1, 4.1)*

PROJECT ACTIVITIES	COMMUNITIES AFFECTED	Any groups within the community particularly affected?
POTENTIAL OFFSET ACTIVITES	**COMMUNITIES AFFECTED**	**Any groups within the community particularly affected?**

Identification of Communities Affected *(Steps 1.1, 1.2, 2.1, 2.2, 4.1)*

Communities Affected		**Activities (Including Project and Offset) Affecting Each Community**	**Any groups within the community particularly affected by the project and offset** (e.g. women, landless families, elders, shamans)**?**
Name of community	**Summary description of community** (including the location, size, distribution and organisation of the community, and any key features about the population's work and livelihoods).		
(Enter name of first community here)			
(Enter name of second community here)			
(Enter name of third community here)			
(Etc)			

Current Community Use and Enjoyment of Biodiversity in Area of Project Activities *(Steps 1.3, 5.1)*

Affected / Involved Communities	Direct Use (Consumptive) Values			Non-Consumptive Use Values			Cultural Use/Non-Use Values			Future Trends/Changes
	Terrestrial	Freshwater	Marine	Terrestrial	Freshwater	Marine	Terrestrial	Freshwater	Marine	
DIRECT AREA OF INFLUENCE										

Add rows as needed for any more Communities in the Direct Area of Influence

INDIRECT AREA OF INFLUENCE										

Add rows as needed for any more Communities in the Indirect Area of Influence

Current Community Use and Enjoyment of Biodiversity in Area of Potential Offset Activities *(Steps 3.2, 5.1)*

Affected / Involved Communities	Direct Use (Consumptive) Values			Non-Consumptive Use Values			Cultural Use/Non-Use Values			Future Trends/Changes
	Terrestrial	Freshwater	Marine	Terrestrial	Freshwater	Marine	Terrestrial	Freshwater	Marine	
DIRECT AREA OF INFLUENCE										

Add rows as needed for any more Communities in the Direct Area of Influence

INDIRECT AREA OF INFLUENCE										

Add rows as needed for any more Communities in the Indirect Area of Influence

Impacts of Project on Community Use, and Handling Residual Impacts
(Steps 1.4, 1.5, 1.6, 4.1)

Affected / Involved Communities	Project Activity	Impacts	Avoid?	Reduce?	Residual Impacts to Offset	Offsettable?	Offset Needed? *(Yes/No)*	Comments
DIRECT AREA OF INFLUENCE								
Add rows as needed for any more Communities in the Direct Area of Influence								
INDIRECT AREA OF INFLUENCE								
Add rows as needed for any more Communities in the Indirect Area of Influence								

Impacts of Potential Offset Activities on Community Use *(Steps 2.1, 3.3, 4.1)*

Affected / Involved Communities	**Potential Offset Activity**	**Impacts**	**Particularly affected groups.** Are any groups/households within the Community particularly affected *(e.g. landless households, women, shamans)* ?	**Comments**

Add rows as needed for any more Communities in the Indirect Area of Influence

Defining and Applying Valuation Methods, Results *(Step 5)*

Affected / Involved Communities	**Impacts**	**Particularly affected groups.** Are any groups/households within the Community particularly affected *(e.g. landless households, women, shamans)* ?	**Type of Value**	**Valuation Method**	**Comment** (Rational on why particular valuation method was chosen)	**Results**	**Approach**	**Key Assumptions**
I. PROJECT ACTIVITIES								
DIRECT AREA OF INFLUENCE								
Add rows as needed for any more Communities in the Direct Area of Influence								
INDIRECT AREA OF INFLUENCE								
Add rows as needed for any more Communities in the Indirect Area of Influence								
II. POTENTIAL OFFSET ACTIVITIES								
Add rows as needed for any more Communities in the Direct Area of Influence								

Final Results: Compensation to Communities, by Community *(Activity 4)*

Affected / Involved Communities	**Impacts**	**Particularly affected groups.** Are any groups/ households within the Community particularly affected *(e.g. landless households, women, shamans)*?	**Valuation Results**	**Final Decision** on the Offset needed, and the values involved, including dollar values for compensation and amounts and nature of offsets measured in biodiversity proxies (eg volumes of medicinal plants, or hectares of woodlots, etc).	**Justification**
(Community 1)	**Total**				
(Community 2)	**Total**				
(Etc)	**Total**				

Final Results: Compensation to Communities, by Project and Offset Activities *(Activity 4)*

Project Residual Impacts / Potential Offset Impacts	**Communities Affected**	**Particularly affected groups.** Are any groups/ households within the Community particularly affected *(e.g. landless households, women, shamans)*?	**Valuation Results**	**Final Results**	**Justification**
Project Activity 1, Residual Impact 1	Community A				
Project Activity 1, Residual Impact 2	Communities A and B				
Project Activity 1, Residual Impact 3	Community C				
Potential Offset Activity 1, Impact 1					
Potential Offset Activity 1, Impact 2					
Potential Offset Activity 1, Impact 3					

Part 3: Guidance and Additional References for using this Handbook

Activity 1: Identify the project's direct and indirect residual impacts on local use and enjoyment of biodiversity

The Handbook begins with an identification of the project's direct and indirect residual impacts on local use and enjoyment of biodiversity. Much of this analysis may already have been done in project design documents and the ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA), and some of the biodiversity related impacts may have been addressed as part of social engagement programmes. The aim of this activity is to identify biodiversity related impacts on local stakeholders that have been missed in the project design and appraisal process or that have not been adequately addressed. After examining the scope for avoiding or reducing these impacts according to the MITIGATION HIERARCHY and considering whether any of the remaining impacts are non-offsettable for social or cultural reasons, the offset planner will have identified a set of RESIDUAL IMPACTS that need offsetting.

Step 1: Determine the project's direct and indirect residual impacts on local use and enjoyment of biodiversity

Objective

Identify a set of residual impacts on biodiversity based LIVELIHOODS and AMENITY that need to be offset in each affected community or local stakeholder group, taking account of current and future trends in biodiversity use in the 'without project' situation.

1.1 Define the components of the project

About this step

This involves identification of the various activities involved throughout the various stages of the project life cycle.

Guidance

See the Biodiversity Offset Design Handbook, Step 1: Review project scope and activities; Step 2: Review the legal framework and / or policy context for a biodiversity offset; Step 3: Initiate a stakeholder participation process.

Tools

- Table: Project Activities, Offset Activities and the Communities Affected
- Table: Identification of Communities Affected

1.2 Identify the affected local stakeholders

About this step

The local stakeholders whose use and enjoyment of biodiversity are likely to be affected by the project are identified. In many cases this will be a list of communities in the DIRECT AREA OF INFLUENCE and in the INDIRECT AREA OF INFLUENCE of the project, but in some cases other types of stakeholders such as a local ECOTOURISM enterprise might be identified. For the purposes of illustration, the subsequent steps take local communities as their focus.

Guidance

The starting point for identifying the affected communities is the project's site boundaries as given by the physical locations and activities for each stage within the project life cycle (see Step 1 in the Biodiversity Offset Design Handbook). This will give a direct area of influence of the project and the communities within this area can then be identified. But as some of the project impacts on ECOSYSTEM FUNCTIONS may have further consequences at other, more distant locations, for example when emissions to a watercourse have effects on aquatic biodiversity downstream, there is also a need to delimit an indirect area of influence and identify communities within this area. Establishing the boundaries of the indirect area of influence and identifying the affected communities is not straightforward and is likely to be an iterative process. More detailed examination of project impacts in subsequent steps may reveal other pathways of indirect impact and hence other communities affected indirectly.

For some projects, the communities may have already been identified in the project design documents and Environmental and Social Impact Assessment (ESIA). Nevertheless, it will be important to check whether any communities have been left out because of failure to appreciate the significance of DIRECT IMPACTS on some social and cultural aspects of biodiversity use or to trace through indirect impacts on biodiversity use in communities further afield.

Completion of this step will result in a list of affected communities in the direct area of influence and in the indirect area of influence of the project. These communities will be the focus of the subsequent steps.

Tools

- Table: Project Activities, Offset Activities and the Communities Affected
- Table: Identification of Communities Affected

1.3 Define the 'without project' BASELINE

About this step

It is important to have a reference point for local people's use and enjoyment of biodiversity, in order to assess the project's impacts on affected local stakeholders. The appropriate reference is not just the current or pre-project situation, although this is an important starting point. The impacts need to be assessed against a 'without project' situation over an appropriate timeframe. This takes into account ongoing trends in local people's resource use, linked with expected changes in income and employment, and other future external influences.

It is also important to highlight any differences in biodiversity use within the various local stakeholder groups. For example, it may be that particular groups within a rural community, such as landless people or female headed households, are more dependent on collecting non-timber forest products (NTFPs) for their livelihoods than others.

This baseline information can help in identifying 'important' biodiversity or 'KEY BIODIVERSITY COMPONENTS' affected by the development project that are set as priority targets for the offset. This is often an important early step in the biodiversity offset design process. It is one of the topics of Step 4 in the Biodiversity Offset Design Handbook. Such a process of identifying particularly important biodiversity components should embrace the consideration of local use and CULTURAL VALUES, which are assessed in depth in this Handbook. Results from this step of the Cost-Benefit Handbook can thus be useful input to Step 4 of the Offset Design Handbook.

Guidance

In the course of designing the project, several studies will typically be conducted, such as an ESIA. Where this information exists, it should be examined first, as it may provide much if not all of the baseline data required. However, there may be gaps in the information, such as a lack of attention to future changes in biodiversity use or insufficient coverage of the communities affected indirectly by the project. Table 2 provides a checklist of questions to assess whether pre-project information available is sufficient to establish the baseline and otherwise to identify the gaps that need to be filled.

Table 2: Assessing baseline information

Issue	Questions
Coverage of the communities and other local stakeholders	• Are all communities that are impacted directly covered by the baseline data? • Are all communities that are impacted indirectly by the project covered by the baseline data? • Is consideration given to different groups within communities?
Uses of biodiversity by communities and other local stakeholders	• Are all types of land and resource use examined? Agriculture, grazing, fishing, fuelwood, NTFPs, other? • Is the use of biodiversity for recreation examined? • Are cultural uses of biodiversity considered? Is their significance assessed?
Future changes in biodiversity use	• Is sustainability of resource use considered? • Are future changes in biodiversity use by the community in the 'without project' situation considered?
Source of the information / reliability	• What is the information based on? Literature, key informants, group discussion, household survey? • How reliable is it?

Additional baseline studies may be needed to fill gaps in the information. Depending on the context, baseline studies can be carried out using rapid participatory methods, and where necessary followed up by interviews with a random sample of community members. See Appendix 3 Table A1 for a checklist of questions setting out how different characteristics of the affected communities will imply different research methods for obtaining information.

Many of the techniques used in PARTICIPATORY RURAL APPRAISAL or PARTICIPATORY LEARNING AND ACTION can be useful in the context of valuation for generation of preliminary information about communities and local stakeholders or to aid design of questionnaire surveys. These techniques are mostly applied in focus groups, which can consist of a mix of stakeholders or can be confined to specific stakeholder categories such as women or youth or village elders. Techniques suitable for establishing the current availability and use of biodiversity include resource mapping and transect walks. Ranking and matrix scoring can be used to examine the importance of different biodiversity resources, while critical event analysis and historical matrices may help in identifying factors affecting current use of biodiversity and likely changes in the future (see Appendix 3 for more details).

Table 3 shows a simple form of a Key Biodiversity Components Matrix which is a tool that can be used to help OFFSET PLANNERS identify particularly important biodiversity components and the local use values and cultural values associated with them. This issue is discussed in Step 4 of the Biodiversity Offset Design Handbook.

Table 3: Key Biodiversity Components Matrix

BIODIVERSITY COMPONENT	INTRINSIC VALUES (vulnerability / threat, irreplaceability)	USE VALUES	CULTURAL VALUES
Species	Threatened species; restricted range and / or ENDEMIC species; congregatory species.	Species providing fuel, fibre, food, medicines, etc.	Totem species.
Habitats	Rare or threatened HABITAT TYPES; exemplary habitats.	Recreational sites.	Sacred sites (e.g. sacred groves, burial grounds); sites of aesthetic importance.
Whole landscapes / ecosystems	Climate regulation; seed dispersal; pollination.	Air and water quality regulation; soil fertility; pollination.	

Tools

- Table: Current Community Use and Enjoyment of Biodiversity in Area of Project Activities

1.4 Identify impacts

About this step

This step aims to identify the impacts of the project on local uses and enjoyment of biodiversity. Each project activity is examined to check whether it is likely to affect any of the local stakeholders' use and enjoyment of biodiversity resources, in the direct and indirect area of influence.

Guidance

If the project is at an advanced stage, details on project impacts can be obtained from the ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) and project design documents. If the project it is still in the pre-feasibility stage, it is possible that a detailed project description may not yet be available. In this case, the project developer will need to work with the best available information and consider each of the various options under consideration for the scale and siting of the various components of the project. Each project activity is examined to check whether it is likely to affect any of the local stakeholders' use and enjoyment of biodiversity resources, identified in the previous step. A project activity and impact matrix can be used to help identification of the impacts of project activities on different aspects of community use of biodiversity. These impacts can then be linked with the various communities in the areas of direct and indirect influence.

See also Step 4 in the Biodiversity Offset Design Handbook.

Tools

- Table: Impacts of Project on Community Use, and Handling Residual Impacts

1.5 Define compensation measures already included in project design and ESIA

About this step

This step analyses the measures being undertaken or already envisaged to compensate communities as part of project design or as a result of recommendations in the ESIA. For example, projects involving land take will usually involve COMPENSATION to landowners or provision of land in another area. The aim is to assess whether these measures adequately address any, or all, of the impacts of the project on the community's use and enjoyment of biodiversity. For example, it is possible that the land compensation measures do not take account of informal community access to medicinal plants in common property land or public land.

Completion of this step will result in identification of a set of biodiversity related impacts that are not adequately covered by compensation measures. It is also highly likely that compensation measures included in the project design could form a basis for offset site selection and design.

If the conclusion drawn is that the compensation measures address all the impacts on community use and enjoyment of biodiversity adequately, the offset planner can skip the remaining steps under Activity 1 and proceed directly to Activity 2 which concerns the offset site.

Guidance

It is necessary to examine the community engagement and social development plans drawn up for the project, including recommendations from the ESIA where this has been conducted already, to identify compensation measures for local communities. These compensation measures need to be assessed against the impacts of the project to identify gaps in coverage. A checklist of questions (see Table 4 for an example) can be applied to assess the adequacy of community coverage and residual impact coverage, to gauge whether this is sufficient from the community perspective and whether groups within communities are fairly compensated. This will identify gaps in information and the needs for offsetting in each affected community.

Table 4: Assessing the compensation measures already addressed in project design

Issue	Questions
Community and local stakeholder coverage	• Are all communities / local stakeholders that are impacted directly covered by compensation measures already foreseen in the project design? • Are all communities / local stakeholders that are impacted indirectly by the project covered? • Are different groups within communities e.g. women, poor households, adequately covered?
Residual impact coverage	• Is there compensation to communities for loss of land? • Does compensation for loss of land include all biodiversity related livelihoods related to this land, i.e. loss of agricultural production, grazing, NTFPs, cultural services? • Is there compensation to affected communities for reduced informal access to or availability of natural resources? • Is there compensation for water pollution and its impact on fish? • Are measures being taken to address pressure on biodiversity by workers and other incoming migrants? • Are other compensation measures contemplated to compensate communities for the loss of use and enjoyment of biodiversity? • Are measures being taken to address loss of recreational sites for local stakeholders?
Is compensation sufficient from community perspective?	• How has compensation been determined? • Has community been consulted? • Has a household survey or focus group discussion been conducted?

Tools

- Table: Impacts of Project on Community Use, and Handling Residual Impacts

1.6 Identify residual impacts

About this step

This step aims to identify any residual impacts of the project on local uses and enjoyment of biodiversity which ultimately affect the well-being of indigenous peoples and local communities and other stakeholders. This is after considering compensation measures in project design and identifying steps that can be taken to mitigate (avoid and reduce) the impact of the project on people's biodiversity related livelihoods and amenity. A further aim is to examine whether any of these residual impacts simply cannot be offset (i.e. are 'non-offsettable') because of the uniqueness of the cultural services of biodiversity affected and consequent implications for the well-being of the local people concerned.

Guidance

The biodiversity related impacts that are not addressed adequately by the compensation measures in project design are examined to determine whether there are any ways of avoiding or reducing them. For example, if the project is occupying land where communities have traditionally collected certain NTFPs, it may be possible to arrange for limited and controlled access at the time when these NTFPs are ready for harvesting.

Further qualitative and quantitative information is needed to make a preliminary assessment of these impacts. Suggestions for the type of information needed are given in Table 5. This preliminary assessment has two purposes:

- To identify the impacts which are significant enough to warrant further investigation.
- To identify impacts which are 'not offsettable'.

This relates closely to Activity 2, Step 5 in the Biodiversity Offset Design Handbook.

Table 5: Checklist of information requirements for assessing residual impacts

Impact	Key information needed
Loss of community land	• Area, current land use, land use potential, natural resources present and used (non-timber forest products including medicinal plants, fuelwood, wood / building materials).
Loss of access to natural resources in other land (i.e. not owned by community): • Non-timber forest products, including medicinal plants • Fuelwood • Wood / building materials • Water / fish	• Area affected. • Actual use of resources by community. • Potential sustainable harvesting rates.
Loss of cultural services / sacred sites	• Number and area of sites. • Number of communities affected. • Significance to communities.
Pressure on natural resources in remaining community area and other access areas (influx of workers / migrants)	• Area affected. • Current use. • Carrying capacity / potential sustainable harvesting rates. • Number of new users of resources.
Degradation of terrestrial / aquatic resources in remaining community land from project processes e.g. air and water pollution, soil contamination	• Area affected. • Current use of the resources which will be degraded.
Loss of recreational sites for local stakeholders	• Number and area of sites. • Number of visitors to sites.

KEY ISSUE: Determining which social and cultural values related to biodiversity are 'not offsettable'

Some projects' impacts on social and cultural aspects of biodiversity simply cannot be offset or compensated in financial terms, because of the uniqueness of the service provided that will be impacted by the project. While it may be possible to offset loss of access to medicinal plants through provision of an alternative source, a sacred site, for instance, may not be so easy to replace or move to another site. A well managed process will generate adequate information to make the determination on whether impacts can be offset very early, so that it can feed into the company's broader decision on whether to proceed and also any government authorisation or project consent process. (This is sometimes known as the 'GO / NO GO' decision).

Local stakeholders' use and cultural values are core to understanding the severity of the impacts from their perspective, so their involvement in understanding which impacts can and cannot be offset is critical. However, even if such 'non-offsetable' impacts are identified very early, a government may decide that there are reasons of overriding public interest for a project to go ahead. There is also a scenario in which information revealing that a project's residual impacts on social and cultural uses of biodiversity cannot be offset only comes to light after project approval. In this case, it may be possible to make more strenuous efforts to avoid the impact in the first place. If, however, the impacts cannot be avoided, mitigated of offset, it is important that the developer should acknowledge that the compensation measures in this case cannot be considered a biodiversity offset.

Tools

- Table: Impacts of Project on Community Use, and Handling Residual Impacts

Activity 2: Identify the impacts of proposed offset activities on local stakeholders

Offset options are likely to involve a package of different activities, some aimed at securing CONSERVATION GAINS through direct management of land, and others through socioeconomic activities which influence people's livelihoods, thus relieving pressures on biodiversity. Socioeconomic activities can generate conservation gains and make an important contribution to the suite of potential offset activities. For instance, provision of renewable energy to communities in return for their commitment not to cut trees or gather timber for fuelwood could result in higher conservation values on the land concerned.

At the same time, it is important to bear in mind that some offset activities through land management (whether establishing a protected area, buffer zone or conservation corridor, decreasing the livestock levels on the land identified as the offset or ceasing to gather fuelwood) may have a negative socioeconomic and cultural impact on the indigenous peoples and local communities living on and around the offset site(s). Building compensation and incentive mechanisms into the offset package, will be important to benefit the communities who will be affected by the offset's conservation activities and to secure its long-term success.

This part of the Handbook will therefore explore how conservation activities that may impact indigenous and local communities at the offset site can be compensated. It will also suggest that socioeconomic activities that result in conservation gains should be identified and included, where appropriate, as potential components of the biodiversity offset. As part of this, it will discuss how offset planners can work with communities to identify and assess the package of benefits (delivered through mechanisms such as conservation agreements and payment schemes) that have the potential to secure the agreed conservation activities by the communities.

In summary, there are three principal types of offset activity related to people's use and enjoyment of biodiversity:

- **At the IMPACT SITE(S):** activities required to offset the project's residual impacts on local stakeholders' use and enjoyment of biodiversity (if not already covered by compensation measures associated with social engagement programmes);
- **At the offset site(s):** activities required to compensate local stakeholders at the offset site(s) for any impacts on their biodiversity livelihoods caused by the presence of the offset activities and give incentives to participate in the delivery of conservation gains; and
- **At the offset site(s):** any additional socioeconomic activities such as provision of renewable energy or non-timber forest products that could result in CONSERVATION OUTCOMES if accompanied by conservation agreements with local stakeholders, payment schemes etc.

Step 2: Identify potential offset activities

Objective

Identify a set of offset activities, including those needed to address the project's residual impacts on local stakeholders' use and enjoyment of biodiversity (as identified in Activity 1 of this Handbook) and those identified in Step 6 of the Biodiversity Offset Design Handbook, and narrow down to address concerns about LEAKAGE and OUT-OF-KIND offsets.

About this step

Offset options are likely to involve a package of different activities, some aimed primarily at addressing ecological impacts through improved land management, others at bringing about conservation outcomes through addressing aspects of livelihoods and consumption patterns, yet others addressing impacts on community use and enjoyment of biodiversity.

A list of all potential offset activities under consideration is compiled. Table: Project Activities, Offset Activities and the Communities Affected may be helpful for this purpose. The starting point is the set of offset activities identified in Step 6 of the Biodiversity Offset Design Handbook (see **www.forest-trends.org/biodiversityoffsetprogram/guidelines/odh.pdf**). These measures, which might include 'conserve forest A' or 'strip out invasive alien species to improve management of land parcel B', are aimed at ecological improvements but may have socioeconomic consequences, as they may restrict land use options for communities local to these offset activities. To succeed, the biodiversity offset is extremely likely to require the cooperation and involvement of local communities, who may need to be compensated for associated impacts on their livelihoods. Socioeconomic activities that result in conservation gains should be identified and included, where appropriate, as potential components of the biodiversity offset. To these activities should be added offset options aimed at compensating for any residual impacts of the project on local people's use and enjoyment of biodiversity, identified in Activity 1. Together, all the activities proposed for the biodiversity offset will thus be captured.

KEY ISSUE: How can leakage be prevented?

Some of the offset activities initially identified may raise concerns about leakage. This is where the harmful activities addressed by the offset are simply transferred to another area. If a fuelwood lot and a medicinal plant nursery are planned, what guarantee is there that the community will curtail their unsustainable harvesting of these products from natural forests? Extraction of fuelwood and NTFPs may be transferred to another site, threatening biodiversity there. Or if a cash payment to communities is being contemplated, may they use this to fund unsustainable activity elsewhere, for example by purchasing more livestock? The offsets therefore need to incorporate measures that address these concerns. Such measures could include conservation agreements in which the community undertakes to meet certain conditions such as restricting land and resource use in a given area in return for certain benefits such as provision of renewable energy, or establishment of income generating activities, or a cash payment.

KEY ISSUE: Are 'out-of-kind' offsets acceptable?

The potential offset activities may include some element of cash payment or provision of goods and services which appear only remotely linked to biodiversity. This raises the issue of to what extent 'out-of-kind' offsets are acceptable.

In the context of ecological offset options, an 'out-of-kind' offset is where the project impacts one type of habitat and the offset conserves a different one. The challenge is to decide whether it is appropriate to offset impacts on the first habitat with an offset that will conserve the other, and to determine how much of the second type of habitat needs to be conserved in order to compensate for the loss of the first.

In the case of impacts on community use and enjoyment of biodiversity, the distinction between IN-KIND and OUT-OF-KIND offsets is more complex, as shown in Table 6. At one end of the spectrum, an in-kind offset can be considered as one that aims to replace a component of biodiversity that is used or enjoyed by local communities and is impacted adversely by the project. An impact on access to medicinal plants is offset by providing an alternative source of medicinal plants. At the other end of the spectrum, an out-of-kind offset would be a cash payment in compensation for an impact on a biodiversity component. In between these two extremes there are less clear cut situations (see Table 6).

Many socioeconomic offset options can be considered out-of-kind. The aim of valuation is to establish what offset activity would be equivalent to the project's residual impact. If valuation is applied appropriately, there is no economic reason why a cash payment should not be considered to offset a local community's loss of fuelwood or access to NTFPs as a result of the project. Some communities may prefer cash payments to more in-kind offset options.

Table 6: The 'in-kind' to 'out-of-kind' offset spectrum

		Example
In-kind offsets	Replacement of biodiversity component impacted by the same one in the offset	Offset replaces foregone access to medicinal plants by providing a medicinal plant nursery – same species.
↓	Replace impacted biodiversity component by one providing similar services even though ecologically different	Provide a medicinal plant nursery of different species but able to address the same health problems.
↓	Replace impacted biodiversity component by provision of the related services in a non-ecological way	Provide healthcare.
↓	Replace impacted biodiversity component by another biodiversity component	Provide a fuelwood lot.
Out-of-kind offsets	No direct link with biodiversity component impacted by project or with biodiversity	Cash payment.

However, project developers and some project stakeholders may find unacceptable a heavy emphasis on out-of-kind offsets and cash payments in particular. This is partly due to concerns about leakage (see KEY ISSUE above). One way to address this concern is to agree a package of benefits with local stakeholders in exchange for their contribution to the offset activities. The offset planners therefore need to decide, through a participatory process, which point on the 'in-kind to out-of-kind spectrum' is acceptable to local stakeholders, while addressing other stakeholders' concerns about potential leakage. This may help narrow down the original set of potential offset activities to a shortlist of activities that would be acceptable to all parties.

Tools

- Table: Project Activities, Offset Activities and the Communities Affected
- Table: Identification of Communities Affected
- Table: Impacts of Project on Community Use, and Handling Residual Impacts

Step 3: Identify impacts of proposed offset activities on local stakeholders at the project and offset sites

Objective

Identify any socioeconomic and cultural implications of the offset activities for the various communities and other stakeholders concerned.

Once the potential offset activities and the local stakeholders affected by them have been identified, it is possible to assess any socioeconomic implications of the offset activities for the various communities and other stakeholders concerned. There may be some positive implications (e.g. a proposed fish farm may bring employment opportunities and technical assistance to a particular community). But there may also be some negative implications for the communities. For instance, the land where the proposed fish farm is to be established may already be used for other activities by the community, which will have to stop. Or, for example, the option to conserve a forest may imply restriction of local community land uses in the future. This underlines the importance of incorporating some additional components in the offset package to provide conservation incentives to stakeholders. For example, provision of access to non-timber forest products or renewable energy accompanied by incentive mechanisms such as conservation agreements with communities, payment schemes[7], etc. would help achieve the conservation gains needed for the offset. It is particularly important to identify whether and how offset impacts might affect certain groups or individuals within communities more than others. A fuelwood lot may have the most benefit for those who live close to it but these may not be the people that are most affected by the loss of access to fuelwood resulting from the project.

While the focus here is on the socioeconomic impacts of offset activities on local stakeholders, it is important to check that the offset activities do not entail any adverse impacts on biodiversity. A fish farm established to compensate communities for water pollution induced loss of fish stocks, may itself lead to water pollution or may affect aquatic biodiversity if non-native species are used. Avoiding these impacts will affect the choice, scale and design of offset activities. A fish farm may need to be reduced in size or limited to local species, with consequent implications for costs and benefits.

3.1 Identify the local stakeholders affected by the proposed offset activities

About this step

The OFFSET PLANNER identifies which communities may be affected by each of the proposed offset activities, also noting those groups within each community (e.g. certain households or groups within the community) that might be most affected.

Guidance

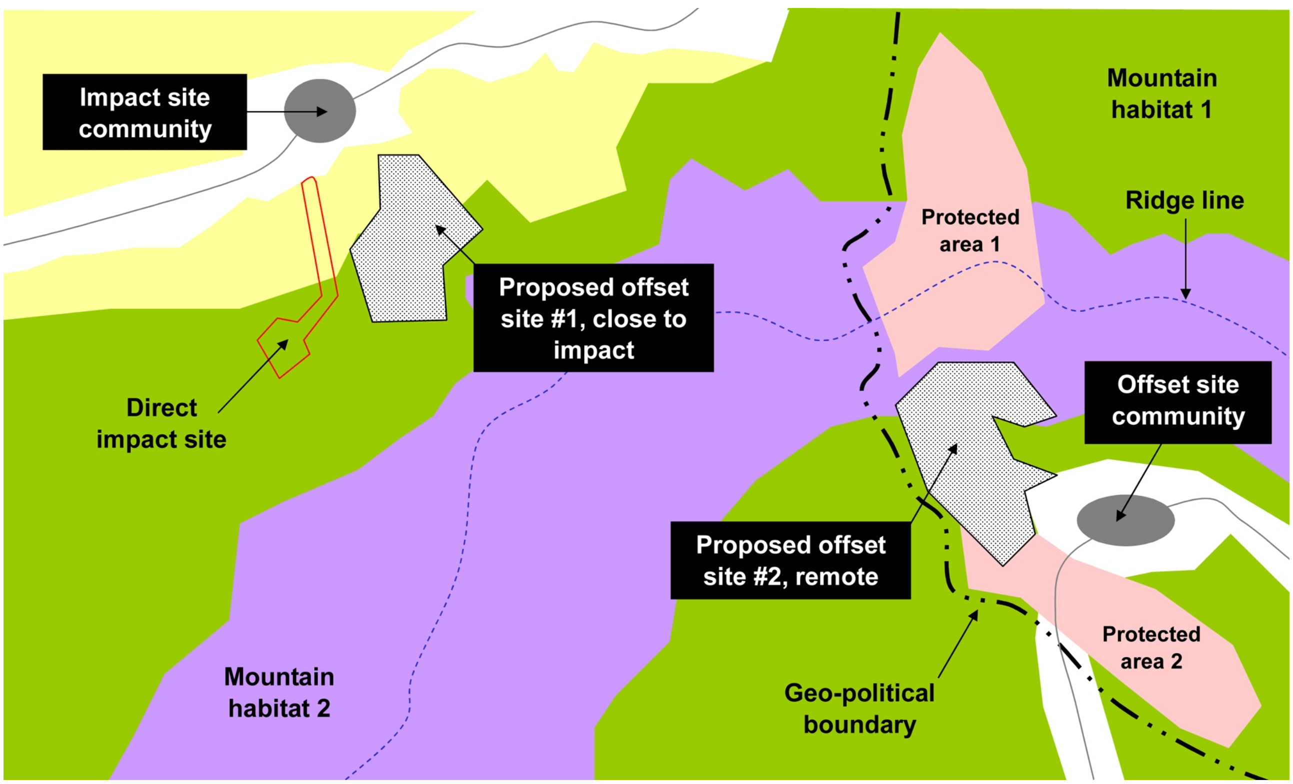
Two main groups of affected local stakeholders are distinguished in this step, as illustrated in Map 1. The first group, called here the 'IMPACT SITE COMMUNITIES', are those that are affected by residual biodiversity related impacts of the project, as well as by the offsets. The second group, called here the 'OFFSET SITE COMMUNITIES', are not affected by any residual biodiversity related impacts of the project but are involved in and affected by the offset activities. As set out in Table 7, the compensation requirements for these two types of community are different, in that the impact site communities require compensation for the residual project impacts as well as for helping to deliver the offset and ensure its conservation outcomes.

7 See the Biodiversity Offset Implementation Handbook (**www.forest-trends.org/biodiversityoffsetprogram/guidelines/oih.pdf**) for more information about payment schemes and how they might operate in a biodiversity offset.

Table 7: Types of affected community and compensation needed

Type of affected community	Compensation needed
Impact site communities – affected by the project impacts as well by the offsets	Compensation for project impacts and to ensure conservation outcomes and offset sustainability
Offset site communities (that are not also impact site communities)	Compensation to ensure conservation outcomes and offset sustainability

Map 1: Example of one community affected by the project impact alone and another community affected by the biodiversity offset, but not the project impact



Tools

- Table: Project Activities, Offset Activities and the Communities Affected
- Table: Identification of Communities Affected

3.2 Conduct rapid assessment of baseline stakeholder use of biodiversity at offset sites

About this step

As offset activities may change or restrict use of land and biodiversity resources at the offset sites, it is necessary to have a clear understanding of current use of biodiversity at these locations, including likely future trends in use.

Guidance

The information requirements for determining the BASELINE use of biodiversity in the offset sites are very similar to those of the project impact sites. For impact site communities, information from ESIA / project design may be sufficient if offset sites are close or similar to impact site. For offset site communities (that are not also impact site communities) the information in the ESIA / project design may not be relevant. It will be necessary to obtain information from elsewhere or conduct primary research. Table 8 provides a checklist of information requirements.

The discussion on research methods including participatory approaches set out in Appendix 3 may also be useful here.

Table 8: Checklist for baseline determination in offset sites

Issue / Aspect	Key questions
Land use	• How is the land (and freshwater and sea) currently used by local people? • What is the likely future land use? (Consider rate at which natural vegetation is being converted to agriculture.)
Freshwater and marine resources	• How are freshwater and marine resources used?
Agriculture	• What is the breakdown between subsistence agriculture and cash crops? • What crops are grown in the two kinds of agricultural systems • What are the yields? • What kind of agricultural system? Chemical input intensive or organic / sustainable agriculture?
Collection of non-timber forest products / fuelwood / building materials	• What NTFPs are used? • How much of each is collected? • How do these rates compare to sustainable off-take rate?
Other biodiversity values	• What other direct uses of biodiversity are there? • What NON-USE VALUES of biodiversity are important?
Intra-community differences	• Are any of the above uses and values of biodiversity more (or less) important for particular groups within the community e.g. women, landless and / or poorest households?

Tools

- Table: Current Community Use and Enjoyment of Biodiversity in Area of Potential Offset Activities

3.3 Determine impact of proposed offset activities on the use and enjoyment of biodiversity by local stakeholders

About this step

Each offset site and set of offset activities requires identification and assessment of the positive and negative effects on the local community's use and enjoyment of biodiversity and ECOSYSTEM SERVICES. For example, the offset activities may increase community access to biodiversity resources through establishment of a medicinal plant nursery. On the other hand, the offsets may involve restriction of land and resource use for the community or groups within it.

Guidance

For each offset activity, the offset planner needs to examine the baseline information on the relevant affected communities and go through a checklist of questions on the likely impacts (see Table 9). For example, if the offset involves placing an area of land under protection, the offset planner needs to ask what existing community uses of resources there will be affected and whether certain vulnerable groups will suffer restrictions on their LIVELIHOODS.

Table 9: Checklist of questions for determining impacts of offset activities

Offset option	Key questions
Compensation for project impact	
Replace wild harvesting by cultivation (e.g. fuelwood lot, medicinal plant nursery, food garden, fish pond)	• Will communities have to provide the land for this? • What other inputs will communities have to provide? • How much risk is involved?
Strengthen community land and resource TENURE	• How will this affect communities on the ground? • Greater protection from outside incursions? • Security for investment?
Replace wild harvesting by non-biological provision of services, e.g. solar energy to replace fuelwood collection	• Will this be an adequate substitute from perspective of communities • What risks are involved, e.g. technical breakdown
Cash compensation	• How much and with what conditions?
Work with communities to address threats to biodiversity	
Promote sustainable practice: agriculture, forestry, livestock, fishing etc	• How will yields and harvesting rates be affected? • How will costs of production be affected? Manufactured inputs and labour inputs? • What market benefits are there? • What risks are involved?
Pay community guards	• Is there underemployment? • Will this be additional income or reduce time available for agriculture / grazing, etc?
Payments to communities to plant native species, conserve forest etc	• How does this restrict land use?
Strengthen protected areas	
Buy land to extend protected area	• Does this affect informal access to land and resources of any group?
Support park ranger service	
Support park management	
Impacts on vulnerable groups within the community	• Do the offset restrictions on use of biodiversity resources affect some groups within the community more than others e.g.: women, landless, etc.?

Tools

- Table: Impacts of Project on Community Use, and Handling Residual Impacts

Activity 3: Estimate the costs and benefits to local stakeholders of project residual impacts and offset options

After completing Activities 1 and 2, the offset planner will have identified the various indigenous peoples and communities and other local stakeholders affected by the project's residual biodiversity related impacts and those that are likely to be affected positively and negatively by the proposed offset activities. The challenge is to design the offset options so that they fully compensate for the residual impacts of the project, where relevant, and leave communities no worse off.

To design a biodiversity offset which adequately compensates an affected community for the project impacts and for the costs associated with the offset itself requires assessment of the value to the community of project impacts and of offset costs, in terms that can be compared with the benefits of biodiversity offsets. Where there are multiple impacts, and offsets involve a package of activities, these comparisons may be difficult. Application of valuation techniques will help make this comparison of project impacts with offset packages and so inform the design and negotiation of the offset. In some cases, physical units – components of biodiversity – will suffice as the CURRENCY for comparing impacts and costs and benefits of offsets. In others, the complex range of impacts and offset activities may mean that it will be necessary to convert them to monetary terms to enable comparison.

Economists have developed a number of methods to estimate the monetary value of impacts on biodiversity and ecosystem services. There is now a significant body of experience in the application of these methods and as a result, considerable improvements have been made in valuation methodology. Nevertheless, economic valuation is not without limitations, particularly with regard to estimation of intrinsic biodiversity values. There are also significant challenges in applying valuation in developing countries because of lack of data, resources and skills.

In the steps that follow, various methods for making these cost-benefit comparisons are explained.

Step 4: Scoping of cost-benefit comparisons for affected stakeholders

Objective

Draw together the cost-benefit comparisons for each affected community and local stakeholder group, making decisions about the sub-groups within local stakeholder groups that need special attention, the timeframe over which comparisons will be made and the approach to take in the case of illegal or unsustainable use of biodiversity.

About this step

The cost-benefit comparisons that need to be made are set out for each affected community and local stakeholder group, drawing together the information on residual impacts from Activity 1 and on impacts of offsets from Activity 2. Consideration also needs to be given to vulnerable groups within the community which may be particularly affected by the project or by the offset. Table 10 gives an example, for a hypothetical project, of the different types of cost-benefit comparison that can be expected for different communities in the direct and INDIRECT AREA OF INFLUENCE of the project and at the offset sites.

Table 10: Hypothetical example of offset costs and benefits for local communities

Affected community	Offset option	Project residual impacts Cp	Cost of the offset Co	Benefit of the offset Bo	
Impact site communities					
Community A	Fish farm	Reduced fish catch		Assistance to establish fish farm	
	Medicinal plant nursery	Reduced access to medicinal plants		Assistance to establish medicinal plant nursery	
	Payment	Loss of cultural sites		Cash payment	
	Food garden	Loss of food sources		Land, seed, inputs to establish food garden	Affects landless people only
Community B	Fuelwood lot, medicinal plant nursery	Loss of NTFPs for food, fuel, and medicinal plants	Loss of production as land is currently used for grazing	Assistance to establish fuelwood lot	
				Assistance to establish medicinal plant nursery	
	Payment?	Loss of recreational sites			
	Payment?	Loss of cultural sites			
	Community protected area of x ha		Loss of option to clear land and extract fuelwood, reduced harvesting rate for NTFPs		
	Sustainable agriculture in z ha		Reduced yields	Inputs, technical assistance	
Indirect area of influence					
Community C	Fish farm	Reduced fish catch		Assistance to establish fish farm	
Offset site communities (that are not also impact site communities)					
Community X	Protected area guards		OPPORTUNITY COST of labour	Salaries of community guards	
	Payments for restoring native vegetation		Opportunity cost of labour and of land	Payments	
Community Y	Extend protected area through land purchase		Opportunity cost of land (foregone returns to agriculture)	Payment for land	

			Loss of access to NTFPs		Affects landless people
Community Z	Payment scheme for organic / sustainable agriculture in x ha		Reduction in returns to land and labour because of lower yields and higher labour requirements	Payments	
	Support NGO providing extension services			Premium price, market access	

For IMPACT SITE COMMUNITIES that are affected by the project:

- The benefits of the offset must be greater than or equal to the sum of the costs of the project residual impact and the costs of the offset.

In Table 10 above, for Community A the offset options are aimed solely at compensating for project impacts and do not appear to involve any costs for the communities. The task here is to ensure that the benefits to the community from the offset options are sufficient to compensate for the residual project impacts identified.

For Community B, the offset options are aimed both at compensating for project impacts and working with the community to reduce threats to biodiversity. Both types of offset option are likely to imply costs for the community because of restriction of land use. The task here is to ensure that the benefits to Community B from the offset options are sufficient to compensate for both the residual project impacts identified and the costs to the community of the offsets.

For offset site communities that are not affected by the project:

- The benefits of the offset must be greater than or equal to the costs of the offset.

In Table 10 above, Communities X, Y and Z are not affected by the project but the offset options proposed imply both costs and benefits for these communities. The task here is to ensure that the benefits of the offsets to each community or affected group within the community are greater than or equal to the costs. For example, payments to communities for planting native species on degraded land need to be sufficient to compensate for the opportunity cost of the labour and land involved.

In order to meet these conditions it may be necessary to examine a number of different design options for each offset activity. For example, if a woodlot is proposed to compensate for the project's impact on community access to forests, or for resource use restrictions proposed as part of the offset package, the cost-benefit comparison can be made for different sizes of wood lot area. The cost-benefit analysis can help to determine the size of woodlot area that would be judged equivalent to what the community is losing as a result of the project or of the offset package. Similarly, where payments are proposed in return for commitments to change to sustainable agriculture, analysis of the costs and benefits to the community of making this change can be used to determine the required payment level.

KEY ISSUE: Examining intra-community differences in costs and benefits

Some project residual impacts or offset activities may affect some members of the community more than others. For example, it may be those members who are landless or with very little land who rely most on common property resources and NTFPs. Women who rely on fuelwood for cooking and wild resources for supplementing food supplies may value biodiversity resources more than men do. These differences might be missed if an approach based on rough calculations of average use per community member is employed or if only a limited number of people in the community are interviewed.

It is important to capture these intra-community differences in the assessment of costs and benefits because they have implications for the success of the offset. If the project impacts and / or any costs associated with offset activities are affecting some parts of the community more than others, this needs to be reflected in the offset design. If the affected people are not adequately rewarded by the offset activities in relation to the costs, they will have little incentive to support the offset and any resource management conditions put in place.

The estimation of costs and benefits therefore needs to examine differences in value for biodiversity dependent groups within the community. These groups will be identified in Step 1.2 in the course of the social / cultural biodiversity assessment. Valuation methods need to be applied to distinguish between these different groups with sub-samples large enough to be representative and / or use of focus group discussions giving special attention to these groups. Table 11 gives a checklist of questions to address intra-community differences. A discussion with community leaders or a sample survey which averages across the whole community might not show loss of access to NTFPs as being an important cost. However, a focus group discussion with a group of the poorest community members might reveal (for example) that they are particularly affected by a loss of access to NTFPs as they do not have land on which to grow food and cannot afford to buy medicines. Assessment of an offset option to extend a protected area by buying some community forest land (as in the case of Community Y in Table 10) would need to take this into account. There is a danger, which would need to be addressed, that payment for the land might go to community leaders for the benefit of the community as a whole and the landless people might not receive anything.

Table 11: Checklist for intra-community differences

Issue	Questions	Methods
Key differences within the community / stakeholder group	What sub-groups can be identified that might be expected to be affected differently from the community in aggregate by the project residual impacts on biodiversity and the offset options? • Gender. • Female headed households. • Age. • Income. • Means of livelihood – farming, fishing etc. • Caste. • Ethnic. • Religion. • Location. • Land and resource tenure. • Migrants.	• Review of pre-project information. • Social mapping (see Appendix 3). • Venn diagrams (see Appendix 3).

Dependence on biodiversity	Are any of these sub-groups more dependent on biodiversity affected by the project?	• Resource mapping (see Appendix 3). • Stratified sampling (see Appendix 3).
	Are any of these groups more dependent on resources the use of which is restricted as part of the offset?	
Impact of the project	Which sub-groups will be most adversely affected by the project residual impacts?	• Focus groups discussions with key sub-groups. • Stratified sampling (see Appendix 3).
Impact of the offset	Which sub-groups will be most adversely affected by the proposed offset activities?	
	Which sub-groups will benefit most from the proposed offset activities?	
Intra- community differences / is compensation adequate?	Are there sub-groups that will not be adequately compensated by proposed offset activities?	

KEY ISSUE: How to compare different patterns of costs and benefits over time

When the losses from the project impact and the net benefits from offset activities do not change from year to year, comparing them is straightforward. A more common situation though is that the project impacts and / or the offset costs and benefits vary over time. For example a project might result in a loss of access to 1 tonne of fuelwood per year for ten years while the offset activity of a fuelwood lot might be able to provide 3 tonnes of fuelwood per year but only after five years. To determine whether the offset activity is adequate compensation requires consideration of the relative value of costs (or benefits) occurring in different years. Is a tonne of fuelwood available after five years worth the same as a tonne available now? Most people would think not. It is therefore necessary to apply a weighting to reflect this. The further into the future the costs (or benefits) occur the less they are likely to be worth in comparison to costs (or benefits) occurring now. The approach to reconcile this difference is known as ‘discounting’, and could be approached as noted below.

The first step is to calculate over a specified period the net benefits from resource use that are lost to the community as a result of the project. A DISCOUNT RATE is then applied to make the net benefits in each year comparable to the present year. The discounted net benefits in each year can then be added up to give a total in present value terms. This can then be compared with a similarly discounted stream of net benefits from an offset.

Two issues are raised: what is the appropriate time horizon and what should the discount rate be? The answer depends on the situation and is ultimately a question of judgment. From a community standpoint, the discount rate may need to be high because of the high cost of funds. It is important though that the same discount rate is used for the impacts and for the offsets so that they can be compared on the same basis.

An example of the use of discounting is given by Peters *et al.* (1989), who analyse alternative forest uses in Mishana, Rio Nanay, Peru. They compare the financial benefits of maximum sustainable extraction of wild fruits and latex to the potential returns from forest conversion for timber harvesting. Their estimates of sustainable fruit and latex yields for a one hectare (ha) plot of forest are based on field analysis, interviews with collectors and existing literature. Using average retail prices for forest fruits, based on monthly surveys of the Iquitos produce market, and rubber prices (which were controlled by the Peruvian government) from the agrarian bank office, the value of the harvest was derived by multiplying the sustainable yield by the market price. By deducting estimated harvesting and marketing costs (using data on labour inputs, prevailing wage rates and transport costs), the net revenue from a single year’s harvest of fruit and latex production was estimated at US$422 / ha. Assuming that this amount can be obtained in PERPETUITY, constant real prices and a discount rate of 5 percent, the authors then calculate the NET PRESENT VALUE (NPV) of the forest for sustainable fruit and latex production at US$6,330 / ha, considerably higher than the returns from plantations or from clear cut timber harvesting followed by cattle ranching. These results need to be treated with caution as they are very specific to the hectare of forest analysed which was relatively close to Iquitos and cannot therefore be extrapolated over a wider area because of likely higher transport costs and limits to demand.

KEY ISSUE: How to make estimates in circumstances where community resource use is illegal or unsustainable

A decision is taken on how to value project impact costs or offset costs when community resource use is unsustainable or illegal.

When use of resources is above the sustainable rate, or is illegal, there are some ethical issues involved.

Two main positions on dealing with such a situation can be distinguished:

- 'Moral position': if the community's use is illegal and / or unsustainable, the 'moral position' would suggest that they should not be compensated for ceasing the use. Otherwise, they have an incentive to pursue illegal / unsustainable uses and can hold society to ransom.
- 'Utilitarian / pragmatic position': a more 'utilitarian' or 'pragmatic' response is to assert that the most important thing is to shift the community's behaviour to legal / sustainable uses. If it takes economic incentives to get there, it is worth it and should be done.

Assuming that the pragmatic position is more aligned with the aim of biodiversity offsets there are three options:

- Compensate communities according to the sustainable harvesting rate even if their current use exceeds this rate. The disadvantage is that will simply transfer the problem elsewhere.
- Compensate communities according to the actual rate of use over the years until the resource is totally liquidated, discounted to the present day. Depending on the discount rate and the time frame this is likely to be higher than for the option based on sustainable harvesting rate. Again this may transfer the problem elsewhere.
- Compensate communities according to the actual rate of use, recognising that if LEAKAGE is to be avoided it will be necessary to provide for current (and short-term future) biodiversity needs in an offset.

Provided conditions can be attached to the offset to prevent further leakage, the third option is most likely to ensure the desired long-term CONSERVATION OUTCOMES. This may seem like encouragement of unsustainable practices. However, if the offset incorporates an agreement with the community that they will not increase resource use further and includes viable alternatives such as support to sustainable agriculture, it is more likely to be successful.

Tools

- Table: Project Activities, Offset Activities and the Communities Affected
- Table: Identification of Communities Affected
- Table: Impacts of Project on Community Use, and Handling Residual Impacts
- Table: Impacts of Potential Offset Activities on Community Use

Step 5: Estimate costs and benefits

Objective

To estimate the costs and benefits to an affected community (or other local stakeholder group) of project RESIDUAL IMPACTS and of offset options in terms that can be compared.

Estimating the **costs of the project impacts** is likely to be more challenging than estimating the costs and benefits of the offsets, because non-marketed components of biodiversity are often involved. In the example given in Table 10, the project affects access to medicinal plants and cultural sites for Community A. Estimating the cost of these impacts to the community is not straightforward as communities often do not sell medicinal plants, nor do they pay to visit or charge entry fees for their cultural sites. It is necessary therefore to use special valuation techniques to estimate the monetary value of these impacts. Another challenge is to trace through the impact of the project on ECOSYSTEM FUNCTIONS to impacts on human well-being. In Table 10, Community C's access to fish stocks / fishing activity is affected by the project's discharge of wastewater upstream which affects the food chain for fish. In order to estimate the cost of this impact, it is necessary to be able to model how fish stocks in the vicinity of Community C will be affected. A further factor to take into consideration is that, by providing employment and income locally, the project may change the way people use biodiversity resources and reduce the extent of their dependence on them.

In some cases, though, the impact involves loss of a widely marketed good such as fuelwood (as in Community B in Table 10), and estimation of the value of this loss is not so complex. However, if this is just one of a wide range of impacts, it may be necessary to use a combination of methods.

The costs and benefits of the offset activities should be less complex to estimate than the project residual impacts but as there may be a wide range of potential offset activities to consider, a variety of valuation approaches will be needed. **Offset benefits** are likely to be more straightforward to estimate than project costs, as they often involve establishment of a new activity (woodlot, fish farm, etc.) to produce a marketed good such as fuelwood or fish. An immediate benefit is the cash value of the direct inputs made by the project developer to help an affected community establish the new activity. The challenge is to get beyond this to estimating the returns to the community of this new activity over time. This will depend on a number of factors such as the community's capacity in this activity, the extent of assistance that is provided, the appropriateness of soil and climate conditions and the access to markets.

To some extent, these considerations are also relevant to estimating the cost implications of a project impact, such as reduced access to fuelwood from natural forests. The difference is that on the impact side this is not a new activity for the community. This means that there is information from the existing community activity on which to base estimates.

In some cases, the proposed offset benefit will be a payment scheme and the task here is to estimate how high the payment needs to be to compensate for the costs of the offset and / or of the project residual impact.

It is also possible that there are other more indirect benefits of the offsets, if conservation activities have a positive impact on ecosystem services and economic valuation techniques can help to estimate the value of these. An example of this is given in Section 5.7 below.

There are four types of likely **costs of the offset** to an affected community:

- Opportunity cost of foregone land use from restrictions on land use, for example if the community agrees to extend a protected area;

- Opportunity cost of foregone resource use, for example if the community accepts a reduction in harvesting rates;
- Reduction in returns to agriculture and other land-based productive activities, for example a switch to sustainable agriculture which might imply reduced yields or greater labour inputs; and
- Opportunity cost of community labour, for example where a community agrees to carry out certain protection activities or to patrol an area.

The first three usually involve reduced production or harvesting of marketed goods so are relatively straightforward to estimate. The opportunity cost of labour can be estimated by reference to market wage rates or the average production per unit of labour.

The remaining text under this step (Sections 5.1 – 5.7) takes the offset planner through identification of the types of value involved (Section 5.1) and gathering of information on biodiversity proxies as the starting point for cost-benefit analysis (Section 5.2). Thereafter, Sections 5.3 to 5.7 offer a number of alternative ways for estimating costs and benefits. Each section includes an explanation of when it may be appropriate to use each of these ways of estimating costs and benefits, and how to do so. Section 5.3 describes when and how to use the market price method, Section 5.4 covers when and how to use surrogate market approaches, Section 5.5 the PRODUCTION FUNCTION METHOD, Section 5.6 the REPLACEMENT COST METHOD, and Section 5.7 STATED PREFERENCE METHODS.

5.1 Identify types of value involved

About this step

A distinction can be made between DIRECT USE VALUES, indirect use values and non-use values of biodiversity:

- Direct use value – this kind of value includes the benefit of using environmental resources as an input to production or as a consumption good, e.g. the use of forests for recreation or for the harvesting of medicinal plants. Sometimes a further distinction is made between:
  - Consumptive direct use values, where biodiversity resources have to be consumed in order to capture the value; and
  - Non-consumptive direct use values, which can be captured without involving consumption of the underlying biodiversity resources, for example, recreational value.
- Indirect use value – this kind of value includes the support and protection provided to economic activity and to property by natural ecosystem functions, e.g. forests are thought to play a role in controlling sedimentation which in turn can affect drinking water quality, or hydropower generation.
- NON-USE VALUES – these include intangible benefits derived from the mere existence of environmental resources or quality. What distinguishes non-use values from recreational value is that people can hold these values for a site, even if they have no intention or opportunity to visit it.

There are a number of methods for converting biodiversity impacts to monetary terms, depending on the type of impact. Different types of value require different valuation methods (see Table 12 below). Direct use values can be quantified using fairly simple methods, provided information is readily available on how and to what extent communities make use of biodiversity. Indirect use values are more complex to estimate, as they rely on modelling of biophysical relationships between the project's (or offset's) impact on an ecological function and the subsequent effect on economic activity. Non-use values require stated preference methods.

Table 12: Different valuation methods for various uses of biodiversity

Type of value	Examples	Valuation Methods
Direct use values (consumptive)	Fuelwood Medicinal plants	*Biodiversity proxies* MARKET PRICE METHOD
Direct use values (non-consumptive)	Recreation	Travel cost* HEDONIC PRICING* Stated preference (for recreation)
Indirect use values	Avoided erosion Pollution control Flood control Nutrient cycling	Damage cost avoided Replacement or substitute cost Dose-response functions combined with market prices
Non-use values	CULTURAL VALUES Religious values	STATED PREFERENCE: CONTINGENT VALUATION CONTINGENT RANKING CHOICE EXPERIMENT

* Unlikely to be as relevant as the other methods.

Guidance

The offset designer needs to examine the various impacts identified as ‘offsetable’ and in need of offsetting, and classify them as direct, indirect and non-use values, as this will influence the selection of valuation methods. For example, if the main residual impact is loss of access to non-timber forest products used for fuelwood and medicinal plants, valuation methods suitable for direct use values need to be employed. The same classification needs to be made for the offset costs and benefits, although it is likely that most of these will fall in the direct use value category.

There may be direct, indirect and non-use values for any one project as the example below shows, so OFFSET PLANNERS may need to use a combination of valuation methods to cover the different types of value. It is also helpful where appropriate and where resources permit, to use more than one method to value an impact on a biodiversity component and compare the results.

Selecting appropriate valuation methods

The choice of valuation method depends very much on the particular circumstances of the project and the financial and human resources available, as well as data availability. However the following principles may be helpful:

- Start with the simplest method and only move on to more complex methods if absolutely necessary:
  - Use biodiversity proxies as much as possible but move on to other methods where necessary (see next section).
  - Use approximate methods where these are likely to overestimate the impacts on the affected community, rather than underestimate them.

- Use methods appropriate to the type of value impacted. If non-use values are not impacted, the market price method is likely to suffice.
- Use methods based on observed behaviour rather than hypothetical behaviour, unless there is no alternative.
- Use information gathered in applying the simpler methods to identify the need for more complex methods and to inform their application, e.g. in designing CONTINGENT VALUATION method surveys.
- Use more than one method to allow for cross-checking.

The various methods have advantages and disadvantages in the context of biodiversity offsets, as set out in Table 13.

Table 13: Advantages and disadvantages of different valuation methods

Valuation method	Advantages	Disadvantages
Biodiversity proxies	Simple, low cost, transparent.	Not suitable if offset sites are different from impact site (e.g. greater distance from community) or involve different uses.
Market price	Relatively simple. Appropriate for impacts involving consumptive direct use values and most offset costs and benefits.	Excludes non-use values. Cost of own labour can be difficult to determine.
Travel cost	Most appropriate for impacts on recreational use.	Requires large data sets.
Hedonic pricing	Most appropriate for valuing impacts on landscape and AMENITY.	Not appropriate where property markets are poorly developed. Requires large data sets.
Production function	Can be applied to wide range of project residual impacts.	Extensive data requirements for credible modelling of biophysical linkages.
Replacement cost	Simple, low cost.	May overestimate the value of the impact.
Contingent valuation	Can be applied to wide range of values, including non-use values. Useful where there is a wide range of impacts and offset activities involving costs for the communities.	Costly to apply and problems of bias. Only appropriate where the offset involves a cash payment.
Choice experiment	Can be applied to wide range of values, including non-use values and to packages of impacts and offset components.	Complex and difficult to explain transparently.

Tools

- Table: Defining and Applying Valuation Methods, Results

5.2 Gather information on biodiversity proxies as the starting point for cost-benefit analysis and decide whether it is appropriate to base cost-benefit comparisons solely on these

About this step

Biodiversity proxies involve the use of physical INDICATORS of biodiversity to compare the costs associated with residual impacts of the project (and / or costs associated with offset activities) with the benefits of offset options. No attempt is made to assign monetary values. For example, the amount of fuelwood lost as a result of the project, or as a consequence of resource use restrictions implied by the offset, could be compared with the amount of fuelwood provided by establishment of a woodlot. These proxies can be used as an alternative to valuation in monetary terms in limited circumstances. They also constitute the first step in information collection for economic valuation but need to be complemented by other information such as location and quality.

Guidance

For the impacts involving DIRECT USE VALUES, it is necessary to quantify them in physical terms. For example, calculation of how much fuelwood or how much of the key types of medicinal plants the community will lose access to as a result of the project. This requires the collection of information on:

- Quantities of biological resources currently used by the community in the land area impacted by the project e.g.:
  - Volume of fuelwood consumed or traded.
  - Volume of medicinal plants consumed etc.
- Quantities of biological resources likely to be used in the future (in the 'without project' situation).
- Sustainable harvesting quantities.

The amount of the resource in physical terms that the community loses as a result of the project is a rough indicator of what is needed in the offset. But it is also necessary to consider whether it is possible to provide the same amount of the biodiversity use, for instance fuelwood, without significantly affecting the amount of labour involved in harvesting or travelling to the site. It is also necessary to examine whether the timescale over which the resource will be provided in the offset will be different from the current situation. For example, a fuelwood lot may take some time to mature, and it may also be further from the users than timber they used to collect before the arrival of the project. If there are such differences in labour requirements and timescale, it will be necessary to go further in information collection to apply economic valuation techniques that take these factors into account.

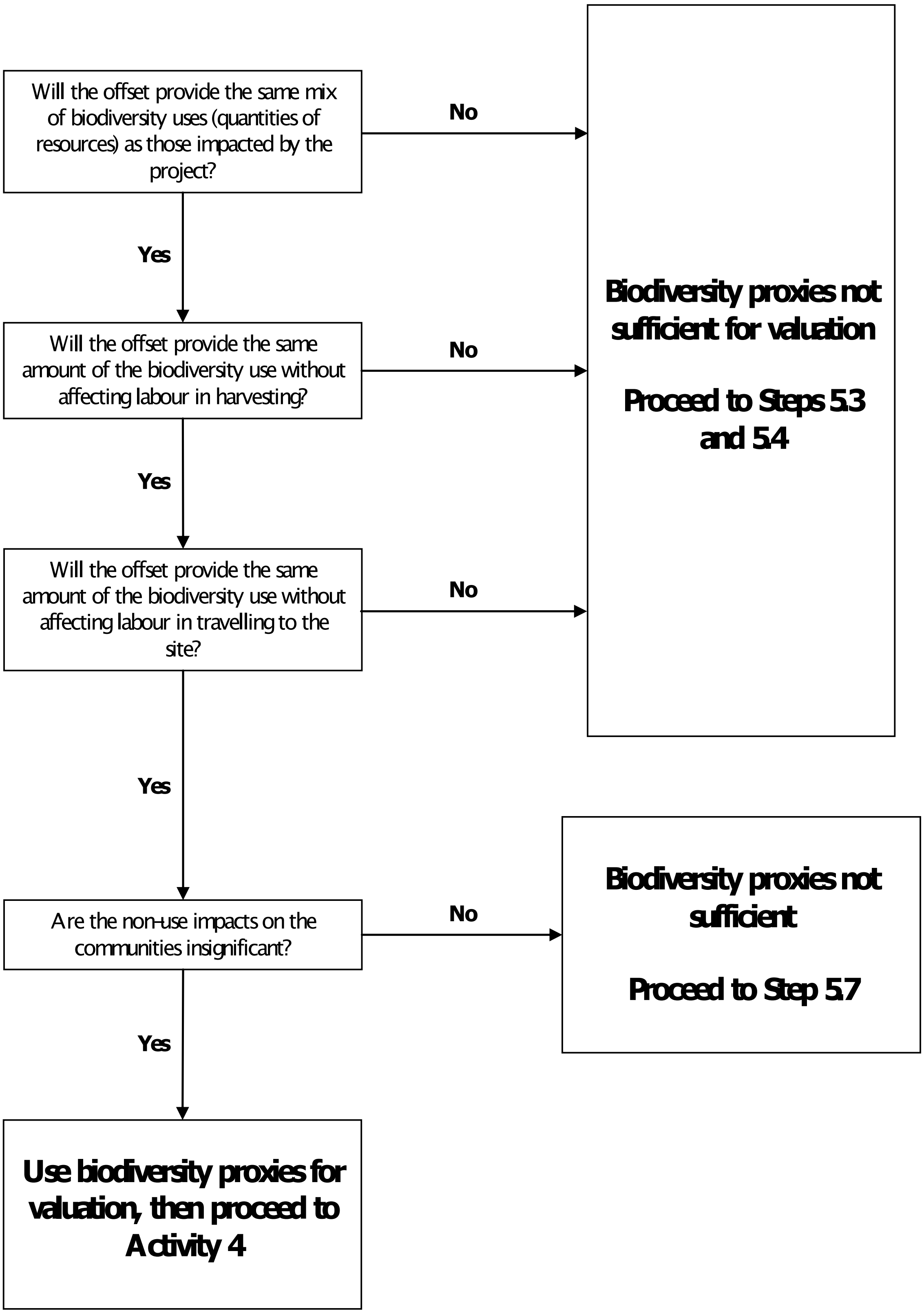
Pros and cons of biodiversity proxies for valuation

Biodiversity proxies have the advantage of being simple, and relatively easy to calculate. An area of land providing the same amount of fuelwood as the amount lost as a result of the project appears to give an easy comparison. The disadvantage of this approach is that it oversimplifies and disregards what may be key aspects of biodiversity use from the economic viewpoint. The same amount of fuelwood can have a different value depending on where it is located. The farther away, the lower the value, because of the time needed for getting to and from the site. Non-use values are also hard to capture adequately in biodiversity proxies.

Decision tree on biodiversity proxies

A decision tree on the use (or not) of biodiversity proxies is shown in Figure 3.

Figure 3: Decision tree on biodiversity proxies



Conditions when biodiversity proxies are appropriate for valuation

Biodiversity proxies can be used for valuation to enable comparison with offset packages in rather limited circumstances. They are appropriate for valuation when:

- NON-USE VALUES are not impacted or are not considered important.

AND

- It is possible to provide the same biodiversity use in an offset without affecting the amount of labour involved in harvesting (fuelwood in an area close by is different in value to fuelwood available further away).

AND

- The project impacts one main use of biodiversity by the community.

OR

- The project impacts more than one main use of biodiversity by the community but it is possible to provide that same mix of biodiversity uses (expressed as quantities of different resources) in an offset.

When this mix of conditions does not apply, it will be better to apply economic valuation techniques as opposed to using biodiversity proxies. Biodiversity proxies however, can be considered as a starting point in information gathering for economic valuation.

5.3 Estimating costs and benefits: when to use the market price method

About this step

In this step, the project residual impacts and offset costs and benefits associated with direct consumptive use values such as use of biodiversity for fuelwood or for food or medicinal purposes are quantified in monetary terms. Most offset costs and benefits and some types of project residual impact involve direct use values associated with a market good. The market price method will therefore be appropriate in most cases on the offset side and to a lesser extent on the impact side.

Direct non-consumptive use values such as recreation value require other methods such as HEDONIC PRICING or TRAVEL COST METHODS. Information on these other methods is given in Section 5.4.

Guidance

The value of the loss that the project residual impact or the offset (e.g. through land or resource use restrictions) or of the benefit of a new productive activity represents for the affected communities is estimated from three pieces of information:

- The amount of the product that the community collects or produces each year (or per month or day);
- The price of the product or an equivalent in the market; and
- The costs of production.

Taking the impact of a project on harvesting of wild fruit as an example, the price of the fruit (or a fruit similar to the wild fruit) could be observed in a local market and the annual amount collected by the community obtained through fieldwork: focus groups or a survey of households. However, this would overstate the value of the wild fruit because it does not take into account costs of production. The cost of labour expended in travelling to the site, harvesting, processing, and travelling to the market needs to be deducted from the price as well as the costs associated with use of tools for harvesting.

The explanation above uses project residual impacts on wild fruit as an example but the method is equally applicable to other NTFPs, including fuelwood, and to fish, agricultural products and grazing. It can also be used to estimate the cost of an offset activity, for example if it involves a commitment by the community to curtail harvesting of wild fruit in a certain area. It also serves for estimating the benefit of an offset where a new productive activity is established to provide an alternative to wild resources. For example it could be used to estimate the returns to the community of establishing a fruit tree orchard.

If little change in community use of biodiversity resources is expected from year to year, and if this use is below the sustainable rate, it is appropriate to estimate a yearly value of the impact and compare this with the yearly value of an offset. This will also be easier to communicate to the community concerned.

This is less appropriate when resource use is changing from year to year, because of demographic changes or changes in income. Taking the current year's data alone to value the project residual impacts could lead to a serious underestimation of the costs they represent for local communities. There are also complications if costs and benefits are unevenly distributed over the years, for example, if there are higher costs in some years to purchase tools or machinery, or if benefits on the offset side take some time to accrue. While wild fruit and fuelwood can be harvested at the same rates with the same amount of labour input every year, offset activities to establish a fruit tree orchard and a woodlot are likely to involve a relatively high initial cost and labour outlay and a waiting period before harvesting is possible. In these cases, it will be necessary to examine values over a specified time frame, say 30 or 50 years and use a DISCOUNT RATE to convert values at different points in time to a present day value.

For further information on the market price method see Appendix 4.

Checklist of information requirements for market price valuation

The information requirements for estimating project residual impact costs and offsets costs are broadly similar. Table 14 provides a checklist.

Table 14: Information requirements for market price valuation

Residual project impact costs / offset costs	Data required
NTFPs, fuelwood, fish, bushmeat	*Quantity* • Amount harvested, consumed and traded currently. • Amount likely to be harvested over the next 30 – 50 years. *Costs* • Amount of labour expended in harvesting and processing the resources, e.g. how long does it take to gather fuelwood. • Costs of tools and equipment: rental value or an estimate of wear and tear. • OPPORTUNITY COST of labour (minimum wage or other indicator – extent of employment options). • Costs of transport to market. *Price*

Residual project impact costs / offset costs	Data required
	• Price of the product (or equivalent product) in the market.
Agriculture / grazing	*Quantity* • Area cultivated. • Yield per hectare. • Amount produced of different qualities. • Amount consumed. *Costs of production* • Hired labour. • Opportunity cost of own labour. • Inputs. • Costs of tools and equipment: rental value or an estimate of wear and tear. *Price* • Amount traded. • Price for different qualities in the market or for equivalent product.
Offset benefits	**Data required**
Woodlot, fish farming, medicinal plant nursery	*Quantity* • Expected volume of production, given: – Area cultivated. – Technology. – Community experience and capacity. – Local climatic, soil, water, topographic conditions. *Costs of production* • Amount of labour required at different stages. • Hired labour. • Opportunity cost of own labour. • Cost of inputs. • Tools and equipment. *Price* • Amount traded. • Price for different qualities in the market or for equivalent product.

Examples of the use of the market price method

The following examples illustrate how the market price method can be utilised to estimate project impact costs (Box 4: Ratanakiri, Cambodia) and to estimate offset costs and benefits (Box 5: Los Negros, Bolivia).

Box 4: Estimating the value of fuelwood resources to local communities using the market price method – the case of Ratanakiri, Cambodia

Ratanakiri is a forested area in NE Cambodia. Over 85 percent of the population of Ratanakiri belong to ethnic minorities who depend on swidden agriculture and resources collected from the forest for their livelihoods. Foreign and commercial interest in the forest has been intense.

The objective of the study was to examine the social and environmental costs and benefits of different uses and management of forest land in Ratanakiri.

Staged approach to information collection

1. Discussions with provincial government and with NGOs working in the area. Preliminary analysis undertaken by Oxfam / Novib in the area showed use of NTFPs to be significant. Five categories of NTFP (fuelwood, rattan and bamboo, medicine, wildlife and malva nuts) selected as the focus of the study.
2. Rapid rural appraisal in two villages entailing three days of fieldwork starting with a meeting with the village headman, Researchers worked in pairs each responsible for one category of NTFP. Each team held a discussion with a group of 6 – 12 villagers. At the end of the session, each team presented the results of the group discussion to the whole gathering, providing an opportunity for cross-checking of the information.
3. Selection of the study site (Tapean Forest and four villages with total population of 149 households) and conducting of a forest inventory of 0.5 ha of forest. Aerial photographs were used to obtain information on the area of forest and land use.
4. Interviews with 42 households in the four villages.

Valuation of fuelwood

Fuelwood is used by all families in the study villages for cooking and heating. In Kancheung village, fuelwood is collected from around the village.

Price

A market study carried out in the nearest town (Banlung) showed that the price of fuelwood averaged 1,000 riel per basket (average weight 12.6 kg).

Quantity

One family uses on average 25 baskets per month or 300 baskets per year. Annual use of fuelwood by the whole village (48 households) equals 14,400 baskets.

Cost

It takes 30 minutes on average to collect one basket. However due to seasonality of gathering and the lack of other available activities for the family members involved in gathering, the opportunity cost of the labour involved is assumed to be zero.

The annual value to the village of the fuelwood resource is therefore 1000*14,400 = 14,400,000 Riel (US$5,640).

Source: Bann 1997

Box 5: Costs and Benefits of Payments for Conserving Forest – Los Negros, Bolivia

The Los Negros river payments for environmental services scheme in Bolivia provides an example of cost and benefit estimation that is relevant to biodiversity offsets. The Los Negros river is vital to agriculture in the area as it provides irrigation water necessary for year-round production of cash crops. Over the last 10 years the water levels in the river have declined and this is attributed by downstream farmers in Los Negros to deforestation by upstream farmers in Santa Rosa in the cloud forests near the headwaters of the river.

A local NGO, Natura, has worked to establish a payments scheme whereby farmers in Santa Rosa sign a contract agreeing to protect a given area of forest. In return farmers are given one beehive worth US$35 for every 10 hectares (ha) of forest they conserve each year under the scheme. In addition, they are given training in beekeeping estimated to be worth about US$35. The immediate benefit to farmers of the PES scheme can therefore be considered as US$3.5 – 7 per ha per year. But it is also necessary to examine what farmers earn from beekeeping, as this is measure of the lasting benefit of the scheme.

One beehive yields 20 – 30 kg of honey per year, and the current market price is US$1.92 per kg. Gross income from honey production is therefore US$38 – 57 per year or US$31 – 46 / hive per year (transportation costs to the market are taken into account).

If labour input and returns are considered over time, a different result is obtained. Labour inputs include an up-front investment of 10 days for the training and establishment of the apiary. This equates to US$32 at local wage rates. Recurrent labour inputs are 1.5 hours / hive / week or seven days per year. This equates to US$22 per year at local wage rates.

Total income is therefore US$31 – 46 / hive per year, minus up-front labour costs of US$32 and recurrent labour operating costs of US$22. In the first year the income from the hive will not be sufficient to cover both the establishment costs and the operating costs. In the subsequent years however, it will exceed operating costs by US$9 – 24 per year. It is therefore necessary to examine the returns from the hive over its whole lifetime. Assuming an expected lifetime for the hive of 15 years and a discount rate of 8%, the net present value of the returns from the hive ranges between a loss of US$152.5 (negative value) and a gain of US$126.6 depending on the yield achieved. That is, the total value today to the farmer of the returns over 15 years from the new activity of beekeeping established in return for conserving 10 hectares for one year could be negative (a loss of US$152.5 meaning their labour would be remunerated well below current market wage rates) or could be up to US$126.6 for those farmers that manage to get high honey yields.

The opportunity cost of conserving 10 hectares of forest per year can be estimated by examining returns to agriculture in the area and the costs of clearing forest. However returns to agriculture vary considerably from close to zero for land on steep slopes that are not suitable for agriculture to US$100 per ha per year for prime agricultural land without irrigation and US$400 per ha per year for land with irrigation. Most of the land placed in the payment scheme in the early years was on steep slopes so the opportunity costs were very low.

Source: Robertson and Wunder 2005

5.4 Estimating costs and benefits: when to use surrogate market approaches

About this step

For consumptive direct use values it is possible to estimate value by observing people's consumption of biodiversity resources and the prices at which these goods (or similar goods) are exchanged in the market. For non-consumptive direct use values such as recreation, a different approach is needed because recreational sites such as wildlife reserves or areas of natural beauty are often accessed without entrance fees. The surrogate market approaches aim to estimate value by examining people's behaviour in a related market. The main methods are as follows:

- Travel cost method – this method estimates the WILLINGNESS TO PAY for a recreational site by examining the costs that individuals incur to visit a site, including travel time, transport costs, entrance or parking fees.
- Hedonic price method – this method attempts to isolate the specific influence of an environmental amenity on the market price of a good or service, usually property values.

These methods are only likely to be relevant to biodiversity offsets where there are project residual impacts on recreational values, or where the offset will enhance or reduce recreational values for local communities. Both methods are also highly data intensive and therefore relatively costly to apply, unless there are existing datasets that can be used. If recreational values are not important and / or if there is limited existing information on use of recreation sites or on property prices, OFFSET PLANNERS will find other methods more useful and should therefore proceed to Section 5.5.

Guidance

For more details on the travel cost method (TCM) see Appendix 4. Further information on the hedonic pricing method is also available in Appendix 4.

5.5 Estimating costs and benefits: when to use the production function method

About this step

In this step, costs and benefits associated with indirect use values are estimated by examining the knock-on effects of project residual impacts or offset activities on ECOSYSTEM FUNCTIONS, and tracing through to an effect on human well-being. The resulting changes in production or consumption are then valued, usually on the basis of market prices. For example, removal of natural vegetation may affect wild pollination which in turn may affect economic activities such as agricultural production, or it may increase flooding propensity with consequent increase in damage to property and infrastructure downstream. Conversely, an offset activity may have beneficial effects on ecosystem functions and in turn on local economic activities.

Valuation of indirect use values using the production function method is only likely to be applicable or practicable when the project is very large and can support the level of detailed studies required or when there is sufficient data or models already available.

Guidance

For more details on the production function method see Appendix 4.

Checklist of information requirements

The information required will depend on the type of impact examined. The checklist in Table 15 illustrates the different types of biophysical and economic information that would be needed to estimate the value of damage caused by water pollution associated with a mining project on fishing activities downstream.

Table 15: Checklist of information requirements

Task	Information required
Relate project activity to change in water quality in affected communities	• Water quality trends. • Other influences on water quality, e.g. changes in land use upstream.
Model the effect of change in water quality on fish stocks in affected communities	• Trends in fish stocks. • Other influences on fish stocks, e.g. fishing by affected communities, fishing technology.
Estimate the value of the change in fish stocks	• Amount extracted. • Costs of production (labour time, equipment, boats). • Prices of fish species.

Examples of application of the production function method

The examples below illustrate the complexities involved in modelling biophysical linkages (Box 6, Rio Chiquito, Costa Rica) and the potential when good historical data series exist (Box 7, mangrove forests, Thailand).

Box 6: Analysis of the impacts of forest conversion on hydroelectricity production

The study focuses on the impact of forest conversion in the Rio Chiquito watershed on three hydroelectric power plants which draw water from Lake Arenal. These plants account for 44 percent of Costa Rica's hydroelectric power, which itself accounts for over 70 percent of the nation's total electric power generating capacity.

The Rio Chiquito Watershed is one of three large micro watersheds that form the upper Arenal watershed and provide the majority of the water supply to Lake Arenal. The other two watersheds are largely forested and are managed by conservation organisations. As the only micro watershed in the upper Arenal watershed that is largely converted to pasture, Rio Chiquito has been the subject of much debate about the impacts of land use change.

The authors develop a simulation model linking land use to power generation and the marginal opportunity cost to society of the power. They model four relationships that affect the impacts of land use change on hydroelectricity:

- The relationship between land use and hydrological function;
- The relationship between hydrological function, water storage and water utilisation (reservoir operation);
- The relationship between water, other inputs and hydroelectric power generation (production function); and
- The relationship between power generation from a given reservoir, alternative generating sources and the demand for hydroelectric power (replacement cost).

The model incorporates changes in sedimentation and runoff associated with forest conversion and provides a framework for estimating impacts on dead and live storage in reservoirs in a context of changing demand and supply of electricity through time.

Sedimentation under pasture and under full forest cover is examined using the program CALSITE (Calibrated Simulation of Transported Erosion) which calculates simulated erosion using the Universal Soil Loss Equation and then applies a sediment transport model to generate estimates of delivered sediments to the live and dead storage areas of the reservoir. Calibration of CALSITE drew from previous studies in the area and ones commissioned specially for the project Because it is integrated with a Geographic Information System, CALSITE is able to determine the suspended sediments generated by each cell (of $50m^2$) in the watershed. The study found that the presence of pasture in place of forest increased sedimentation, reducing slightly the capacity of the reservoir to hold water for electric power generation. It also found significant variations in the per hectare rate of sedimentation across the watershed.

To examine water yield under the two land uses, a variation of the water balance approach was used with runoff estimated from the precipitation, less evapotranspiration and additions to soil moisture. The study found that runoff under pasture was higher than under forest by 690 to 2,850 m^3 / ha / year. The positive effects of this on additional power generating capacity outweighed the negative effects of increased sedimentation.

The authors therefore conclude that the impacts of forest conversion on hydroelectric power production are broadly positive.

Source: Aylward et al. 1999

Box 7: Conversion of mangroves to shrimp farms, Thailand

This study sought to evaluate the benefits provided by the mangrove forests around Tha Po Village in Thailand and compare them with the benefits provided by conversion to shrimp farming. In Tha Po village approximately 400 ha of originally more than 1,000 ha of mangroves remain intact. Using a combination of methods, the study estimated both the local direct use values of the mangroves in terms of fish and NTFPs, and the indirect use values associated with their functions as breeding grounds for offshore fisheries and coastal protection from erosion.

The authors used the production function approach to value the breeding ground service of mangroves. Data from a survey of fishing in Tha Po village were used in combination with official secondary data collected by the government fisheries departments for all fishing zones in the region. To estimate the influence of the coastal mangrove forests on the offshore fishery, the authors used a statistical model with historical data across all fishing zones in the Gulf of Thailand on catch rates, fishing techniques, time spent per fishing technique and mangrove area. Fish harvest was modelled as a function of fishing effort and area of coastal mangroves. The annual value of the effect of retaining mangroves on fish stocks in the offshore fishery was estimated to be US$20.8 – 68.9 per ha, depending on assumptions about the extent of demand elasticity.

A replacement cost approach was used to value the coastal protection and stabilisation services provided by mangroves. At coastal strips where mangrove forests are lost, breakwater dams need to be constructed in order to avoid erosion. These dams cost US$875 / m. This cost provides a basis for estimating the cost of replacing the coastal protection function of mangroves by dams. A Cabinet Resolution of 1987 based on previous ecological studies had stated that it is necessary to preserve mangrove forests with a width of at least 75 m along the coastline to stabilise the shore to the same extent as the breakwaters. From this and an assumption that the breakwater is one metre wide, a cost of protecting the shoreline with a 75 m wide stand of mangroves can be calculated at US$ 11.67 per m^2 and US$ 116,667 per ha. Over 20 years, the annualised value (estimated using a 10 percent discount rate) of the coastal protection function of mangroves amounts to US$12,263 per ha.

However, it is acknowledged that this could be an overestimate of the value. "…if all the mangrove area was "replaced" with breakwaters, there is no guarantee that there would be sufficient demand for this protection function to make such an investment worthwhile." The authors refer to information from the Harbour Department that approximately 30 percent of the coastal areas in the region have experienced severe erosion and require some kind of protection as an indication of current demand for coastal protection. They therefore take 30 percent of their original estimate to give an estimate of annual value of US$3,678.96 per ha.

The local direct use values were estimated at US$87.8 per ha per year. When converted into net present value terms over a period of 20 years the direct use values on their own far exceeded the net present value of conversion of mangrove forests and subsequent shrimp farming. Adding the indirect use values made the case for mangrove conservation even stronger.

Source: Sathirathai and Barbier 2001 and CBD 2007

5.6 Estimating costs and benefits: when to use the replacement cost method

About this step

In this step costs and benefits associated with project residual impacts and offset options are estimated using methods which focus on the costs of replacing or restoring environmental goods and services. While often relatively straightforward to apply, replacement cost methods may overestimate the value of the service being replaced. They should therefore be used where overestimation is not considered problematic for example if the goal is to show a NET GAIN for local stakeholders rather than to make more precise estimates of each impact.

These methods are often used in combination with other methods, for example with the production function method discussed in the previous step. An example of such an application is provided by Aylward *et al*. 1999 who model the impact of changes in land use on runoff water yield and sedimentation and in turn on hydroelectric power generation (see Box 6). However, the method is often used as a shortcut in cases where there are limited data and models of biophysical linkages are not available or easily developed. This approach is taken in the example in Box 7 for valuing the coastal protection service of mangrove forests.

Guidance

More details on the replacement cost method can be found in Appendix 4.

Example of the application of cost-based techniques

See Box 7 above.

5.7 Estimating costs and benefits: when to use stated preference approaches

About this step

In this step, costs and benefits can be estimated using stated preference methods which ask people directly about how much they value attributes of biodiversity affected by the project or by the offset activities. These methods are most likely to be useful when the project RESIDUAL IMPACTS relate to non-use values of biodiversity such as the cultural significance of sacred sites, or when the offset packages are complex and the details not fully worked out, for example what size of woodlot area should be established or whether and at what level to include a cash payment component. Qualitative approaches can be appropriate in a small, homogenous community or as a means of generating information for quantitative approaches. The main quantitative methods are CONTINGENT VALUATION and CHOICE EXPERIMENTS.

Guidance

Qualitative approaches

The starting point in cases where there are project residual impacts (or offset impacts) on non-use values is the generation of qualitative information on non-use values and their importance to the community relative to use values. Participatory methods can be used for this purpose, applied in focus groups consisting of a mix of local stakeholders or confined to specific stakeholder categories such as women, or youth or village elders (see Appendix 3). Ranking and scoring methods will be particularly useful in this context:

- **Ranking** is simply allocating a value to items in a list in which the value reflects the relative preference that those doing the ranking attach to it. The simplest way to rank is allocate the numbers 1, 2, 3 etc. Alternatively, points can be given to each item out of a maximum score. For example, the group or person can decide that 30 is the maximum score and then allocate scores between zero and 30 to all items on the list. Seeds or stones can be used for this purpose.

- **Matrix scoring** requires the eliciting of criteria against which to assess similar options. These options could be the main types of forest function or types of fuelwood used. Participants represent and place these options along one axis. They then identify the advantages and disadvantages of each alternative. These become the criteria and are recorded on the other axis to create a matrix. The group then evaluates how well the options satisfy each criterion by comparing them and giving them a score. Making a matrix can lead to an animated discussion as people evaluate the options.

In small, homogenous communities, this qualitative information, together with quantitative information on DIRECT USE VALUES relating project residual impacts and offset costs and benefits, should be sufficient to support a discussion and negotiation with community members on what is an equivalent package of community-oriented offset options to what is being lost as a result of the project impacts and the land and resource use restrictions necessary to deliver certain offset components.

This discussion can be informed by estimates made of cost and benefit components, for example the OPPORTUNITY COST of land if restriction of land use is involved. For large or heterogeneous communities a choice experiment based on a random sample of households will be more appropriate.

Contingent Valuation (CV)

This valuation method can be used to estimate the cost to the community of project impacts or of the offset through land and resource use restrictions. It is particularly appropriate when it is straightforward to express the socioeconomic offset activities in monetary terms, for example when they are primarily a cash payment.

With this technique, community members are asked how much they would be willing to accept as COMPENSATION for the project's residual impact on their biodiversity related LIVELIHOODS or for helping to deliver the biodiversity offset through change in their land and resource use. The advantage of this technique is that it is simple and builds on what local people want. The disadvantage is that in communities where very little is traded it may be difficult for people to derive meaningful amounts in monetary terms. There are also problems of strategic bias in that it is in people's interests to overstate their WILLINGNESS TO ACCEPT. A further disadvantage is that the offset package also has to be expressed in monetary terms in order to be compared with the impact value. For this reason, this method will not be applicable in all offset situations.

It should be noted that in applications of CV in developing countries, willingness to pay can be measured in non-monetary units if respondents are very poor. It can also be used to estimate willingness to accept compensation as demonstrated by Smith *et al*. (1997), who used a CV survey in Peru to assess farmers' willingness to accept compensation for adopting alternative land use practices that store more carbon (see Box 8).

More details on Contingent Valuation can be found in **Appendix 4**.

Example of application of Contingent Valuation

See Box 8.

Box 8: Estimation of willingness to accept payment to adopt sustainable practices, Peru

A contingent valuation study was conducted to assess Peruvian farmers' willingness to accept compensation for changing their land use practices away from slash and burn agriculture towards forest preservation and multi-strata AGROFORESTRY. There was also a separate estimation of the farmers' willingness to pay for the benefits associated with forest preservation.

Primary data was collected through a questionnaire survey of over 200 farmers including information on their socioeconomic characteristics, e.g. education, income, housing. Farmers were asked in an open ended question to state how much they would be willing to accept as compensation for the losses they would incur by changing land use from slash and burn agriculture to forest preservation or to multi-strata agroforestry. In making their responses farmers were initially asked to ignore any benefits they might expect from forest preservation and agroforestry in terms of forest environmental services. Mean values of the compensation required ranged from US$138 per hectare per year for switching to agroforestry to US$218 per hectare for switching to forest preservation. This latter option proved more costly as land use restrictions are more severe, with farmers being prevented from engaging in tree crop cultivation.

Benefits to farmers from forest preservation were then valued separately. Farmers were asked through an open ended question how much of the compensation they had stated earlier they would be willing to forgo in view of the improved ECOSYSTEM SERVICES (e.g. air purification and improved access to forest products) from forest preservation and agroforestry. This was interpreted as a willingness to pay for forest benefits. Mean values ranged from US$67 / ha for forest preservation and US$41 / ha for agroforestry. The higher willingness to pay for forest preservation reflects the higher environmental values associated with preserved forests.

Source: IIED 2003 (summarising Smith et al. 1997)

Choice Experiments

This method can be used to examine how communities value the project residual impacts and the costs and the benefits of the offset options through analysis of their choices of different offset packages. This involves a random sample of households to determine willingness to accept different packages related to the offset options. The aim will be to determine how community PARTICIPATION in the offset activities, and hence perception that offset benefits are at least equal to or exceed costs, are influenced by the design and scale of the offset components.

The participants in the survey are told about the project residual impacts and the characteristics of different offset packages and their different attributes. For example an offset based on provision of a woodlot might have varying levels of the following attributes:

- Size of woodlot area;
- Level of support for inputs – e.g. the number of seedlings provided;
- The extent of technical assistance; and
- Use of community's own land (implying opportunity cost of land use forgone) versus provision of additional government or private land.

The survey participants are asked to choose between different offset packages with varying attributes and varying levels of attributes. The set of choices also needs to include a status quo option so that participants are not forced to choose between alternative offset packages when they do not like any of them.

Even where OFFSET SITE COMMUNITIES are not affected by the project, or project residual impacts are already fully covered by social engagement programmes, a Choice Experiment may be useful in negotiating an offset package with communities. For example, the offset package might involve promoting a change to sustainable agriculture for local farmers and a Choice Experiment can help to determine what incentives and assistance will lead to the highest levels of participation. This is illustrated by the application in the Bhoj Wetlands (see Box 10).

But Choice Experiments have some drawbacks (both theoretical and practical). The results can be sensitive to the choice of attributes and levels and the way in the choices are presented to respondents (Bateman et al. 2002). Good design by trained specialists is therefore essential and this can be costly. More practically, analysis of the data generated by Choice Experiments involves sophisticated statistical techniques reducing transparency in presentation of results to and discussion of offset options with affected communities and stakeholders.

More details on choice experiments are available in Appendix 4.

Application of Choice Experiments to biodiversity offsets

Choice experiments are potentially extremely relevant to biodiversity offsets, particularly where offset options are a package of activities with consequent costs and benefits for local communities. The ability to examine how people choose between different combinations of attribute levels is important in identifying appropriate offset options.

Examples of application of Choice Experiments

The two examples below show how Choice Experiments can be used to value changes in ecosystem services, including NON-USE VALUES in the context of coastal ecosystems (Box 9) and also to examine incentives for farmers to switch to organic agriculture (Box 10). This shows how Choice Experiments can be useful in offset design.

Box 9: Valuation of coastal ecosystems using a Choice Experiment

The Choice Experiment was applied to value coastal ecosystems in Phang Nga Bay, Thailand. Respondents (confined to Thai nationals) were presented with four choice sets, each showing two new management plans for the ecosystems in the bay, and asked to choose between them or to pick the status quo. Each management option was defined using four ecosystem attributes at three different levels (average, i.e. status quo; good; and excellent):

- Increased living coral cover (a proxy for recreational use / direct use value);
- Increased income from fishery (a proxy for consumptive use);
- Flood occurrence (a proxy for indirect use); and
- Increased area protected (a proxy for non-use value).

The increase in income tax to finance a Biodiversity Fund (the payment vehicle) was included as a willingness to pay measure attribute to provide a link between the parameter weights of the ecosystem attributes and money, thus enabling valuation in monetary terms. The study found that willingness to pay for recreation values was highest at US$28 and lowest for non-use values at US$3 per year.

Source: Seenprachawong 2002

Box 10: The Bhoj wetland, India and incentives for organic agriculture

The Bhoj wetland is located on edge of the city of Bhopal, the state capital of Madhya Pradesh, India. The wetland provides important cultural, water supply and environmental services. The upper lake of the wetland provides 40 percent of the drinking water supply to the city of Bhopal. In 2002, Ramsar declared the wetland a site of international significance. Over 160 species of birds and 14 rare macrophytes have been reported in the area. Many people engaged in fishing or sale of water chestnuts depend on the wetlands for their livelihoods.

Many of the urban sources of pollution affecting the wetland have been tackled. The main problem now is agricultural pollution runoff from the Kolans watershed which negatively impacts the trophic status of the upper lake. Measured nitrate levels of 1.5 milligrams per litre are within permissible drinking water guidelines of 50 milligrams per litre. However the nutrient levels are high in terms of primary productivity in the lake. This leads to algae growth, high coliform counts and turbidity contributing to a eutrophic classification in areas of the lake near inflowing channels from upland rural areas. This contributes to high turbidity and coliform counts which increase water treatment costs for reducing the suspended solids and cleaning.

While efforts have been made to promote organic farming techniques, such as vermi-composting and improved composting of farm yard manure, uptake by farmers has been limited and slow.

A Choice Experiment was used to investigate upstream farmers' willingness to switch to organic farm management to contribute to improved wetland management. The attributes examined were price thresholds, CERTIFICATION costs, input demands and own farmer labour inputs to different organic farming scenarios.

Detailed scoping work with institutional actors and stakeholder groups was conducted first to inform design of the Choice Experiment. This was followed by a piloting phase in which three pilot designs were field tested in watershed communities. A locally-based NGO and other institutional actors scrutinised the design and attended the field testing. The final questionnaire and Choice Experiment design were collectively agreed.

The questionnaire in addition to the Choice Experiment included questions on farming systems to assess size of landholdings and current agricultural practices and household characteristics to assess wealth, income and well-being.

The attributes and levels used in the choice experiment were as follows:

- Land commitment to organic farming (acres): 25%, 50%, 75%, 100%.
- Organic crop price increase per 100 Rupees: 5, 7, 9, 11, 13, 15.
- Cost of certification per acre: R1,000 as a group, R3,000 as a group, R3,000 as an individual.
- Compost price per trolley (Rupees): R600, R900, R1,200, R1,500.
- Days to compost per trolley: 4, 8, 12, 16.

In addition to the attributes, a status quo choice was included in all of the choice cards to give respondents the opportunity to opt out or reject the scenarios presented. Each choice card also reminded farmers with simple illustrations that crop yield was likely to fall in the first crop season following conversion to organic farming though yields would increase in later years. Cost savings from not buying agrochemical inputs was also illustrated.

Results indicated that farmers would adopt organic land use management across a range of crop prices subject to farm location, farm size and preference grouping. The organic crop price premium required ranged between 11 percent and 114 percent. On average a 35 percent crop price premium is required. Farmers are more likely to work together to certify their land if there is a differential between group and individual land certification costs. Farmers with more than 10 acres of land are less resistant to switching to organic farming than farmers with less than 10 acres. Farmers in the upper part of the watershed are less likely to commit land to organic agriculture. In view of these results, the authors recommend starting promotion of organic agriculture in the lower watershed and targeting the larger farmers.

Source: Hope, Borgoyary and Agarwal 2006

Tools

- Table: Project Activities, Offset Activities and the Communities Affected
- Table: Identification of Communities Affected
- Table: Current Community Use and Enjoyment of Biodiversity in Area of Project Activities
- Table: Current Community Use and Enjoyment of Biodiversity in Area of Potential Offset Activities
- Table: Impacts of Project on Community Use, and Handling Residual Impacts
- Table: Impacts of Potential Offset Activities on Community Use
- Table: Defining and Applying Valuation Methods, Results

Activity 4: Specify a fair and effective offset package

The final activity is to bring together all the cost and benefit estimates relating to a preliminary set of offset options and examine the implications for local stakeholder groups, including affected communities, groups within communities and the distribution of costs and benefits between affected communities. In conducting this assessment the offset planner needs to involve local stakeholders as much as possible to ensure that the cost and benefit estimations are reasonably accurate, that impacts have not been missed or that particular groups have not been left out[8]. The offset package needs to leave local stakeholders no worse off, fully compensate them for any residual project impacts on their use and enjoyment of biodiversity and to deliver the required conservation gain**.**

If these conditions are not met, it will be necessary to revisit the design and mix of offset options and make adjustments. If it is found that the offset options proposed do not fully compensate communities or that there are concerns about the implications for vulnerable groups within communities or that there are marked differences in the distribution of offset costs and benefits between affected communities, the long-term success of the offset may be threatened. For this reason it is important to ensure that the final offset recommendations adequately address all these issues.

Step 6: Check that preliminary offset recommendations meet cost-benefit requirements

Objective

Check the preliminary set of offset recommendations and associated costs and benefits to ensure that they meet the conditions required for acceptability to local stakeholders and long term success.

The following questions need to be addressed:

- Do the benefits to local people of the offset on average fully compensate for any project residual impacts and costs associated with the offset?
- Do the benefits of the offset to groups within an affected community, particularly vulnerable groups such as the landless or low income households, fully compensate them for any project residual impacts and costs associated with the offset?
- Are there any major differences in the offset benefits received between the various communities (and other local stakeholders) affected by the project and the offset activities? If differences are marked, this may have adverse effects on willingness of local people to cooperate unless there is a clear rationale that can be easily communicated.
- Are the offset recommendations likely to deliver the CONSERVATION GAINS required? Are the conservation agreements proposed realistic and do they incorporate a sufficient margin for risk of unexpected events such as forest fires?

8 For guidance on ensuring effective stakeholder participation see BBOP Resource Paper: Biodiversity Offsets and Stakeholder Participation **www.forest-trends.org/biodiversityoffsetprogram/guidelines/participation.pdf**.

Step 7: If necessary, revisit the design of offsets to bring costs and benefits into balance and address distributional issues

Objective

Adjust the design of the offset if the if the results of the previous steps show that the benefits of the offsets do not fully compensate communities for the project residual impacts or for costs associated with the offsets, or that there are concerns about distribution of costs and benefits.

In making the adjustments to the offset options, it will be important to quantify and note down any changes to the expected conservation gain. For instance, the proposed offset activity may involve paying farmers in an affected community to conserve 1,000 ha of forest, but the above analysis may reveal that this will have adverse effects on a particular group within the community. This may mean that the area to be conserved in this way may have to be reduced and another offset activity adjusted to increase its conservation gain.

Step 8: Make the final recommendations of socioeconomic offsetting activities and quantify the associated conservation gain

Objective

Pull together the results of the cost-benefit comparisons and subsequent adjustments to make final recommendations on the offset options.

Tools

- Table: Final Results: Compensation to Communities, by Community
- Table: Final Results: Compensation to Communities, by Activity

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Appendix 1: Terms of Reference for Economic Consultants

The goal of biodiversity offsets is to achieve NO NET LOSS of biodiversity in the context of capital projects. No net loss of biodiversity needs to take into consideration the point of view of local communities affected by the project and the offset as well as the perspective of other stakeholders, such as scientists with global conservation expertise.

Successful biodiversity offsets[9] will therefore generally involve working with local communities to help them build LIVELIHOODS based on the sustainable use of biodiversity or to address projects' impacts on their AMENITY and enjoyment of biodiversity for three reasons:

- One aspect of 'loss' of biodiversity caused by projects is the impact on the biodiversity based livelihoods and amenity of local communities. For instance, the arrival of a mine may deprive local communities of access to land where they sourced medicinal plants. Or the presence of a project may mean that people can no longer use woodland for recreation. To ensure 'no net loss' of biodiversity, the negative impact on local communities' biodiversity based livelihoods and amenity must be compensated and restored. This may be done through the company's broad engagement with local communities, or specifically through a biodiversity offset.
- In addition, the success of conservation activities at the offset site will generally depend on tackling the underlying causes of loss of biodiversity there. Unsustainable use of biodiversity by local communities is often a principal cause of loss of biodiversity. For instance, conservation activities at the offset site may be compromised by the illegal removal of timber from forest reserves for fuelwood, the planting of crops in areas of native vegetation, or the unsustainable sourcing of medicinal plants. One good approach to an offset is to reduce threats to the biodiversity in a given area by providing local resource users with an alternative source, for example the establishment of a woodlot to provide fuelwood. The design of the biodiversity offset may thus need to address communities' livelihood needs in order to secure long-term CONSERVATION OUTCOMES.
- A principal motivation of companies for undertaking voluntary biodiversity offsets is to secure social license to operate, particularly establishing and maintaining good relationships with local communities. This is only likely if local communities' livelihoods are not negatively impacted (or, preferably, are benefited) by the offset.

Cost-Benefit Analysis and Biodiversity Offsets

To be successful, biodiversity offsets need to fully compensate communities for any residual impacts of the project, and deliver the required conservation gains without making communities worse off because of land and resource use restrictions. It is also important to address the distribution of the costs and benefits of

9 Offsets may well be 'composites' of different activities, generating benefits for the different groups involved. One component of such a COMPOSITE OFFSET is likely to be local to the development project's impact. This component would typically aim to maintain adequate ecosystem services in the project impact area and ensure local communities' use and enjoyment of biodiversity was not adversely affected. Another component of the offset could be further afield. It could support better land use planning at a landscape and even regional scale and contribute to national and global conservation priorities.

biodiversity offsets, ensuring that vulnerable groups within communities are not made worse off as a result of the offset or that there are not marked differences in the benefits and costs accruing to different affected communities.

This is essentially a cost-benefit comparison between the benefits to the community of the offset and the costs to the community of the residual biodiversity related impacts of the project and of the offsets. The relative importance of the two cost elements will vary. In some cases, the offset might not involve costs for the community and it is the project residual impacts that are of most concern. In other cases the projects might have no residual impacts on communities' use and enjoyment of biodiversity because of extensive social engagement programmes, but the offset package might involve working with the community to reduce threats to biodiversity through, for example, curtailing use of fuelwood from natural forests, or actively protecting forests from outside incursions. In these situations, it will be important to examine the costs to the community of the offset package and compare with the benefits. Similarly the offset package may involve working with some communities that are distant from the project and are therefore not affected by it. The key question in such cases is whether the benefits provided to them by the offset are greater than the costs implied by the offset.

The process of examining the costs and benefits to communities involves the following activities at the IMPACT SITE and the offset site:

- Activity 1: Identify the project's direct and indirect residual impacts on local use and enjoyment of biodiversity.
- Activity 2: Identify the impacts of proposed offset activities on local communities.
- Activity 3: Estimate the cost and benefits to local communities of project residual impacts and offset options.
- Activity 4: Identify an offset package which leaves local stakeholders no worse off and fully compensates them for any residual project impacts on their use and enjoyment of biodiversity and delivers the required conservation gain.

Attached is a breakdown of the steps involved. Further explanation is given in the Biodiversity Offset Cost-Benefit Handbook.

Activity 1

Sometimes, little work is required for the first of these activities, because many of the impacts are addressed in the project design as part of social engagement programmes.

In this project, there are expected to be **some / no** (*delete as appropriate*) project residual impacts that need offsetting. In addition, in some cases the steps in Activity 1, such as identifying affected communities and identifying impacts, may be conducted by the offset planner without the need to hire in economic expertise. In this project, the offset planner **will conduct all steps in this activity / will conduct Steps …. to ….in the attached breakdown / will not conduct this activity** *(delete as appropriate and insert step / stage numbers as appropriate)*.

The consultant therefore **will not be required to carry out any of this activity / will conduct Steps … to …. in the attached breakdown / will conduct all of the steps of this activity** *(delete as appropriate and insert step / stage numbers as appropriate)*.

Activity 2

Activity 2 may also be conducted in part by the offset planner. In this project, the offset planner **will conduct all steps in this activity / will conduct Steps …. to …in the attached breakdown / will not conduct this activity** *(delete as appropriate and insert step / stage numbers as appropriate).*

The consultant therefore **will not be required to carry out any of this activity / will conduct Steps … to …. in the attached breakdown / will conduct all of the steps of this activity** *(delete as appropriate and insert step / stage numbers as appropriate).*

Activities 3 and 4 constitute the main tasks in the assignment where economic expertise is required. The consultant is required to apply economic tools of valuation to estimate the costs and benefits to local communities of the project residual impacts and offset impacts in order to determine the mix of offset options of different scales and scope which will ensure that communities are no worse off as a result of the project or the offset and that the required CONSERVATION GAINS are delivered.

The following tasks are involved.

Activity 3

1. Identify the cost-benefit comparisons that need to be made for each affected community.

2. Identify the different types of value involved and the valuation methods likely to be necessary.

3. Start by examining the potential of biodiversity proxies to establish equivalence between offset benefits and costs associated with project residual impacts and offset activities.

4. Use economic valuation methods as set out in Sections 5.3 to 5.7 of the Biodiversity Offset Cost-Benefit Handbook to estimate the costs and benefits and make the necessary cost-benefit comparisons. These methods will include the market price method, which is the method mostly likely to be used in the context of biodiversity offsets, and, depending on the types of value involved, SURROGATE MARKET METHODS, production function based methods, the replacement cost method and stated preference methods. The estimates of offset costs and benefits should be made for different scales and scope where appropriate to allow determination of the most appropriate design and analysis of adjustments in design.

Activity 4

1. Check the preliminary set of offset recommendations and associated costs and benefits, to ensure that they meet the conditions required for acceptability to local stakeholders and long term success. The following questions need to be addressed:
   - Do the benefits to local people of the offset on average fully compensate for any project residual impacts and costs associated with the offset?
   - Do the benefits of the offset to groups within an affected community, particularly vulnerable groups such as the landless, or low income households, fully compensate them for any project residual impacts and costs associated with the offset?
   - Are there any major differences in the offset benefits received between the various communities (and other local stakeholders) affected by the project and the offset activities? If differences are marked, this

may have adverse effects on willingness of local people to cooperate unless there is a clear rationale that can be easily communicated.

- Are the offset recommendations likely to deliver the conservation gains required? Are the conservation agreements proposed realistic and do they incorporate a sufficient margin for risk of unexpected events such as forest fires?

2. If the required conditions are not met by the preliminary set of offset recommendations, make adjustments to bring costs and benefits into balance and meet the required conditions.

3. Produce a final set of offset recommendations with demonstration that communities are fully compensated for project residual impacts and any costs associated with offset activities, that inter- and intra-community distributional issues are adequately addressed, as well as quantification of the associated conservation gain.

Activities, steps and stages in the Community Cost-Benefit Handbook

ACTIVITY 1 Identify the project's direct and indirect residual impacts on local use and enjoyment of biodiversity		
Step 1:	*Determine the project's direct and indirect residual impacts on local use and enjoyment of biodiversity*	
	1.1	Define the components of the projects
	1.2	Identify the affected communities
	1.3	Define the 'without project' baseline
	1.4	Identify impacts
	1.5	Define compensation measures already included in project design and ESIA
	1.6	Identify residual Impacts
ACTIVITY 2 Identify the impacts of proposed offset activities on local communities		
Step 2:	*Identify potential offset activities*	
Step 3:	*Identify impacts of proposed offset activities on local people at the project and offset sites*	
	3.1	Identify the local stakeholders affected by the proposed offset activities
	3.2	Conduct rapid assessment of baseline community use of biodiversity at offset sites
	3.3	Determine impact of proposed offset activities on community biodiversity use and enjoyment
ACTIVITY 3 Estimate the costs and benefits to local communities of project residual impacts and offset options		
Step 4:	*Scoping of cost-benefit comparisons for affected communities / stakeholders*	
Step 5:	*Estimate costs and benefits*	
	5.1	Identify types of values involved
	5.2	Gather information on biodiversity proxies as starting point for cost-benefit analysis and decide whether it is appropriate to base cost-benefit comparisons solely on these
	5.3	Estimating costs and benefits: when to use the market price method
	5.4	Estimating costs and benefits: when to use surrogate market methods
	5.5	Estimating costs and benefits: when to use the production function method
	5.6	Estimating costs and benefits: when to use the replacement cost method
	5.7	Estimating costs and benefits: when to use stated preference approaches
ACTIVITY 4 Specify a fair and effective offset package		
Step 6:	*Check that preliminary offset recommendations meet cost-benefit requirements*	
Step 7:	*If necessary, revisit the design of offset options to bring costs and benefits into balance and address distributional issues*	
Step 8:	*Make the final recommendations of socioeconomic offsetting activities and quantify the associated conservation gain*	

Appendix 2: How Much Will It Cost and How Long Will It Take?

There is insufficient experience with biodiversity offsets to make firm estimates of timing and costs. Much will depend also on the size of the project, the range and magnitude of residual impacts, the number of local stakeholders and the types of value at stake. If a household survey is needed and if NON-USE VALUES are so important that stated preference methods are required, the costs will increase. The cost of a survey depends on the sample size, the complexity of the questionnaire and the location. Bateman *et al*. (2002) have highlighted the variation in cost for stated preference studies, pointing to large studies commissioned by the World Bank costing £250,000 (US$375,000) and small-scale local studies costing as little as £8,000 – 10,000 (US$12,000 – 15,000). They suggest however that stated preference studies at this end of the cost range should be regarded with caution.

However, there is some experience from valuation studies which give an indication of costs involved at different study sites.

Valuation of coral reefs, Saipan (van Beukering *et al*. 2007)

This involved surveys and analysis of country statistics and took a total of 16 months. Two economists, two social scientists, four interviewers and a GIS expert worked for a combined total of 200 person days and a total cost of US$80,000. Costs relating to the survey conducted as part of the study included:

Questionnaires	US$4,000
Interviewers	US$12,500
Data entry and cleaning	US$1,500

Tourist willingness to pay for conservation – Seychelles (van Beukering *et al*. 2007)

This involved a survey of visitors at the airport and took a total of 3 months. One economist, four interviewers and one data-enterer worked for a total of 80 person days at a total cost of US$21,000.

Costs relating to the survey conducted as part of the study included:

Questionnaires	US$2,500
Interviewers	US$6,000
Data entry and cleaning	US$500
Analysis	US$4,000

Appendix 3: Research Methods for the Local Context

The research methods that are most appropriate depend on the size and characteristics of the local stakeholder groups.

Table A1: Adapting research methods to the local context

Type of community	Research method	Next steps	
Small homogenous communities	Discussion with community representatives / key informants and participatory methods with, at minimum, three focus groups (men, women, youth) and community assembly.	If little difference in information given and views expressed, more detailed assessment not necessary.	If significant variation detected, conduct a sample survey with individuals.
Small heterogeneous communities Medium homogenous communities	Discussion with community representatives / key informants and participatory methods with greater number (5 – 6) of focus groups (men, women, youth).	If little difference in information given and views expressed, more detailed assessment not necessary.	If significant variation detected, conduct a sample survey with individuals.
Medium heterogeneous communities	Discussion with community representatives / key informants and minimum three focus groups (men, women, youth).	Use results of focus groups to design a household survey involving interviews with individuals.	
Large community	Discussion with community representatives / key informants and minimum three focus groups (men, women, youth).	Use results of focus groups to design a household survey involving interviews with individuals.	
Insufficient information to characterise the community	Start with a focus group to generate some more information about the community.	Proceed according to the information that emerges about the size and characteristics of the community.	

The best way to adapt research methods to the community context will depend on the most appropriate participatory methods. Some guidance on participatory methods is offered below.

Appropriate participatory research methods

Many of the techniques used in PARTICIPATORY RURAL APPRAISAL or PARTICIPATORY LEARNING AND ACTION can be useful in the context of valuation for generation of preliminary information about communities and local stakeholders or to aid design of questionnaire surveys. These techniques are mostly applied in focus groups, which can consist of a mix of stakeholders or can be confined to specific stakeholder categories such as women or youth or village elders.

Several participatory techniques that could be useful for rapid assessment of impacts are described below[10].

BASELINE information – what biodiversity resources are there and what is used?

- **Resource maps** are perception-based maps sketched on the ground, using local materials, or drawn on paper by local people. They can include any topic, such as natural resources or social facilities. Writing can be used if helpful to everyone. Besides allowing for a dynamic and easy introduction between the research team and the villagers, these maps indicate the location of major resource areas and specific products from, or functions of each area.
- **Transect walks** are focused walks by the research team with the villagers through the area being researched. The walk focuses on specific themes or questions such as 'Which forest sites are most intensely used, and what products are used from them?' The walk is represented as a two dimensional cross section indicating major differences between one section and the next.
- **Flow diagrams** are useful to analyse the inputs needed for an activity and its outputs, or what comes out of a selected area (such as a forest) and to where the resources / products go. They can also be used to analyse the impact of a problem or activity on peoples' lives. To work well, the topic must be specific, such as 'the sources and uses of fuelwood type X'.

Importance of different biodiversity resources

- **Ranking** is simply allocating a value to items in a list in which the value reflects the relative preference that those doing the ranking attach to it. The simplest way to rank is allocate the numbers 1, 2, 3 etc. Alternatively, points can be given to each item out of a maximum score. For example, the group or person can decide that 30 is the maximum score and then allocate scores between zero and 30 to all items on the list. Seeds or stones can be used for this purpose.
- **Matrix scoring** requires the eliciting of criteria against which to assess similar options. These options could be the main types of forest function or types of fuelwood used. Participants represent and place these options along one axis. They then identify the advantages and disadvantages of each alternative. These become the criteria and are recorded on the other axis to create a matrix. The group then evaluates how well the options satisfy each criterion by comparing them and giving them a score. Making a matrix can lead to an animated discussion as people evaluate the options.

Production systems

- **Seasonal calendars** are critical for understanding the time of year when products are used, gathered, hunted, etc. A 12 month calendar is often used, but people may choose to divide the year differently. In some areas, people might prefer to discuss seasons rather than months. After symbolising the months or seasons, they discuss different topics and show seasonal variations by creating a visual comparison between the months. For example, they can compare seasonal changes in the harvesting of medicinal plants.
- **Product chains** are like flow diagrams in that they are drawn as a journey – from the source to the market, identifying on the way which processing steps are taken and which tools or other inputs are used. They help to identify the different stages involved from harvesting to consumption or marketing, and are therefore useful to guide more focused discussions around the costs per stage / input.

10 These are taken from Grieg-Gran *et al*. 2002. See also Guijt and Hinchliffe 1998.

Social issues

- **Social maps** indicate the geographic distribution of socioeconomic aspects. For example, it can be important to know who is better or worse off in a community to ensure that all groups are consulted in fieldwork or to focus on a particular group. The map shows each house in the village and on that relevant variables can be identified.
- **Venn, or institutional diagrams** help to understand which formal and informal groups, or key individuals, play a role in the community. They also help to discuss how important these are to the people. A circle in the centre represents the community itself. After discussing which groups or key individuals exist, the group depicts the importance of each by the size of a circle. The bigger the circle they choose or make, the more important it is. Then the circles are placed in and around the community. The closer the circles are placed to each other, the more contact they are considered to have. The discussion can focus on areas of cooperation, possible conflicts or existing gaps.

Sustainability of resource use

- **Critical event analysis** is a focused discussion that aims to capture the main events in the area being investigated, and how these have affected the research topic. It could focus for example on key environmental shifts or external events that have affected biodiversity in the area.
- **Historical matrices** or trend analysis is based on a more focused discussion than critical event analysis and conveys perceptions about changes related to specific resources. Large eras are identified and the availability and prevalence of each resource being discussed is tracked per time block. Relative trends are revealed in this way, indicating which aspect of biodiversity has changed most.

Sampling to capture intra-community diversity

For large and heterogeneous communities it will be necessary to go beyond group discussions and key informant interviews and conduct a sample survey to pick up variation at the individual level. A sample of head of households, or families could be selected and questions asked about use of biodiversity resources, cultural biodiversity values, attitudes to offset activities etc.

In order for the survey to yield results that can be extrapolated to the whole population of interest, the sample needs to be drawn on a probabilistic basis. A common approach is simple random sampling each member of the population being sampled has an equal chance of being selected. This does not work so well for heterogeneous communities unless large samples are used. Where there is a known to be a small group that is different from the rest of the community, for example a group within a predominantly farming community who depend solely on fishing for their LIVELIHOOD, a random sample might include only one or two of this group. This would not be sufficient to generate any statistically rigorous information about this group.

For this reason stratified sampling is often used where there is some prior knowledge about the composition of the population. This involves identifying key subgroups (or strata) of interest in the population and drawing a separate random sample from each of these. The strata should be mutually exclusive so that no member of the population appears in more than one. The strata could be main livelihood activity as in the example above, or income, or gender of the head of household or any factor that. The sampling fraction could be the same for each stratum or could be made higher for some of them to ensure sufficient sample size. For example a community might consist of 100 very poor households, 600 poor households and 300 well off households. A sampling fraction of 10% could be applied to the poor and well off households giving strata samples of 60 and 30 respectively and a larger fraction of 30% for the very poor households, giving a strata sample of 30.

The challenge is to have sufficient knowledge about the nature of the sub-groups in the population and the number of people in each of these. This information can be obtained from focus group discussions with the community and participatory methods such as social mapping discussed above.

Appendix 4: Further Details on Valuation Methods

More details on the market price method

The estimated value of the impact cost or the offset cost or benefit can be expressed as:

V = (P-C)Q

Where:

V is the value of the impact cost or the offset cost or benefit to the community. It could be for instance the return to harvesting a natural resource that is lost as a result of the project (impact) or the return to agriculture that communities that forgo if the offset involves extending a protected area (offset cost) or the return to a new activity such as a woodlot (offset benefit).

P is the market price of the product derived from the biodiversity resource.

C is the cost of collection or production and getting the product to the market.

Q is the quantity of the product that the community collects or produces.

Price

Many biodiversity goods are traded, but in remote communities it is likely that most if not all will be used for subsistence and will not be sold in the market. In such cases, the price of the same product sold elsewhere in the region could be used, for example the price of fuelwood in a local market. Where the product is locally specific and is not traded at all, the price of a close substitute could be used, for example where a certain kind of fruit is only consumed locally, a traded fruit with the same nutritional value could be used as a substitute. As prices are likely to vary according to season, an average over a year or a harvesting season needs to be taken. Quality differences also need to be taken into account as this affects price.

Prices are often distorted by taxes and subsidies and other policy measures. Valuation of the costs to society of a reduction in for example, the availability of NTFPs, would have to correct for any such price distortion. As the valuation is primarily from the community standpoint, this may not be necessary unless the tax or subsidy is thought to be temporary and likely to be removed in the short-term.

Cost

The main cost is labour but inputs (seeds, mulch, fertiliser) and tools may also be important.

To estimate the cost of labour requires a calculation of the amount of labour time involved in growing or collecting the product and getting it to market as well as determining a unit cost for the labour. Neither is straightforward, particularly where communities are remote and not integrated into labour markets. Harvesting of NTFPs is often opportunistic or combined with other activities so a simple adding up of hours spent travelling to and from the site will overestimate the amount of labour inputs. The unit cost of labour can be given by the minimum wage rate where this exists or by locally prevailing wage rates. But if there is little opportunity for paid labour locally because of lack of demand or distance from main demanders of labour, the OPPORTUNITY COST of labour involved in NTFP collection or subsistence agriculture may be considerably lower. For this reason some valuations simply work with price as a generous estimate of the value of NTFPs / wild resources.

Quantity

Ideally, the appropriate quantity to take in estimating project impact costs should not exceed the amount that can be harvested or produced on a sustainable basis. Where the community's use is lower than the sustainable rate, current use can be taken but account needs to be taken of possible future increases if the population in the community increases.

If the community's current use exceeds the sustainable rate or involves illegal use, the decision on how to calculate quantity is more complex as it involves some ethical issues. Estimating offset costs to communities where the offset activity involves land and resource use restrictions raises similar ethical issues about what quantity to take for estimation. The land and resource use that the community is forgoing may well involve unsustainable or illegal volumes of production. For more information, click here.

In the estimation of offset benefits, the key issue is what quantity can realistically be expected given that a new activity is usually involved and one in which the community is likely to have little experience. For example, not all trees planted will necessarily survive to be harvested and not all fuelwood or fruit may necessarily find a market. Estimation therefore needs to incorporate some margin for risk and also for learning by doing as communities develop experience in the new activity.

More details on the Travel Cost Method

The travel cost method (TCM) is based on the assumption that consumers value the experience of a particular AMENITY at no less than the cost of getting there, including all direct transport costs as well as the opportunity cost of time spent travelling to the site (i.e. foregone earnings). This survey-based method has been used extensively, especially in richer countries, to estimate environmental benefits at recreational sites (including wildlife reserves, special trekking areas and beaches). TCM has been applied in several developing countries, particularly where higher incomes and rapidly developing markets have been associated with growing demand for amenities such as scenic views and recreational areas.

Three basic steps are involved in travel cost models. First, it is necessary to undertake a survey of a sample of individuals visiting the site to determine their costs incurred in visiting the site. These costs include travel time, any financial expenditure involved in getting to and from the site, along with entrance (or parking) fees. In addition, information on the place of origin for the journey, and basic socioeconomic factors such as income and education of the individual is required.

The resulting data are manipulated to derive a demand equation for the site. This relates the number of visits to the site to the costs per visit. The third step is to derive the value of a *change* in environmental conditions. For this, it is necessary to determine how WILLINGNESS TO PAY for what the site has to offer alters with changes in the features of the site. By comparing the willingness to pay for sites with different facilities it is possible to determine how the total benefits derived from the site change as the facilities of the site change.

In an application of the travel cost method in Costa Rica, Tobias and Mendelsohn (1991) estimate the ECOTOURISM value to domestic users of the Monteverde Cloud Forest Biological Reserve. They derive a national recreational value of the site of approximately US$100,000 per year. Other examples of TCM used to value forests in the developing world include: Adger *et al*. (1995), Kramer *et al*. (1995) and Willis *et al*. (1998).

Application of TCM to Biodiversity Offsets

The usefulness of this technique to value recreational uses of biodiversity, particularly in developing regions, is constrained by the large amount of data required. On its own it is unlikely to be practical for biodiversity offsets. However, if a CONTINGENT VALUATION survey is being conducted it may be useful and cost effective to add on a TRAVEL COST METHOD to enable some comparison of estimates.

More details on hedonic pricing

The hedonic pricing method attempts to isolate the specific influence of an environmental amenity or risk on the market price of a good or service. The most common applications of this technique are the *property value* approach and the *wage differential* approach, which are used to value environmental amenities and dis-amenities. Hedonic pricing is based on the assumption that the market value of land or labour is related to the stream of net benefits derived from it. This stream of net benefits includes a range of factors, including environmental amenities. Therefore, the value of the environmental amenity can be imputed from the observed land or labour market.

Application of the hedonic pricing approach to property values involves observing systematic differences in the value of properties between locations and isolating the effect of environmental quality on these values. The market value of a residential property, for example, is affected by many variables including its size, location, construction materials, and also the quality of the surrounding environment. With sufficient data on property values and characteristics it may be possible to control for size, location, construction materials and other factors, such that any residual price differential may be imputed to differences in environmental quality.

Application of hedonic pricing to biodiversity offsets

The hedonic pricing method requires large data sets, in order to account for and eliminate the influence of all other variables, which affect market prices. The approach also assumes that markets for land are competitive, and that both buyers and sellers are fully informed of the environmental amenity or hazard. One constraint on use of the technique in developing countries is that private property markets are often thin, uncompetitive and poorly documented. This is a particular problem at the frontier of forested areas, where formal title to land may be missing and where land is often essentially an open access resource. For these reasons, hedonic pricing is unlikely to be practical for biodiversity offsets except in developed countries. Even in these countries, the data requirements may preclude the use of hedonic pricing.

More details on Production Function Methods

Production-based estimates are based on the contribution of ECOSYSTEM SERVICES to the production of commercially marketed goods. For example, the impact of coastal mangrove forests on shrimp populations can be traced through to the value of the shrimp catch. The method requires the modelling of relationships between changes in the ecosystem services and changes in impacts on human activities. The data requirements are therefore extensive, as spatial or time series data is needed to derive a relationship.

These methods are sometimes called the *change in production* technique, sometimes the *input-output* or *dose-response* method, or the *production function* approach (the latter term is used here). The production function approach may be used to estimate the INDIRECT USE VALUE of ecological functions, through their contribution to market activities.

Use of this approach involves a two step procedure. First, the physical effects of changes in the environment on economic activity are determined. This may be done through laboratory or field research, observation or controlled experiments, or statistical techniques. The second step consists of valuing the resulting changes in production or consumption, using market prices where these exist and are not distorted, or costs of alternatives (see Section 5.6 on the replacement cost method) or stated preferences (see Section 5.7). In this way the monetary value of the ecological function is derived indirectly.

The production function approach has been used extensively in both developed and developing regions to estimate the impacts of changes in environmental quality (e.g. deforestation, soil erosion, and air and water pollution) on productivity in agriculture, forestry and fisheries, on human health, and on the useful life span or costs of maintaining economic infrastructure. An essential requirement of the approach is good information on the physical relationship between the state of the environmental resource and the economic activity or asset it supports. In addition, market conditions and policy distortions affecting production decisions need to be taken into account.

Application of production function methods to biodiversity offsets

While the production function approach has been applied extensively, the modelling of the linkages involved has often relied heavily on assumptions and has lacked credibility. Data requirements are extensive even where a single ecological function is being valued, as described in Aylward *et al*. 1999. In the case of *multiple use systems*, i.e. where a single forest regulatory function supports several economic activities, or where there is more than one non-market ecological function of economic value, applications of the production function approach are even more problematic. In particular, assumptions concerning the relationship between the various uses must be carefully constructed. One difficulty is the risk of 'double counting' when estimating the total economic value of a forest area from various sub-component values (Aylward and Barbier 1992).

For this reason, use of the production function method is only likely to be practical when the project is very large and can support the level of detailed studies required, or where there is sufficient data or models already available from previous research.

More details on the replacement cost method

The replacement cost technique generates a value for the benefits of an environmental good or service by estimating the cost of replacing the benefits with an alternative good or service. For example, where logging or road construction in upland forest areas leads to increased runoff and sedimentation, some studies use information on the costs of dredging or flood control as a rough estimate of the non-market benefit of watershed protection.

The technique rests on the availability of such an alternative, which should - as nearly as possible - produce the same type and level of benefits as supplied by the resource or environmental function being valued. This method therefore works best when used in combination with production function approaches which model the impact of changes in the resource or environmental function on the level of benefits provided. An example of such an application is provided by Aylward *et al*. (1999) who model the impact of changes in land use on runoff water yield and sedimentation and in turn on hydroelectric power generation (see Box 6). They then proceed to value the change in hydropower electric generation by reference to the cost of alternative (thermal) sources of electric power.

However, the method is often used as a shortcut where in cases where there is limited data and models of biophysical linkages are not available or easily developed. This approach is taken in the example in Box 7 for valuing the coastal protection service of mangrove forests. In the absence of information relating different rates of mangrove forest clearance to flooding and in turn to damage to economic activities, the simple approach is taken of using the cost of building coastal breakwater dams.

When developing a replacement cost scenario, it is normal practice to select the least cost option among all possible technologies, so as not to overestimate the value of the environmental benefit.

Application of the replacement cost method to biodiversity offsets

The replacement cost method is commonly used where there is limited time and resources for more rigorous estimation of environmental benefits. For biodiversity offsets, they may be the most practical option, particularly where indirect use values are considered important. However, such techniques must be used with care, because cost-based techniques do not directly measure willingness to pay for environmental goods and services. The resulting estimates may over- or underestimate benefits by a large margin. Problems arise when potential rather than actual expenditures are used, as it is not always clear that the environmental benefit in question justifies the costs of replacement, relocation, etc. This is illustrated in the mangroves example from Thailand shown in Box 7. Where such methods are used, key assumptions about the relationship between estimated costs and associated benefits should be stated clearly.

More details on Contingent Valuation (CV)

CV elicits individual expressions of value from respondents for specified increases or decreases in the quantity or quality of a non-market good. CV has mostly been used to determine WILLINGNESS TO PAY but can also be used to estimate willingness to accept COMPENSATION for decreases in the quantity and quality of a non-market good. Most CV studies use data from interviews or postal surveys (Mitchell and Carson 1989). Valuations produced by CV are ‘contingent’ because value estimates are derived from a hypothetical situation that is presented by the researcher to the respondent. The two main variants of CV are open ended and dichotomous choice (DC) formats. The former involves letting respondents determine their ‘bids’ freely, while the latter format presents respondents with two alternatives among which they are asked to choose. Open ended CVM formats typically generate lower estimates of WTP than DC designs (Bateman *et al.* 1995).

CV is the only generally accepted method for estimating NON-USE VALUES, which are not traded in markets and for which there are no traded substitutes, complements or surrogate goods that can be used to impute values.

On the other hand, because no payment is made in most cases, some observers question the validity of stated preference techniques. Critics argue that CVM fails to measure preferences accurately and does not provide useful information for policy (Diamond and Hausmann 1994). Even practitioners accept that poorly designed or badly implemented CV surveys can influence and distort responses, leading to results that bear little resemblance to the relevant population’s true WTP. Much recent attention has focused on overcoming potential sources of bias in CVM studies[11]. Resolving these difficulties involves careful design and pre-testing of questionnaires, rigorous survey administration, and sophisticated econometric analysis to detect and eliminate biased data. While CVM is accepted by the US legal system as a basis for assessing environmental damages, the procedural requirements for using CV estimates in court cases are very strict (Arrow *et al.* 1993).

While CV is accepted by the US legal system as a basis for assessing environmental damages, the procedural requirements for using CV estimates in court cases are very strict (Arrow *et al.* 1993).

11 Bias is any aspect of a study that consistently skews responses in one direction, thereby leading to results that diverge from the true WTP of the population. Bias may arise in any of the four steps in survey design and implementation: construction of the market scenario; development and application of the method and vehicle for eliciting responses; sample design and implementation; and drawing inferences from the results.

Several studies have demonstrated the feasibility of applying CVM in the developing world. For example, in a case study of forest recreation in Costa Rica, Echeverría *et al*. (1995) used a 'take-it-or-leave-it' personal interview survey of ecotourists to estimate WTP for the Monteverde Cloud Forest Preserve. In another example, Willis *et al*. (1998) used CV together with an Individual Travel Cost Model to estimate consumer demand for forest recreational sites in Peninsular Malaysia. They found that the two methods generated comparable estimates, and that the aggregate benefits of forest recreational areas exceed the (direct) costs of their provision.

It should be noted that in applications of CV in developing countries, WTP can be measured in non-monetary units if respondents are very poor. It can also be used to estimate WILLINGNESS TO ACCEPT compensation as demonstrated by Smith *et al*. (1997), who used a CV survey in Peru to assess farmers' willingness to accept compensation for adopting alternative land use practices which store more carbon (see Box 8).

Application of Contingent Valuation to biodiversity offsets

The valuation task in the context of biodiversity offsets is to compare the value of a set of project impacts with a set of costs and benefits of offset activities. Where the offset package primarily involves cash payments or activities that can easily be converted to monetary terms, the contingent valuation method can be useful in assessing willingness to accept compensation for project residual impacts or for offset-related land and resource use restrictions. Depending on how it is applied, the Contingent Valuation method captures non-use values as well as direct USE VALUES and perceptions of indirect use values. Where project impacts are varied and complex and the offset options consist of a mix of activities, expressing both impacts and offsets in monetary terms may be challenging. A CHOICE EXPERIMENT (see below) may be a more direct way of determining the offset package that would be adequate compensation for project impacts.

More details on choice experiments

In a choice experiment (CE), respondents are presented with a set of alternatives and asked to choose their most preferred alternative (Bateman *et al*. 2002). This approach can be applied to environmental goods and services. Individual respondents are asked to choose among alternative bundles of non-market goods such as forest landscapes or wildlife habitats, which are described in terms of their attributes and the levels of these attributes, including a hypothetical price. In the case of forests, for example, a CE survey may ask respondents to choose between alternative landscapes (in the form of images), which vary by species mix, age diversity, percentage of open area, the presence of roads and the hypothetical price (given a particular payment vehicle) to the individual (Hanley *et al.* 1998; Adamowicz *et al.* 1998). When individuals make their choices, they implicitly make tradeoffs between the levels of the attributes in the different alternatives presented (Seenprachawong 2002). On this basis the values placed on changes in attribute levels can be estimated by means of CE.

Recent applications of choice experiments to natural resource issues include Seenprachawong (2002), who examined the value of coastal ecosystems (Box 9), and Hope *et al*. (2006), who utilise this method to examine incentives for farmers to switch to organic agriculture (Box 10).

Application of Choice Experiments to biodiversity offsets

Choice experiments are potentially extremely relevant to biodiversity offsets, particularly where offset options are a package of activities with consequent costs and benefits for local communities. The ability to examine how people choose between different combinations of attribute levels is important in identifying appropriate offset options. But choice experiments have some drawbacks both theoretical and practical. The results can be sensitive to the choice of attributes and levels and the way in the choices are presented to respondents

(Bateman *et al*. 2002). Good design by trained specialists is therefore essential and this can be costly. More practically, analysis of the data generated by choice experiments involves sophisticated statistical techniques reducing transparency in presentation of results to and discussion of offset options with affected communities and stakeholders.

Guidance on Using Benefit Transfer

Valuation methods particularly for indirect use values and non-use values can be data intensive, and therefore costly and time consuming. For this reason, many valuation studies constrained by small budgets and tight deadlines have had to take shortcuts, making use of information from previous studies rather than conducting primary research. Benefit transfer (or values transfer as it is sometimes known) refers to the use of information about benefits from one site (study site) to apply to another site (transfer site). Three main approaches can be distinguished:

- Transfer of the values estimates from the study site to the transfer site.
- Transfer of the value function.
- Transfer of values estimates from meta analysis.

For all three approaches, the value from the original study must be theoretically and methodologically sound.

Transfer of values estimates

Values estimates can be transferred directly when there are sufficient similarities between the study site and the transfer site. Crucial factors include the socioeconomic characteristics of the relevant population (income, land and resource TENURE, livelihood strategies) the physical characteristics of the site and the magnitude of the change or impact. Where there are insufficient similarities, adjustments can be made. A common adjustment made for benefit transfer across countries is to weight by the ratio of income in the two countries.

Transfer of value functions

Where the original study incorporated a benefit function relating the estimated value to a number of explanatory variables, such as the function can be transferred to the transfer site. The values for the variables can be based on information at the transfer site.

Meta analysis

An alternative approach is to derive a benefit function from a meta analysis of valuation studies addressing the same ecosystem service. This has been done for wetlands by Schuyt and Brander (2004) who examined 89 wetland valuation studies. They derived a wetland value function relating value to wetland type, income per capita, population density, wetland size and location by continent.

Sources of information on valuation studies

In order to facilitate benefit transfer, efforts have been made to develop databases of valuation studies on different ecosystems. These include:

- Environmental Valuation Reference Inventory: **www.evri.ec.gc.ca/evri**
- Envalue : **www.environment.nsw.gov.au/envalue**
- Ecosystem Services Database: **http://esd.uvm.edu**

To learn more about the BBOP principles, guidelines and optional methodologies, go to:

www.forest-trends.org/biodiversityoffsetprogram/guidelines