UNDERSTANDING COMMUNITY-BASED REDD+

A MANUAL FOR INDIGENOUS COMMUNITIES

IWGIA and AIPP
2011

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INTRODUCTION

INTRODUCTION

In December 2010, after years of negotiations, an agreement on REDD was finally reached at the 16th Conference of Parties (COP 16) of the United Nations Framework Convention on Climate Change in Cancun, Mexico. Indigenous representatives worked hard to get the rights and concerns of indigenous peoples included in the agreement and they were successful. The references to indigenous peoples and their rights in this agreement are not as strong as they would have liked them to be, but at least they were included. And the agreement also refers of the UNDRIP, even though only in the Annex.

If you have already gone through and studied the first community guide "What is REDD?", you will be familiar with the REDD agreement, and you will remember that the crucial paragraph is number 72, in which country Parties (that means governments) are requested to ensure "the full and effective participation of relevant stakeholders, inter alia, indigenous peoples and local communities" when developing and implementing their national strategies or action plans on REDD.

Paragraph 2 of Annex 1 of the agreement gives the details of the safeguards that governments are asked to promote and support when implementing REDD+. And one of these safeguards again talks of "the full and effective participation of relevant stakeholders, in particular indigenous peoples and local communities".

But what does "full and effective participation" mean? This question is the main motivation for writing this manual.

What is the purpose of this manual?

While our first community guide "What is REDD?" aims to help indigenous communities to understand what REDD+ is and what its implications may be for them more generally, this manual looks at REDD+ at the project level and tries to provide some guidance to finding answers to questions like: How does REDD+ fit into the overall livelihood and forest management systems of indigenous peoples? How does REDD+ work on the ground? What are the typical activities of a REDD+ project? Who are involved in a REDD+ project? What are the particular knowledge and skills needed for implementing a REDD+ project?

By assisting communities in finding answers to such questions, the **purpose** of this manual is to help indigenous communities acquire the knowledge and skills needed to take a decision on whether to join a REDD+ project, and if they do, to be able to fully and effectively participate in it.

Like the first manual, this second manual does NOT intend to convince anybody to be for or against REDD+. It was written solely with the intention to help communities form their own opinion. And in order to do that it is important that communities fully understand how REDD+ works at the concrete project level before they start considering whether to join or not.

However, we believe that full and effective participation of indigenous peoples is only possible in the context of a REDD+ project that fully recognizes and protects IP rights and respects and promotes indigenous peoples' social and cultural systems. Therefore, this manual is based on and seeks to promote in a holistic way an approach to REDD+ that respects and promotes

- The rights of indigenous peoples as provided for in the United Nations Declaration on the Rights of Indigenous Peoples
- Indigenous peoples' social and cultural systems, values and practices
- The protection of the environment and biodiversity.

Who is this manual for?

The manual will be useful for indigenous communities who:

- Are going to be affected by REDD+ projects initiated by outsiders and who, therefore, need to know what it is all about to be able to decide whether to go along with it or not
- Are considering to be a part of a larger REDD+ scheme initiated by others and want to know how to ensure their full and effective participation
- Are considering of having their own REDD+ project with an outside partner and want to know how this can be done so that they remain in control

Each country has its own set of laws and policies that affect a community's decision making on REDD+. Nevertheless, 147 member countries of the UN have approved the UN Declarations on the Rights of Indigenous Peoples (UNDRIP). The UNDRIP is an important tool for indigenous peoples to assert their rights vis-à-vis REDD+ project. In the first community guide "What is REDD?", there is a separate chapter dealing with the UNDRIP and why it is important and useful for indigenous communities in the context of REDD+. Besides the UNDRIP, the UN has also developed a number of other international legal instruments that can be used for the protection of your rights.

Furthermore, it is important to remember that in addition to the REDD agreement mentioned earlier, the UNDRIP and other international legal instruments, most of the big players in REDD+ - the UN REDD Programme, the World Bank, donor countries or conservation agencies – have policies that at least to some extent recognize and protect the rights of indigenous peoples.

How do you use this manual?

If you are not even sure what REDD+ is at this point, do not worry. Our previously published community guide "What is REDD?" will equip you with the required basics. And if you want to know more, you can look up the references listed there. There is also a glossary so that you can easily look up unfamiliar terms you come across.

This manual is the second of a series of four manuals:

I. What is REDD?
II. Understanding Community-Based REDD+
III. FPIC for REDD+ - A guide for indigenous communities
IV. Advocacy, Lobbying and Negotiation Skills in REDD+

The first community guide "What is REDD?" intends to help indigenous communities gain a general understanding of what REDD is, what the "plus" in REDD+ means, what the possible impacts of REDD+ are and how their rights can be protected.

To get into a REDD+ project, there are many technical requirements, and we want to ensure that the community is not left out in this part of the project; these are discussed in the second manual of our series "Understanding Community-Based REDD+". This manual also covers some technical information that may be useful to the community whether or not they engage in REDD+, for instance inventory of their carbon stock. The purpose of this manual is to help indigenous communities acquire the knowledge and skills that would be needed for a full and effective participation in REDD+.

After knowing what REDD+ is all about and what it entails to be part of a REDD+ project, the forthcoming third manual "FPIC for REDD+ - A guide for indigenous communities" will provide an introduction to the principle of Free Prior Informed Consent (FPIC) and guidance on how FPIC can be applied. Its purpose is to help indigenous communities make a decision on whether they want to engage in REDD+ in general, or in a particular REDD+ project, and to ensure that their rights are fully protected.

Finally, in order to get their rights recognized by governments and other actors involved in or responsible for REDD+ strategies, programs and projects indigenous communities, their leaders and organisations may have to take action in the form of advocacy campaigns, lobbying decision makers, and in any case they will have to negotiate in order to make sure their positions are adequately taken into considerations. The aim of the fourth manual in this series on "Advocacy, Lobbying and Negotiation Skills in REDD+" is to help improve the skills needed for all so that their advocacy and lobby work can be more effective.

This manual consists of four parts:

I. Before we start: Some basic concepts and facts

The first module of this manual gives a short introduction which will first reflect on the meaning of participation and how genuine participation is only possible if people are fully empowered, i.e. are in control of the process. It is followed by a brief outline of what Community-based REDD+ is.

II. Community-based REDD+ in practice: Some basic knowledge

This part has two modules: The first (Module 2) focuses on those aspects of forest conservation which under REDD+ are called "co-benefits": biodiversity and livelihood. After introducing these two topics, an overview of different forms of land use in tropical forests, how they impact on biodiversity and what they offer in terms of livelihood for indigenous communities is given. This is followed by a chapter on the costs and benefits of REDD+ and a concluding chapter on land-use planning.

The second module of this part (Module 3) tries to explain how REDD+ projects work, what are their components and what knowledge and skills are needed in their implementation. We are not covering all aspects in detail and the manual does not aim at providing the comprehensive technical training needed for independent REDD+ implementation. Our objective is to ensure that communities gain sufficient knowledge to fully assess what participation in REDD+ implies, including the need for more specific capacity building and support. We will provide some references that will help in accessing these.

III. Community-based REDD+ in practice: Some useful skills

The third part aims to help communities acquire some skills that are useful not only in REDD+ projects, but also in community-based forest management in general. This part also consists of two modules. The first (Module 4) provides a simple guide on how to conduct independent carbon stock assessment and carbon monitoring. This is only one of the skills needed for the successful implementation of Community-based REDD+ projects. Communities may need to acquire other skills as well, which should be assessed with the help of a needs assessment. But carbon monitoring is for most a new activity and few communities may possess these skills already. Furthermore, being able to make carbon stock assessment and do regular carbon monitoring independently will be crucial for remaining in control of a REDD+ project.

The second module of this part (Module 5) introduces two forest management techniques that have been developed and found very useful by the Ikalahan, an indigenous people of the Northern Philippines, FIT and enrichment planting. These techniques may also be helpful in the context of a REDD+ project.

IV. Do we want REDD+? Steps in assessing readiness for REDD+

In the final part of this manual (covered in Module 6) we will provide some guidance on how a community can make an assessment of and take a decision on a REDD+ project. It will briefly discuss how the principle of Free Prior Informed Consent (FPIC) can guide a community in dealing with REDD+ projects initiated by outsiders. After that guidance will be offered on how a community can assess whether it is ready to engage in a REDD+ project.

There are additional parts which will provide useful information:

- A **glossary** gives a handy definition for terms related to REDD+.
- The **annex** contains sample materials and further information.
- **References** are provided for each module if one would like to learn more about REDD+.
- A **CD with various resource, like some of the references in PDF, MS Excel exercise files and visual material** for the preparation of PowerPoint presentations (table of contents of the CD in annex 1).

PART I.

BEFORE WE START: SOME BASIC CONCEPTS AND FACTS

MODULE 1
BASIC CONCEPTS AND FACTS

This module intends to prepare the ground for what is to come in the main part of this manual. Since the REDD agreement of the UNFCCC emphasises "full and effective participation of relevant stakeholders", among them indigenous peoples, we consider it worthwhile to reflect a little on the meaning of participation, and to compare it with a concept which we believe reflects more closely the aspirations of indigenous people within the debate on REDD+: empowerment. This discussion will be followed by a definition of and a brief reflection on our understanding of the concept "Community-based REDD+".

Finally, we would like to draw your attention a few basic facts about REDD+ which we believe are very important to keep in mind before considering to engage in any REDD+ initiative. These facts are so important for avoiding misconceptions or false expectations that we want to highlight them already at the beginning. They will be elaborated further in the later parts of the manual.

Chapter 1: On Participation and Empowerment

Participation is very much about the rights of people. Generally, the word "participation" refers to either the act of taking part in something, or having a share in something. There has been a lot of talk about participation in development over the past decades, and today it is commonly understood that participation in development is about how people (communities) can influence and take part in controlling development initiatives, especially in decision making and resources use.

There are different reasons why community participation is promoted: to reduce costs (communities are asked for contributions of goods, labour money), to make a project more effective and efficient, to strengthen the capacities of the communities, or in order to empower communities, which means to help them increase their control over critical resources and decisions that affect their lives.

The reason why the full and affective participation of indigenous communities has been included in the REDD agreement of the UNFCCC is mainly because of the latter: indigenous leaders advocated and lobbied the UNFCCC relentlessly because of their concern that REDD will be implemented without any say of indigenous peoples in its design, planning and implementation. It was feared that decisions will be taken and resources allocated without indigenous peoples' active involvement.

However, there are indeed other reasons too why the participation of indigenous peoples in REDD+ is being promoted. There is ample evidence from across the world that communities, especially indigenous communities, have been very effective in forest conservation. A recent report on Mesoamerica(Fundación PRISMA – Grupo CABAL 2011) found that in general, forests in indigenous territories are better protected and are regenerating better. And a global study (Ashwini Chhatre and Arun Agrawal 2009) found that there are both high carbon storage and livelihood benefits in places where communities have control over larger forest areas. Many more studies could be quoted here which prove that community-based conservation is very effective or, conversely, that forest protection or biodiversity conservation failed when the local communities were excluded or even antagonized.

When we talk about the participation of indigenous communities in REDD+, we have to be aware that we are talking about different levels.

REDD+ strategies and plans are developed at the national levels, by national governments. However, REDD+ project are or will be implemented on the ground directly affecting and involving the people living in or near the forests targeted by them. The only concrete examples we so far have with REDD are a few pilot projects, which are financed by donors or through the voluntary carbon market. How REDD+ will actually be implemented in the future is still being discussed. One of the open questions is how it will be funded: through funds or a carbon market or both, or maybe through other means? The other question is at what scale REDD+ will be implemented. Will it be a national approach (one large national-level REDD+ programme) or a sub-national (individual projects run by e.g. NGOs, local governments, companies, etc.), or a combination of both?

Whatever approach will ultimately be chosen, it is quite certain that national governments will in any case play a key role. Even in a so-called "nested approach", which means an approach to REDD+ in which we have sub-national (local) REDD+ projects that are directly dealing with their international partner, there will be a national policy regulating REDD+, with rules and regulation any sub-national project has to comply with.

So participation in REDD+ has to take place at all levels: at the level where national policies and laws, or programs on REDD+ will be designed and decided on; and the local level where programs and projects are implemented.

Practically, for indigenous peoples participation at the national level is through your leaders who have been or will be engaged in the REDD+ discussion and who are advocating for the respect of indigenous peoples' rights and concerns. We are not going to discuss more about this here. Many issues relevant for this advocacy work have been covered in Module 1, and there will be a separate module on advocacy and lobby work.

It is at the local level that communities will be directly participating in REDD+, and this is what we will be mainly concerned with in this manual.

As mentioned earlier, participation means taking part in something and/or having a share in something. This is of course rather vague and in reality we have a wide range of different forms through which "participation" is realized.

In the worst case, "participation" consists of not much more than a superficial "consultation" with communities, in which they are basically just told what is going to happen. The decisions have already been taken and there is no way the communities can influence that. And there are also cases in which communities do have a say in what is going to happen and how, in which there is a proper process in which communities can obtain all information they need to form an opinion, in which they have the time and freedom to discuss everything among themselves, and in which they can come up with a decision on their own. These are cases where the principle of FPIC is applied.

When participation of indigenous peoples is guided by the principle of FPIC, we can say that it is genuinely empowering. It creates the precondition under which the communities freely, on their own will and thus with full commitment engage in the initiative. A REDD+ project which is based on such a genuine partnership with indigenous communities can be called community-based REDD+.

For truly effective participation in a REDD+ project, i.e. to be able to engage in a community-based REDD+ communities, however, you will have to gain some basic knowledge and a number of new skills. It depends on a number of factors whether a REDD+ project can be implemented independently by communities or whether they need external assistance. Among these factors are the national REDD+ policy and relevant laws, whether the project is to be funded through the carbon market or through a fund or by bilateral donors, the size of the project, who all is to be involved, etc., and of course the existing capacity in the community. We will return to this question in part IV of this manual.

EMPOWERMENT

Generally, empowerment refers to act of giving someone authority or power to do something. (http://www.oxforddictionaries.com)

In our context, it refers to the increasing the spiritual, political, social, or economic strength of individuals and communities. It often involves the empowered developing confidence in their own capacities. (http://en.wikipedia.org/wiki/Empowerment)

For now, let us first have a look at what we mean when we talk about "Community-based REDD+".

Sources and references

Ashwini Chhatre and Arun Agrawal 2009. Trade-offs and synergies between carbon storage and livelihood benefits from forest commons. www.pnas.org_cgi_doi_10.1073_pnas.0905308106

Fundación PRISMA – Grupo CABAL 2011. Designing a REDD+ Program that Benefits Forestry Communities in Mesoamerica

Chapter 2: What is Community-based REDD?

Most of the currently running REDD+ projects have been initiated and are largely implemented by government agencies, bilateral donors or international and local NGOs. They often cover rather large forest areas, involve sophisticated modern technologies (like using satellite images and Geographical Information Systems) and are, therefore, led and controlled by highly educated and skilled professionals.

REDD+ projects are highly complex and demanding with respect to knowledge, skills and the financial means needed. For indigenous communities, the challenge is to develop methods and forms of partnership which allow the REDD+ project to remain under the control of communities. To emphasise community control and empowerment in REDD+ projects we have chosen to call projects with such an approach "Community-based REDD+".

First and foremost, community-based REDD+ (CB REDD+) initiatives should be planned, designed and implemented in such a way that they fully comply with the safeguards referred to in the UNFCCC agreement on REDD, as well as the provisions of the Unite Nations Declaration on the Rights of Indigenous Peoples (UNDRIP). Depending on the national or local context, other concerns and legal rights may be taken into consideration.

Thus, CB REDD+ projects among others should:

- Have obtained the FPIC of the communities involved if the respective project has not been initiated by themselves;
- Address the need to secure the communities' right to land and resources, where necessary;
- Ensure that communities have the right to their own community forest governance, or at least to a full and effective participation in decision making regarding the management and conservation of their forests;
- Build on and strengthen indigenous knowledge and practices;
- Respect the right of communities to their traditional livelihood and natural resource management systems;

- Ensure the conservation of natural forests and biodiversity;
- Ensure equitable sharing of benefits from REDD+ within the community;
- Ensure the full and active participation of women in all activities.

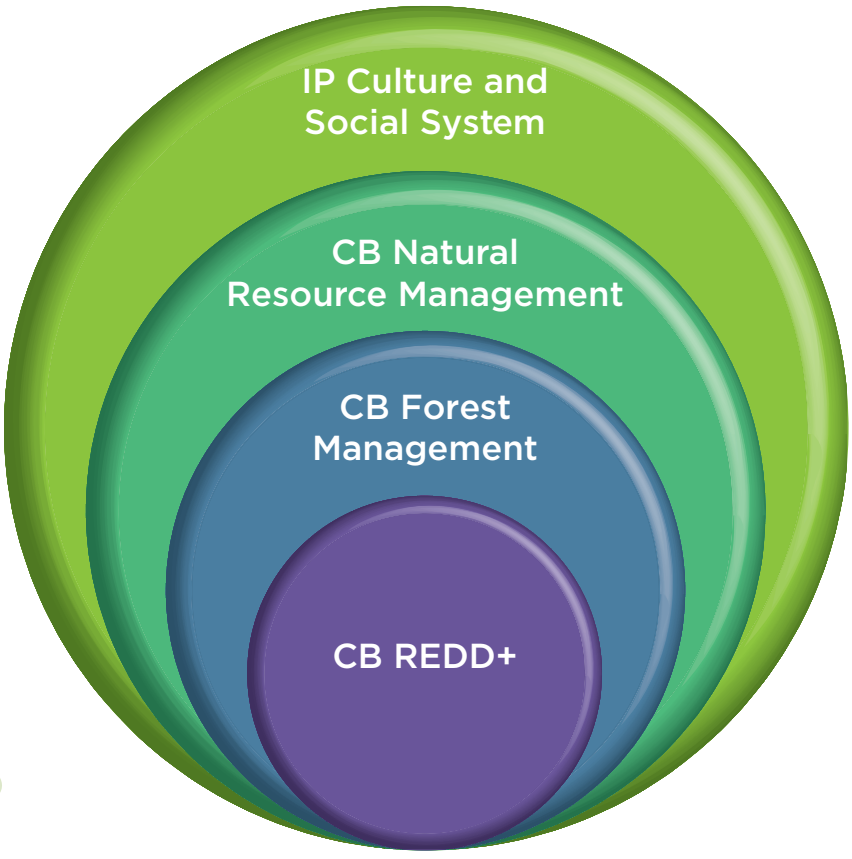
ODDAR MEANCHEY COLLABORATIVE REDD PROJECT

The Oddar Meanchey Collaborative REDD Project is located in Oddar Meanchey in the Northwest of Cambodia. It involves of 58 villages which have formed 13 Community Forest Management Committees (CFMC) and manage and protect 67,783 hectares of forest. The project has been initiated mainly by the NGO Community Forestry International (CFI), but involves numerous other agencies and organisations.

Actors involved in the Oddar Meanchey Collaborative REDD Project in Cambodia	
Actor	Role
Community Forestry International (CFI)	Project identification—REDD strategy design—design team coordinator
Forestry Administration	Carbon seller—Lead agency representing the Royal Government of Cambodia; coimplementing agency
Terra Global Capital	Carbon calculator—carbon broker—technical adviser
PACT	Proposed implementing agency
Technical Working Group on Forests and Environment/ DANIDA	Funding agency for project design and monitoring body
Clinton Climate Initiative	Funding agency for project certification
Children's Development Association	CFMC training and field project management activities
Buddhist Monks of Samraong Pagoda	Organizers of monk's conservation forests (Sorng Rokavorn, 18,600 hectares)
13 Community Forest Management Committees (CFMCs) from Oddar Meanchey Province	Local implementing organizations for forest patrolling, restoration, activity planning

Source: Poffenberger et.al. 2010

Graph 1. The place of REDD+: REDD+ is considered a part of community-based forest management, which is part of a community's natural resource management system, which is part of the encompassing socio-cultural system on the indigenous people which the community is part of.



What about the additional benefits?

At least since the agreement reached at the UNFCCC COP 16 in Cancun, it seems to be widely accepted that REDD+ is not just about carbon anymore. REDD+ should also provide other benefits, like the conservation of biodiversity, and it should "take into account the need for sustainable livelihoods of indigenous peoples and local communities and their interdependence on forests" (as referred to in the footnote to Annex 1, paragraph 2, of the agreement).

In CB REDD+, however, these "additional benefits" are actually considered more important than carbon. So we can say that the priorities are reversed. ***First come the rights and the well-being of indigenous communities and for that purpose the conservation of forests and biodiversity.*** Second come the prevention of carbon emissions and the enhancement of carbon uptake by forests. However, this does not mean that carbon is irrelevant, otherwise we would not refer to it as CB REDD+.

To talk about "reversed priorities" is to emphasize that ***in CB REDD+ the rights and wellbeing of indigenous communities are the basic, non-negotiable framework within which REDD+ is supposed to operate.*** Reducing carbon emission and enhancing carbon sequestration is a key concern, but the aim of CB REDD+ is to achieve a so-called "win-win situation"; a situation in which all are "winning" and thus benefiting: the communities, biodiversity and the climate.

Sources and References

Poffenberger, M., S. De Gryze, L. Durschinger 2011. Designing Collaborative REDD Projects. A Case Study from Oddar Meanchey Province, Cambodia. Community Forestry International. http://www.communityforestryinternational.org/publications/research_reports/index.html

Chapter 3: Some Important Facts About REDD+

There are some vital facts about REDD+ that are very important to remember when you are considering to engage in a REDD+ Initiative. They are of such fundamental importance that we want to highlight them here before proceeding any further. Please review them or start thinking about them if you haven't yet. We will discuss them in more detail in the sections that follow.

REDD+ is about changes, but sometimes not...

Keep in mind that the basic idea behind REDD+ is to compensate people for a change in behaviour, and sometimes also for not changing good behaviour. Under REDD+ money is paid for

- **Changes** in land and forest use which lead to less deforestation and less forest degradation;
- **Changes** in forest and land use which lead to increased growth and health of forests (and other vegetation);
- **Continuation** (*not* changing) of land and forest uses which conserve forests and, therefore, the existing carbon stock, plus maintain and enhance the ongoing additional carbon sequestration in these forests.

Whatever kind of REDD+ project we are looking at – whether largely externally driven or community-based – people have to be aware that engaging in it implies that they are willing to:

- **Refrain from doing certain things** which they so far may have been engaged in. Since the very beginning of the discussion on REDD this has been one of the main concerns of indigenous peoples. Many rightfully still fear that REDD+ will impose restrictions on their traditional livelihood, land and forest use, and it is important that indigenous peoples continue their advocacy work to ensure that their rights are respected in all REDD initiatives. But even in REDD+ projects in which these rights are respected, engaging in REDD+ will inevitably imply that certain activities are stopped (for example commercial firewood extraction, unsustainable logging, conversion of forest land to agricultural land, etc.).
- **Engage in new or unfamiliar activities** which are necessary to make the REDD+ project work (like measuring and monitoring carbon, making reports, etc.).

In the third part of this module which follows below, we will have a closer look at how a REDD+ project looks like in practice, its components, its implications for the communities and what is required from them, in particular the new skills needed.

Scale – Small is beautiful but....

Whether it is a fund, a donor or a carbon buyer (a company or a carbon trader), all those who are willing to pay for REDD+ are interested in large projects saving large amounts of carbon. Carbon traders and investors are looking for projects offering at least 10,000-20,000 tCO_2/year. So they are not likely to be interested in an agreement with a single community involving only a few dozens or a few hundred hectares of land and forest. They want a lot of carbon and are, therefore, keen on having agreements covering large forest areas. So unless you are a large community with a very large forest you have to consider doing it together with other communities in your area, or to join a large program initiated by somebody else.

In some parts of the world, indigenous peoples have gained the legal recognition of their rights over their territories, for example, in many countries in Latin America, where indigenous peoples have communal titles over millions of hectares of land and forests. In Asia, it is in the Philippines where the rights over indigenous territories are well recognized. There, the government has over the past decade issued certificates recognizing indigenous peoples' legal ownership over more than 4 million hectares of ancestral domain, what indigenous lands are called in the country. Since one of the clearly recognized preconditions for REDD+ - and in particular community-based REDD+ - is the security of rights over land and forest, the indigenous peoples in these countries are in a much more favourable situation than their brothers and sisters in other countries.

Since some of the territories of indigenous peoples in these countries are quite large, amounting to over 100,000 hectares, and also have forest areas of a few ten thousand hectares, they would be in the position to have their own REDD+ project. Those with smaller territories and/or forest areas may have to engage in a REDD+ project jointly with others. This is currently being done in a REDD project in Oddar Meanchay province in the Northwest of Cambodia with a number of non-indigenous communities. The project brings together 13 community forestry (CF) groups, comprising 58 villages, which protect 67,783 hectares of forest. Over 30 years they expect to sequester 7.1 million tons of CO_2, or 233,333 tons of CO_2per year (Poffenberger, M., S. De Gryze, L. Durschinger 2011, p.ii).

Costs – there is no free lunch...

REDD+ projects are supposed to benefit indigenous and local communities, but before engaging in any project, the communities have to be aware that there are also costs involved. There are significant costs already involved during the preparation of a REDD+ project, and more during its implementation. There are not only direct costs involved for all the work that needs to be done and the equipment that needs to be bought, but also indirect costs when the communities refrain from practicing other forms of land use in favour of REDD+. These are called opportunity costs and we will discuss these in more detail a little later.

Technical requirements – can we do it alone?

REDD+ projects are also demanding with respect to the knowledge and skills required to implement them. Communities can acquire these skills and knowledge, but it may take time and can be expensive, and you may, therefore, prefer to have a partnership with others, like NGOs, who can provide the support needed.

The need to comply with standards – External verification

If a REDD+ project aims to fund itself through the sale of carbon credits on the voluntary market,

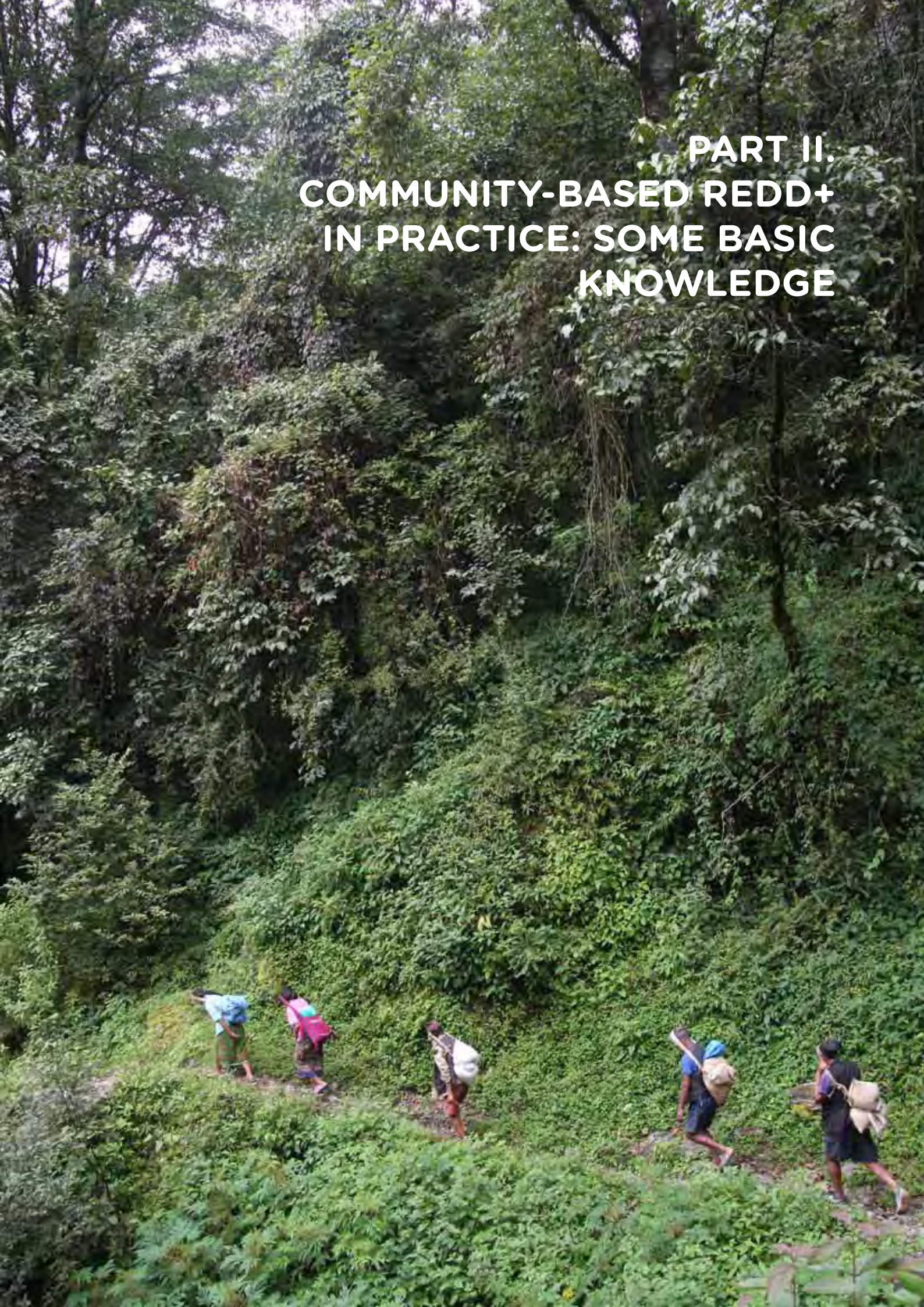
it will have to follow internationally recognized standards, otherwise the carbon credits would not be recognized and registered, and could not be sold. This again implies additional costs. There are several recognized standards, some of which will be discussed in Module 3. Now that an agreement on REDD+ has been reached at the UNFCCC, it is certain that global standards for REDD+ will be developed by the UNFCCC as soon as an agreement on the funding of REDD+ will be reached. This is likely to happen at the 17th Conference of Parties (COP) in South Africa in December 2011.

National framework – The need to deal with the state

Many governments all over the world are presently developing national policies and laws on climate change, and therefore also on REDD+. So whatever REDD project you may want to initiate or decide to be involved in, it will have to follow the rules and regulations laid out by the laws and policies of your country. Therefore, it is important for you to carefully study these laws and policies before you engage in any REDD+ initiative.

Sources and references

Poffenberger, M., S. De Gryze, L. Durschinger 2011. Designing Collaborative REDD Projects. A Case Study from Oddar Meanchey Province, Cambodia. Community Forestry International. http://www.communityforestryinternational.org/publications/research_reports/index.html



PART II. COMMUNITY-BASED REDD+ IN PRACTICE: SOME BASIC KNOWLEDGE

PART II. COMMUNITY-BASED REDD+ IN PRACTICE: SOME BASIC KNOWLEDGE

In order to know whether to initiate or engage in a REDD+ project, indigenous communities first need to be equipped with the knowledge needed to make a well-founded assessment. This part of the manual aims to provide some basic knowledge that might be useful for that.

This part has two modules: The first focuses on those aspects of forest conservation which under REDD+ are called "co-benefits": biodiversity and livelihood. It will give an overview of the importance of forests for biodiversity and indigenous peoples' livelihood, followed by a discussion of how different forms of land use in tropical forests impact biodiversity and what they offer in terms of livelihood for indigenous communities. After that, the costs and benefits of REDD+ will be reviewed, and compared with other forms of land use. The concluding chapter highlights the importance of community land use planning and briefly explains how it is done.

The second module introduces and explains how REDD+ projects work, and the knowledge and skills that are needed for the different steps in REDD+ implementation. This, we hope, will help to fully assess what participation in a REDD+ project implies, including the need for a more specific capacity building and external support.

MODULE 2
REDD+ OR RATHER SOMETHING ELSE? ASSESSING THE OPTIONS

Working with REDD+ means you decide to devote a part of your community land to forest conservation or forest regeneration. You probably already have been doing forest conservation since a long time. There are many good reasons for that. But under REDD+, forest conservation is quite a different story since its main concern is carbon, and all other benefits of forest conservation are "additional" benefits.

While forest conservation brings many benefits to communities, biodiversity and other people, under REDD+ the benefits that come from carbon are financial: your community would be paid for implementing REDD+ activities. But doing so also implies costs, and you are well advised to carefully look at these costs, and compare them with the benefits you can expect from REDD+.

In this module, we will try and give you an overview of what we think you should take into account when you consider engaging in a REDD+ partnership. This includes an assessment of the different alternatives you have for using your land and forest. Each option has certain advantages and disadvantages in terms of income and livelihood security, and the conservation of the environment and biodiversity.

Livelihood security for communities and the conservation of biodiversity are the key "co-benefits" which REDD+ is supposed to have and which are given priority in community-based REDD+. So when comparing alternative forms of land and forest use, including REDD+, we will have to pay due attention to these two aspects. We will, therefore, begin this second part of the manual with a short overview of these key values of forests for indigenous communities.

Chapter 1: Forest Use and Biodiversity

a. What is biodiversity?

Biodiversity is the variety of life on Earth: the different plants, animals and micro-organisms, their genes and the ecosystems of which they are a part. Nobody knows how many species live on our planet. Estimates of biologists range widely, mainly because most living species are microorganisms and tiny insects and other small creatures, but most estimates fall between 5 million and 30 million species. Roughly 1.75 million species have been formally described and given official names, which means that most species that exist on our planet are still not known to scientists.

Each ecosystem has its own, particular community of species, and there are certain ecosystems which have more different species than others. These ecosystems are said to have a higher biodiversity than the others.

Tropical rainforests have the highest biodiversity of all ecosystems. Rainforests once covered 14% of the earth's land surface; today they cover only 6%. But it has been estimated that still about half of the world's species of plants, animals and insects are found in the tropical rainforests.

SOME AMAZING FACTS

- In Borneo, in a 10 hectares large plot of rainforest, more than 700 tree species were identified, which is equal to the number of tree species found in the whole of North America (US and Canada), which is a huge area of millions of hectares.
- Europe has about 320 butterfly species while in the Peruvian rainforest of Manu National Park, 1300 species have been counted.
- In Peru, one single rainforest tree was found to be home to forty-three different species of ants, which is about the same number of ant species found in Great Britain.

Biodiversity is often used as a measure of the health of biological systems. A healthy natural forest has a higher number of species – a higher biodiversity – than a degraded forest.

There is a notable overlap between biologically rich areas and indigenous peoples' territories, especially with respect to tropical forests. In Latin America, the Congo Basin in Africa, and several countries of tropical Asia, there is a clear correspondence between areas of remaining tropical forests and the presence of indigenous peoples.

Table 1. Plant biodiversity in tropical forests and forest-derived land uses

	Number of plant species within a 200 m^2 plot		
Land use	Brazil	Cameroon	Indonesia
Natural forests	63	103	111
Managed forests	-	-	100
Logged forests	66	93	108
Extensive agroforests	47	71	112
Intensive agroforests	-	63	66
Simple tree systems	25	40	30
Long fallow agriculture	36	54	43
Short fallow agriculture	26	14	39
Continuous annual cropping	33	51	15
Pasture/grasslands	23	25	11
Intensive pasture	12	-	-

Scientists of the Alternatives to Slash and Burn (ASB) programme (www.asb.cgiar.org/) identified the number of plant species per standard plot of 40x50m.

Source: The World Bank 2011, p. 8-13

b. What is the impact of human beings on biodiversity?

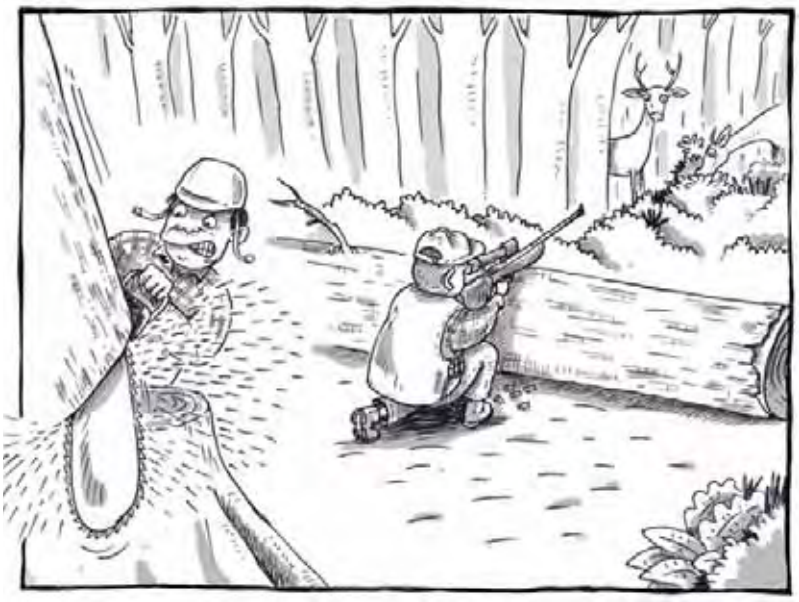
Human beings are just one of the many species living in the forest. All creatures, big and small, are connected to and depend on each other in manifold ways. They constitute a complex web of life, or a system called the ecosystem. Tropical forests are the most complex ecosystem on earth and, as we have seen, have the highest biodiversity.

Despite all our powerful technologies, human beings also depend on other species. This should make us humble, make us respect other beings and be aware of our responsibilities towards them.

Compared to other human societies, indigenous people's traditional land-use methods have a modest impact on their environment. At the same time, they depend more than other human societies on natural resource and thus on biodiversity. This has led to the development of resource management practices that help conserve biodiversity.

However, this is not the case among all indigenous peoples, and even less so among other people, particularly modern industrialized societies. As humans have spread across the earth, many species have become extinct. They have become extinct mainly due to the modification or destruction of the natural environment in which they live, but also due to over-hunting or over-harvesting, or the introduction of alien species. While species extinction is a natural process and humans have contributed to the extinction of species throughout their history, today, it is taking place at an unprecedented scale. It has been estimated that up to 150 species are becoming extinct every day. Climate change has made this even worse and it is predicted that up to 30% of all species will be extinct by 2050 if climate change continues at its current pace.

Does this mean that people and biodiversity don't go together?



For biodiversity to be maintained in an environment where people live, first of all, there has to be enough space for all the different species to live in. This means that the environment – their habitat – has to be sufficiently large for them to maintain populations large enough to reproduce over time. Secondly, if these species are used by humans in one way or the other – are being gathered, hunted or cut – it has to be done at a level which leaves enough untouched so that they can mature and reproduce. This is also for the benefit of future generations of people who may also like to use or will depend on these species. Such a way of harvesting or using resources is called "sustainable use" of resources.

It is precisely among indigenous peoples that these conditions have often been met. Indigenous peoples have traditionally practiced land use or hunting methods that do not have heavy impact on biodiversity and the environment as a whole. Many indigenous societies have also developed strict rules for the use of land and forests, or for hunting and gathering, and therefore, have used their resources in a sustainable way, which also allowed the maintenance of biodiversity.

BAMBOO HARVESTING RULES AMONG THE KAREN OF HUAY HIN LAD

The Karen of Huay Hin Lad community in Northern Thailand closely observe the life cycle of the native bamboo in order to sustainably use them. In traditional bamboo harvesting, farmers annually gather only the first two pairs of bamboo shoots exposed over the soil from each bamboo clump in July and August. They keep the last pair of bamboo shoots, which will bear in September, for reproduction in the next season. To ensure long-term usage of the bamboo worm, which is one of the favorite foods of the Northern people, farmers cut only the specific bamboos that have worms inside. In addition, there are defined protected areas for conserving the bamboo worm.

Source: Northern Development Foundation (NDF) and Huay Hin Lad community 2011,

Biodiversity can also directly benefit from people's presence in the forest. For example, traditional shifting cultivation creates a more diverse forest because parts of the forest are turned into fields, which are then left fallow so that the forest grows back. As a result, along with the original old-growth forest there are patches of forest of different age, each with its own specific and different composition of species. Some areas may also be turned into and maintained as grasslands. Species which are very much valued by hunters, like wild pigs, deer or wild cattle, find more food in such a diverse landscape, and their populations therefore increase.

However, there are other species that cannot adapt to and survive in a forest altered by human. They need a forest which is left untouched. Among them are many bird species that feed and make their nests only on large old trees. Some monkeys, like gibbons, spend almost their whole life on trees and don't like to come down to the ground. They need a forest with mature trees dense enough for them to move freely from tree to tree. In addition, some species, especially large mammals like elephants, wild cattle like gaur or banteng, and even more so the large predators like tigers or leopards, need large areas to have populations big enough to survive

over time. These animals can live in or even benefit from a forest changed by humans, but the changes cannot be too drastic either. The forest areas also need to be large enough in order to avoid conflict with humans. At places where the natural habitat has been reduced too much, these animals are forced to encroach on cultivated land, or to kill livestock to feed themselves.

In order to help vulnerable species survive, protected areas have been created. However, it has often been overlooked that many of these species can share their habitat with indigenous communities. Thousands of indigenous communities have been forcefully relocated out of protected areas even though this is not necessary for the survival of these species. Such forced relocations are a severe violation of the basic human rights of the indigenous communities.

What is needed are solutions adapted to the specific situations encountered, solutions that take into account the particular form of land and forest use of the communities and their needs, as well as the specific needs of other species living in that forest. Indigenous communities know their territories and the species living there. Their intimate knowledge of their environment and biodiversity can form the basis for planning and developing regulations on how the forest can be used in a way that allows both people and other species to live together, and thus allow the rich biodiversity of our forests to survive.

Sources and references

Northern Development Foundation (NDF) and Huay Hin Lad community 2011: Climate Change, Trees and Livelihood: A Case Study on the Carbon Footprint of a Karen Community of Northern Thailand. Chiang Mai: AIPP, IWGIA and NDF

The World Bank 2011. Estimating the opportunity costs of REDD+ A training manual. Washington: The World Bank. PDF available at:

http://www.asb.cgiar.org/PDFwebdocs/OppCostsREDD_Manual_v1.3.pdf

Chapter 2: The Importance of Biodiversity for Indigenous Peoples

a. Why is biodiversity important for indigenous peoples?

Among all indigenous peoples, land is worshiped and respected and forms the core of their culture and the source of their identity. Many indigenous peoples are well aware of their close relationship with other beings and their dependence on them. In some indigenous societies, the view that all living and non-living things in the universe are closely interlinked is expressed in ceremonies and shamanistic rituals. Humans are seen as just one, particular form of life in a wider community of living beings. These indigenous people interact with other living beings with similar rules as those regulating the relationships among human beings.

Most indigenous peoples inhabiting forests still rely on natural resources for making a living. In most cases, they have a very diverse economy: they plant crops, raise animals, fish, hunt and gather all kinds of plants in the forest. Their houses are built with timber from the forest, thatched with leaves or grasses, and they still manufacture tools and other utensils like baskets and bags with vines and fibres found in the forest. Thus, they directly depend on a large number of plant and animal species, wild and domesticated, for their daily needs.

Indigenous swidden farmers are known for the enormous diversity of plants they cultivate. For example, the Karen of Mae Tae Khi village in Thailand plant 192 varieties of 52 plant species in their fields. Besides cultivated plants, there is a large number of wild plant species which indigenous peoples use. In the Naga village of Khezhakenoma, villagers identified among others 264 varieties of cultivated plants, 260 tree species, 92 species of wild fruits and vegetables, 41 species of mushrooms, 40 medicinal plants, 10 plant species whose fibres are used, 74 that can be used for ropes, and 21 whose latex or resin are used.

A research done in Laos in the late 1990s showed that an average of 74% of meat consumed in indigenous communities is meat from wild animals, and 71% of non-rice plant food (vegetables, herbs, tubers) is from wild plants, most of them hunted or collected in the forest. Over 700 edible NTFPs have been recorded so far in Laos: edible shoots and other vegetables, fruits, tubers, mushrooms, small water animals, etc. Forest resources are also important for cash income of forest dwelling people. A research in two districts in Laos showed that NTFPs contributed to 61% of cash income at an average. Income from the sale of NTFPs is the main source of cash for buying rice in times of rice shortage.

THE VALUE OF FORESTS 1

A research among seven indigenous communities in Malinau District of East Kalimantan, Indonesia, has documented the value people put on forest biodiversity. The communities belong to the Merap (who are mainly shifting cultivators) and Punan (who have specialized on hunting and gathering forest products).

Hunting still plays a significant role in the area. Out of all sources of animal protein wild species contribute more than half (58%) of what people rated as important. In remote communities such as among the Punan the importance of wild species reaches 81%.

Fish are also an important source of animal protein, especially when pigs are scarce or the time available for hunting is reduced by farming activities. Many remote Punan groups cultivate little and are regularly dependent on wild food resources such as palm starch (sago). Other ethnic groups also rely on these palms during occasional crop failures due to droughts and floods: all villages reported several such events within living memory. In primary forest, the palms are common enough and are protected by community management practices. However, they are rare in logged forest. Reliance on sago has, however, been strongly stigmatized as being symbolic of backwardness, to the point at which communities are ashamed to discuss it.

Source: Sheil, Douglas et.al. 2006

THE VALUE OF FORESTS 2

The researchers made a survey among on the importance of different land types with respect to five categories: food, medicine, light construction, heavy construction and boat construction. Of course, some land types were more important for some uses than for other uses. But their calculation of the overall relative value for all forms of uses had the following results:

Land use	Importance (in %)
Village	13
Old village site	6
Garden	11
River	13
Marsh/ swamp	7
Cultivation	14
Young fallow	7
Old fallow	8
Forest	21
100	

The relative value of different forest types were assessed by the seven villages as follows:

Forest Type	Importance (in %)
Unlogged forest	31
Logged	forest 10
Secondary forest	16
Swamp forest	19
Mountain forest	24
	100

Even the people of Langap, who practice rather sophisticated forms of cultivation, rated the forest more important than cultivation because, as they explained, it is the most important source of medicine and timber.

Source: Sheil, Douglas et.al. 2006, p. 20

Importance of biodiversity for people in a less apparent way

Some grasses grow very fast in the fields but when they are in the forest, they are shaded and grow slowly. In the open, they would quickly become "pests" or weeds but the locust from the forest, and the cows and horses in the fields eat the grasses and keep them under control. Birds, spiders and other predators eat the locust so that they, too, are kept under control. If the natural systems are protected, everything will be balanced and there will seldom be any "pests."

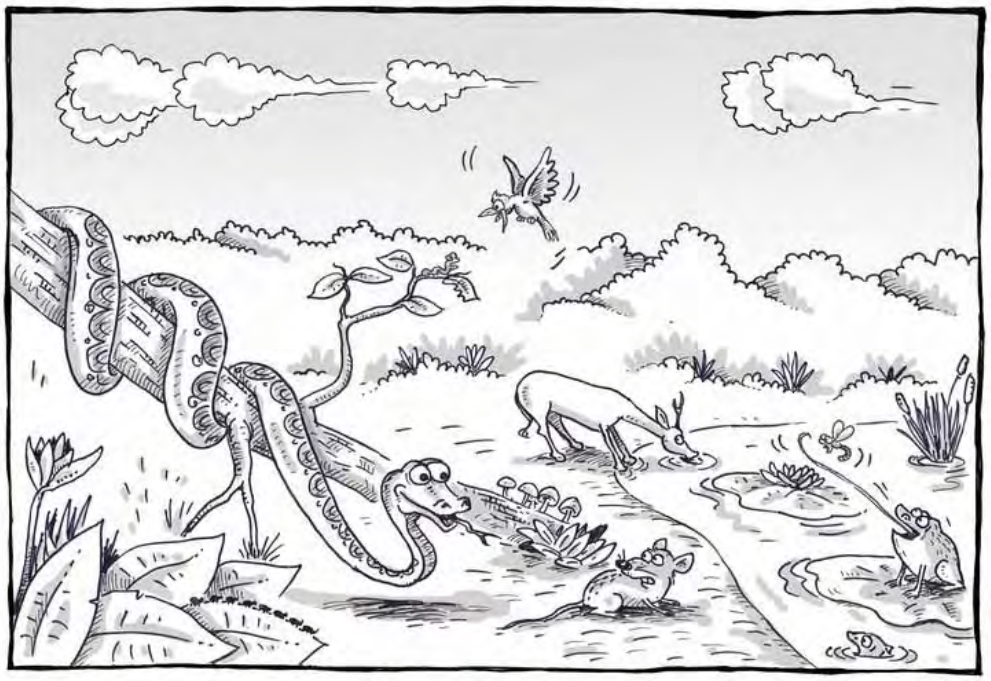
The predators that destroy the locust live in the forest and in the shrubs. If the forests are damaged and the shrubs removed, there will be no place for the predators to live. The locusts will then multiply rapidly, eat all the grasses in the remaining forest and then leave the forests to destroy the rice and corn and other crops in the fields. There will not be enough predators to control them so the systems will be unbalanced. However, people should not blame the locust. The problem lies in the lack of balance.

In most forests, there are fruit bats. They eat the fruit from many kinds of trees. They swallow the seeds and when they defecate, the seeds are planted in new parts of the forest. The forest feeds the bats and the bats give back to the forest by planting more trees. They are symbiotic. These fruit-eating bats depend on the trees for their food but if people destroy too many trees, the bats will have no more food and they will die. Subsequently, if no bats are available to plant trees, the forests will continue to get worse because the balance has been upset.

Some bats live and defecate in caves. The accumulated bat droppings in those caves are called *Guano*. Farmers gather the guano and use it for fertilizer. The farmers protect the caves and the bats provide the guano for their farms and gardens.

Today, many farmers wonder why there are more pests on their crops than there were sixty years ago. One of the primary reasons is that logging, pesticides and other chemicals have upset the balance of the natural systems. Many of the pesticides have also destroyed the nitrogen-fixing bacteria and *mycorrhiza* that provide nutrients to help the plants to remain healthy and overcome diseases and pests.

If the natural predators such as wasps, spiders, bats and birds are encouraged, they can keep the destructive insects under control so that they will not destroy crops. If the snakes and raptors are protected, they will keep the rats from becoming pests. If pests are only controlled rather than destroyed, they will just keep the predators alive. The few remaining "pests" will not be able to do any harm.



Scientists are still discovering new cycles and symbiotic relationships in the forests. They are also discovering new ways by which populations are kept in balance. These are not really new ways because they have been functioning for centuries but it is only now that people have begun to understand them so people think they are new.

While scientists are studying the forests to learn how things work, people should protect the forests and the balance on their farms so that all the parts continue to balance each other. If people exploit any of the systems in any way, the parts will probably become unbalanced and something will become a pest or will be destroyed by pests. People must not take the risk of destroying the balance of the ecosystems that was designed to keep this earth operating.

THE IMPORTANCE OF PRIMARY FORESTS

A primary forest, one that has not been disturbed, has many different species of plants and animals in it and we can say that it has good biodiversity.

There are very few primary forests, mangrove swamps or coral reefs remaining, therefore, it is very important that we protect those that remain. They contain important genetic resources that will probably become even more valuable in the future. People call them *Gene Banks* because they save the genes for use at a later time.

When scientists discover new systems and relationships in the uplands and want to restore the balance in some damaged areas, they can go to the gene banks and borrow some planting materials or a few animals. Those plants or animals can then be multiplied in the second growth forests or farms in a way that will be beneficial to the ecosystem and to people. People must also protect the secondary forests and fishing grounds so that they will not be overused and will be able to maintain their bio-diversity, even while they are being used. People should merely be a part of the environmental balance.

Sources and references

Sheil, Douglas et.al. 2006. Recognizing Local People's Priorities for Tropical Forest Biodiversity. Ambio, Vol. 35, No. 1 (Feb., 2006), Royal Swedish Academy of Sciences, pp. 17-24

Chapter 3: Forests and Livelihood

a. The many dimensions of dependence on forests

Indigenous peoples living in tropical forests to a larger or lesser extent all depend directly or indirectly on forests irrespective of whether their main form of land use is hunting and gathering, shifting cultivation, or some form of permanent agriculture. Forests provide many products they need in their daily life, ranging from materials used in house construction to food for daily meals and medicine for curing illnesses. Many forest products have since centuries been important trade goods and today are often a major source of cash income. But besides these obvious tangible benefits, forests also provide "ecosystem services". This means that a healthy forest environment does things that are useful for human, like regulation of water and the local climate, and can, therefore, be considered "services".

Nowadays people are much more dependent on cash income. At the same time, it is becoming more difficult to earn that cash from farming alone. Therefore, many are forced to leave the community and seek employment elsewhere. However, forests can provide alternative sources of income for indigenous communities. We are going to discuss a few of these options.

Forests are valuable to people not only because of all the goods they can get from them and the money they can earn that way, but also because of many other reasons. To indigenous peoples in particular, many forest products and the forest itself have a strong cultural and sometimes spiritual value which cannot be measured in terms of money. Forests often harbour sacred places which are important for worshiping, and the cultural and spiritual values of forests have a strong influence on the preferences of people and how they define "well-being". Hunting, for example, may not be very productive if compared to other activities. But for the hunters, the hunting itself is valued highly and the meat of wild animals are often cherished above any other meat.

However, in the subsequent paragraphs, we will focus mainly on the material, the livelihood benefits of forests for indigenous peoples.

1. Non-timber forest products

When thinking about the usefulness of forests, most people tend to think first and foremost about lumber procured through logging and used for construction, making furniture and many other things. And indeed, for indigenous peoples, trees used for these purposes are a very important resource. However, they also have spiritual significance, either as sacred trees or groves where spirits dwell, or when trees are cut and brought to the village for the construction of ritual buildings, for ritual posts and poles or log drums, etc.

But there are many more products indigenous peoples get from the forest. All the different things people get from the forest which are not timber are called "non-timber forest products" (NTFPs). They include fruits, nuts, seeds, fish, game, rattan, bamboo, resins, tree barks and honey, etc. Timber is the word for the wooden trunk of the tree that is harvested normally to construct buildings and furniture. Another word used in English is lumber.

Indigenous peoples gather many NTFPs for their own use. NTFPs are a source of food, medicines, baskets, mats, shelter and other necessities of cultural value. But NTFPs have also since centuries been very important trade goods, which today provide substantial cash income. The United Nations' Food and Agriculture Organisation (FAO) estimated that NTFPs are collected and used by an estimated 600 million people in developing countries for subsistence or traditional use. Some NTFP have been channelled into local and international markets, providing these communities with a vital source of income. In 2001, the United Nations Conference on Trade and Development (UNCTAD) estimated the total value of world trade in NTFPs is around US$11 billion.

Like with all natural resources, harvesting NTFPs has to be done in a sustainable manner to ensure that future generations can also benefit from them. This is less a problem with resources used for people's own consumption than with NTFPs which are gathered for trade and are in high demand. NTFPs that can be sold for a good price are more vulnerable to overexploitation. When more and more communities become dependent on cash income, maintaining the availability of such forest resources can often no longer be assured.

Another reason for the decrease of NTFPs is population growth. As more people harvest NTFPs, the pressure on them increases. This is made worse when forests areas are decreased due to clear-cutting and the conversion of forests to farm land, plantations or mines, or when forests are degraded as a result of heavy logging. Logging and mining, among others become more appealing since these provide swift and higher income. Timbers and minerals are of higher value than NTFPs, but are more destructive to the environment given that they take more time for re-growth or replacement, and result in a steep decrease of biodiversity. Logging and mining also release significant quantities of carbon. With these threats, there is an increasing realization of the need for more sustainable alternatives for forest use. Although indigenous peoples have long been dependent on NTFPs, conservationists are now promoting the sustainable use of NTFPs as such an alternative.

Often, when NTFPs are extracted and sold by indigenous communities they fetch a low price. This is partly due to the general discrimination by buyers, poor access to markets, weak marketing skills, but it is also because the products are not processed.

Indigenous peoples bring products usually from remote places without road access. It takes hours or days to bring these products to the market either by people or with the help of animals,

putting the products more at risk of being ruined and further decreasing the already low market value. In this regard, some indigenous peoples are attracted to illegal logging and charcoal making to ease out these inconveniences. These activities provide swift and relatively higher income but at the expense of the environment. As an alternative to these activities, processing of NTFP can add value and thus increase the income of communities from forest products. There is a broad range of possibilities: making mats, baskets and furniture from rattan, bamboo and various palms and vines, making food products like jam, jellies or chips from wild fruits, making spice powder, oil from nuts and seed, herbal medicine, purifying and bottling honey, etc. Such products are less susceptible to transport-related problems and above all they have a higher value in the market. In addition, since NTFPs grow faster than timber, extraction of these is more sustainable and has less impact to the forest and biodiversity.

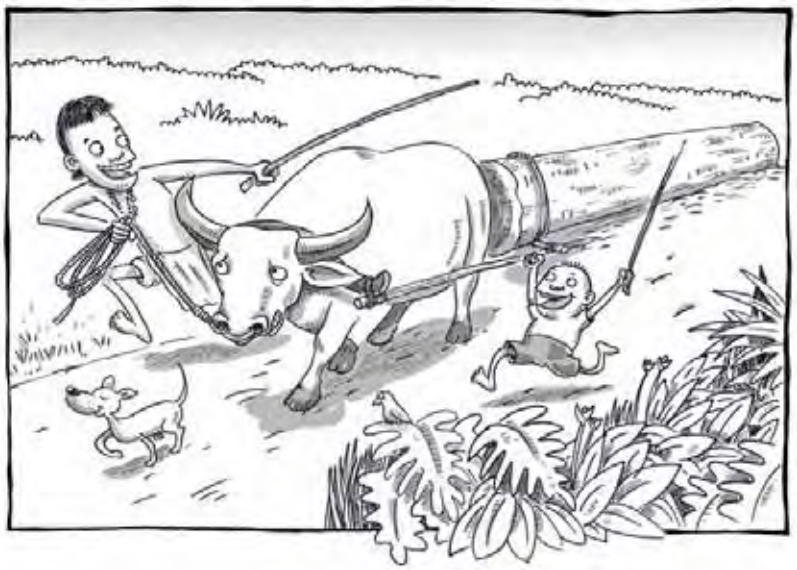
These processed NTFPs when sold in the market are then called commercial NTFPs. Carbon can also be considered a commercial NTFP because carbon conserved or sequestered under REDD+ can be sold on the "carbon market".

There is an intensive discussion going on at the moment about sustainable forest management for mitigating climate change, and how this can affect local and international trading of commercial NTFPs and other forest resources. Among other issues there is also a demand for the regulations of the harvesting of NTFPs in the name of reducing or preventing forest degradation. It is proposed that such regulation is done through certificates and permits to help ensure NTFPs and other forest products are extracted sustainably. However, these proposals are problematic for many indigenous communities since they may affect and limit their already precarious and unstable source of income. It is important for indigenous communities that any policies regulating forest conservation – whether it is about carbon, NTFP, biodiversity, etc. – need to take the right of indigenous communities to their resources and traditional livelihood as a point of departure.

For more information on NTFP you can visit: http://www.for.gov.bc.ca/hre/ntfp/; http://www.fao.org/docrep/x2450e/x2450e0d.htm and http://tradestandards.org/en/Topic.18.aspx

2. Community-based timber harvesting and wood processing

For most of us timber harvesting means large-scale commercial logging conducted by governments and private companies. However, community-based logging (or, community-based timber harvesting) has been practiced by indigenous and other forest communities since centuries, although mostly to cover their own needs for lumber and other wood products. Community-based timber harvesting and wood processing can be an important source of income for indigenous communities provided that communities have control over their forests and these forests are of sufficient size and in good health.



In Module 5, we will learn about a particular technology applied in community-based forest management: the Forest Improvement Technology (FIT), which is a technology of forest management that allows regular harvesting of lumber while keeping the forest healthy. The removal of lumber can not only provide a regular income but can also help increase the absorption of carbon by our forest.

Income from timber harvesting can be considerably increased if you process the lumbers instead of selling the raw lumber. The more you process the wood, the higher your income will be from your forest. So cutting lumber into boards, posts or bars and, even better, making furniture and other finished wood products can provide considerable and steady income. For that you will have to acquire the necessary knowledge and skills. There are vocational training schools run by governments and courses offered by NGOs which can help you acquire the necessary skills.

3. Ecotourism

Indigenous communities which have conserved their environment well may consider using this as an asset in engaging in another kind of income generation: ecotourism. It is the fastest growing area of the tourism industry. A healthy environment is a precondition for an ecotourism enterprise to succeed and sustain. In turn, income generated from ecotourism can contribute to reduce the pressure on the environment and help conserve it.

Tourism is defined as travel for leisure or recreation but the word also refers to the whole service industry that has developed around people's travelling. Ecotourism is defined as "responsible travel to natural areas that conserves the environment and improves the well-being of the local people".

Some of the basic principles of ecotourism are:

- Minimize impact;
- Build environmental and cultural awareness and respect;
- Provide positive experiences for both visitors and hosts;
- Provide direct financial benefits for conservation;
- Provide financial benefits and empowerment for local people;
- Raise sensitivity to host countries' political, environmental, and social situation.

Some characteristics of ecotourism are:

- **Focus or content**: It highlights destinations that have strong value in terms of natural resources, for example, high biodiversity and beautiful, striking or rare geographical formations.
- **Objectives:** The activities are planned to promote or profit environment objectives or causes, such as beach clean-ups, and benefit the local peoples.
- **Process:** At the very least, the travel does not harm the environment or the local people. For example, campfires indiscriminately using wood from a forest and exposing it to the risk of forest fires are not acceptable. Or catering from outside the community using ingredients that must be bought outside of the community is discouraged.

Many people do not recognize the difference between ecotourism and mass tourism. They are actually very different.

Table 2. The difference between ordinary tourist and eco-tourist

Features	Ordinary Tourist	Eco-tourist
Sidewalks	Concrete or asphalt	Grass or gravel
Facilities	Hotels with running water and other facilities	Tents or simple shelters with or without running water.
Attitude	Local people are in the business of serving the tourist and are expected to think first of money.	Local people are the caretakers of the environment and are to be respected and remunerated as good teachers.
Spending habits	Want to buy little curios for remembrance but do not want to spend very much.	Not much interested in curios but must have good photos or recordings.
Food habits	Not interested in local cuisine but wants to have good food. They often bring their own food with them.	Interested in local foods and willing to eat in local shops although they often do their own cooking.
Pollution	Usually careless about throwing plastic wrappers and other garbage. Expect others to clean up their garbage.	Frequently bring their own bags and carry away their own garbage. Avoid pollution.
Local customs	Continue their own customs and often impose them on the local community.	Usually respectful of local customs and show an interest in learning about local customs.
Results	Usually cause social and material pollution. Potential income for local people not great in the long run. Local community loses self respect.	Seldom cause any pollution. A good potential for local income in the long run. Local community grows in self respect.
Requirements	Produce curios. Be a servant for obnoxious visitors.	Maintain the environment well. Prevent damage. Provide guides and teachers.

With an ecotourism project, there is more assurance that the enterprise will protect the environment and foster respect for the indigenous culture. At the same time it can be a great tool for advocacy because ecotourism intends to touch the visitor at a personal level. It is hoped that the visitor may be moved to do something about the issues seen, even if just at the level of talking about them later. Exchanges between hosts and guests include "what can be done" and not just "what is there". To further ensure benefits for the locals, community-based ecotourism is encouraged. This is a form of ecotourism where the local community has substantial control over its development and management, and receives most of its benefits. Therefore, many development organisations believe that ecotourism has a large potential for sustainable development.

But there can be a negative side due to the conditions that make ecotourism a sustainable development enterprise. Because significant economic gains may not immediately be received, there

will still be a problem of addressing immediate income needs of the local community. Also, an ecotourism project will not be able to match the immediate profits from a mass tourism project. And even though the capital investment needed may not be as big as that for a mass tourism project, there may be a need to ask for financial inputs from outsiders, with all the dangers this implies.

In addition, an ecotourism project has to be at a smaller scale than a mass tourism project, and so the economic gains may never be as large as desired. Since it is smaller in scale, there is a danger of involving and thus benefiting fewer people than mass tourism. In addition, the smaller scale may make it more expensive for the individual tourist. That is why there are concerns expressed that ecotourism can be elitist because it may not be affordable to many tourists, especially if the community is more geographically distant and isolated.

In an ecotourism project, the danger of stereotyping or commercializing one's indigenous culture does not disappear, though it may be considered a good thing that if it does happen, it will be with less intensity. The community may also expect to clash with government agencies which are in charge of enforcing environment protection laws but often with little capacity or commitment to implement locally.

Despite the limitations and dangers described, the two long-term gains for the community from ecotourism – environment protection and respect for indigenous culture – will hopefully be seen as worthwhile against the short-term profits of mass tourism which in the end adds to the destruction of these two gains. It is also worth noting that in many ways, these are also the limitations and dangers faced by communities in contemplating projects that also pose danger to the environment and culture, such as commercial logging and mining, which may also be seen to provide immediate profits.

Ultimately, the key would be community-wide awareness-raising on the potentials and limitations of ecotourism, and a working participatory-governance system to ensure that involvement and benefits are available to all.

Chapter 4: Forests and Livelihood - Payment for Ecosystem Services

Ecosystem or environmental services are simply the benefits that people get from ecosystems. Ecosystem services are generally about maintaining the ecological balance. Nature has a system of keeping everything in it in harmony with each other such as birds eating fruits and helping to scatter seeds and thus allowing new trees to grow so that the future generation birds will also have something to eat. As butterflies flutter on flowers, they help spread pollens for new flowers to grow, this ensures that new butterflies also have flowers to flutter on. As trees and plants grow, they provide food and nesting sites for insects, birds and other animals, help maintain soil fertility and the cleanliness of water. All these are beneficial to animals and human beings. Keeping the rich biodiversity intact is an ecosystem service.

Biodiversity has many gifts to people. Trees help provide abundant water to farms, they help to make the water clean and safe for drinking and they help to control flood. Birds and animals also help in controlling pests (like insects or rats). Indigenous peoples often live in areas rich in biodiversity and have developed ways of using and managing natural resources which help preserve the natural environment and its biodiversity. But with rapid population growth, raising needs for cash income and scarcity of livelihood opportunities, there is an increasing threat to the balance of nature.

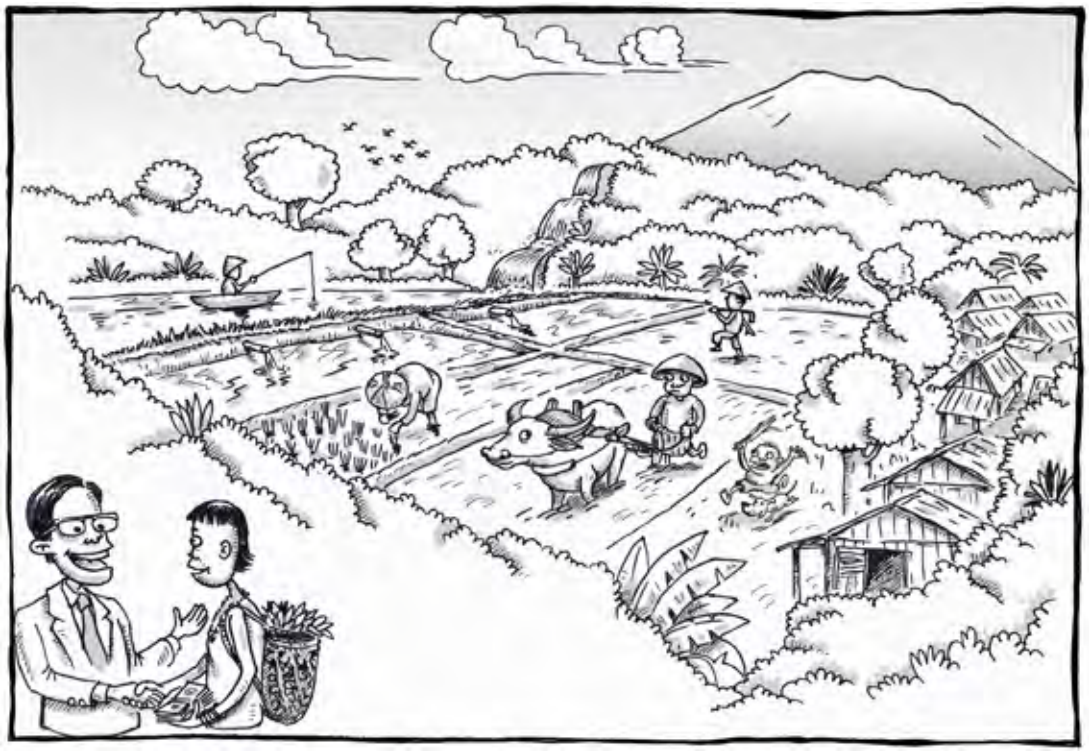
Given the increasing difficulties for indigenous communities and other forest people to make ends meet, it takes an effort to refrain from overharvesting and ensure sustainable use of natural resources, and therefore to conserve the natural environment and biodiversity. In other words: conserving the environment implies costs for the people living there. The idea behind Payment for Environmental Services (PES) is that other people, who benefit from the conservation effort of communities in a particular area, pay those communities a compensation for their conservation effort. This is the recognition of the "service" these communities provide while protecting the environment.

Since REDD+ is a kind of PES, it can be very valuable for us to learn about experiences made with other forms of PES. Therefore, we will discuss PES here a little more in detail.

What is Payment for Environmental Services

Indigenous peoples who live in forested areas are generally aware of benefits that those outside of their indigenous lands are not aware of. What is usually not imbibed is the reality that outside their communities, most if not all things are equated with a commercial or market value. This means that every single thing (like goods and services) can be measured in terms of money or currency. But that is the view on which the concept of PES is based.

PES can be simply defined as a way to ensure that those who provide environmental goods and services get paid by those who benefit from these goods and services. It may not always be a matter of cash payment; it may also be in the form of other compensation or rewards. The intention is that these payments or compensations will encourage the community members to use the land in a more sustainable, eco-friendly way.



A PES SCHEME IS

- A voluntary transaction where
- A well-defined environmental service
- Being "bought" by a (minimum of one) environmental service buyer from a (minimum of one) environmental service provider if and only if the environmental service provider is able to secure the provision of the environmental service

Example of a PES Scheme: Watershed Protection

Of the types of PES projects mentioned above, watershed protection is the most common. The people who live downstream clearly benefit from the water conserved and cleansed by a forest (the environmental service) upstream. For example, a company bottling mineral water (the environmental service user) will pay the people living upstream to keep the forests intact (the environmental service provider) so that there will be a sustainable flow of mineral water even in the future. A watershed management project is considered to have great potential for PES because it covers a more or less easily identifiable and comparably small area; there is easy identification of benefits, buyers, sellers; and the costs for making the exchange arrangement (transaction costs) are comparably low.

Motivations for Pursuing a PES Scheme

There are already many PES schemes that have been put into practice. The following are known to be already earning at a commercial scale:

- Watershed protection, such as protecting forests and reforestation in catchment areas of rivers, or planting trees along waterways
- Biodiversity protection, such as guarding an area with high biodiversity
- Landscape beauty, such as preserving an area for ecotourism
- Carbon sequestration and stock conservation, such as under REDD or the Clean Development Mechanism already discussed

But the motivations of the buyers may not necessarily be the motivations of the service provider (like a community protecting a watershed). The motivation for conservation (the "service") may not necessarily be the protection of the environment in itself, or at least not only that. It can be seen as:

- A source of monetary income for daily needs;
- A source of resources (not cash) for making a living
- An expression of upholding cultural and social values (like the cultural value of a particular forest where rituals are performed, where there are burial grounds, where certain spirits dwell, etc.)

However, the practice of assigning a "cash value" to an environmental service may help make a community more conscious of the importance of their own environment, and encourage them to preserve it.

A study of PES schemes in practice shows that the PES concept appears to be most suitable under these conditions:

- Small areas covered;
- The threats to the environment are not immediate or urgent; the environmental degradation can be observed or is acknowledged, but is not too widespread. High threats imply higher costs, so such an area will not be attractive to a buyer.

Critical Issues in Implementing a PES Scheme

A number of critical issues have emerged in implementing PES schemes.

- There is unequal distribution of impacts. When a PES scheme is put in place, the arrangement within the scheme may mean changes in who will have access to the resources and who makes decisions about the whole area. The poor are particularly vulnerable to having their access to daily needs (food and energy resources) restricted. Thus the impact of PES may not be equally distributed in a community.

- There is unequal distribution of benefits. The PES scheme is a business and therefore aims to make a profit. To make a greater profit, there will be a desire to reduce the implemen-

tation costs as much as possible. Therefore, the one initiating a PES scheme (usually the buyer of the service) might not be open to covering the cost of strengthening the capacity of more disadvantaged community members to be able to participate. In such a situation, those who already have the capacities (and are not the most disadvantaged members of the community) will be the ones to benefit. This means that not all will benefit equally.

- Who should receive payments or benefits? Should the payment be given to individuals in communities or the community as a whole?
- Should the payment be in cash or in kind? If the payment is in kind and in the form a physical structure like a road or a health clinic, will there be support as well for maintenance cost and human resources needed?
- The PES scheme may decide to pay those who engage in practices that are harmful to the environment, so that they will stop. If this is done, will this develop a feeling of "destructors" being rewarded? Will this encourage some people to start such practices with the expectation that they will be paid if they stop later on?
- Community members may receive cash income for practices that they used to do because of their importance to the community's solidarity or culture. If they now get paid money for the same practices, the social or cultural value of these practices might be undermined.
- When should the payment be given? When there is clear evidence that the environmental service has been given? Do the buyer and the service provider agree on what is "clear evidence"? What if the service has been given but other factors prevented a good result – will the buyer still agree to pay?

A number of conditions have been identified that make it more likely for a PES to be successful, for both environmental protection and poverty reduction. Among these are:

- Smallholders are the service providers;
- Supportive policies and procedures are in place;
- Poverty reduction is explicitly addressed;
- Resource rights and tenure are secured;
- Rights and responsibilities of all parties, including the intermediaries, are clearly defined;
- Fees are transparently assessed, collected, and effectively disbursed;
- The costs of making the exchange (called the "transaction costs") between buyer and service provider are minimized;
- PES scheme is designed to operate at national and local levels independent of long-term external financial resources.

Since PES projects are found to be more workable at a smaller scale, the PES scheme is generally seen as a local action. REDD+ is one form of PES, but REDD+ is a more large-scale (national and global) response. In some REDD+ projects, depending on the nature of the project, service providers and buyers may live far apart, actually on different continents. Experiences from existing PES suggest that such arrangements may be far more difficult to implement.

As with all PES, addressing the issue of rights is critical. Under REDD+, forest people are paid to maintain or increase carbon stocks either from funds or by trading carbon credits. However, for this to become effective, it is important to address land and carbon rights. Who owns the land? Who owns the carbon? Without clearly settling unresolved tenure issues, any PES scheme can become more of a threat for indigenous communities and benefit outsiders rather than indigenous peoples.

PAYMENTS FOR ENVIRONMENTAL SERVICES: WHAT THE IKALAHAN DO

Caring for a forest can be expensive. The problem is that the community that cares for the forest has to pay for all the expenses but other communities, usually very far away, harvest the benefits. This is unfair but it often requires legislation for a forest community to be paid for its protection of the forest. If a community, for instance, lives in a water shed forest it will want to protect that forest but the water that is produced will be used for generating electricity or irrigating farms in another province 20, 50 or even 100 km away. The province that benefits might not want to pay for the benefit.

The Ikalahan people in the Northern Philippines are keeping a record of the amount of water that is going from their rivers into the irrigation dam downstream. They are also working with the government to arrange that the people who benefit from the irrigation water should pay a small amount each year into a fund which would be given to the Ikalahan in exchange for the production of clean water. This may require a few years but the process is in motion.

One mountain community in Mindanao is already receiving regular payments for the water which is given to a large city downstream. This was done by a special contract by the city with the forest dwellers.

And a Final Point on the PES Scheme ...

A PES scheme depends on an economic valuation of nature. It is based on the assumption that someone is willing to pay money for conservation efforts, because they benefit from this service. But different people with different cultures have different views of the world and the environment. And they have different views of the value of forests. The value of forests and other aspects of the natural environment are not always measured with money. So there are tensions that arise from the fact that many indigenous peoples still do not view the importance of their environment in terms of its potential for generating cash income.

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Chapter 5: How to Make the Best Use of Your Land - Assessing Alternatives

Unlike what many people believe, tropical forests have not been untouched wildernesses until very recent time. In fact, humans have lived in tropical forests since thousands of years. These forests have been shaped by the presence of human beings. All species have an influence on their environment; some have a stronger and more obvious influence while other have a less visible influence. But for humans there are many different ways to live in tropical forests, each having different impacts on the forests. Today, it is not only the indigenous peoples who live in the forest, but many more outsiders, who are using the forest. Some just come and take resources out of the forests and leave. They don't live in the forest and are only interested in the wealth they can generate from forest resources. Other outsiders may come and seek to gain permanent control over parts of the forest, by converting it into a plantation, on which they settle labourers who work for them. Or there may be poor people who want a piece of land for themselves to farm, and who may be encouraged or even supported and brought there by governments.

Indigenous peoples themselves have many different ways of using the forest, and they have always adopted new knowledge and technologies from outsiders and applied them in their communities. This is increasingly the case today and land use is rapidly changing in many indigenous communities. REDD+ is a new form of land use, and when considering to adopt it, it is important to compare it with the other alternatives available.

Here we want to give a short overview of the different forms of land use in tropical forests, the advantages and disadvantages they have for communities, as well as for biodiversity and the climate.

a. Forms of land use in tropical forests

1. Hunting and gathering

Hunting and gathering of forest products have been the oldest ways of using tropical forests. Today, there are only very few indigenous peoples who rely entirely on hunting and gathering for their livelihood. People who live from hunting and gathering need comparably large forest areas and they need to be mobile. After having hunted and gathered in one area for some time resources get depleted and the hunter-gatherers need to move their camps to another area, which allows the previous area to recover.

Hunter-gatherers have the least impact on biodiversity. They just take what the forest provides and do not disturb it much. Since they are very mobile and move around in regular cycles within their territories according to the seasons and the resources available, the resources exploited have sufficient time to recover. This does not mean that overuse of resource does not occur. Species or parts of plants and animals that are in high demand by outsiders – like eagle wood or rhinoceros horn – are easily overused because of the high prizes they fetch in the market.
Today, by far most indigenous communities are practicing some kind of farming. But hunting and gathering of forest products is still an important part of their livelihood systems.

In general, hunting and the collection of forest products cause very little carbon emission. Of all humans, people who live entirely as hunter-gatherers certainly contribute the least to climate change. However, there are some exceptions, for example, the hunting techniques in which fire is used to flush out animals or when some communities, in the drier forests, regularly burn the undergrowth of the forest, partly to enhance the growth of certain plants they prefer.

2. Shifting cultivation

Shifting cultivation, also called swidden agriculture, is practiced widely throughout the world's tropical forests. Many indigenous peoples depend on shifting cultivation for their livelihood. In shifting cultivation, people make fields in the forest and cultivate them for a short time, sometimes just one year, sometimes a few years. Then they let the fields become forest again. The regrowing forest is the fallow which regenerates the land for future agriculture. The young forest growing on fallow fields still yields many useful products. It is also where people let their cattle graze, and many forest animals come to forage and graze in the young forest since for some it provides more food and fodder than the old forests. After a couple of years, that forest can be used for a new field again because in the meantime all the weeds, that make planting difficult, have disappeared, and the fertility of the soil has recovered.

Depending on the type of soil, the local climate, the preference of the people and other factors, the period of fallow is usually between 5 and 20 years. What we described here is the basic pattern. The actual forms of shifting cultivation practiced around the world are very diverse, they differ in the length of the cycles, the kind of forest used, the kind of plants planted, and the way the fallow is managed and used and in many other aspects. Common to all of them is that it is a form of agriculture that depends on forest and is a part of a forest landscape. Indigenous peoples practicing shifting cultivation usually keep a part of the forest untouched, since old-growth forest contain resources which cannot be found in the fallow forest. They usually combine shifting cultivation with fishing, hunting and gathering of a broad variety of forest products. They often also keep animals like cattle, buffaloes, pigs and goats which graze and forage in the fallow forests. Often, shifting cultivators also plant cash crops like coffee or rubber in separate, more permanent plots.

Shifting cultivation provides people with a broad range of products. It is combined with other activities, such as hunting, and gathering, husbandry and cash-crop production; therefore, people can lead a decent life with a high level of economic security, high quality nutrition and above all a high level of economic self-determination. Compared to hunting and gathering, many more people can live in a given area when they practise shifting cultivation. Compared to intensive permanent farming, like wet-rice cultivation, shifting cultivation, however, does not allow high

population densities. Long-fallow systems allow about 4 to 16 people to live on a square kilometre of forest, under short-fallow systems up to 64 people can make a living on a square kilometre with shifting cultivation. (IFAD et.al. 2001: 30)

Shifting cultivation changes a forest landscape considerably. Depending on how many people live in that area and how much forest is used for the shifting cultivation cycle, the changes can be minimal, or they can radically alter the landscape. When only a part of the forest is used for shifting cultivation, the changes brought about by turning forest into field and the subsequent young forests during the fallow period can be good for biodiversity. The landscape itself becomes more diverse, with forest patches of different age. And there is more biodiversity in a more diverse environment. However, when there are too many people and all or most of the forest is turned into fields, and the fallow period is so short that trees cannot become fully mature anymore, there is a sharp decline of biodiversity.

With regards to carbon and climate change, the situation is not so simple. Many governments now blame shifting cultivation for causing climate change because of the burning of forest. But this actually shows that they do not understand how shifting cultivation works. If they look at the whole picture, that is, if they looked at the whole cycle of cutting, burning, planting of fields and regeneration of the forest during the fallow, they would realize that whatever is cut and burned is growing back again, to be cut again for the next cycle. So overall, once the system is established, whatever carbon is released in burning is being absorbed again by the growing trees. Of course, there is less carbon locked in the vegetation in a shifting cultivation landscape as compared to an old forest with all its huge trees. But if we compare a shifting cultivation landscape with a landscape under permanent farming, like what is promoted by many governments, then we can conclude that there is a lot more carbon stored in a shifting cultivation landscape simply because much of the land remains under forest while on permanently used land there are comparably few trees.

3. Agroforestry

Since shifting cultivation is a form of land use which combines forest management with the production of field crops and animal raising, it is considered a form of **agroforestry**. However, there are other kinds of agroforestry. Any land-use systems, in which trees or shrubs are intentionally used within agricultural systems, can be considered agroforestry. Indigenous peoples and other forest-dwelling communities have developed diverse and often very complex agroforestry systems. Examples are the rubber agroforests of the Dayak in Kalimantan, where rubber trees are combined with fruit trees, bamboo and other useful tree and shrub species. Another example is the talun of the Buhid in the Philippines, who combine trees and palms like jackfruit, betel and coconut with bananas, coffee and rootcrops like Tannia (Xanthosoma sp.) and many others, depending on the preference of the owner.

Indigenous peoples usually combine agroforests with the production of food crops in other forms of land use, like shifting cultivation or permanent rice fields. In fact, among shifting cultivators, all this is integrated into one system, where fallow forests may become for example a rubber-agroforest, which will later maybe be cut again to make a field as other fallow becomes a rubber garden. People who depend on agroforests alone often need to buy staple crops like rice, so they are more dependent on the production and sale of cash crops. The level of economic security can be still high as long as a broad range of products are produced and sold. The fewer the products on which people rely for an income, the more vulnerable they are to the ups and downs of prices. The level of self-determination is also high as

people can decide freely what to plant when and how, what to keep, sell, barter, store or give away.

Agroforests change or replace the natural forest and, therefore, change the biodiversity of the natural forest. The impact of agroforests depends on how much of the original forest has been replaced. This can range from just planting a few rubber or fruit tree in a natural forest, through which biodiversity is even increased, to a complete replacement of the natural forest by a forest composed only of chosen species. It is important to look at it at a landscape level and not just as an individual plot of land. The impact on biodiversity on the whole depends on how much of a forest area has been turned into agroforests. Again, agroforests may enrich biodiversity, or they may reduce it, depending on how much of the forest area is transformed. But just like in a shifting cultivation landscape, biodiversity is generally higher than in an area of intensive permanent agriculture or plantations.

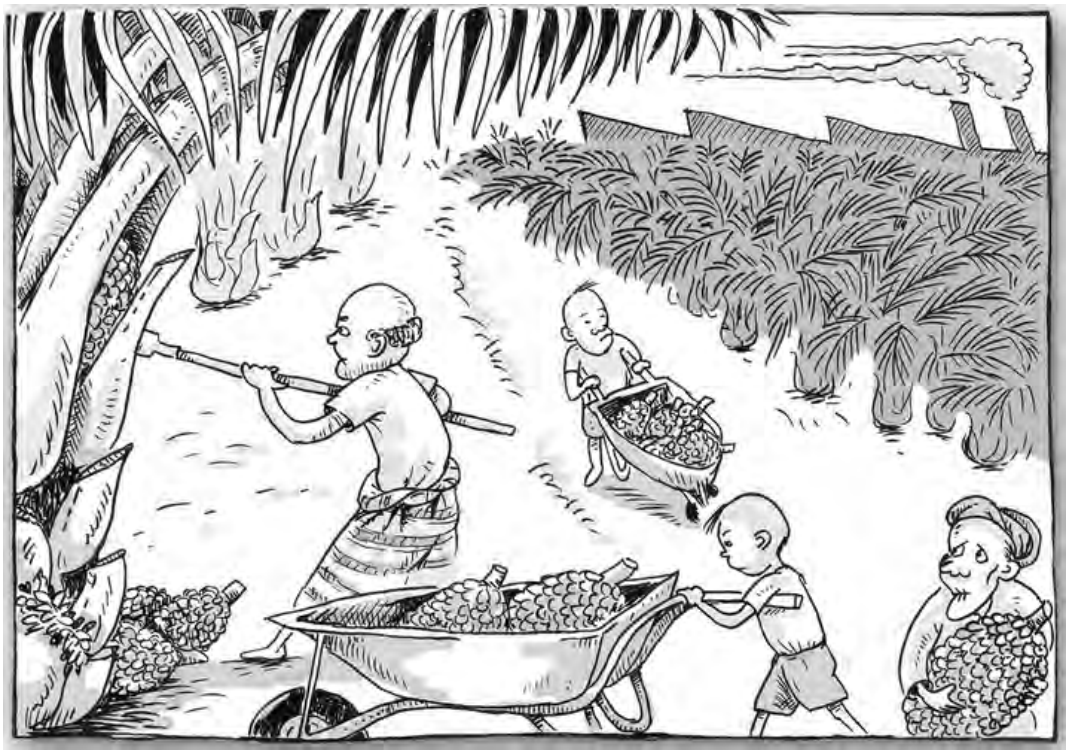
In general, agroforests store a lot of carbon and release very little. Just like a young forest, for many years, even decades after people have started planting them, agroforests absorb much more carbon than what they release. It is for this reason that they are also referred to as "carbon sink" (this means carbon is "sinking" from the air into the agroforests).

4. Plantations

There is a huge difference between an agroforest and a **plantation.** While agroforests are a kind of "man-made forest" with a high diversity of plants, a plantation is devoted to one single crop only, like oil palm, rubber, corn or sugar cane. Normally, a plantation is owned by a company, large land owner or the government. They employ labourers to work on the plantation. Often, a plantation is established on indigenous peoples' land and in many cases their land is taken away without their consent. In some cases, the communities may have agreed since they may have been promised compensations or jobs with a steady and good income.

Working on a plantation may indeed appear to give the security of a regular income. But whether the income is sufficient to feed and clothe a family, give education to the children, etc., remains a question that can be answered only by those who are working for the companies. It depends

on the labour laws in your country regarding minimum wage, the company's policy and the profits it is making. In any case, working in a plantation makes the labourers fully dependent on the company. They have almost nothing to say and therefore have lost their economic self-determination.



The number of people who can make a living on a plantation depends on the kind of plantation, i.e. the amount of labour required to run it and the technology used in the plantation. If it is a plantation using modern technology, a lot of machines will be used that will replace human labour.

In some cases, like oil or rubber palm plantations, the government or a company is converting community land into a plantation and gives each household a part of the plantation. Each family takes care of their part of the plantation and delivers the product – like the oil palm fruits – to the company for processing. There are many different forms of contracts between a company and the individual owners of the plots, with different arrangements regarding the costs of investments (like for seedlings, fertilizers, pesticide, transport to the factory, etc.) and the payments for the harvested crop. In Indonesia and Malaysia, many oil palm plantations are a combination of both. They are called Nucleus Estates and Smallholders (NES) scheme in which a company holds a refinery and an estate (plantation) surrounded by smallholdings. Oil palm plantations cause a lot of conflicts: between plantations and local communities or migrant smallholders, between migrants and local communities, or between communities and local governments.

The reasons behind these conflicts are manifold: it is not so much the rejection of oil palms as a crop, but unclear land tenure, promises that were not kept by the company or local government, unfair benefit sharing and problems within smallholders' cooperatives.

In any case, oil palm smallholders depend on a company which runs a processing plant, and the processing plant has to be nearby since the oil palm fruits have to be processed within 48 hours after harvest. And oil palm small holders are facing some other serious challenges: they have to invest considerable amounts of money for buying seedlings, fertilizer, transport (unless they have an agreement with the company), etc., and often end up having debts for many years.

In countries like Indonesia, oil palm is now becoming increasingly popular among smallholders. Oil palm attracts farmers because it can provide a very good income. The income is as good or

even better than from rubber and is much more profitable than rice production. There is actually no agronomic or economic reason why oil palms should be planted in large estates. In fact, small-holder palm oil production is considered a viable and ecologically much better alternative to large plantations. Under fair partnerships between smallholders and companies running the processing plant, oil palm could be a smallholder friendly crop.

The authors of a critical report on oil palm in Indonesia concluded: "Done right, palm oil should generate wealth and employment for local communities. Done wrong, oil palm estates can lead to land alienation, loss of livelihoods, social conflicts, and exploitative labour relations and degraded ecosystems".

The impact of plantations on biodiversity is catastrophic, especially since modern plantations often cover huge areas, therefore, destroying large forest areas. There are plantations in Indonesia owned by international companies which cover an area of 50,000 ha. There are only very few species of plants and animals that can survive in a plantation.

Depending on the kind of plantation, the carbon locked in it may be comparably high (like in a rubber plantation) or very low (like in a corn or sugar cane plantation). For quite many years, carbon is continually absorbed and very little is released in tree plantations (like rubber, oil palm or pulp wood plantations). But the problem is that in order to establish plantations, large areas of forest are destroyed, which releases enormous amounts of carbon into the atmosphere. When it comes to oil palm plantations, we also have to be aware that the processing mills are a source of air and water pollution.

Plantations of seasonal crops like corn, soy beans and sugar cane are even worse because there is hardly any carbon absorption anymore after the forest has been cut. And even the carbon in the soils, which remains quite well preserved for example in shifting cultivation, agroforests or also in plantations, is rapidly decreasing in such plantations.

5. Permanent farming of seasonal crops

The situation is similar when land is converted for small-scale permanent farming of seasonal crops, like when settlers move into a forest and try to recreate the kind of agriculture they practiced where they came from. Many governments also encourage or force indigenous peoples to abandon shifting cultivation and convert their swidden fields into permanent fields for growing seasonal cash crops like vegetables, ginger, flowers, etc.

Since this kind of agriculture depends on the use of agrochemicals such a fertilizer and pesticides, the farmers have comparably high investments. As long as the prices for the respective crop are good, it pays and in many cases, indigenous farmers switching to seasonal cash-crop production have experienced a considerable increase of income. But many also ended up with heavy debts when market prices fell and they could not even cover the investments they made. So permanent farming of seasonal cash crops can provide a good income as long as the prices are good, but it is more risky and farmers are well advised to at least avoid depending on one single crop only, and try and produce some of the food they need themselves. Therefore, many indigenous farmers who start planting seasonal cash crops continue planting food crops like rice, they keep animals and they still hunt and gather in the surrounding forests. Overall, cash-crop farmers still retain a comparably high level of self-determination as long as they are not too indebted or they don't enter into contract farming.

These landscapes are totally transformed by humans and compared to shifting cultivation landscapes or other forms of agroforestry, landscapes of permanent farming are low in biodiversity. But ultimately, this depends on the extent to which forest has been converted into permanent fields. Often, governments promote permanent land use in the name of forest conservation. So what happens is that we have a clear distinction between farming land and forest land. Under shifting cultivation this distinction is not so clear as a particular plot is moving in and out of the "forest" category. Where we have large forest areas mixed with permanent fields there may overall be quite a high biodiversity. Where there is little forest left, biodiversity is low.

The same applies to carbon: at the level of the field, the carbon stored is very low. At the landscape level, it simply depends on how much forest is left.

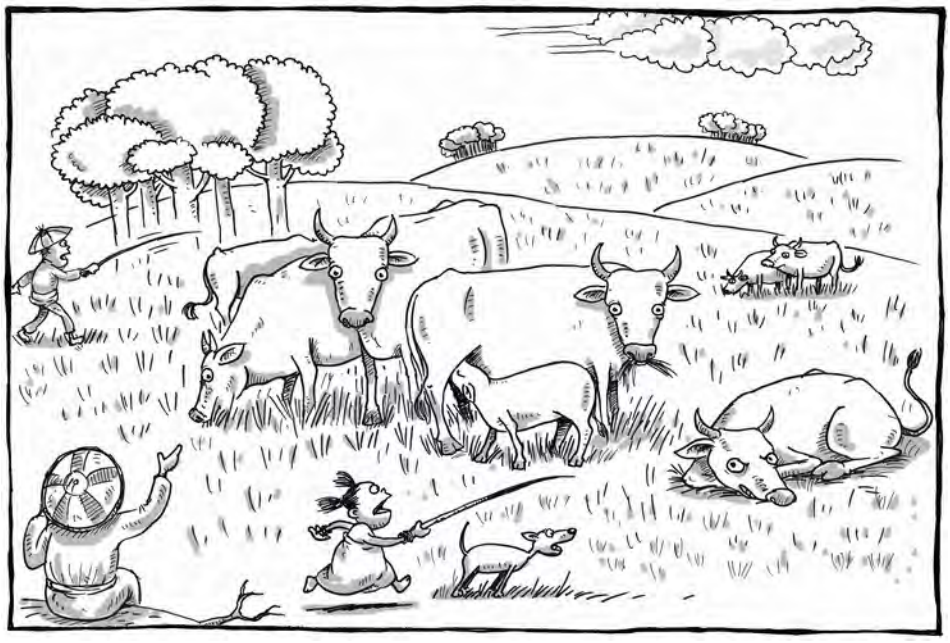
Wet rice (padi) is a very special case of permanent land use. It allows continuous production of rice on the same field over generations. But in the hilly and mountainous areas where most indigenous peoples live, there are very limited areas of land suitable for the construction of rice fields or terraces. While in some cases indigenous communities rely mostly or entirely on wet rice to cover the needs, with a little vegetable gardening and animal husbandry, more often it is combined with other forms of agriculture, like shifting cultivation, agroforestry or permanent upland cash-crop production, as well as with animal husbandry, hunting, gathering and fishing.

Like in the case of the permanent agriculture just described, the impact of padi fields on biodiversity depends on the extent of transformation of the landscape for padi fields. In the lowland plains of Southeast Asia, the once magnificent lowland forests have all been converted into padi fields. The impact on biodiversity was devastating. In the uplands, however, the areas transformed into padi fields are comparably small and their impact therefore limited.

With respect to carbon, the same can be said as above: at the level of the field, the carbon stored is very low. At the landscape level, it simply depends on how much forest is left. But with respect to padi fields we have to be aware that they release considerable amounts of methane gas, which is a very active greenhouse gas, much worse than carbon.

6. Pastures

Another radical transformation of forest land is to convert it into a **pasture** for cattle. This happens on a large scale in South America, but occasionally also in Southeast Asia, like in the uplands of the Philippines. The forest is completely replaced by grasslands used for grazing cattle. Indigenous peoples have traditionally kept parts of their land under grass, both for pasture and for thatch. But these areas are normally small and they do not diminish, but may rather enhance biodiversity. It may also be only a temporary grassland by just delaying the return of the forest and not a permanent grassland.



But where large areas are turned into grasslands, biodiversity is severely diminished. Also, few people can make a living from the land. There are usually only a few employees working as cow-hands for the owner of the cattle. It is not a viable option and thus no alternative to other forms of land use in tropical forests. With respect to carbon, its impact is devastating. Not only are huge amounts of carbon released when the forests are destroyed, the grasslands are also burned regularly to prevent forest growth and the fresh and nutritious shoots of grass, thus releasing more carbon.

7. Protected areas

Protected areas are established to conserve biodiversity. A particular forest may be declared as a protected area because it has high biodiversity, but these forests are also storing large amounts of carbon. The problem is that the establishment of a protected area often has severe impacts on indigenous communities since they are not allowed to continue using natural resources like they prefer. Protected areas give only few jobs, and only few of the few are given to indigenous community members of that area. So in most cases, the income that communities get in the form of employment in the protected area or in eco-tourism, or from the sale of handicraft to tourists, etc. is not sufficient to compensate them for the loss of resources, income and other benefits they used to have when they had free access to the forest.

8. Logging

Finally, outsiders have above all been interested in one form of using tropical forests: logging. The impact of logging on tropical forests depends very much on how it is practised. In clear cutting, all trees are removed. In selective logging, only the valuable trees are taken out. But this can also be done in different ways. Today, often heavy machines are used to bulldoze roads into the forest, to cut trees and pull them to the logging road, and trucks to take them out of the forest. Even though considered "selective" logging, many other trees are destroyed, the soil is disturbed and exposed, leading to erosion and the pollution of rivers. Low-impact commercial logging with light machines or, like in the past, with elephants, is very rare these days. However, low-impact sustainable logging is a possibility to generate income for communities under community-based forest management.

Depending on the form of logging practiced, the impact on biodiversity and carbon varies considerably. Low-impact logging allows most species, except those animals most sensitive to disturbance, to survive, while the destructive large-scale logging operations lead to a heavy and long-lasting loss of biodiversity. The same applies to carbon: under low-impact logging, the soils are left largely undisturbed and the carbon in the soil is preserved. Only a small portion of the carbon of the trees that are removed is released since the timber is usually used to make furniture, buildings and other long-lasting goods. Only the leaves, branches and waste wood

in timber processing are decomposed or burned. In contrast, large-scale commercial logging is extremely destructive. Aside from the trees cut for timber many more are destroyed as logging roads are constructed and large trees pulled out with heavy machines. It also has a tremendous impact on the soil and leads to severe erosion and thus loss of soil carbon.

Logging can generate considerable income, but the question is who benefits from that. The anthropologist Michael Dove (1985: 27) has tried to calculate the **comparative productivity of shifting cultivation and logging in Indonesia.** Indeed, in the early 1980s the Kantu in West-Kalimantan produced crops worth 258 USD per hectare every ten years. The profits made from logging per hectare and over the same period amounted to 1054 USD. This is about four times more. However, most of that money went into the pockets of the logging companies, the army and the forest department. When we look at how many local people could make a living from logging and shifting cultivation respectively, we get a different picture. Dove found that on a square kilometre of land, among the Kantu, 23 people could make a living with shifting cultivation. In one square kilometre under a logging concession, at the most 9 workers were employed. But these jobs are seldom permanent since workers in logging have a job in the long run only if logging is conducted sustainably, which is a rarity in Indonesia and in most other tropical countries.

Sources and references

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Chapter 6: REDD+: Comparing Costs and Benefits

When your community considers engaging in REDD+ you would have to find out how it would fit into your overall land-use system. In what parts of your territory would you want to implement REDD+ activities? What would be the impact? What other forms of land use would it replace? And above all: how would the gains from REDD+ compare with the losses if you have to abandon a certain kind of land use?

Ultimately, it is all about comparing the costs and the benefits of the different kinds of land use with that of REDD+, and assessing how much can be gained if one form of land is changed or abandoned in favour of REDD+.

A first assessment is of course focusing on the financial side of it. We already know that the financial benefits from REDD+ are the payments for activities that conserve carbon. But there are also costs involved, and this is what we are going to look at first.

a. What are the costs of REDD+?

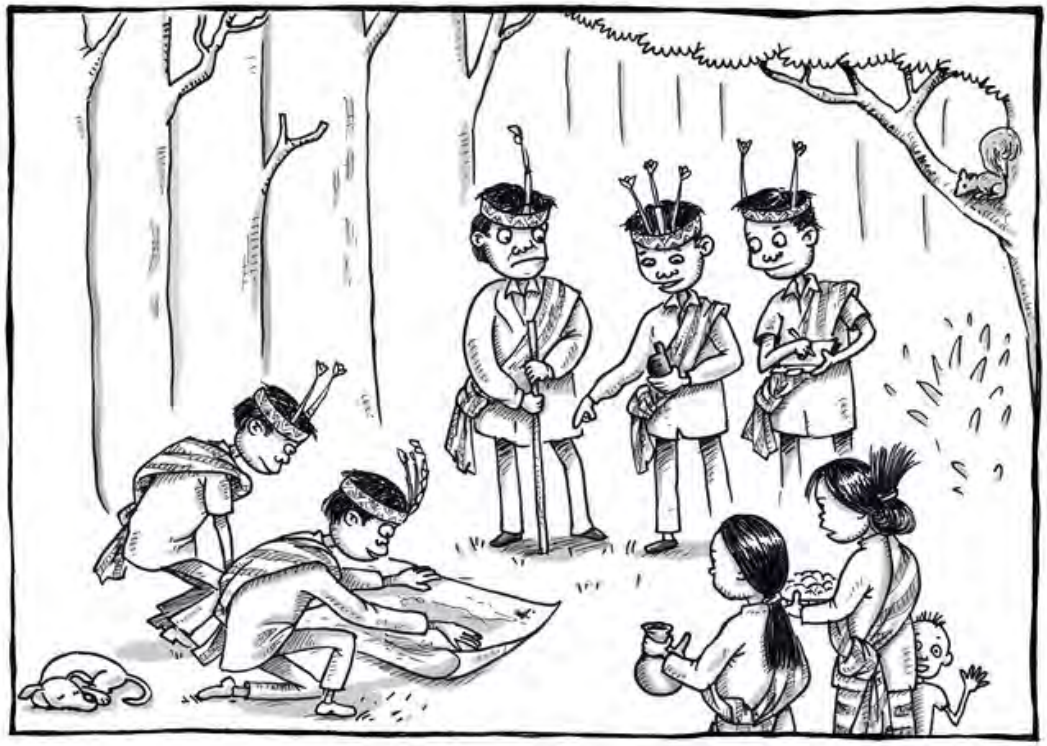
There are three different kinds of costs involved when engaging in REDD+. Some of the costs occur at the regional or national level, to be covered by the government when it is engaging in REDD. We are not going to discuss these, but confine ourselves to the costs at the local level, which the communities may have to at least partially cover, depending on who else is involved in the project.

There are three kinds of costs involved:

1. Implementation costs
2. Opportunity costs
3. Transaction costs

Implementation costs

These are the costs of the activities needed to reduce deforestation and forest degradation, for conserving or enhancing carbon stocks.



Examples of such costs are:

- Delineating and/or titling land when this is not yet done so that you will also have the right to guard your forests and prevent others from encroaching on it for illegal logging, establishing plantations, etc.;
- Replanting trees in degraded or logged forests;
- Providing capacity building, infrastructure or equipment to develop alternative livelihoods to communities;
- Changing timber harvesting methods;
- Intensifying agriculture or livestock husbandry so that less forest land is needed.

Some of these costs have to be covered through investment at the start of the project, others are recurring costs.

It is important to keep in mind that there are also costs involved for capacity-building and strengthening of your institutions at the beginning of the project. These are necessary for your community to be able to handle and keep control over the project. Examples of such costs are: training and research, consultations with government agencies, NGOs, carbon verifiers and the discussions within your own community in order to be able to make proper decisions.

Transaction costs

Transaction costs are the costs involved in establishing and operating a REDD+ project, but not directly implementing it. Examples of such costs are expenses you have when planning and preparing the REDD+ project, when you conduct negotiations with government agencies, NGOs or companies, costs you may have for lawyers or experts to advice you, or the costs of monitoring, reporting, and verifying (MRV) the emission reductions. Especially the MRV (including its preparation at the start of the project) can be quite expensive if you have to use a recognized certifier. We will get back to MRV and the certifier later.

An important part of any REDD+ activity is stabilization, which means the need to prevent deforestation or degradation from moving to another area. In REDD+ this "moving somewhere else" is called "leakage". Communities can deal with leakage only to a certain extent, within their own territories and maybe in neighbouring areas. Leakage has to be addressed also at a higher level, the national level, by the government of your country. So it is not yet clear to what extent communities participating in REDD+ will have to include costs for stabilization, i.e. preventing leakage.

Opportunity costs

These are the costs which result from the decision to stop a particular kind of land use and do something else (like REDD+) instead. Or, in other words, they are the costs of the loss of the income or other benefits you would have received had you continued with the kind of land use you were practicing.

There are direct and indirect economic opportunity costs, and there are also social and cultural costs that need tom be taken into account.

Direct costs

For example, activities that are considered a kind of forest degradation, like selective logging, the collection of firewood or other forest products, or the grazing of animals in forest areas provide considerable benefits to people. If you decide to stop some or all of these activities in a certain area for a REDD+ project you are losing these benefits. And the loss of these benefits are (part of) the opportunity costs of REDD+.

Or you may consider turning part of your forest into a rubber garden, or plant coffee, fruit tree or oil palms, which would generate a certain regular income. If you decide not to deforest that area and use it for your REDD+ activities instead, you are losing that (future) income from the planned garden or plantation. This loss of a future income is also an opportunity cost of the REDD+ project.

The direct opportunity costs are in most cases the biggest part of the costs of a REDD+ project.

THE IMPLEMENTATION AND TRANSACTION COSTS OF REDD

The estimates for the implementation and transaction costs vary considerably. Some estimate them to lie between US$2 and 10 per ton CO2e. (Olsen, N. and J. Bishop 2009). According to others it is between US$ 2 and 4 USD per ton of avoided emissions.

(The Economist 2010.)

Indirect costs

Since a REDD+ project may bring about changes in land use, this can affect not just the people practicing it, but also other people who are somehow linked to that form of land use. For example, if logging is stopped in an area the saw mills will have no more logs to process, or there might be a local plywood or furniture factory which will have difficulty obtaining the wood they need. The price for wood may increase in that area, and the government will get less income from fees and taxes.

For communities these indirect costs are usually far less relevant than the direct costs when assessing the costs and benefits of REDD+, but it is always good to also keep in mind what impact ones actions have on others.

However, there are some other direct costs of REDD+ for a community, which can be considerable but cannot be measured with money.

Social and cultural costs

Stopping certain land use practices can have a considerable impact not only on the livelihood but also on the social relations and the culture of a community. These include changing work patterns and the social relations that are linked to them, the loss of traditional knowledge re-

lated to that form of land use, or it may have an impact on the spirituality of some people or the whole community if religious life is closely connected to the activities that are to be changed or stopped. The loss of certain forms of land use may actually bring about a drastic loss of identity. A good example is shifting cultivation. If a REDD+ project was to impose stopping shifting cultivation, it would not only mean opportunity costs in terms of the loss of a wide range of food and other products from shifting cultivation fields and the fallow land (like non-timber forest products, grazing land for livestock, hunting, etc.), but would also cause social and cultural costs. In many indigenous communities, the ritual cycle is closely linked to shifting cultivation and there is no other activity that can replace that. It may also lead to the disappearance of labour exchange or collective labour, which is often found in shifting cultivation. This will again have an impact on the social relations within a community.

OPPORTUNITY COST

A benefit, profit, or value of something that must be given up to acquire or achieve something else. Since every resource (land, money, time, etc.) can be put to alternative uses, every action, choice, or decision has an associated opportunity cost.

As an example, picture yourself and some friend going out and eating together in a restaurant:

You have the choice among several dishes (several opportunities). The opportunity cost of eating rice with fish could be trying rice with chicken. The opportunity cost of ordering both rice and fish could be twofold - the extra money to buy the second dish, and your reputation with your friends, as they may think you to be greedy or excessive for ordering two dishes.

TRANSACTION COST

A transaction cost is the cost associated with exchanging goods or services. They include costs like communication charges, legal fees, informational cost of finding the price, quality, and durability, etc., and transportation costs.

Wikipedia gives the following example:

"Or consider buying a banana from a store; to purchase the banana, your costs will be not only the price of the banana itself, but also the energy and effort it requires to find out which of the various banana products you prefer, where to get them and at what price, the cost of travelling from your house to the store and back, the time waiting in line, and the effort of the paying itself; the costs above and beyond the cost of the banana are the transaction costs. When rationally evaluating a potential transaction, it is important to consider transaction costs that might prove significant."

b. What income can we expect from REDD+?

In order to be able to compare the costs and benefits of different forms of land use with REDD+, you need to have an idea of how much income REDD+ will generate.

This will of course depend on the particular project and above all on the kind of funding, i.e. whether it is through a fund or through the carbon market. Then it will depend on a number of other factors which determine the amount of carbon emission prevented or carbon sequestered, like the size and type of forest, etc. Since the purpose is to get a rough idea of what you can expect, you do not need to make very detailed calculations. In any case, i.e. whether the financing source is a fund or the carbon market, the income from REDD+ will depend above all on the amount of carbon you are going to "produce" (which you prevent from being emitted or which you help sequester). For a rough estimate of what you can expect to earn you need to know:

- The size of the land area devoted to REDD+;
- The types of vegetation found there, the area of each of these and the amount of carbon presently stored in each of them;
- The kind of activities you are planning to get engaged in: avoiding deforestation or degradation or both; forest conservation, reforestation, etc. and the expected carbon increase or avoided loss of carbon through these activities.

With an initial rough estimate of the carbon (or more precisely: the carbon dioxide) you can expect to save from emission or increase in the vegetation per land area (per hectare), you can calculate the expected income from REDD+.

How much money you will ultimately get depends on two factors, the form of payment and the price of carbon.

a) The f orm of payment

The first factor is whether the payment will come from a fund, a donor-financed program, or from the carbon market.

There is still no global agreement on how REDD+ will be funded. Such an agreement is expected to be reached at the upcoming Conference of Parties (COP) of the UNFCCC, in December 2011 in Durban, South Africa. Most likely, there will be a combination of funding sources, so there will most likely be a possibility to choose between different forms of payment.

It is important to distinguish between the different forms of payment systems because they have different implications. The carbon market solution, for example, has been heavily criticized, among others because it would allow rich countries to continue polluting the atmosphere if they can "compensate" this by buying "cheap" carbon credits from REDD+. We have discussed this in detail in part II of the first community guide "What is REDD?"

Another implication is the amount of money that will reach the community. Like with any goods that are sold through the market, only part of the price that you pay in the shop goes to the actual producer, like the farmer. The larger part of the price is divided among the retailer (the shop keeper), the wholesaler (the trader), maybe a processer (processing and packaging) and the government (for taxes).

The most basic distinction usually made is between the farm-gate price (this is what the farmers get when they sell their product), and the wholesale (or sub-national) market price (which is the price at which goods are bought and sold in the national market). There is also a border price or export price (the price fetched when goods are exported abroad).

Farm-gate prices, however, make up only a fraction of the national or international market price. According to the World Bank, farm-gate prices lie between 20 and 95% of a national or international market price (2011 p. 6-4).

The same distinction needs to be made for carbon: a community will get only part of the price of carbon on the international market, depending where and to whom they will sell it.

If a REDD+ project is funded through a donor-financed program or a fund it is likely that a larger part of the funding reaches the community. Furthermore, it is also possible that payment will not only depend on the amount of carbon emission prevented or carbon sequestered but also take co-benefits (other eco-system services like biodiversity conservation etc.) into consideration.

b) The price of carbon

When a REDD+ project is to be funded through the carbon market the income you can expect will of course depend on the price of carbon.

When we talk about "carbon" we actually mean carbon dioxide, which is calculated in tons of carbon dioxide equivalent or tCO_2e. One ton of carbon stored on plants is equal to 3.67 tons of CO_2e. Carbon dioxide equivalents are currently traded mainly in connection with the Kyoto Protocol. In order to reduce the emission of carbon, countries have been allocated certain amounts of carbon emission allowances (amounts of carbon they can emit), or they can create carbon credits like through the Clean Development Mechanism projects. Each of the countries that signed the Kyoto Protocol has to establish mechanisms through which they comply with the Kyoto Protocol's regulations. This has resulted in specific emissions limits that were defined for individual companies in the more carbon-intensive industries. The countries are also supposed to establish a trading mechanism, through which carbon permits and credits can be exchanged. These are called Regulated Markets for emission allowances.

The largest of these trading schemes or Regulated Markets is the European Union Emission Trading Scheme (EU ETS) which includes all 27 member countries of the European Union, as well as three non-EU countries: Norway, Iceland, and Lichtenstein. It is the world's largest market in greenhouse gas emissions. They are trading the so-called European Union Allowances (EUA).

Under the Kyoto Protocol's Clean Development Mechanism, companies from rich nations can invest in emissions-cutting projects in developing countries, and in return receive

CERs (Certified Emission Reductions) which can be used towards their own emissions reduction goals or sold for profit.

End of April 2011, the prices for the EUA stood at 16.77 EUR, the price for CER stood at 12.57 EUR. (http://www.carbonplace.eu)

However, carbon credits as generated by REDD+ are not recognized under the Kyoto protocol and, therefore, cannot be traded in these markets. For example, the EU ETS does not allow emissions reductions credits from forestry projects to be included. One of the most critical decisions of the UNFCCC in the near future will have to be on whether and how REDD+ carbon credits can be traded, whether they will be treated like all other carbon credits or, if there will be a market for REDD+ carbon credits, whether this will be a separate market.

At present, REDD+ carbon credits are being sold on a so-called "voluntary carbon market". This means that companies are ready to buy such carbon credits for ethical reasons, to compensate for emissions caused voluntarily. They are motivated by what is called "corporate responsibility". However, some companies do it because they expect to be forced to do so by law very soon and think they could get carbon credits (emission allowances) cheaper when they buy them now. In 2010, buying and selling of carbon credits on the voluntary market happened through the Chicago Climate Exchange (CCX) and the so-called Over-the-counter (OTC) market, where participants trade over telephone, facsimile or electronic network instead of a physical trading floor. There is no central exchange or meeting place for this market.

The amount of carbon emission allowances traded in the voluntary market is much smaller than those traded in the Regulated Market.

In 2009, a total of 94 million tons of CO2e with a value of 387 million USD were traded on the voluntary market. In the Regulated Market, it was a total of 8,625 million tons with a value of 143,897 million USD. Therefore, in terms of volume, the voluntary market covered only 1% of the total amount of carbon traded in 2009.

The fact that the trading of carbon is done voluntarily in the voluntary market is also reflected in the price. In general, carbon credits traded on the voluntary markets have so far fetched only 10-20 % of the price in the Regulated Market (also called "Compliance Market") like the European Union's Emission Trading System. (Butler, Rhett A. 2009)

In 2009, the average price of CO_2e on the Regulated Market was 16.68 USD, whereas, in the Voluntary Market, it fetched an average price of 4.12 USD per ton. The different kinds of carbon credits had quite different prices too. While CO_2e under solar energy projects were sold for up to 33.8 USD per ton, for projects on avoided deforestation, the price was only 2.9 USD per ton of CO_2e. And the volume of carbon traded for avoided deforestation was only 7% of the total volume traded. (Ecosystem Marketplace and Bloomberg New Energy Finance. 2010)

If carbon from REDD+ is allowed to be traded in the Regulated/Compliance Market, its price will most likely rise. However, others fear that a flood of REDD+ carbon credits will bring down the overall price of carbon. So it is difficult to say at the moment what price we can expect for carbon credits from REDD+, and therefore, we need to use a rather conservative figure for our assessment.

INCOME FROM REDD FOR COMMUNITY FOREST MANAGEMENT

The "Kyoto: Think Global Act Local" project has investigated the feasibility and cost-effectiveness of training local people already engaged in CFM to map their forests and measure annual carbon stocks. The project encompasses approximately 20 sites in six countries, including mountain forests in India and Nepal and savannah forests in Africa. Annual increases in carbon stocks due to CFM at these sites are in the range of 1–3.5 tonnes/ha for mountain forests and 0.5–1.5 tonnes/ha for savannah forests, equivalent to around 3.5–12.5 and 1.5–5.5 tonnes/ha/year CO_2 respectively. Emissions avoided should also be included (because the forest has not been allowed to degrade) and could conservatively be estimated at 3.5 tonnes CO_2 per ha/year.

It is not yet clear how much this carbon would be worth on the world market (currently CO_2 from CDM projects is valued at €5 –20 per tonne), and there would of course be overhead costs involved in independent verification and trading, but costs of the forest inventory as undertaken by local people are estimated to be around only €2-3 per ha/year. Even at the forest-gate price of €2 per tonne CO_2, CFM would make economic sense. It could bring a new source of income to the communities involved and encourage others to start.

Source: Skutsch, Margaret 2008

WHEN AND HOW IS PAYMENT MADE UNDER REDD+?

REDD+ projects usually have a duration of at least 20 years, more common even 30 years. In the contract, a payment is agreed on for the carbon credits generated over the whole project period.

Typically, it is an agreement on a "forward purchase" at a fixed price. This means the total amount of carbon to be bought is calculated and a fixed price is agreed on. Payment is usually done when the verified credits are "delivered" according to the standard used (for example the CDM or VCS standard; see more on standards in Module 3). This is called a "spot purchase" or "payment–upon delivery".

This form of sale is good for the buyer since it reduces the risk of paying for carbon that cannot be delivered. Since there is little risk, the carbon price should be high. However, there is a problem for those selling the carbon: they do not have any income until the first verification is completed, which usually happens every two years. So the seller would have to cover all the initial investment and run the project for at least two years without any payment until the first payment is made.

There are buyers who are willing to make pre-payment on a portion of the credits, but only in return for a lower price to compensate for their risk.

Covering the initial costs of a REDD+ project is one of the biggest problem for communities, since these costs can be very high (see example of financial projection for the Oddar Meanchey project in Cambodia on next page). In addition to an agreement that includes pre-payment, there are other possibilities for dealing with this, like seeking support from donors, taking loans, or offering the possibility for investment in the project to others, who will then get a share of the profits.

Source: Poffenberger, M., S. De Gryze, L. Durschinger 2011

Table 10: Financial Projections without Carbon Sales

CATEGORY	CUMULATIVE TOTAL PER PERIOD						
	0-5yrs (with start-up)	6-10yrs	11-15yrs	16-20yrs	21-25yrs	26-30yrs	Total
Project Costs							
Project Design and Prep Costs	$100,850	$0	$0	$0	$0	$0	$100,850
Project Implementation Oversight	$1,412,038	$0	$0	$0	$0	$0	$1,412,038
Establishment and Equipment–Project Actions	$373,116	$181,800	$177,200	$177,800	$162,200	$196,800	$1,268,916
Ongoing Project Costs	$921,000	$1,165,000	$1,115,000	$1,115,000	$780,000	$780,000	$5,876,000
Total Project Costs	$2,807,004	$1,346,800	$1,292,200	$1,292,800	$942,200	**$976,800**	**$8,657,804**
Inflation on Project Expenses	$121,713	$103,875	$83,213	$82,480	$65,927	$59,900	$517,108
Total Project Costs with inflation	$2,928,716	$1,450,675	$1,375,413	$1,375,280	$1,008,127	**$1,036,700**	**$9,174,912**
Carbon Monetization Costs							
Carbon Preparation Costs[1]	$36,000	$0	$0	$0	$0	$0	$36,000
Up-front Validation, Registration Registry Costs[1]	$189,277	$157,060	$162,151	$137,648	$93,022	$50,265	$789,422
Transaction-Related Costs[1]	$15,000	$0	$0	$0	$57,675	$31,165	$103,840
Ongoing Carbon Monitoring and Verification Costs[1]	$144,173	$264,260	$219,173	$264,260	$219,173	$264,260	$1,375,298
Total Carbon-Related Costs[1]	$384,450	$421,320	$381,324	$401,908	$369,870	**$345,689**	**$2,304,560**
Total Project and Carbon Costs	$3,313,166	$1,871,995	$1,756,737	$1,777,188	$1,377,997	**$1,382,389**	**$11,479,471**

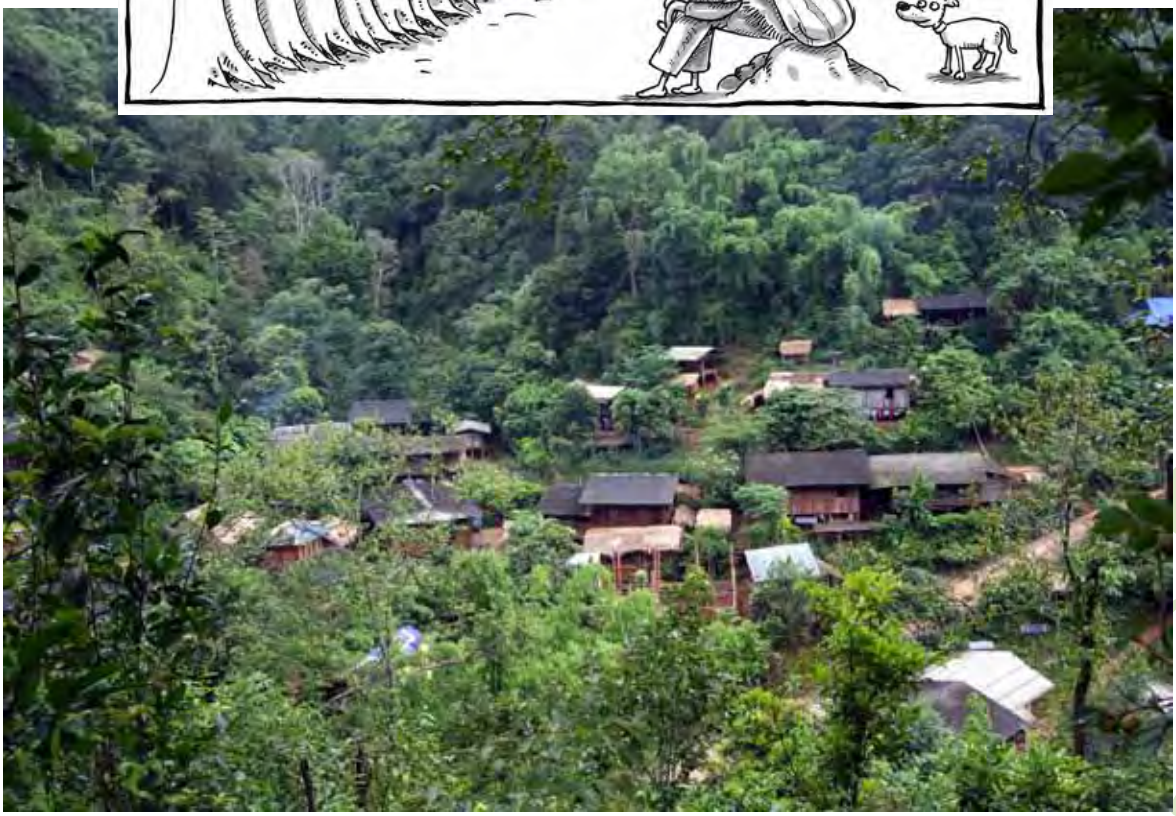
1. The carbon monetization costs excluded: methodology development, standard operating procedures for biomass inventories, PD development for VCS and CCB, support for development of monitoring systems, structuring of in-country agreements, development of financial projections, marketing of credits as these were provided in exchange for carbon credits.

Table as in: Poffenberger, M., S. De Gryze, L. Durschinger 2011, p. 59

c. What is the best choice? Comparing alternative forms of land use

As already pointed out, the biggest costs to be considered when thinking about engaging in REDD+ are the opportunity costs, the costs resulting from the loss of benefits when you chose not to engage in a new form of land use, or to give up a certain form of land use in favour of REDD+.

Several studies have already been done to assess the opportunity costs of various forms of land use. To make the comparison with REDD+ easier, the income of different forms of land use is converted into US Dollar per ton of CO_2e. In other words: it is the prize that would have to be paid for a ton of CO_2e if the forest was not converted into that particular form of land use.



ASSESSING THE OPPORTUNITY COSTS OF REDD+: AN EXAMPLE

The figure below summarizes the carbon stock and profits of each land use. The forest has approximately 250 tons of carbon per ha (tC/ha), whereas agricultural use has about 5 tC/ha.14.

The estimated profits from agriculture are $400/ha, while forest profits are $50/ha, expressed in Net Present Value (NPV) terms. NPV is used in business to assess whether an investment or project should be made or not, which means: whether it would be profitable. NPV is the present value of the expected cash made in the future minus the initial investment and future expenses over the same time.

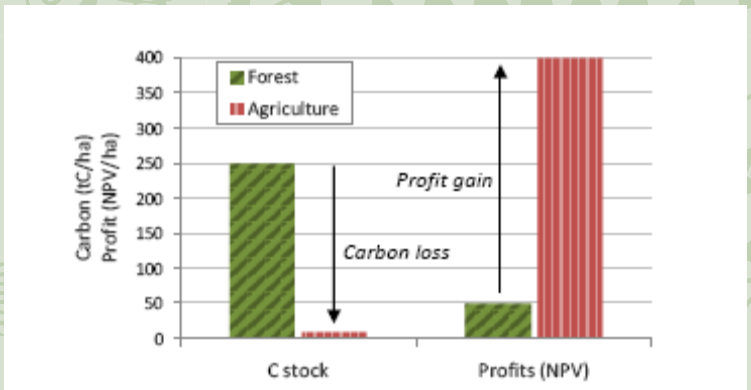


Figure: Carbon loss and profit gain from converting forest to agriculture

While the forest stores more carbon, agriculture produces more profit. Converting a forest into an agricultural land use increases profits by $350/ha but reduces carbon stock by 245 tC/ha.

Therefore, the opportunity cost of not changing forest to agriculture is equal to the $350/ha of profit difference ($400–$50=$350/ha) divided by the 245 tC/ha notemitted (250– 5=245tC/ha). Thus, the opportunity cost, per ton of carbon, is $1.43/tC (=$350/245tC).

However, REDD+ compensations are paid per ton of carbon dioxide equivalents (CO2e). One ton of carbon is equivalent to 3.67. tons of CO2e. So the 245 tC/ha not emitted are equal to 899tCO2e/ha.

By dividing the $350/ha profit difference by 899t of avoided CO2e emission per ha, we can calculate the opportunity cost of not converting a forest into agricultural land to be $0.39/tCO2e.

This means the REDD+ project would have to get a carbon price per ton CO2e of at least $0.39.

Adapted from: The World Bank 2011, p. 1-17f

Since the expansion of oil palm plantations is one of the biggest drivers of deforestations in Southeast Asia, a lot of focus was put on estimating the opportunity costs for oil palm plantations. For example, according to Indonesia's National Council on Climate Change, the opportunity cost of forgoing an oil-palm plantation is $30 a ton of CO_2e. Others concluded that a carbon price of US$18-46 per ton of CO_2e would be needed so that income from REDD credits could cover the opportunity costs of an oil palm plantation (Koh, Lian Pin and Rhett A. Butler 2010). Other estimates are lower (see box on the next page).

OPPORTUNITY COSTS FOR SOY BEAN, OIL PALM AND LOGGING

A study conducted by the International Union for the Conservation of Nature (IUCN) looked into the income generated from different forms of land use in Brazil and Indonesia in order to see how REDD+ compares with them, or, in other words, what are the opportunity costs of REDD+. The study also calculated with US$1/ton CO_2e as a rough global estimate of implementation and transaction costs.

For soybean production in Brazil, they found the opportunity costs range from US$2.5 to US$3.4/ton CO2e. To this one would have to add US$1/ton CO_2e for the implementation and transaction costs.

In another calculation, in which they included an initial income from the harvesting of timber followed by cattle ranching and soybean production, plus the addition of implementation and transaction costs increases, the costs per ton ofCO_2e came up to US$7.1.

In Indonesia, they found that the highest opportunity cost of REDD occurs where forest conservation competes with palm oil production. Most palm oil production generates returns (and thus opportunity costs) equivalent to US$3–7/ton CO2e, but range between US$0.49/ton CO2e for small holder farming in Sumatra up to US$19.6/ton CO2e for conversion of degraded forest land to palm oil. Unsustainable logging is the next most profitable land use. Opportunity costs range from US$1.65/CO2e for commercial logging in Sumatra to US$3.44/ton CO2e for unsustainable commercial logging in Southeast Asia and the Pacific.

Source: Olsen, N. and J. Bishop 2009

If we only look at the money that can be made on a particular piece of land, then we see that the opportunity costs for REDD are quite high where the alternative form of land use can generate high income, like with oil palm. So from a purely profit-oriented point of view, REDD+ can only compete with such forms of land use if the land contains good forest so that a lot of carbon credits can be generated, and, of course, if the price for carbon is good.

Now let us look at the opportunity costs of a few different forms of land use, which have been calculated for Indonesia. The table on the next page summarizes the findings. It is important to note that the calculation uses two scenarios, one for areas with forests on ordinary soils, and one for forests on peat soils which have a very high carbon content. So deforestation results in the loss of considerably more carbon. It is also important to note that the researchers had to use a price for commodities, such as palm oil, which reflects the rice level over a longer period of time. Naturally, as prices for commodities produced in plantations go up and down, so do profitability and, therefore, the opportunity costs.

Table 3. Opportunity cost estimates in Indonesia by land use

Land use		Opportunity cost $/ton CO2e			
		Low carbon content (a)		High carbon content (b)	
		Low estimate	High estimate	Low estimate	High estimate
Oil Palm	Large scale		6.3		2.1
	Supported growers		5.1		1.7
	High yield independent		4.4		1.5
	Low yield independent		1.8		0.6
	Smallholder		0.5		0.2
Rubber		0	4.2	0	1.6
Subsistence agriculture		0	1.53	0	0.47
Logging		3.82 (Sumatra)	7.96 (SEA + Pacific)	1.65 (Sumatra)	3.44 (SEA + Pacific)

Source: Olsen, N. and J. Bishop 2009, p. 42
(a) Refers to forests on ordinary soil with average soil-carbon content, while (b) refers to soils on peat soils which have a very high soil-carbon content.

Unless your community is engaged in large-scale plantations and logging, the more important figures are those for smallholder oil palm, for rubber and subsistence agriculture. In all cases, the opportunity costs have been calculated to be rather low. This means that income from REDD+ could be more profitable than any of these kinds of land use.

But you have to be careful not to come to a conclusion too quickly since there are some potential dangers involved.

First, by concluding that the opportunity costs for REDD+ are low in areas of subsistence agriculture, smallholder oil palm or other agroforestry systems can also mean it is cheaper for investors to implement REDD+ in these areas than in areas that are designated for large-scale oil palm plantations or for logging. Or it may mean that they would pay lower prices for carbon to communities than they would have to pay to oil palm or logging companies. Which would bring the REDD+ investor higher profits. Keep this in mind when you are having your negotiations.

Second, this calculation is only about money, and does not include other costs, like the social and cultural costs we have talked about earlier. Or the costs for biodiversity, or the costs for the loss of ecosystem services which forests provide.

The price for carbon does so far not include these so-called additional benefits or co-benefits. But it may be different in the future. A recent survey among buyers of carbon credits on the voluntary market showed that most buyers would be willing to pay a higher price (like 1 US$ more per ton of CO2e) if the carbon comes from a project which does take these additional benefits into consideration and which has a certificate for that, for example, the certificate issued by the Climate, Community and Biodiversity Project (Schneck, Brian et.al. 2011). You will learn more about such certification and the standards they apply in Module 3.

COSTS AND BENEFITS OF REDD IN COMMUNITY FOREST MANAGEMENT: A CASE STUDY FROM NEPAL

The potential costs and benefits of REDD for communities were assessed in a recent study in Nepal. It was conducted in three sites in the Himalaya region, namely Ilam, Lamatar and Manang.

In the 1980s, the Nepal government started to recognize community forest management, and today about one third of the forest in the Himalaya region of Nepal is under community control. This has in most places reversed the degradation of forests. Community forest management in Nepal involves guarding against encroachment and fires, and agreed quotas for the collection of products such as fodder and firewood which are used by the local people. The management is done at grass roots level by locally based Community Forest User Groups ('CFUGs'). This type of community forest management (CFM) is an integral part of the rural subsistence economy in many parts of Nepal.

Local communities have been managing forest without carbon revenue because CFM already provides an incentive for forest management, and this has been the reason why CFM has been successful in the Himalayan region in Nepal. Carbon trading will only be attractive when the benefit from carbon management under a REDD project exceeds benefit from existing management.

The research conducted in the three areas shows that income from carbon revenues can bring about additional benefits under certain conditions.

When the local communities managing forest are paid for the carbon sequestered at rates that just about cover all the costs involved (called the "breakeven cost", which means there is no profit) for annual forest inventory and carbon assessment, this payment could still provide the incentive to do this work in addition to the forest conservation they are already practicing.

Such local survey work would be essential if the state is to claim carbon credits at an international level under REDD, since such data cannot be obtained from other sources such as remote sensing at this level of detail.

For the communities, the benefits from sustainable management of forest are already high. But if the rates for carbon credits are considerably higher than the costs of REDD, then it may be a real incentive to strengthen and promote sustainable forest management.

The study concluded that the best results are found when sustainable harvesting of forest resources by local communities is permitted and credit is only awarded for what is left after the collection of these forest products.

The study clearly showed that strict forest protection with the aim of only increasing carbon sequestration, and thus the banning of all collection of forest products (timber for domestic use, firewood, fodder and other non-timber forest products) is not a feasible option, because communities would loss more than what they would gain.

Therefore, the researchers concluded that REDD policy must be built upon the existing CFM policy where communities are recognized with their forest-use rights. They also pointed out many additional benefits from this kind of forest management which have not been accounted for in the study, but which are also important, for example, biodiversity conservation, water catchment protection, and the aesthetic and cultural values that will be maintained.

Source: Bhaskar Singh Karky and Margaret Skutsch 2010

d. Why is it important to assess co-benefits?

Forests have many benefits for people aside from absorbing and storing carbon. In the previous sessions, we have already talked about some of the benefits of forests for communities. In REDD+, these other benefits are called co-benefits.

But co-benefits are enjoyed not only by the community itself or people living close by your community forest. For example, maintaining healthy watershed forests and thus a good flow of clean water is benefiting a lot of people, some of whom may live far away. Or the benefits of a beautiful landscape and rich biodiversity will benefits visitors like tourists coming from far-away places. Or researchers may benefits from the rich biodiversity by having a huge storehouse of plant diversity that can be used for the development of new medicines, ultimately benefiting sick people all over the world.

So co-benefits of REDD+ have to be assessed not only at the local level but at the regional and national levels. Nevertheless, communities need to make their own assessment. The question is how to take all the many aspects of possible co-benefits into account when thinking about the advantages and disadvantages of REDD+? It is easier with the more tangible and direct benefits, like all the forest products in a forest rich in biodiversity, or irrigation and drinking water. You can also consider the possible income from a PES project, in which you could get financial compensation for watershed protection (as explained in the session 4 of this module).

It is more difficult to include all the more indirect, less concrete, but still important benefits that have to do with your culture, social relations or livelihood security.

There are ways to estimate the financial value of some of these benefits (like drinking or irrigation water or possible income from eco-tourism), but they are often quite difficult and demanding in terms of technical skills and time. Above all, many co-benefits cannot be measured with

money. So when you are making your assessment you have to make sure that these are not ignored simply because there is no "price tag" on them. You will have to make these assessments in meetings with all community members, young and old, men and women. Get the opinion of everyone: how do they value biodiversity, how do they value the spiritual and cultural significance of forests or a particular land use practice. The previous sessions on forest use and biodiversity and on forests and livelihood may also help in doing this assessment.

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Chapter 7: Looking at the Whole Picture - Land-use Planning

Taking a decision on REDD+ is complex – there are so many things to consider, but the same is true for other decisions regarding land use changes in your community. Often, problems occur because there is too little discussion on the costs and benefits and other advantages and disadvantages or a particular new form of land use within a community. Some individuals may just go for it and others may follow and the negative consequences are felt only later, sometimes too late to make any corrections.

Therefore, your community is well-advised to have a more general discussion on the future direction they want to take with respect to the use and management of their land and forests. REDD+ may provide a good opportunity to have this discussion. And a good way to have this discussion is through land-use planning.

a. Why is land-use planning important?

Indigenous peoples' land use systems are diverse and complex, guided by customary regulations and laws, even though there has hardly ever anything been written down in a document. There was no need for that as long as the communities had control over their territories, resources were abundant, there was little pressure from outsiders and changes happened at a pace that people could easily cope with.

But this situation is changing rapidly everywhere in indigenous communities. There are many more pressures they have to cope with, first and foremost by defending their rights to their lands and forests. For that it is important to have clear boundary delineations. There is also a heavier pressure on communities to change their land-use systems because they need a higher and more regular cash income, or because government policies are forcing them to make changes.

Land-use planning can help a community to take important decisions on how to use and develop their lands and forest, for their own benefits and that of future generations.

b. What does a land-use plan include?

A land-use plan normally includes a background of the area and the people living within it, an inventory of the different parts of the landscape, resources found there and their uses, and the written or unwritten rules and regulations on their use.

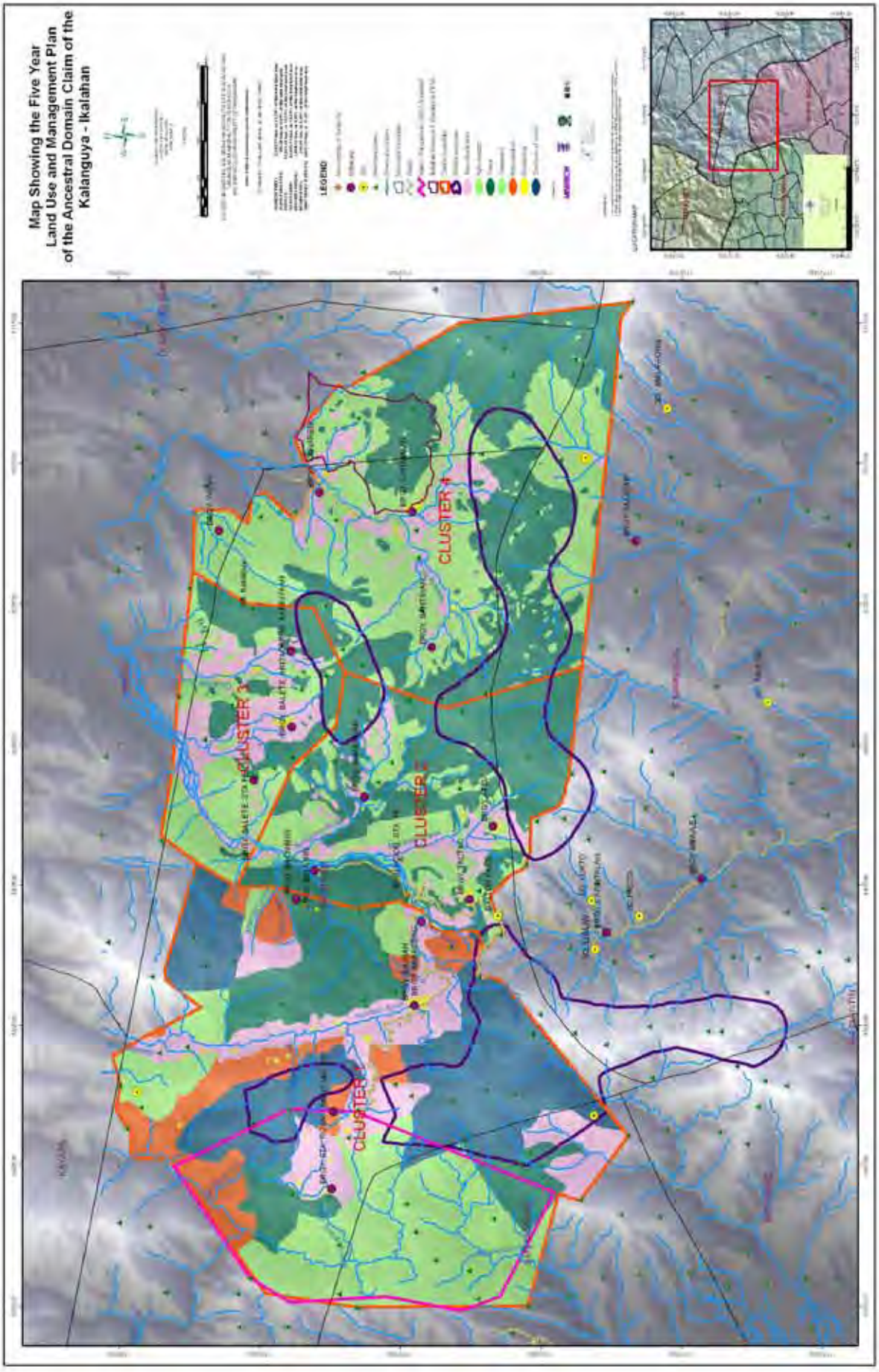
In a land-use plan, the community can identify how a particular area within their territory is to be used or to be developed as a basis for an overall community management and development plan that can ensure the sustainability of land and resource use.

In the context of REDD+, the formulation of a land-use plan is important because this will be the basis of identification of the forest area that will be protected for carbon emission reduction. A forest area with a land-use plan will help deal with concerns such as *permanence*, *leakage* and *additionality,* (see more in Module 3). It is also important to combine this with other land use or development plans such as those from the government or adjacent land owners.

c. How is land-use planning done?

In developing a land-use plan, people who live in the locality identify the uses and importance of the different parts of their territory. Outside support, if needed, can be tapped to guide them in the formulation of the plan or help them create a model of the territory in the form of a 3-dimensional (3D) map, topographic map or sketch map, as a visual tool the helps them in their planning.

As an example, let us look into the experiences of the Ikalahan, an indigenous people living in Nueva Vizcaya province in the Northern Philippines. In this case, land-use planning was an integral part of the formulation of their resource management plan.



Courtesy Kalahan Educational Foundation (KEF)

The following is the process the Ikalahan went through:

Step 1: WHY?

The Ikalahan went through a seminar on why there is a need to formulate a resource management plan. They conducted a basic ecology seminar wherein they tackled the importance of managing the resources in their environment.

Step 2: WHAT?

They conducted a resource survey workshop where they made an inventory of the resources found in their community. They identified the amount and use of these resources as well as the threats and actions to address these threats. They then identified the resources that can be used and those that are to be protected. They also identified the problems each resource is facing and the concrete actions that need to be done, delegating people with the responsibility of implementing the actions identified.

Step 3: WHERE?

The Ikalahan identified the location of the significant areas in their territory where the resources can be found. They conducted this using the 3-dimensional map of their territory. The significant areas they identified are the following:

- Watershed
- Housing supplies
- Wildlife sanctuary
- Agricultural lands
- Orchards
- Fishponds, pastures
- Irrigation
- Houses
- Drinking water
- School, church
- Wastes
- Roads and trails
- Processing centre

Step 4: HOW?

This part is where the management of the land was identified. How will the Ikalahan protect, manage and supervise the particular areas in their territory? How will they share the resources within? In determining the "HOW" factor, they set up a mechanism on how the management will be conducted. They put up an organisation, identified its responsibilities, assigned the number of leaders needed, how these leaders will be elected, how long a term they should serve, how the registration of the organisation will be carried out, and the particular tasks of the leaders in the organisation.

Step 5: WHO?

Having set up the management system, the people who will fill in the positions in the organisation were elected and delegated. The organisation then applied for registration to the Securities and Exchange Commission, the government body that certifies Philippine organisations as a legal entity.

Step 6: PERMITS

In the Philippines, since certain resources need permits for harvesting and selling, a management

agreement was drafted to cover all resources that will be used commercially. The agreement was then presented to the concerned government agency for negotiation after which the agreement was finalised. The final agreement is then the license/permit used to harvest and sell resources.

For a comprehensive discussion on land-use planning, please refer to *Guidelines for land-use planning* published by the UN Food and Agriculture Organisation, 1993 and reprinted in 1996. Can also be found in http://www.fao.org/docrep/t0715e/t0715e00.htm#Contents as of July 17, 2010.

How can people live in the forest? Insights by the Ikalahan

People need to live in the forest the same as animals do. They must find resources that they can use SUSTAINABLY and then use them.

1. If a forest farmer uses FIT, (more on this in Module 5) and plants a garden in a small open area he/she can make a sustainable living from the forest. This might require 7 to 10 hectares per family but the forest would still be a good watershed and sequester a huge amount of carbon to prevent climate change.
2. If there is wildlife such as birds in a forest, the forest community can establish sanctuaries where they are protected but not caged. Bird watchers, for instance, are happy to hire guides to lead them through the forest if they are sure that they will see birds. The farmer can still maintain a garden near the sanctuary to provide food for the family.
3. If there are waterfalls or caves in or near the forest or other special views, the community can sponsor eco-tourism.
4. If there are medicinal plants that can be produced sustainably, they should be multiplied and processed as necessary for the market. Sustainability must be carefully monitored.
5. Handicrafts can be produced from sustainably produced raw materials. Sustainability must be carefully monitored and pollution controlled.
6. The forest can provide planting materials for orchids or other ornamental plants and the plants multiplied in 'back-yard-forests' for sale. The forest farmer also has a garden for the production of food for his own family.
7. The forest farmer should try to be as self-sufficient as possible. This is especially true when entertaining eco-tourists.

MODULE 3
REDD+ PROJECTS: WHAT ALL IT TAKES

If you are considering to make REDD+ part of your community's land-use strategy, you need to know what all would be required to make it work: the time and money, the people, knowledge and skills that are needed, and the concrete activities that you would have to undertake.

Only few REDD+ projects have so far been implemented. They are all quite complex and demand a lot of knowledge, skills, human and financial resources. We do not expect this to change. There will hopefully be some simpler methods, rules and standards so that it is easier for communities, who do not have a lot of resources and professional people, to actively engage in REDD+ or initiate their own CB REDD+ project. But you have to be aware that being part of, and especially running a REDD+ project is not easy. This module tries to give you an overview of what all it takes to engage in or run a REDD+ project.

Chapter 1: REDD+ Standards

One of the crucial requirements is that a REDD+ project has to follow certain rules on how things are done, especially how carbon is measured and monitored. Such set of rules are called "standards".

REDD projects have so far been largely funded through the voluntary carbon market. This means they have made agreements with private buyers of carbon credits. These are companies and carbon traders, i.e. firms who specialize in buying and selling carbon credits.

Today, you would not be able to sell any carbon credits on the voluntary carbon market without following one of the internationally recognized standards and getting a certification from them. The same will be the case once carbon credits from REDD+ are traded in the compliance market like all other carbon credits. Standards for REDD+ will most likely be developed by the UNFCCC, and experiences made with the existing voluntary standards will probably have a strong influence on these future international standards.

So before we look at any other aspects of a REDD+ project works, we want to briefly look at how the existing standards are used.

a. What are standards and why do we need them?

When people buy things like food, for example, they want to know what they buy. What kind of rice are they selling? Where was it grown and how? And of course, how much does it cost?

It's the same thing with carbon (or rather, as mentioned already, the carbon dioxide equivalent). However, the tricky thing is that you can't simply pick it up and carry it away to wherever you want to sell it. You can't even see it directly. The carbon is part of the trees and other plants growing in your forest, and the carbon you are supposed to sell is the carbon you have protected from being released (by avoiding the forest to be cut), or the carbon that has been added to your forest through increased growth of trees as a result of your forest conservation or tree planting.

Whoever wants to buy carbon credits from you wants to be sure that what you claim is true: that the carbon has indeed been prevented from being emitted, and that carbon has indeed been added in your forest. And they also want to know how much that carbon actually is.

There are different ways of measuring this, but anyone who wants to buy carbon wants to be sure that the way it is measured is done in a correct way. And that's what standards have been made for. These standards have been developed by specialized organisations or companies. They themselves or another recognized company or organisation will come and regularly check your project and issue a certificate stating that what you are doing is complying with their standards. So, in other words, they are certifying that what you are saying is true. This is called "verification" – confirming that something is true or correct.

So, again: In order to be able to sell carbon credits on the voluntary market, the carbon has to be verified by someone who is not part of the agreement and who is recognized for being able to do that. This independent "third party" is called the "verifier".

In order to get the approval from the verifier, you have to comply with their rules regarding how the project is implemented, among them:

- How the carbon is measured;
- How the project deals with the problem of permanence. How does it ensure that the carbon protected or sequestered remains in place and is not emitted later?
- How the project deals with leakage. How does it address the danger of forest being destroyed elsewhere as a result of forest protection under the REDD+ project?
- How the project ensures additionality? How does it prove that that the carbon emission reduction or increased carbon sequestration happens because of the project, and that it would not happen without the project?
- How does it prevent negative social and environmental impacts and create social and environmental benefits?

We will learn more about these later on.

The set of rules these "third parties" have developed are called "standards". There are several companies or organisations which have developed such standards and who can be approached to verify (to confirm what you are saying or claiming is true) and therefore to certify your project (which means to give assurance) that your project complies with their standards.

Compared to the regulated market (or compliance market) which has uniform rules, there are no common general regulations for the voluntary market. However, there are few standards that are now widely recognized and used. We will introduce some of the most important ones in the next paragraph.

STANDARDS

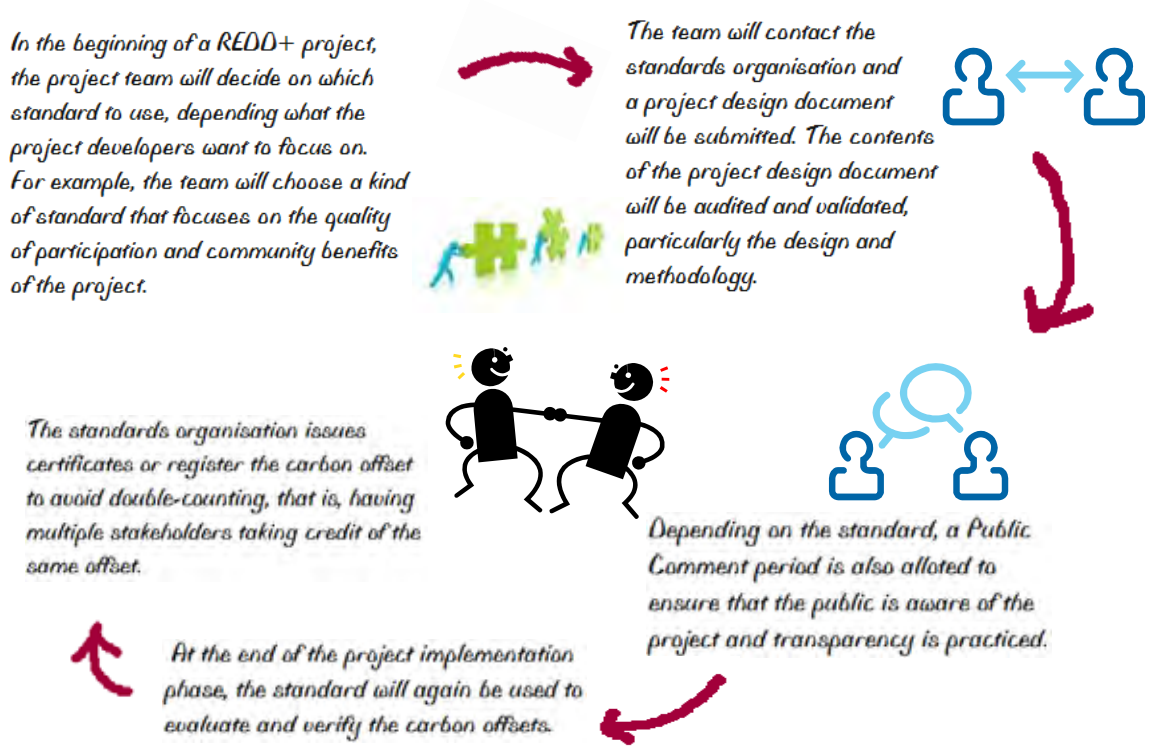
- Are needed to create emission reduction credits ("carbon credits")
- Ensure that each ton that is credited actually represents one ton of emission reductions
- Reduce risks for both the seller (the project developer) and buyer (investors) because they allow each of them to know exactly what they are selling and buying
- Can include additional project benefits such as improved livelihoods for communities or biodiversity conservation and, therefore, allows to differentiate between projects which include these co-benefits and those which do not

b. What standards are there?

At present there are at least ten standards in the carbon market for use in carbon projects, but there is no single universally accepted standard among these.

Common to most standards is that they are trying to make sure that their evaluation of the project is unbiased. For that purpose, they usually involve an outsider ("3rd party) to check on certain crucial aspect of the projects. Standards are applied in a transparent manner, which means they want to make sure that everybody involved knows what is happening. This usually includes a period of public comment, during which anybody can raise questions and concerns. This is to avoid disagreement or even conflict later on. When all goes well, the project will receive a certificate confirming that it meets the requirements of that particular standard.

Graph 2. How are standards applied: Certification of your project



In this manual, we are going to discuss only two standards, since they are the only ones which are used for REDD+, the Voluntary Carbon Standards (VCS) and the Climate, Community and Biodiversity Standards (CCBS). (For more information on the other standards refer to Kollmuss et.al. 2008 and Green Market International 2007.)

1. Verified Carbon Standard

The Verified Carbon Standard(VCS) – formerly called Voluntary Carbon Standards – is the most widely used standard for the quantification of emissions reductions from REDD projects. It was founded in 2006 by The Climate Group, the International Emissions Trading Association and The World Business Council for Sustainable Development.

The VCS aims to be a universal quality standard that is simple, affordable and with less administrative burden on the part of the project implementers. VCS has become the most often used standard. In 2009, almost half (48%) of all carbon transaction in the voluntary market used VCS. Unlike the CCBS (which we are going to introduce a little later), the VCS does not require to con-

sider social and environmental impacts or benefits to the community, but it does use the local and national environmental laws as a basis and also requires documentation of consultations and ways to communicate with the different actors involved in the project.

In order to pass VCS verification, the carbon and other GHG emissions reduction must be:

- Real (must have genuinely taken place)
- Measurable (must be quantifiable by recognized measurement tools)
- Permanent (must not only be temporarily removed; where there are events of reversibility, safeguards must be in place)
- Additional (must be supplementary to the current situation of the area)
- Independently verified (have undergone verification from an accredited verifier)
- Unique (carbon reduction and removal must only be single-counted)
- Transparent (information is open to public)
- Conservative (assumptions and computations are not over-estimated)

In order to be able to apply all these criteria, there has to be a so-called baseline which allows the VCS to assess how much carbon has been "produced". A baseline is a set of data on the situation at the beginning of the project. These data include the existing carbon stock, the rate of deforestation and degradation, etc. We will get back to this in more detail later on. Only when there is such baseline data, it is possible to measure what carbon has been added or lost in a given area.

VCS has to approve the project baseline, and they also have to approve the methodology used in measuring carbon regularly throughout the project duration (called carbon monitoring).

To ensure nobody doubts what they are doing, VCS uses a double approval system. This means two independent external auditor (the one who will validate the project) are hired, one by the project developer and the other by the VCS organisation. If both accept the baseline and methodology, the project is approved. If not, the project will be rejected. If the project developer appeals, the VCS organisation will get an external consultant who will study it further, and the decision will be made based on this result.

OFFSETTING EXPLAINED

What is a carbon offset?

An offset is a greenhouse gas emissions reduction or removal that is used to counterbalance or compensate for ('offset') emissions from other activities. Offsets can be purchased by countries, companies or individuals. The key criterion for an offset is that its greenhouse gas reduction would not have happened anyway i.e. is "additional" to business-as-usual activity.

When to offset?

Offsetting should always be considered as a third step in a strategy to reduce emissions. The first two steps are to reduce emissions yourself, either through reduced consumption or improved efficiency and then to green up your electricity supply by using renewable energy electricity. To find out some easy ways to reduce your emissions at home, visit www.together.com.

Once these cost effective emissions reduction opportunities have been exhausted, offsetting provides a way to balance out the remaining emissions.

From VCS web-site: http://www.v-c-s.org/offsetting.html

When the baseline and methodology are approved, the implementation of the project can start. After a certain time, the VCS sends an accredited verifier to see if the output has indeed met the standards, and consequently lead to the expected reduction of carbon emissions. If the project has passed the verification, the project holder can apply for registration of the carbon credits in the VCS registry. The registry supplies the carbon credit with a serial number so that double-counting can be avoided, which means that the carbon emissions that have already been counted as reduced or removed can no longer be counted again. Once registered, the carbon credits can be sold on the voluntary carbon market. Just like VCS, the other voluntary carbon market standards have their own registries. (For more information on the Verified Carbon Standards and for downloading a PDF of its standards "Agriculture, Forestry and Other Land Use (AFOLU) Requirements", visit www.v-c-s.org)

2. Climate, Community and Biodiversity Standards

Climate, Community and Biodiversity Standards (CCBS) was initiated by a consortium of companies and non-governmental organisations in 2003, known as the Climate, Community and Biodiversity Alliance (CCBA). These standards were designed for projects that include co-benefits, i.e. social and environmental benefits in addition to emission reduction.

Unlike the VCS, the CCBS only focuses on project design and development, and it does not issue certificates for emissions reductions (carbon credits). CCBA actually encourages using their standards in addition to those of the VCS in order to complement VCS' lack of socio-environmental aspects.

The CCBS is a project design standard, which means CCBS evaluates land-based carbon mitigation projects in the early stages of development. CCBS checks the quality of the design of a project to ensure that these projects are addressing climate change, and at the same time are providing benefits to communities and helping conserve biodiversity. CCBS also seeks to promote good and innovative project designs.

Projects to be certified by CCBS have to include social and environmental documentation in its base-line data for evaluating a project's social and environmental impacts. This makes it possible for carbon credit buyers to have an option of choosing projects that are certified also for including social and environmental co-benefits.

CCBS certified project also needs to have evidence of stakeholders' involvement (including the community) as well as a documentation of the public commenting activities. Negative impacts of the project or critical issues that are not dealt with properly by the project (such as leakage) will disqualify a project under the CCBS. (For more information on the CCBS, visit http://www.climate-standards.org/; the resource CD enclosed in this manual contains a PDF file of the latest edition of the CCB project design standards in folder "Carbon offset standards")

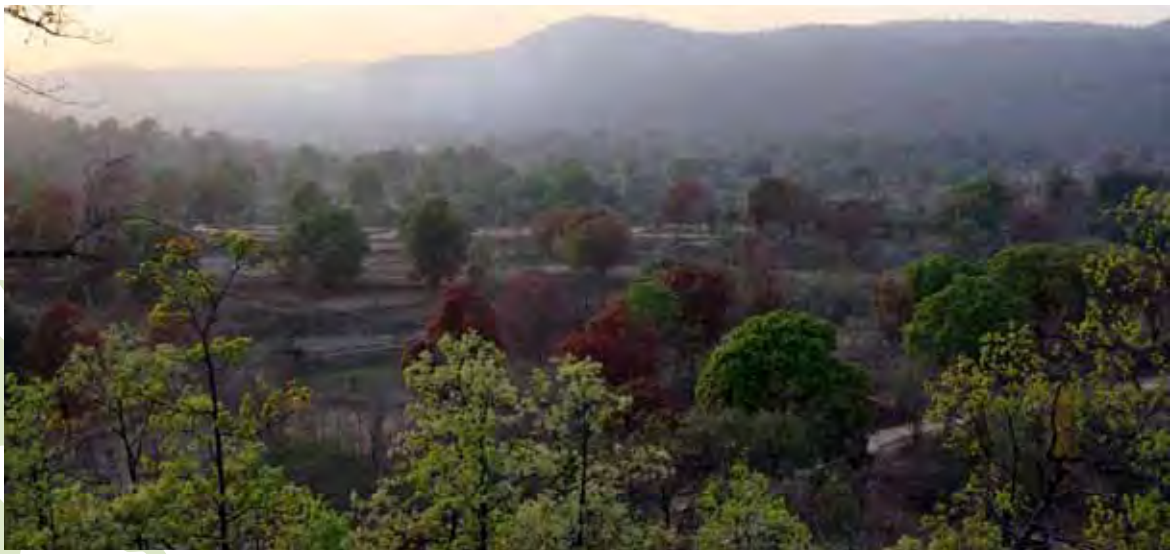


Table 4. Comparison of Verified Carbon Standard and the Climate, Community and Biodiversity Standards

	Verified Carbon Standard	Climate, Community and Biodiversity Standards
Type of standard	The Voluntary Carbon Standard focuses on greenhouse gas reduction only and does not require projects to have additional environmental or social benefits. The VCS 2007 is broadly supported by the carbon offset industry (project developers, large offset buyers, verifiers, projects consultants).VCS approved carbon offsets are registered and traded as Voluntary Carbon Units (VCUs) and represent emissions reductions of 1 metric tonne of CO2e.	The Climate, Community & Biodiversity Standards (CCBS) focus exclusively on co-benefits in land-based carbon sequestration and mitigation projects. The CCBS are project design standards and offers rules and guidance for project design and development. They are intended to be applied early on during a project's design phase to ensure good project design and benefits for local communities and biodiversity. They do not verify carbon offsets and do not register them.
Verification frequency	At least every five years	Every five years
Accepted project size	There is no upper or lower limit on project size.VCS classifies projects into three categories based on their size: • Micro projects: under 5,000 tCO2e per year • Projects: 5,000–1,000,000 tCO2e per year • Mega projects: greater than 1,000,000 tCO2e per year The rules on validation and verification are to some degree different for projects that fall in the 'micro' or 'mega' categories.	No limits on project size.
Environmental requirements	The VCS does not focus on environmental and social benefits. It is sufficient for VCS projects to show that they are compliant with local and national environmental laws.	Has to demonstrate environmental benefits. Major negative impacts that cannot be mitigated lead to project disqualification.
Social requirements	The project document must include "relevant outcomes from stakeholder consultations and mechanisms for ongoing communication." (VCS 2007, p. 14)	Has to generate positive social and economic impacts. Stakeholder involvement is required and must be documented. CCBS require a 21-day public commenting period.

	Verified Carbon Standard	Climate, Community and Biodiversity Standards
Accepted methodology for baseline scenario	New methodology must be approved through a double approval process. Performance standards or best practice approaches are allowed but have not yet been developed. Any new methodologies approved under a GHG Programme (e.g. CDM) that has been approved under the VCS are automatically recognised. Other individual new methodologies must be reviewed and approved by two VCS accredited independent verifiers and are then accepted by the VCS Board (though the Board retains the right to examine each methodology).	Baselines as defined by the Land use, land-use change and forest (CDM LULUCF) methodologies of the UNFCCC's Clean Development Mechanism (CDM) or by Intergovernmental Panel on Climate Change's Good Practice Guidance (IPCC GPG). New methodologies are reviewed and approved by CCBS-approved auditors.
Fees	VCS validation and verification is estimated to range between 15 000 and 30 000 US$ for each third party audit. The registration fee for each Voluntary Carbon Unit issued is 0.04 Euros (November 2007). Account fees will be set by each of the VCS approved registries.	Cost for validation of a project ranges from €3,500 to €10,000.

Source: Kollmuss, et al. 2008

CERTIFICATION COSTS

Each project validation and the subsequent verifications with the CCBS are estimated to range between 5 000 and 40 000 US$.

The CFS charges 1 500 € (2 050 US$[5]) for validation, 0.50 € (0.68 US$) for each sold CO_2 certificate, and estimates each verification procedure to cost between 8 000 and 15 000 € (10 900 - 20 500 US$).

CFS / CCBS combined certification is estimated to cost 10 000 - 20 000 € (13 700 - 27 400 US$).

Plan Vivo validation costs between 5 000 and 12 500 US$ and the Foundation charges 0.30 US$ for each sold CO_2 certificate. Each verification procedure is forecast to cost between 15 000 and 30 000 US$.

The VCS validation and verification is estimated not to remarkably differ from other standards, ranging between 15 000 and 30 000 US$ for each third party audit. A further 0.04 US$ for each CO_2 certificate must be paid directly after issuance.

Merger 2008, p.6

PURCHASE & PRICING OF CO_2 CERTIFICATES

CO_2-buyers can purchase carbon units called 'VERfutures' from CFS-certified projects either directly from project developers via the CFS website or from brokers that cooperate with projects. Similarly, Plan Vivo Certificates can be purchased from project developers or from brokers that are registered by the Plan Vivo Foundation. Also, VCS carbon credits (Voluntary Carbon Units) can be purchased from project developers or from brokers.

In 2009, the CFS expects a price range of 10 - 20 € (14 - 27 US$) for each CO_2 certificate, whereas the Plan Vivo Foundation estimates a price between 8 and 30 US$. The VCS anticipates prices between 12 and 18 US$ for its credits.

Merger 2008, p.7

Making REDD+ work means to show how much carbon has been saved from emission or has been sequestered through your initiative. Another way to say this is: you need to produce "carbon credits" or "carbon certificates" that are either sold to buyers (the carbon market) or for which you may get a compensation from a fund.

The way to get to the point that you actually get a compensation for your efforts, or when you can sell carbon credits is quite long and challenging. What we are trying to do in the following paragraphs is to provide you with a simple overview of all the steps needed to initiate and run a REDD+ project that complies with any of the so far recognized standards.

Sources and references

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Chapter 2: A REDD+ Project: The Steps to Take

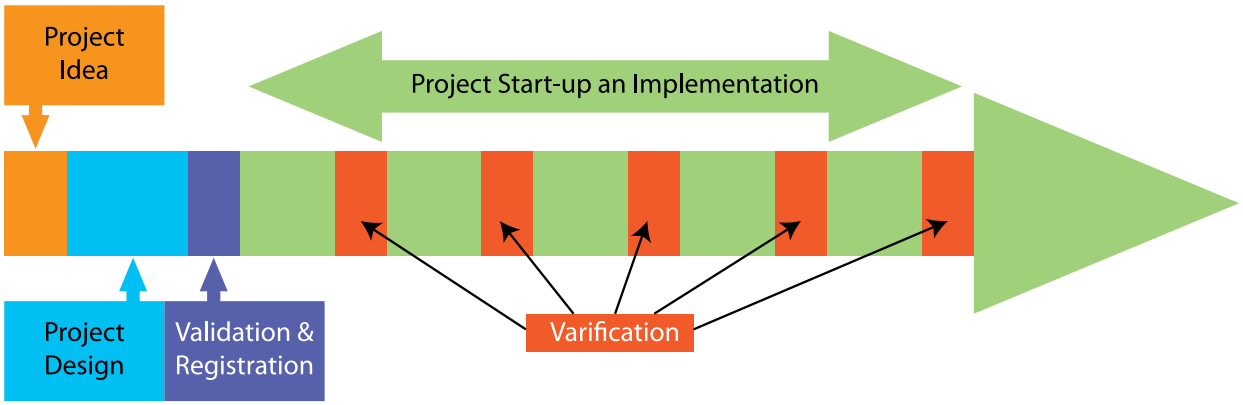
We do not intend to provide you with detailed guidelines on how to initiate, plan and run a REDD+ project. This would be too demanding for this simple introduction. Our purpose is only to make you sufficiently aware of what all it would imply if you indeed decide to engage in a REDD+ project or initiate your own CB REDD+ project.

If you decide to do so, you can consult the various training manuals and guides that have recently been developed and based on which this overview was written. We are giving you the references below and some of the publications are included in the CD enclosed in this manual.

We can identify five steps in a REDD+ project:

1. Developing the project idea
2. Making a project design and project document
3. Having the project validated and registered by one of the offset standards
4. Implementing the project
5. Having regular verification in accordance with the standards

Graph 3. The REDD+ Project Cycle



Step 1: Developing the Project Idea

The first step is simply to find out what you want to do where and with whom and whether it is likely to work. This can take more time and effort than you may think because it is important to do this carefully by investing the required time. It has been estimated that this can take between 6 months to 2 years.

You will also have considerable expenses for travel, consultant fees, capacity building, meetings, and logistics. So you may have to approach donors or find other funding sources to cover these expenses. And it is very important to consult with and involve the relevant government agencies from the beginning in order to avoid problems later on.

To develop the project idea, you will have to do each of the following steps:

1. **Obtain community consent:**

   - Organise community meetings to discuss the initial idea and get the general consent to go ahead with the planning

2. **Define your aims and objectives:**

   - Reduction of greenhouse gas (carbon) emissions?
   - Increase carbon storage in your forest?
   - Conserve biodiversity?
   - Increase income for your community?
   - Secure your land, forest and resource rights?
   - Any other?

3. **Define what the project should include (the scope of your project):**

   - If you want to reduce carbon emissions: through reducing deforestation, or reducing forest degradation, or both?
     * If you want to increase carbon storage in your forest: just through forest protection, or through reforestation, assisted natural reforestation (ANR), enrichment planting or other forest management techniques?

4. **Identify the project area:**

   - What will be the boundaries of the REDD+ project area?
   - What land is it? Who owns it: Private or communal or public land?
   - Would a REDD+ project be allowed on that land?

5. **Identify potential partners:**

   - Who all will be involved: the communities, private landowners, NGOs, local governments and specialized government agencies, etc.?

6. **Consult and seek advice:**

   - Have consultation meetings with other people, organisations or institutions which are likely to be involved as partners, or will be somehow affected (other land owners, companies, NGOs, local governments, government agencies, etc.)

7. **Check on the legal situation:**

   - Who owns the land? Is land ownership recognized (i.e. are there legal titles)?
   - What are the customary ownership and use rights over land and forests?
   - Who has the rights over carbon? Is there any existing national law on this?
   - Would the project actually be allowed on your land, according to national law?
   - Are there any national REDD+ policies and rules and regulations which you have to follow?

8. **Compile background information:**

   - Information on the land, vegetation, biodiversity, etc.
   - Socioeconomic information: who are the people involved or affected, what is their economic situation, how are they related to each other economically, socially, politically, etc.
   - What are the drivers of deforestation or forest degradation? Distinguish between the immediate drivers (the illegal loggers, outsiders encroaching, unsustainable harvesting or land-use methods applied within the community, etc.) and their causes (business interests of timber merchants in towns, corrupt forestry or government officials, demands for certain forest products, poverty, lack of access to knowledge and technology, etc.)

Making a preliminary feasibility assessment

After you have identified what you would like to do and gathered the necessary information, you need to ask yourself: Can the project actually work?

Designing and running a carbon project is not easy and there are many challenges you would have to face.

First and foremost, you would have to know whether the project is **financially feasible**: whether it would generate enough income to cover all your costs, including the opportunity costs we have already talked about, and to generate enough profit beyond the costs involved to make it attractive.

You will have to decide on a **standard** and apply for registration. At present, only voluntary standards are applicable for REDD+, but the UNFCCC will soon come up with "official" standards once a decision on financing of REDD+ has been taken. You would have to find a project/programme financing REDD+ from **public or private funds**, or find **buyers of carbon credits**. Finally, you need to decide on how to use and **share the income** within your community, etc.

You will have to be aware of all the **technical requirements**: for carbon measurement and monitoring, for reporting, for accounting and the overall project management.

It might be advisable to involve an independent person or organisation to help you with a first feasibility assessment. Such a person should have the necessary technical knowledge and know about how to sell carbon.

It has been found that carbon projects usually face three dangers:

1. The danger of overestimating the size of the project, i.e. the amount of carbon credits produced
2. The danger of overestimating the income from carbon credit sales: not just because of an overestimation of the amount of carbon that is expected to be produced, but also due to the overestimation of the carbon price.
3. The danger of not defining the project activities clearly enough. If activities needed to address the drivers of forest degradation or deforestation are not clearly defined, at a later stage, the project may face a situation in which it is realized that dealing with these problems is not as easy as expected, the strategy chosen is wrong, the money allocated for the respective activities is not sufficient, etc. In short, you may realize that it doesn't work the way you thought and you need to find other solutions, which may be more difficult when things are already running and you are under pressure to "create" the carbon credits needed in order to comply with the agreement made with the buyer.

Designing a REDD+ project is lengthy and can be quite expensive. It may also create a lot of expectations among all involved, the communities, government officials, donors or investors. So it is important to carefully review one's assumptions, expectations and possible challenges. Involving someone with experience in designing REDD+ projects can be very helpful in assessing whether a project designed may actually work.

For community-based projects, the feasibility assessment should of course involve extensive consultations and review with the communities in order to build a common understanding and sense of ownership, and corrects unrealistic expectations. In any case, you are well-advised to be rather conservative in your calculations and expectations.

The **result** of developing a project idea should be a document, usually called the **project concept note**.

Project duration, permanence and risks

REDD+ projects, like other forest carbon projects, are long-term projects. They usually last 30 years. This is a very long time and it is important to keep this in mind. For both the carbon seller and the buyer, such long-term agreements carry considerable risks. The company agreeing to buy carbon credits may go bankrupt and simply stop paying. If a fixed carbon price has been agreed on for the whole duration, you may find yourself losing out if the carbon price on the global market has risen. You also have to be aware that you cannot easily break a contract and stop complying with the agreement if you find other more advantageous forms of using the land and forest. The agreement with the carbon buyer may include clauses which require refunding in case of breach of contract. The carbon buyer also wants to be sure that the carbon saved and se-

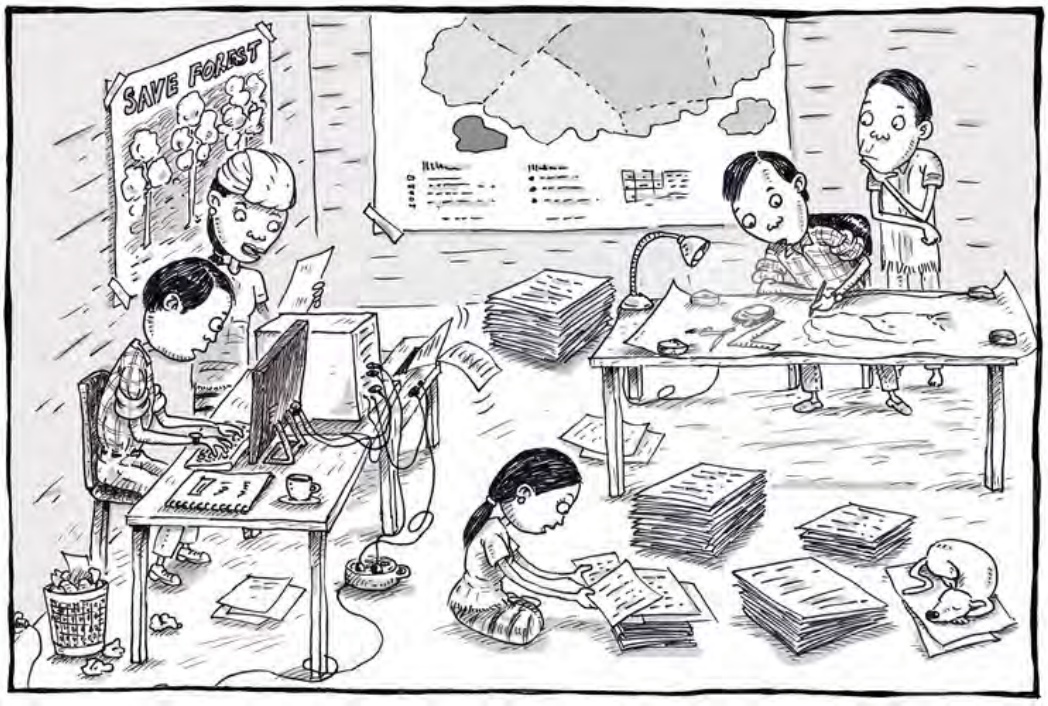
questered during the 30 years of the contract will remain in place afterwards, i.e. the gains made are permanent. There are of course considerable risks for the carbon buyer also, for example, the seller stops in the middle of the contract period or there is no permanence and deforestation may start soon after the project period. For this reason, VCS, for example, requires that a certain percentage of the carbon credits included in a contract are put in a fund that is used for compensation payments in case the seller cannot fully comply with what has been agreed on.

Step 2: Designing a REDD+ Project

Once you have finalized the project idea and written a project concept note, you can move ahead and develop the actual project. You need to have a detailed project document in order to secure the external validation (by using one of the recognized standards) and funding needed. You will most likely need funding for the start-up phase of your CB REDD+ project.

Making a project design and writing the project document can be very demanding and help from various experts may be needed, like on carbon measurement, boundary delineation and mapping, Geographic Information System (GIS) analysis and remote sensing, all the legal aspects, financial planning and management.

Designing a project will of course build on the project idea and the project concept note you have already developed, but it will still need a lot of additional work to complete a project document that fulfils the requirements of external validators and the donors you may want to approach.



Designing a REDD+ project involved the following steps:

1. **Identify the standard used:** If you intend to access the voluntary carbon market (or in the future: the compliance market), you need to decide on what standard you are going to use since this will determine what all you need to cover when designing the project and what will finally have to be included in the project document. For example, if you follow only the VCS, you would not have to include any additional benefits. But you will have to include biodiversity and community benefits if you add the CCBS.
2. **Consent and consultation of communities and others who will be involved:** First and foremost, it is important that everybody involved or affected by the project knows about it and agrees to it. For a CD REDD+ project with indigenous peoples this means an FPIC

has to be obtained from all indigenous communities to be involved. A separate module on how to organise a proper FPIC process is presently being developed and will be made available soon. In the project document, you will have to describe the FPIC process as well as other consultations conducted and the results.

3. **Legal matters:** Clarifying rights over land and carbon, securing community rights and making agreements: This is an aspect of fundamental importance for indigenous communities. There cannot be any REDD+ project on indigenous peoples' territories and with the involvement of indigenous communities without a clear recognition of their rights to their lands, forests and resources. The land rights situation needs to be clearly assessed and necessary steps have to be initiated in order to secure the communities' land rights. It is also important to clarify all other legal matters. This includes the land and other ownership rights of other communities, individuals, companies and organisations involved. Above all, it has to be clearly established who, according to the national law, actually owns the carbon. Without this it will not be possible to make any carbon agreements. Finally, agreements will have to be signed between partners, with landowners, with government agencies, carbon buyers, the verifiers, etc. It will include agreements on benefit sharing. The agreements on carbon reduction between a "carbon seller" and a "carbon buyer" are usually called Emission Reduction Purchase Agreement (ERPA).
4. **Roles and responsibilities:** The roles and responsibilities of everybody involved will have to be well defined. This includes the financial and other benefits the different parties will get.
5. **Awareness raising and capacity building:** In order to ensure the full and effective participation of communities, various awareness-raising and capacity-building activities may be needed. A thorough training needs assessment will have to be conducted for that purpose.
6. **Activities to be implemented:** The basic question for this is: how are you protecting your forests now and in the future? To answer this question, you need to identify the threats, the so-called "drivers" of deforestation and/or forest degradation. You need to identify the causes of deforestation and forest degradation and identify what you are going to do about them. This also means: the activities that you are planning to conduct to prevent carbon emissions (due to forest destruction), and the activities – if any –that you are planning to conduct in order to enhance carbon sequestration. Activities may include, among others, forest boundary demarcation, monitoring, patrolling, fire prevention, assisted natural reforestation, enrichment planting, alternative livelihood activities, etc.
7. **Financial aspects:** A thorough assessment of all financial aspects is of course crucial. What are the initial costs, i.e. the funding needed to get the project started? What are the expected expenses and income – the financial flows – during the project periods? What agreements must be signed?
8. **Carbon monitoring Methodology:** How are you going to calculate the so-called "carbon benefits", the amount of carbon emissions prevented or carbon sequestration increased? What are you going to measure, how and how often? To be able to get compensations for "carbon benefits", a project has to use an approved methodology for the assessment of carbon stocks and for carbon monitoring, i.e. the calculation of the expected reductions of carbon emissions and/or the expected increase in carbon sequestration over the project period. There exist different methodologies, which are also continuously being improved. The methodology has to be in accordance with the standard chosen for a REDD+ project. The VCS, for example, has its own draft methodology which is currently being further developed. Another commonly used methodology has been developed by the Intergovernmental Panel on Climate Change and is described in detail in its "Good Practice Guidance for Land Use, Land-Use Change and Forestry". Methodologies include instructions for the establishment of a baseline (the basic information on carbon stocks and carbon and maybe other GHG emission levels before and without the project), the measurement and monitoring of changes of carbon stocks (and maybe other GHG), the assessment of leakage and the carbon/GHG emissions caused by the project. If co-benefits are included, the methodology chosen will also have to cover the impacts on and the benefits for biodiversity and the well-being of indigenous and other communities.

THE PROJECT DOCUMENT

The contents of a project document of course depend on the standard used in a project. It will have to show that the project has been designed according to the requirements of the standard chosen.

Generally, a project document has to include a detailed description of the following:

- The project concept and duration
- The baseline and the calculation of expected emissions reduction/ sequestration increase
- The methodology applied in the baseline calculation and monitoring
- The activities planned for emissions reduction/sequestration increase
- Legal matters
- Who all will be involved and how, and especially how consultations have taken place
- Social and environmental impacts
- Who will get benefit and how
- Social and biodiversity co-benefits

KEY ELEMENTS OF CARBON PROJECT/REDD+ METHODOLOGIES

Project Boundaries

The boundaries of the land and forest areas on which the REDD+ project is implemented have to be clearly defined to allow project monitoring and verification. In addition to the actual project areas, most REDD methodologies require the demarcation of the so-called baseline reference areas and a leakage belt. The baseline reference area is an area in which no project activities take place and which can be used for comparison, i.e. to be able to assess the actual impact of the project on carbon stocks. The leakage belt is an area outside the project boundaries which needs to be monitored in order to establish whether and to what extent leakage happens, and how this can be prevented.

Today, the delineation of geographical boundaries is usually done with the help of remote-sensing and/or GPS technology.

Land Eligibility

Depending on the standards used, the land included in the project has to meet certain criteria. For example, where reforestation or forest regeneration is involved, it has to be proven that the project area has been already deforested/degraded at a certain time before the project start in order to prevent so-called “perverse incentives”, i.e. that land owners deforest an area and afterwards claim carbon credits for reforestation. Evidence has to be provided for the particular land cover, i.e. the particular kind of forest (dense, degraded, deforested, etc.).

Additionality

The project has to prove that the carbon benefits created (the reduction of carbon emissions or the increase of carbon sequestration) actually happened because of the project and for the purpose of creating carbon benefits. In other words, the project has to show that the reduction of carbon emissions or increase of sequestration would not happen without the project. Some of the standards (like VCS) have developed tools that can be applied in order to prove additionality.

Baseline and Project Scenarios

In order to prove the impact of a project on carbon emission and sequestration, one has to be able to make a comparison between the "without project situation" and the "with project situation".

The "without-project situation" is called the baseline scenario. This means it describes how the situation would be with respect to carbon emissions if there was no project. Detailed data and evidence have to be provided on the carbon stocks and emissions in the project area before the project starts. The different methodologies describe in detail how this has to be done.

Furthermore, a detailed estimate has to be made on the expected impact of a project on carbon, i.e. on land-use practices and drivers of deforestation and how the project will deal with them in order to bring about the desired changes in carbon emission and sequestration. There will also have to be an assessment of the social and biodiversity impacts of a project. For all this, the project has to provide sufficient evidence.

Emission Reductions and Increase of Sequestration

Since the financial benefits of a REDD+ project depend on the extent to which carbon emission has been reduced or carbon sequestration has been increased, the project has to provide detailed estimates for these for the entire project duration. External verifiers will review and verify the actual reduction of carbon emission or sequestration increase at regular intervals. Therefore, predictions need to be as credible as possible, and be rather conservative since there are always difficulties in collecting accurate data, there will be difficulties in implementing some project activities, and there will be unavoidable "leakage". Furthermore, certain project activities may in fact cause carbon emissions, like the use of vehicles or other machines which are run by burning fossil fuel, or the cutting of fire breaks or other forest management activities. All these emissions have to be calculated and deducted in the carbon accounting.

Leakage

Leakage happens when an activity which a project seeks to stop– such as logging or illegal forest clearing – is happening somewhere else after the REDD+ project starts. Some activities are less likely to "leak" – like when a community decides to stop selling timber – because there is good enforcement and control. However, in other cases preventing leakage is more

difficult, like logging by outsiders or land conversion by migrant settlers, and enforcement needs to be done at a higher level, by the government. A thorough analysis of possible leakages, the reasons behind them and how these can be addressed and by whom is, therefore, a crucial part of any REDD+ methodology. Any unavoidable leakage will have to be deducted from the carbon benefits claimed by a project. The area monitored (the leakage belt) has to be clearly defined.

Monitor Social and Ecological Impacts

If a project is using a project standard (like the CCBS) in addition to the carbon standard (like the VCS), the methodology also has to include monitoring of the project's social and environmental impacts. There are many tools available for community-based social impact assessments of projects or for community-based biodiversity monitoring.

Step 3: Project Validation and Registration

Once the project design has been completed, the project has to be evaluated by an external auditor. This is called "third-party audit" because it involves a person who is not otherwise involved in the project.

The third-party audit will check whether:

- The project has used an appropriate methodology and whether it has been applied correctly
- The appropriate steps have been followed, including the stakeholder consultation, and whether it all has been done according to law
- The expected emissions reductions or sequestration increase have been calculated correctly. This includes an assessment of the baseline data

If the auditor concludes that the project complies with all the requirements of the particular standard that has been chosen (for example the VCS or the CCBS), the project will be approved and can be registered under that standard.

Step 4: Project Implementation

When a project has been validated and registered, its implementation can begin. All the activities that have been planned during the project design phase are now put into practice. Among others, these activities include:

- Sign all contracts and agreements: the sales contract with the buyer of carbon credits, benefit sharing agreements, agreements with government agencies, agreements with land owners where necessary, etc.
- Conduct awareness-raising and capacity-building programs.
- Implement REDD+ activities: forest boundary demarcation, monitoring, patrolling, fire prevention, assisted natural reforestation, enrichment planting, alternative livelihood activities, etc.
- Monitor project impacts: monitor ongoing deforestation rates in project site as well as leakage, implement activities aimed at mitigating leakage, monitor social and ecological impacts.
- Monitor co-benefits: is biodiversity better protected as expected? Is it increasing or still continuing to decrease? Do communities get the benefits they were promised? Is the benefit sharing being implemented as agreed? Does it work that way? Are there any abuses? Are changes necessary?

It is very important that communities benefit from REDD+ projects soon after implementation starts to ensure everybody remains committed to the project. If it was agreed to change or even abandon certain land-use methods in favour of forest conservation, the increase of carbon sequestration in community forests, the alternative livelihood activities that have been agreed on as a compensation for the loss of income must begin very early in the project as well. They should start at the same time or even before the new forest protection activities. This also means that any training or other forms of capacity building to introduce alternative livelihood activities and new forest protection and management methods have to be done at the very beginning of a project.

Step 5: Verification

Verification is done by a "third-party", called "verifier" or "auditor". The purpose is to get the confirmation by an independent expert that the project is implemented according to the standard that has been chosen for the project. This means the verifier checks whether:

- The project has been implemented according to the design and methodology agreed on
- Carbon monitoring has been done correctly and as planned
- The amount of carbon emission reductions or sequestration increase (removals of carbon) calculated is correct
- Negative impacts have been identified and properly addressed
- The co-benefits for communities and the environment have been realized as expected

A first verification happens after all project activities have been implemented, and it is repeated in regular intervals throughout the whole project period. When the verifier has evaluated the project according to the selected standard, a certificate will be issued for the verified amount of carbon emissions reductions and removals, and the carbon credits can now be sold.

Income from REDD+: Some concluding comments

No matter how they are designed, REDD+ projects intend to create "carbon benefits" for which- either financial compensations are paid from a fund, or which are sold as "carbon credits" on thecarbon market. In any case, REDD+ projects are rather complex and complicated undertakings andneed a lot of knowledge and skills if they are to succeed. Communities need to be well aware ofwhat all is needed in order not to rush into something over which they might soon lose control.

However, we have given you only a very short overview of how a conventional REDD+ project works. There is much more that you need to know if you are seriously considering joining or initiating a REDD+ project.

The books, guides and manuals listed below can help you obtain a deeper understanding. They have been used extensively for writing the overview we have just given you here. But you have to be aware that some have been written mainly for people who intend to run conventional REDD+ projects, not necessarily including co-benefits, or emphasizing community control and ownership.

ANSAB, FECOFUN, ICIMOD 2010. Forest Carbon Stock Measurement: Guidelines for measuring carbon stocks in community-managed forests. Kathmandu, Nepal. ISBN: 978-9937-2-2612-7. Available on-line at: http://www.ansab.org/wpcontent/uploads/2010/08/Carbon-Measurement-Guideline-REDD-final.pdf

GOFC-GOLD 2009. A sourcebook of methods and procedures for monitoring and reporting anthropogenic greenhouse gas emissions and removals caused by deforestation, gains and losses of carbon stocks in forests, remaining forests, and forestation. GOFC-GOLD Report version COP15-1. GOFC-GOLD Project Office, Natural Resources Canada. Alberta, Canada. Available on-line at: http://unfccc.int/files/methods_science/redd/methodologies/other/application/pdf/sourcebook_version_nov_2009_cop15-1.pdf

Olander, Jacob and Johannes Ebeling 2010. Building Forest Carbon Projects: A Stepby-Step *Guide. Version 1.0. November 2010. Forest Trends, the katoomba group, EcoDecision. Available on-line at*: www.foresttrends.org/documents/files/doc_2555.pdf

The World Bank 2011. Estimating the opportunity costs of REDD+ A training manual. Washington: The World Bank. PDF available at: http://www.asb.cgiar.org/PDFwebdocs/OppCostsREDD_Manual_v1.3.pdf

Verplanke, J.J. and E. Zahabu, Eds. 2009: A Field Guide for Assessing and Monitoring Reduced Forest Degradation and Carbon Sequestration by Local Communities. 93p. Available online from www.communitycarbonforestry.org

The following two, very detailed and technical guidelines have been produced by the Intergovernmental Panel on Climate Change (IPCC) and are often used as reference for carbon standards:

Intergovernmental Panel on Climate Change (IPCC) 2003. Good Practice Guidance for Land Use, Land-Use Change and Forestry. IPCC National Greenhouse Gas Inventories Programme. Edited by Jim Penman, Michael Gytarsky, Taka Hiraishi, Thelma Krug, Dina Kruger, Riitta Pipatti, Leandro Buendia, Kyoko Miwa, Todd 108 Ngara, Kiyoto Tanabe and Fabian Wagner. Published for the IPCC by the Institute for Global Environmental Strategies (IGES), Hayama, Kanagawa Japan

Intergovernmental Panel on Climate Change (IPCC) 2006. 2006 IPCC Guidelines for National Greenhouse Gas Inventories; Volume 4: Agriculture, Forestry and other Land Uses Prepared by the National Greenhouse Gas Inventories Programme, Eggleston H.S., Buendia L., Miwa K., Ngara T. and Tanabe K. (eds). Published: IGES, Japan

As already mentioned earlier, if you consider engaging in the carbon market, you have to be aware that selling carbon credits is not simple, that getting the credits on the market involves a number of steps in which external experts and agencies have to be involved, and which costs

money. This is true for carbon credits sold on the compliance market (like under the Clean Development Mechanism of the UNFCCC), the REDD credits presently sold on the voluntary market, and it will remain the same once REDD credits can also be sold on the compliance market, or on other markets that may be developed in the future. The table below presents an overview of the costs of getting carbon credits on the market for CDM projects. This will give you at least an idea of what it might imply for a REDD+ project. A community-based REDD+ project, if run independently, may be a small project, but the costs are still considerable. These costs will have to be covered by the carbon sold, which can be a substantial share of the income from carbon sales.

Table 5. Estimated costs of getting carbon credits on the market under the Clean Development Mechanism (in US$)

Activity	Full Scale CDM Project	Small Scale CDM Project	Voluntary Gold Standard*
Project Design Document Preparation	45,000	20,000	7,500
Stakeholder Consultation & Host Country Approval	10,000	5,000	2,500
Validation	30,000	12,500	5,000
Registration Fee	30,000	5,000	NA
Transaction Negotiation & Contracting	20,000	10,000	5,000
Project Monitoring (Periodic)	varies	varies	varies
Initial Verification	15,000	7,500	2,500
Periodic Verification (Cost per Verification)	10,000	5,000	2,500
Approximate Total	>160,000	>65,000	>25,000

Note: Actual costs will vary considerably depending on several factors
**This illustration is for a "micro-scale" project <5,000 tCO2/Yr. The costs for larger-scale projects would tend to be substantially higher*
Source: Green Markets International web-site: www.green-markets.org/voluntary.htm

In light of all this, there are two important things to consider: First, when considering REDD+ it is important not to think only of income from carbon sales but to also of all the other benefits communities get from well protected and managed forests. Second, indigenous communities have to try and think of alternatives to conventional REDD+ projects. Indigenous peoples' organisations engaged in REDD+ processes at the international level are particularly wary about the carbon market solution and are much more in favour of funding of REDD+, at least when implemented in indigenous peoples' territories, through public funds. This will allow for more flexibility in designing REDD+ projects and may create the necessary space for project designs that are socially and culturally more appropriate for indigenous communities and allow for greater control by indigenous communities.

AMAN'S PROPOSAL FOR A REDD+ FUND FOR INDIGENOUS PEOPLES

AMAN, the national indigenous peoples' alliance in Indonesia, has come to conclude that for now and at least in the near future it will be difficult for indigenous communities to get involved in the carbon market. There are many unresolved and critical issues linked to the market solution for REDD+, like the lack of capacities, and its global and national economic and political implications. At present AMAN considers the carbon market solution more a threat than opportunity for indigenous communities. Therefore, AMAN suggests that indigenous peoples' contributions to REDD+ should be detached from the market mechanism. Instead, there should be a funding mechanism or trust fund exclusively for indigenous peoples. The fund should recognize the contribution of indigenous communities to REDD through their forest management and conservation practices, which are based on their traditional knowledge. Indigenous communities would still measure and monitor carbon in their forests, but not in connection with carbon trading, i.e. not in order to sell carbon credits on the carbon market. What AMAN suggests is that carbon emission prevention and the carbon sequestered in indigenous communities' forests would be included in the State's national carbon accounting system. It would help the State to meet its obligations that are part of REDD+ agreements or the carbon emission reduction targets of the UNFCCC. The "payment" to communities would be a form of payment for environmental services (PES).

PART III. COMMUNITY-BASED REDD+ IN PRACTICE: SOME USEFUL SKILLS

PART III. COMMUNITY-BASED REDD+ IN PRACTICE: SOME USEFUL SKILLS

This manual has so far tried to provide an overview of the key features of REDD+ projects that allow for full and effective participation of indigenous communities and can thus be called community-based REDD+. We have also provided a basic description of how conventional REDD+ projects work. As you will remember, a key requirement for any REDD project is the measuring and monitoring of carbon. Since we believe that in order to really know how REDD+ works and to assess whether it could be an option for indigenous communities, it is also important to have at least an idea of carbon monitoring. Therefore, we decided to include a short and basic module on this particular skill needed in the implementation of REDD+.

Forest management is of course not only about carbon. The whole discussion on carbon and climate change is fairly new, and before that forest management had and it of course continues to have other purposes.

There are some specific forest management techniques which can be useful both for increasing carbon sequestration and for increasing other benefits for people. In the second part of this chapter, we will very briefly introduce two such forest management techniques which have been successfully applied by the Ikalahan, an indigenous people living in the mountains of the Northern Philippines.

MODULE 4
KNOW YOUR CARBON: COMMUNITY-BASED MEASUREMENT AND MONITORING OF CARBON

This module intends to help you acquire the basic skills needed for measuring and monitoring carbon in your forests. Measuring and monitoring carbon is indispensible for the implementation of any REDD+ project. However, as the first chapter of this module explains, there are also good reasons to learn these skills for communities who are not sure whether to engage in REDD+, or who have decided not to do so.

In this module we are trying to provide a simple and practical guide on how to conduct carbon measurement and monitoring. We are however aware that it may still be necessary to seek the help of experienced people who can provide initial field training, and further assistance later on.

Chapter 1: Why Community-based Carbon Monitoring Makes Sense

Knowing how to measure and monitor carbon can be useful not just for communities running their own CB REDD+ project, but also if your community decides to join a REDD+ project in which carbon monitoring will be done mainly by others. At least you will know how carbon measurement is done, which will also help you understand better what REDD+ is all about. You will be in a better position to present your conditions, demands and claims (e.g. for benefit sharing), and you will be better able to check on what has been done and is happening in your forests under a REDD+ project.

Knowing how to measure and monitor carbon can also be useful for communities who decide not to participate in any REDD+ project. Knowing your carbon stock, the amount of carbon your forests sequester or how much carbon is emitted and what are the reasons for that can help you in your negotiations with governments, NGOs or companies who want to interfere in and change your land use and management practices. "Knowing your carbon" can help you counter allegations about the impact of your land-use practices on the climate.

And, finally, community-based carbon monitoring has been found also beneficial for others, like government agencies and NGOs who are trying to estimate carbon stocks of forests, carbon emissions due to deforestation and forest degradation, or carbon sequestrations happening in natural, regenerating or replanted forests.

Governments entering into REDD+ agreements will have to comply with the requirements for monitoring, reporting and verification (MRV), which includes detailed reporting on carbon stock change. To do this for a whole country is an enormous task, especially given the high standards for accuracy and reliability needed. It has therefore been recognized that involving indigenous and other forest-dwelling communities has an enormous potential to generate the capacities needed for fulfilling these requirement. Without their involvement it may even be impossible or extremely costly to do that.

There are several ways to measure carbon stocks. Some involve sophisticated technology like remote sensing (which means images taken of forest areas by cameras that are mounted on satellites which orbit around the earth), or aerial photography (photos taken from airplanes while flying over a forest), with radar and even laser technology.

While these technologies are very useful for making carbon estimates for large areas, they are all not very accurate especially for dense tropical forests. Even the most sophisticated technology, like LIDAR (Light Detection And Ranging, an optical remote sensing technology using laser) is not as accurate as the on-the ground measurement. Technologies will be refined further and may become more accurate in the future, but using them is also very expensive.

Therefore, even for carbon estimates of large areas, at least some on-the-ground measurement has to take place, and the results combined with those obtained through other technologies like remote sensing will be used in order to come up with results that are acceptable.

Some researchers have concluded that local measurement would be essential also for state governments if they want to claim carbon credits at an international level under REDD, because data that is sufficiently accurate cannot be obtained from other sources such as remote sensing (see e.g. Karky and Skutch p. 6). If trained properly, communities are a great potential for the collection of reliable carbon data needed at the national level.

A comparison between biomass measurement conducted by communities and the subsequent control survey made by experts showed that the results differed only very little. The difference was never more than 7%, and mostly less than 5%. It is also important to note that the costs for surveys conducted by communities are much lower. Even in the first year, when costs for the community surveys were high because of the initial training and other preparations, the costs were between 70% and 30% of the costs of professional surveys. Costs became much lower afterwards, when surveys were done every year and little retraining was needed. Overall, the average cost of community biomass inventories over four years was about 25% of the cost of a professional survey (Skutsch et.al. 2009, pp. 109f).

Chapter 2: How to Measure and Monitor Carbon - A Simple Guide

If you want to measure and monitor carbon for a REDD+ project, you have to do it in such a way that it meets the recognized standards we have mentioned earlier. This is because the results of your measurements need to be verifiable. This means, an external verifier or auditor should be able to check whether your measurements are correct. And for that, the verifier has to know how you did it and whether the method you used was properly applied or not.

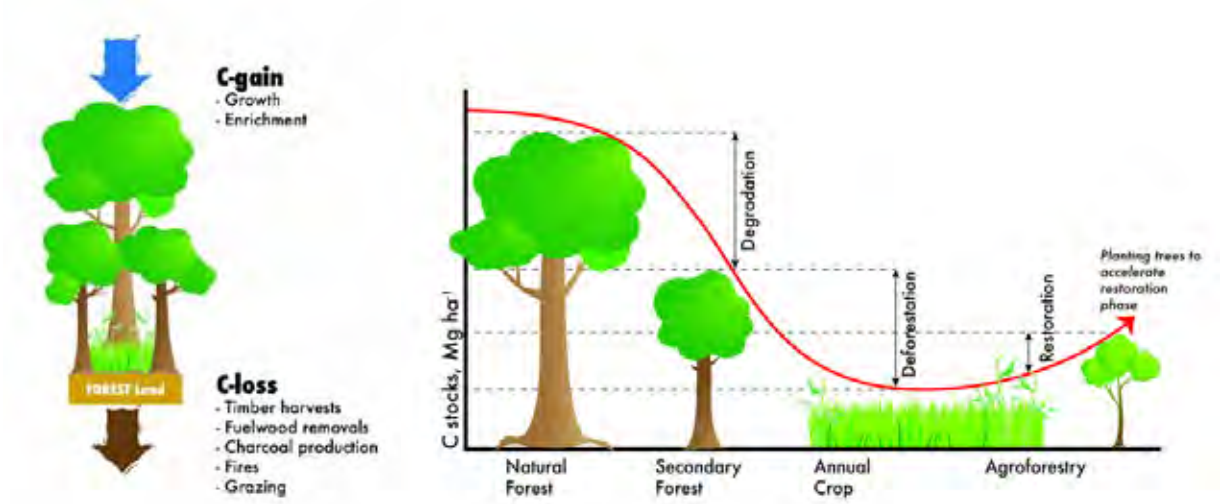
We are providing you with a simple guide which largely follows the recognized methodology (basically the IPCC Good Practice Guidelines). We are trying to make this guide as simple as possible, so that it can easily be applied by communities. However, there are certain aspects that we do not cover in detail. Depending on the purpose for which you are using the carbon measure-

ment and the particular standard you are following, you may have to seek further guidance and maybe external assistance. We will provide you with the necessary reference material.

Monitoring carbon means to find out whether and how the amount of carbon stored in your forest is changing: is it increasing or decreasing? There are basically two ways of doing this:

- One way is to measure carbon is the so-called gain-loss method. This means measuring the increase of biomass as a result of natural growth (which requires knowledge of average growth rates of trees and other plants in the forest), and measuring the loss of biomass due to the cutting of timber, damage to the forest because of logging, collecting of fuelwood, and other forest products, fire, grazing, etc.
- Another method is the so-called stock-difference method. Carbon stocks in each carbon pool (trees, litter, soil, etc.) are measured at the beginning and again after a certain period, and the results are compared which allows the calculation of the change of carbon stocks.

Graph 4: Gain-loss method (left) and stock-difference method (right) of carbon monitoring



Which method to choose depends on the available data. The first method requires a lot of detailed information which is usually not readily available. Therefore, the second method is used in most cases, and we will introduce this method here.

So for the stock-difference method, an inventory of the carbon stock has to be made at the beginning and in regular intervals over the project period. For this method a set of principles and techniques have been defined by the Inter-governmental Panel on Climate Change (IPCC), and the method is usually referred to as the standard carbon inventory method.

The **standard carbon inventory method** consists of the following steps:

1. Delineating the project boundaries
2. Identifying and mapping different forest blocks or strata (areas with different forest types)
3. Making a pilot inventory to assess variation in each strata or block (how tree densities vary) and to determine the number of permanent sample plots needed in each strata
4. Establishing the permanent sample plots
5. Preparation of field measurement (including orientation and training of communities)
6. Conducting the field measurements in the permanent sample plots
7. Analyzing the data (calculation of carbon stock for each strata/block and compilation for a total carbon stock estimate)
8. Analyzing and monitoring leakage
9. Writing a report

We are going to describe them one by one in the following paragraphs.

a. Identifying and delineating the boundaries

The first step to take is to identify the land and forest areas to be included in the REDD+ project, to delineate the boundaries and to make a map.

MAPPING AND LAND TITLING

Preferably, you are demarcating the land areas to be included in a REDD+ project after or as part of the overall community mapping in which you are delineating and mapping the territory of your community. The mapping of your community territory is one of the steps needed for obtaining titles or other forms of official recognition over your territory. Getting your land and forest rights recognized is a precondition for engaging in REDD+. It is important that you insist on obtaining tenure security over your territory before you are signing any contract; or that you insist on including this in a contract. Since the legal provisions and procedures to get land and forest rights recognized differ considerably between countries we are not covering this in this manual. We also have not included community mapping methods since the methods used have to comply with officially recognized standards, or the mapping has to be done my officially recognized geodetic engineers in order to get the government recognition needed for titling procedures.

Clearly defining the boundaries of the areas to be included in a REDD+ project is important for accurate measurement, monitoring and accounting of carbon stock, and for the external verifier to conduct the verification.

DELINEATING THE REDD+ PROJECT AREA: WHAT LAND TO INCLUDE AND WHAT NOT?

You need to have a thorough discussion on which areas you intend to include. For example, if you include land used for shifting cultivation and you want to continue with shifting cultivation there, you will have to account for the carbon emissions that occur when you cut and burn a new field. So even though fallow land for shifting cultivation stores a lot of carbon, it might cause too much work to do all the measuring of carbon emissions and it might be preferable to just exclude the areas used for shifting cultivation.

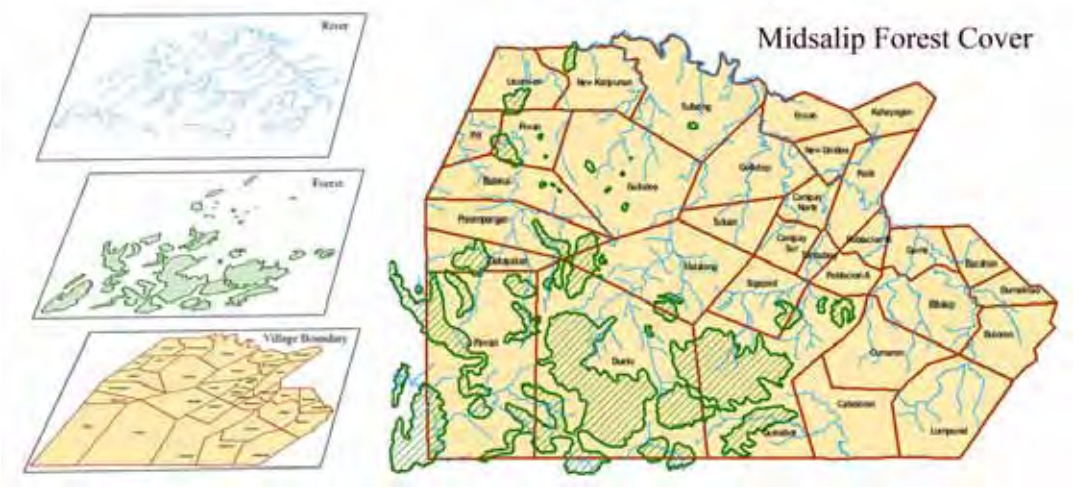
These days, boundary delineation is done with the help of GPS (Geographic Positioning System) and maps are produced with GIS (Geographic Information System).

A GPS is a handheld device that identifies, with the help of satellites, the position of the place where it is used at that moment on earth. Satellites are machines that circle the earth for the purpose of gathering data. They can measure temperature, take pictures, and send out signals received by the GPS through which it is possible to pinpoint locations.

Every single location on the earth can be given an "address". The "address" of this location is expressed as x (longitude or where the item is on the earth's surface in an east-west direction) or y (latitude or where the item exists on the earth's surface in a north south direction). So it's like there is a grid laid over the earth with the lines running north-south given numbers and the lines running east-west are given numbers. The address of a location is where these lines intersect and is expressed in numbers which identify the longitude and latitude.

With the help of GPS, boundaries of certain features of the earth can be identified: the boundaries of forests, or of different types of forest, the boundaries of rice fields, the location of buildings or sacred sites, roads and paths. All this geographic information can be transferred to a computer and, with the help of special GIS software, maps can be produced for all kinds of uses.

Graph 5. Compiling geographic information into a map



Courtesy Dr. S. Padilla Jr., Anthrowatch

Such maps can be very valuable for community land-use planning, resource management and community development planning, and of course also for managing REDD+ projects.

GPS and GIS can be used for very specific forest management or conservation work. For example, the location of a single important tree, like a mother tree that needs to be protected for seed production and regeneration, can be identified with a GPS. The GPS is turned on and it connects to the available satellites so that they can give the location's address in longitude and latitude. But it is also possible to put in additional information, not just the name of the location, but also the type of tree, its approximate age uses, use and cultural significance, etc. This entire information can then be transferred to the computer and put into a GIS database.

In this manual, we are not going to give you an introduction on how to use GPS for the delineation of the boundaries of your REDD+ project area. There are many handbooks and guidelines available. You can also easily get help for boundary delineation or obtain training in the use of GPS and GIS from NGOs in your country.

The two following guide books on carbon stock measurement, which are more detailed than the short guide we are providing here, contain a chapter on the use of GPS and GIS for boundary delineation and the production of maps.

> Verplanke, J.J. and E. Zahabu, Eds. 2009: A Field Guide for Assessing and Monitoring Reduced Forest Degradation and Carbon Sequestration by Local Communities. 93 p. Available online from www.communitycarbonforestry.org

> ANSAB, FECOFUN, ICIMOD 2010. Forest Carbon Stock Measurement: Guidelines for measuring carbon stocks in community-managed forests. Kathmandu, Nepal. ISBN: 978-9937-2-2612-7. Available on-line at: http://www.ansab.org/wp-content/uploads/2010/08/Carbon-Measurement-Guideline-REDD-final.pdf

b. Identifying and mapping different forest blocks (strata)

You cannot possibly measure each and every single tree in your forest to calculate its carbon stock. But there is a mathematical method (based on what is called the "statistical sampling theory") which enables you to provide a measure of the biomass that is "good enough" to be used in carbon accounting by measuring only a fraction of the trees.

For that you not only have to use the correct method that allows an accurate and precise meas-

urement of carbon, but you also have to identify a certain number of plots distributed all over your forest, which represent the nature of your forest. Then you measure the trees and other carbon pools in these plots and based on that you can calculate the carbon stock for the entire forest. The crucial question is how many of these sample plots are needed in order to be able to make a calculation which is "good enough".

GOOD ENOUGH – TO BE ACCURATE AND PRECISE

Good enough means that the measuring of carbon (or biomass) is both accurate and precise.

A measurement is accurate when it does not differ too much from a reference measurement (which means a measurement conducted by experts with more experience and more sophisticated technology).

A measurement is precise when more or less the same result will be obtained if it is repeated in the same way.

See ANSAB et.al. 2010, p. 10

If you had a forest which looks all the same, like a forest plantation, you could just make a checkerboard grid on the map and identify a number of plots where you will take the measurement (called sample plots) and you would get data that is accurate enough for a calculation of the whole forest.

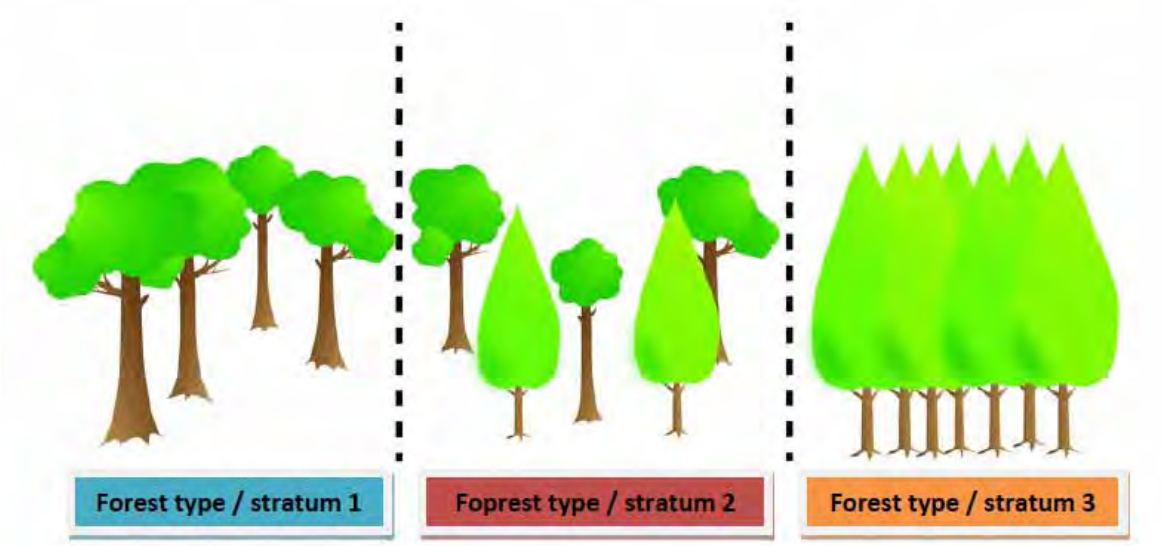
However, in reality forests are not the same everywhere. Therefore, there are also different carbon stocks in different types of forests. The differences of forests and carbon stocks depend on a number of physical factors, like rainfall, temperature, soil type, topography (steep of flat), altitude (lowland or highland forests), biological factors (the composition of tree species and other plants, their age, density of forest) and human factors (logging, extraction of fuelwood and other forest products, temporary clearing for farming, livestock grazing or intentional fires, etc.).

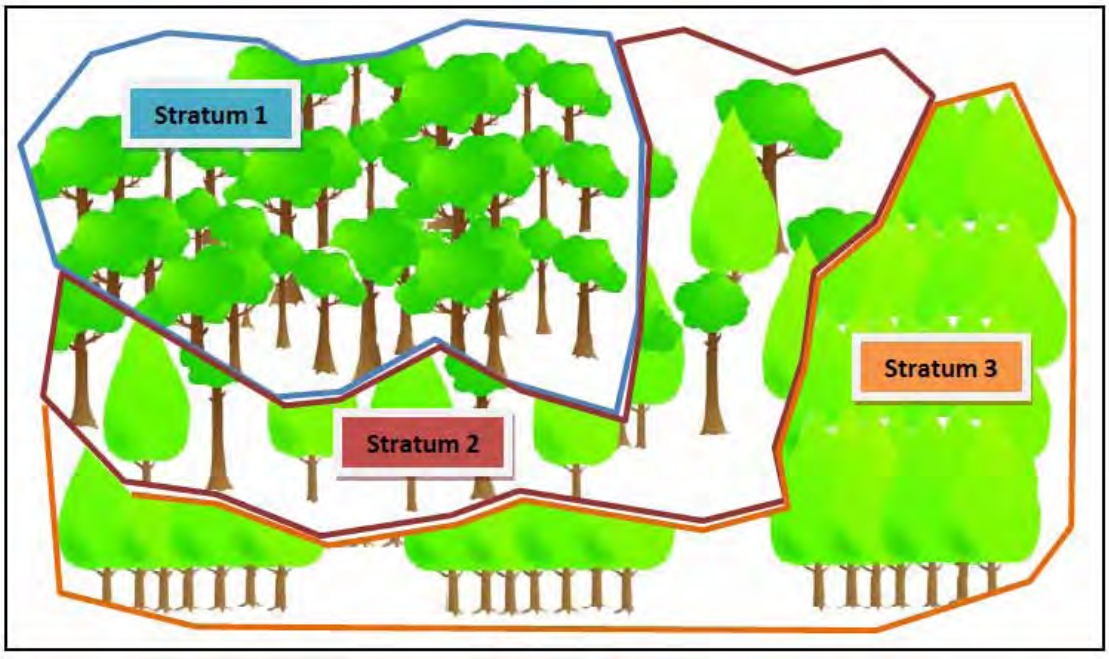
So in order to measure carbon stocks in your forest accurately, you have to distinguish between different forest types. Since you know your forest very well you should be easily able to identify the different forest types and where they are located. It can be helpful if you have a good satellite image or a forest map made on the basis of such images for identifying and delineating the areas or blocks of different forest types.

Dividing up a forest area according to the different types of forest found there is called stratification, and the forest blocks identified and delineated are called forest strata.

You will have to delineate the boundaries of the different forest strata or blocks and map them.

Graph 6. Identifying forest strata





THE IKALAHAN AND CARBON: IDENTIFYING FOREST BLOCKS

The Kalahan Educational Foundation (KEF) is the legal personality of the Ikalahan, and indigenous people in the area of Santa Fe, Nueva Vizcaya, Philippines. Through the KEF, the Ikalahan were able to get legal control of a large portion of their Ancestral Domain in 1974. The staff of the KEF struggled with the problem of how to provide a good livelihood for their people without damage to the extensive forests. Moises and Delbert, two of the staff members, kept up to date on the problems regarding global warming from newspapers and magazines. They realized in 1993 that there might eventually be a market for carbon sequestration. It happened that at that time they had some funds which could be used for documentation so they focused the work on documenting carbon.

They discussed the problem with various environmentalists and foresters and decided that the usual "chess board" methods of setting up a system for sampling the growth of their forests would not be suitable because of the steep slopes and thick forests. Then one of the foresters suggested that they set up homogeneous blocks of the forests. (A homogeneous block is an area of irregular size and shape which contains the same kind of forest throughout the block.) A graduate student in forestry volunteered to set up the blocks using satellite images. It took her several weeks to do it. Some of the blocks had to be changed later but most of the blocks were satisfactory.

The Kalahan area has three types of forest: pine, oak and dipterocarp. Some of the blocks are thick pine forests and some are open pine forests. A few are thick mossy oak forests. Others are medium stand dipterocarp forests, etc. All of them have high biodiversity except, of course, the pine forest which has some biodiversity but not a very high one. The smallest blocks are about 40 hectares and all together they total about 10,000 hectares.

Then Moises and Delbert got one of their foresters to set up sample plots of 50 x 50 meters in each of the blocks. The forester that set up the plots should have been more careful and scattered the plots more evenly because in some cases there are two plots fairly close together with a long distance to the next plot in the same block. However, this was not realized until later in the research. As the research continued, new plots were added in a few blocks in order to improve the sampling. There is a maximum of 4 or 5 plots per block. The result was about 190 plots.

c. Making a pilot inventory to assess variation in each stratum or block

The number of plots you need in each stratum or block for a reliable carbon measurement again depends mainly on two factors:

a) The precision of your measurement: The more precise you need to be, the more plots you need to measure. Precision is measured mathematically and used in an equation with which the number of plots is calculated.

Related to this is the question of costs, because the more precise you want to be, the more effort and money it takes.

Usually, the level of precision for forest projects like under the Clean Development Mechanism is +/-10% of the average carbon value, which means the calculation of the carbon stock made can be up to 10% higher or lower than the actual carbon stock. In small-scale Clean Development Mechanism (CDM) forestry projects, a precision level of up +/- 20% is accepted.

The higher the precision, the more costly since it takes more intensive field measurements. In a REDD project in Bolivia, it was calculated that for a precision level of +/-5%, a total of 452 sample plots would be needed, but for a precision level of +/-10%, only 81 plots were needed (The World Bank 2011, p. 5-15)

b) The variability of the forest: This means how much the forest actually varies within each block or strata. For example, a block of open degraded forest may have some areas that are still quite dense whereas in other parts there are only few large trees. So there is variability in terms of density. A plantation forest with only one or few trees has a low variability as compared to a natural old-growth tropical forest. The more the forest within a block or strata varies, the more sample plots you need in order to get an accurate measurement. A plantation forest needs much fewer plots than an old-growth forest.

So in order to find out how many sample plots you need in each block, you also have to find out how much the forest within each block varies. There is a mathematical value by which this variability is measured. It is called the coefficient of variation. This value is also used in the mathematical equation which can be used to find out how many sample plots are needed in a forest block.

Now, in order to find out the variation in a particular forest block, you need to make a pilot inventory.

Once you have decided on *how precise* your measurement should be, and once you have conducted the pilot inventory and thereby established *the variation* of a particular forest block or strata, you can calculate the number of permanent sample plots needed with the help of that mathematical equation already mentioned. We will provide a brief guidance for the use of available tools to calculate the number of sample plots in paragraph 5 below.

The following is a brief description of the **steps to take in a pilot inventory:**

1. **In each forest block or stratum identify 10-15 sampling plots:** The selection of the plots within each block should be done randomly. The size of the plots depends on the density of the forest. The denser the forest, the smaller the plot can be, and the size can range between 100 m2 for very dense forests and 1000 m^2 for areas with only few trees. According to some guidelines, a rule of thumb is that the plot size should be big enough to contain at least seven large trees.

   The table in paragraph 4 (Establishing the permanent sample plots) can help in deciding on the size of the plots.

MEASURING DISTANCES ON STEEP SLOPES

Since distances are supposed to measured horizontally we need to correct the up-slope measurements of distances taken on steep slopes in order to be accurate. This is necessary on slopes of over 10%, which means: if the altitude increases by 1 metre for every 10 metre horizontal distance.

With a good GPS and if the signal is strong enough, you can read the horizontal distance between two points from the GPS.

There are also equipments like the clinometer which can be used for that but it is quite complicated and you can make the correction also with help of the following simple calculation.

For example, if a slope increases in altitude by 20 metre per 100 metre distance measured horizontally (a 20% slope), the length of the distance measured along the slope will be 102 metre (101.98 to be precise). There are instruments (like the clinometers) which can be used to measure horizontal distances on slopes, but you can also do it with a simple method that requires only some basic mathematics.

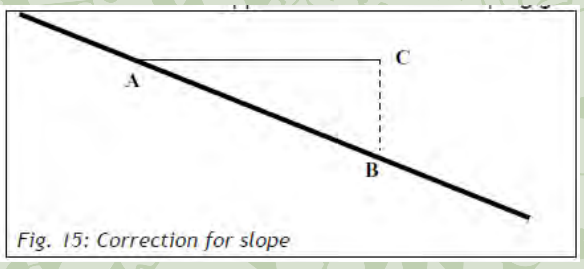


Fig. 15: Correction for slope

1. Measure the horizontal and slope distance:

On the slope, try to measure a short distance (A–C) horizontally with the use of a measuring tape and if necessary a stick. Then measure the distance between the same points (A–B).

2. Calculate the proportion between the two:

If the slope distance (A-B) is 7 metres and the horizontal distance (A–C) is 6 metres the proportion is 7/6.

3. Calculate the full horizontal distance needed

If you need a horizontal distance of 20 metres the slope distance you need to measure is: 20 x7/6 = 23.33 metres

2. **Estimate carbon stock in each plot:** All trees found in a plot with a diameter at breast height (dbh) greater than 10 cm should be measured. Smaller trees/tree saplings of between 1 and 10 cm dbh don't need to be measured in the whole sample plot, but can be measured in a smaller plot (of between 15 and 75 m^2) at the centre of the sample plot. How the carbon measurement is done will be explained in the next paragraph.

   Since the purposed of the pilot survey is to find out how high the variability is in a forest strata (how much the plots differ from each other in terms of tree densities and therefore carbon) we do not need to measure carbon contents of herbs, grasses or the soil.

3. **Record the measurement and other information:** All information of the measurement on the trees and the location, etc. needs to be recorded in a survey form prepared beforehand (see example at the end of this chapter and in the annex).

4. **4. Calculate the carbon:** The carbon needs to be calculated per plot, and per hectare for each plot, and then the mean carbon stock per hectare of all the plots needs to be calculated.

5. **Determine the number of permanent sample plots: Since you now have the carbon stock for each plot and the average,** the variability of the forest in each block or stratum can be calculated. When you have the value for variability and you have decided on the precision level, you can determine the number of plots required for the actual carbon inventory and monitoring. This can be done with the help of the mathematical equation mentioned earlier.

You can find guidelines for the calculation of the number of sample plots in the two manuals referred to and provided in the CD enclosed:

- Verplanke, J.J. and E. Zahabu, Eds. 2009: A Field Guide for Assessing and Monitoring Reduced Forest Degradation and Carbon Sequestration by Local Communities on pages 42-44
- ANSAB, FECOFUN, ICIMOD 2010. Forest Carbon Stock Measurement: Guidelines for measuring carbon stocks in community-managed forests, on pages 9-16

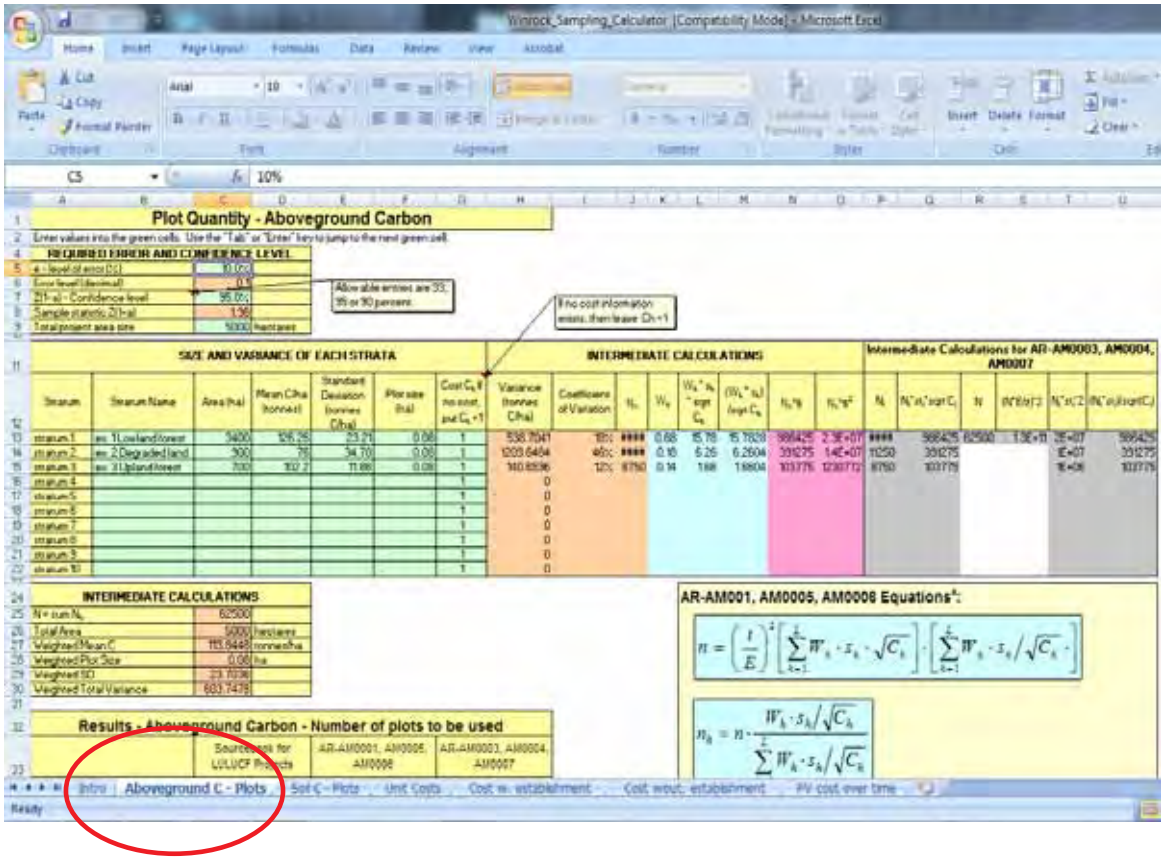
There are however tools available which can save you a lot of work making these calculations. Winrock International created a tool for calculating the number of sampling plots needed for above-ground carbon and soil carbon (the "Winrock Terrestrial Sampling Calculator"). The tool also helps in estimating the costs, like for establishing sampling plots or the measurement costs. It is an Excel file that can be downloaded at http://www.winrock.org/ecosystems/tools.asp and is included in the CD enclosed.

We are providing you a short guidance on how to use the Winrock tool so that you can do it all by yourself. If you are not sure, you can of course seek help in making all these calculations, or maybe also for the planning and the initial phase of the pilot inventory in general.

Using the Winrock tool for calculating the number of permanent sample plots

1. Copy the Excel file "Winrock_Sampling_Calculator" on the CD enclosed on the hard drive of your computer and open it.

2. Select the tag "Aboveground C-plots".

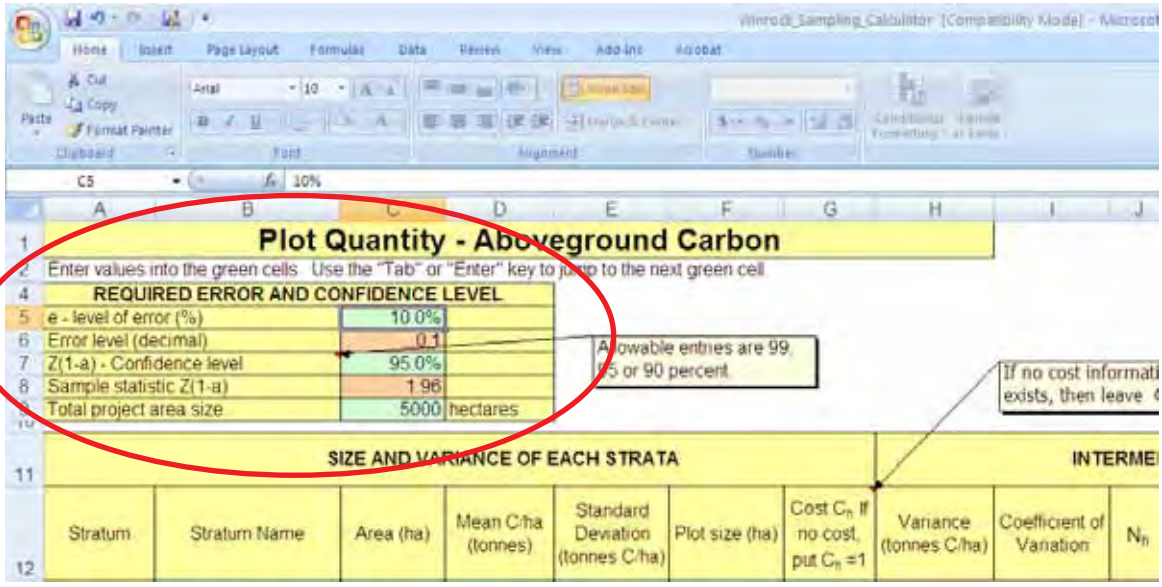


3. In the tool you have to fill in your own data in the green fields. All other fields are locked to avoid unintentional changes of formulas. For our purpose the fields to the left of the sheet are of interest.

4. The tool already contains some data to give you an example of how to do it. So you will have to replace the date you see in the green fields.

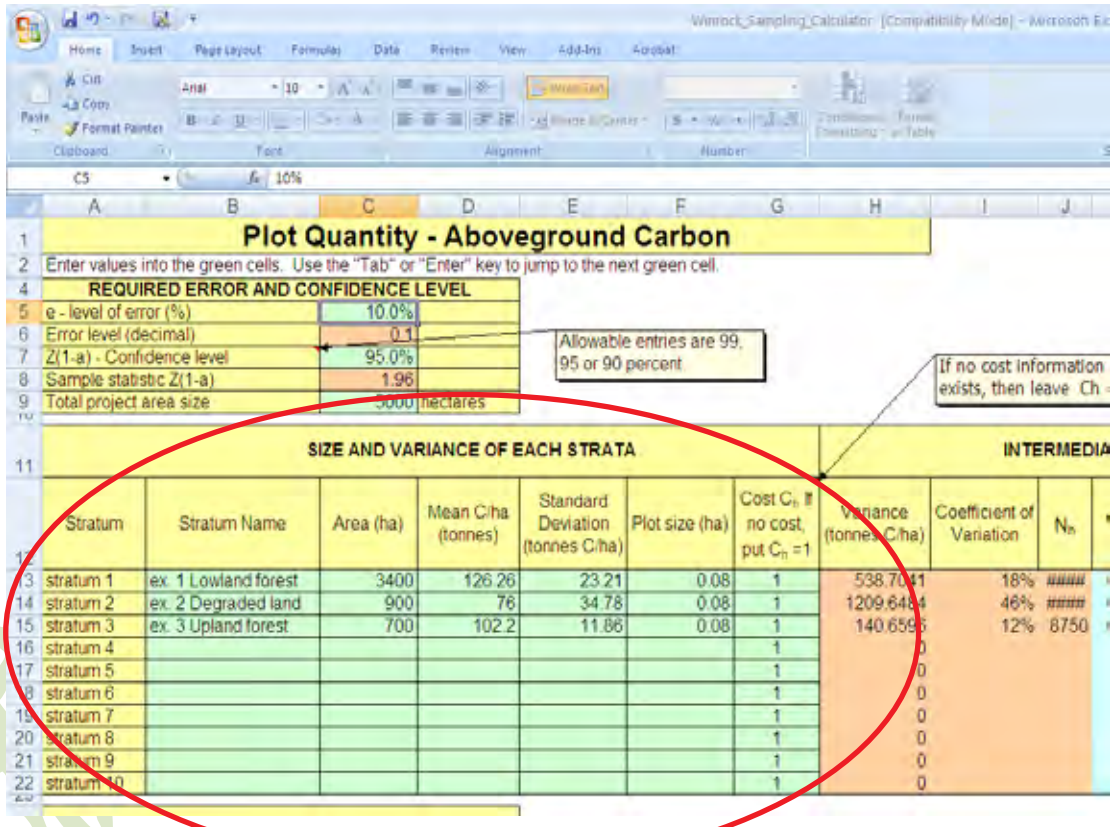
5. First you need to provide the data in the first table (REQIRED ERROR AND CONFIDENCE LEVEL). Look at the green fields C5 (level of error) and C7 (confidence level): You can keep these values since they are generally acceptable and reasonable.

   In field C9 you have to replace the figure (5000 ha) with the size of your project area.



6. Then go to the table just below (SIZE AND VARIANCE OF EACH STRATA). You have to enter your data in the green fields of columns B, C, D, E and F (delete the examples already entered).

- Enter the names of your strata (forest types)
- Enter the area of each stratum
- Enter the mean carbon per hectare, which means: the mean of all the 15 pilot sample plots you have measured (total of all 15 plots divided by 15).
- Enter the standard deviation for each stratum. We are giving instructions on how to calculate standard deviation in Annex 2.
- Enter the size of the pilot sample plots



7. In the third table "Results – Aboveground Carbon – Number of plots to be used" you will get the results. The Winrock tool uses three standard equations (pink, light-blue and grey columns), which however all have the same result. The table gives you the number of permanent sample plots needed for each stratum and (in row 46) the total number of plots.

17	stratum 5						1	0
18	stratum 6						1	0
19	stratum 7						1	0
20	stratum 8						1	0
21	stratum 9						1	0
22	stratum 10						1	0

	INTERMEDIATE CALCULATIONS		
25	N = sum N_h	62500	
26	Total Area	5000	hectares
27	Weighted Mean C	113.8448	tonnes/ha
28	Weighted Plot Size	0.08	ha
29	Weighted SD	23.7036	
30	Weighted Total Variance	603.74784	

Results - Aboveground Carbon - Number of plots to be used

			Sourcebook for LULUCF Projects		AR-AM0001, AM0005, AM0006		AR-AM0003, AM0004, AM0007	
34	Stratum	Stratum Name	Plot Quantity	Rounded Plot Quantity	Plot Quantity	Rounded Plot Quantity	Plot Quantity	Rounded Plot Quantity
35	Total Sample Size		16.65	20	16.65	20	16.65	20
36	stratum 1	ex. 1 Lowland forest	11.09	13	11.09	13	11.09	13
37	stratum 2	ex. 2 Degraded land	4.40	6	4.40	6	4.40	6
38	stratum 3	ex. 3 Upland forest	1.17	2	1.17	2	1.17	2
39	stratum 4							
40	stratum 5							
41	stratum 6							
42	stratum 7							
43	stratum 8							
44	stratum 9							
45	stratum 10							
46	TOTAL NUMBER OF PLOTS			21		21		21

Now that you have calculated the number of permanent sample plots for each stratum you can proceed to establish the permanent sample plots.

d. Establishing the permanent sample plots

Now that you know the number of plots required in each forest stratum/block, you have to decide on their location. This should be done according to the so-called "standard sampling methods", which is a procedure that ensures that the locations of the plots are distributed randomly within a respective area. This can be done with the help of GIS and special software (like Hawths' tool of Arc GIS, available at www.spatialecology.com).

Or you can do it by drawing a checkerboard grid over the map so that you get squares at least ten times the number of plots you need to identify. Then you give each square a number, write them on small pieces of paper, put them in a bag, bowl or basket, jumble them and blindly pick the required number of papers. The numbers will tell you in what square the plot should be established.

However, choosing permanent sample plots only randomly can be problematic. You have to ensure that the sample plots chosen really represent the forest conditions with respect to slope, soil types etc. For example, a plot near a trail may not be appropriate since its conditions are dif-

ferent from a plot further inside the forest. So for choosing the sample plots you need to depend on your knowledge of the forest.

With the help of the GPS (or the map and compass, if you don't have any) you find the plots and put a cemented or wooden pillar at the centre of each plot, so that you can easily find the plots again when you do more measurements for carbon monitoring later on. If you have a circular plot, this is already sufficient since next time you visit that plot you just have to take the radius measurement from that pillar to check on the boundary of the plot. If you have a square plot you may need to put a pillar at each corner as well to make sure you are measuring inside the same area again.

The size of the plots should be the same as those used in the pilot survey. As mentioned already, the size of the plots depends on the density of the forest and can range between 100 m^2 for very dense forests and 1000 m^2 for open forests with only few trees. The rule of thumb is that the plots should contain at least seven large trees.

You can use either circular or rectangular (square) plots. The table below can help in deciding on the size of the sample plots:

Table 6. Vegetation density and size of sample plots

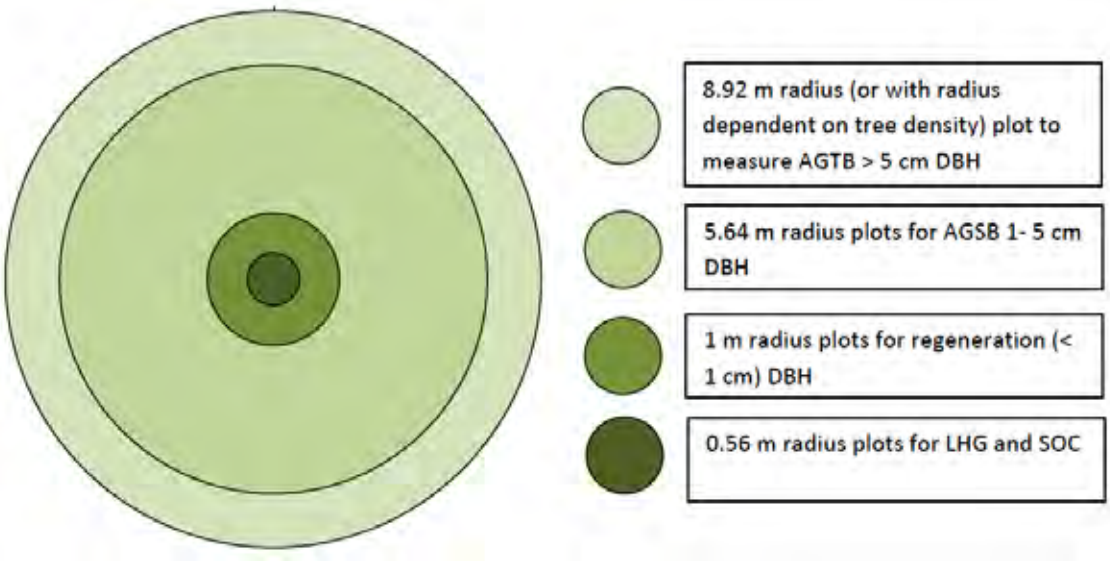
Nature of vegetation (tree density)	Average area covered per tree (m^2)	Size of the plot (m^2)	Circular plot: Radius (m)	Square plot: Side length (m)
Very dense vegetation with large number of small diameter stems, uniform distribution of larger stems (very thick forest with high tree density)	0 - 15	100	5.64	10 x 10
Moderately dense woody vegetation (forest with moderate tree density)	15 -40	250	8.92	15.81x15.81
Moderately sparse woody vegetation (open forest)	40 - 70	500	12.62	22.36x22.36
Sparse woody vegetation (open land with few trees)	70 - 100	666.7	14.56	25.82x25.82
Very sparse woody vegetation (open land with very few trees)	> 100	1,000	17.84	31.62x31.62

Adapted from MacDicken, K.G. 1997

Within each plot, smaller sub-plots are established depending on what you intend to measure.

There are two graphs on the next page showing how this can be done. The first graph is an example for a 250 m^2 large plot (8.92 m radius), in which the above-ground biomass of trees (AGTB), saplings (AGSB), leaf litter, herbs and grass (LHG), soil organic carbon (SOC) and forest regeneration are to be measured.

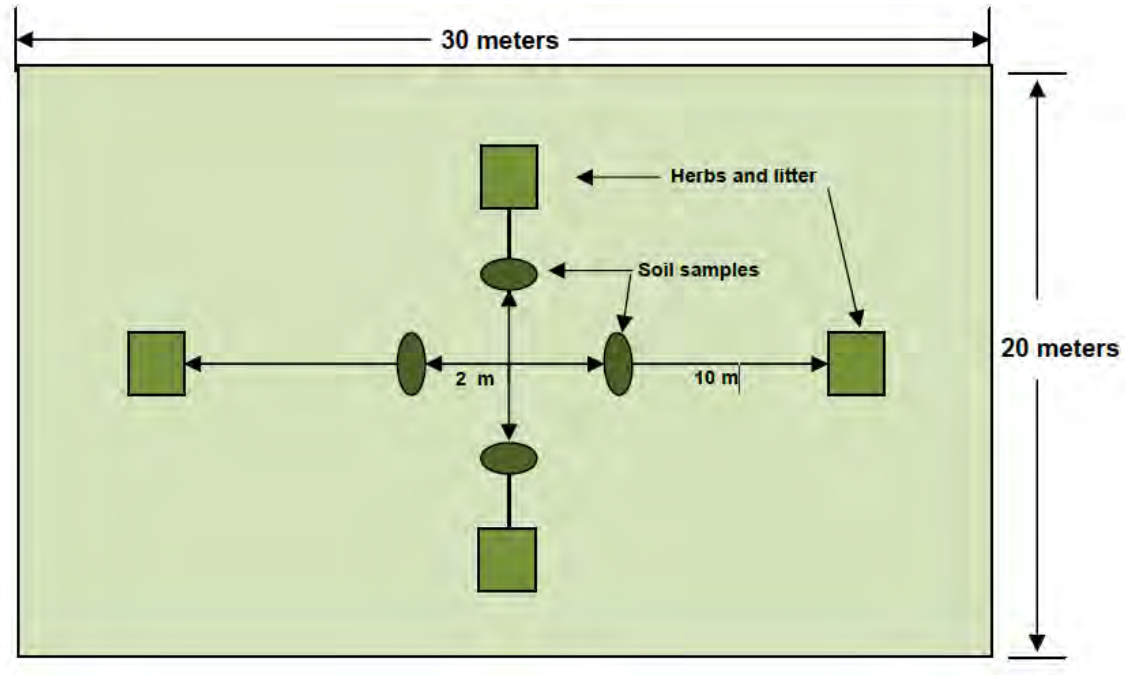
Graph 7. Sub-plots in circular sample plot



Source: ANSAB et.al. 2010: p. 18

The second graph shows a rectangular plot of 600 m^2 in which trees and bamboos (AGTB), dead wood and fallen stumps (DW), leaf litter, herbs and grass (LHG), and soil organic carbon (SOC) are to be measured.

Graph 8. Sub-plots in rectangular sample plot



Source: Sukwong et.al. 2011

e. Preparation of field measurement

Before you conduct your field measurement, it is worthwhile investing enough time in planning and preparing to ensure smooth measurement. It should above all ensure that:

- Everybody in the community is aware of what is going on: what the purpose of the measurement is, who is going to do it, when and where, etc.
- There are enough teams who can conduct the measurements in all plots within a reasonable time period
- All teams have the composition needed (community members trained in carbon measurement and community members with particular knowledge needed, both men and women, external technicians like foresters if necessary, etc.)
- The core members of the teams are all properly trained and thus capable to conduct the measurement
- All equipment and materials (especially the forms needed for recording the data) are ready

LIST OF EQUIPMENTS AND MATERIALS NEEDED

- Forms for recording field data
- Notebook computer
- Maps
- GPS or compass
- Linear tape for distance measuring like plot boundary delineation, distance between trees, etc.
- Rope for plot boundary delineation and other purposes
- For tree height measurement
- Cement of wood pillars/poles for marking centre (and corner) of plots
- Hammer, nails, aluminium tags, paint for marking of trees and bamboo
- Diameter tape for tree measurements (one side of it provides diameter result and the other side the girth). A caliper can also be used for smaller trees, or for logs lying on the ground.
- Spring weighing scale (or other weighing scale) for weighing herbs, grass, litter
- Pruning shear, knife or sickle for cutting grass, herbs, etc.
- Bamboo frame or sticks for marking sub-plots for grass, herbs and litter samples
- Plastic bags of different sizes for collecting samples of and/or weighing herbs, grass, litter, etc.
- Soil sampling hammer
- Soil cores (special tubes for collecting soil samples). In soft soils a soil corer, which is a special equipment for inserting the soil cores, can be used.
- Masking tape for closing the soil sampling tube
- Metal/wood/plastic scale for measuring soil depth

f. Conducting the field measurements in the permanent sample plots

In a forest, carbon is found in biomass (which is the living organic matter) and dead organic matter. Biologists distinguish between different so-called "carbon pools" (reservoirs of carbon), which are as follows:

1. Carbon kept in the biomass:

a) **Above ground biomass** are trunks, branches, leaves, and fruits of all the living plants. Sometimes the distinction is made between trees and understory or undergrowth (composed of shrubs, tree saplings, bamboo and non-woody plants like herbs, ferns, etc.).
b) **Below ground biomass** are the roots of the living plants located under the ground.

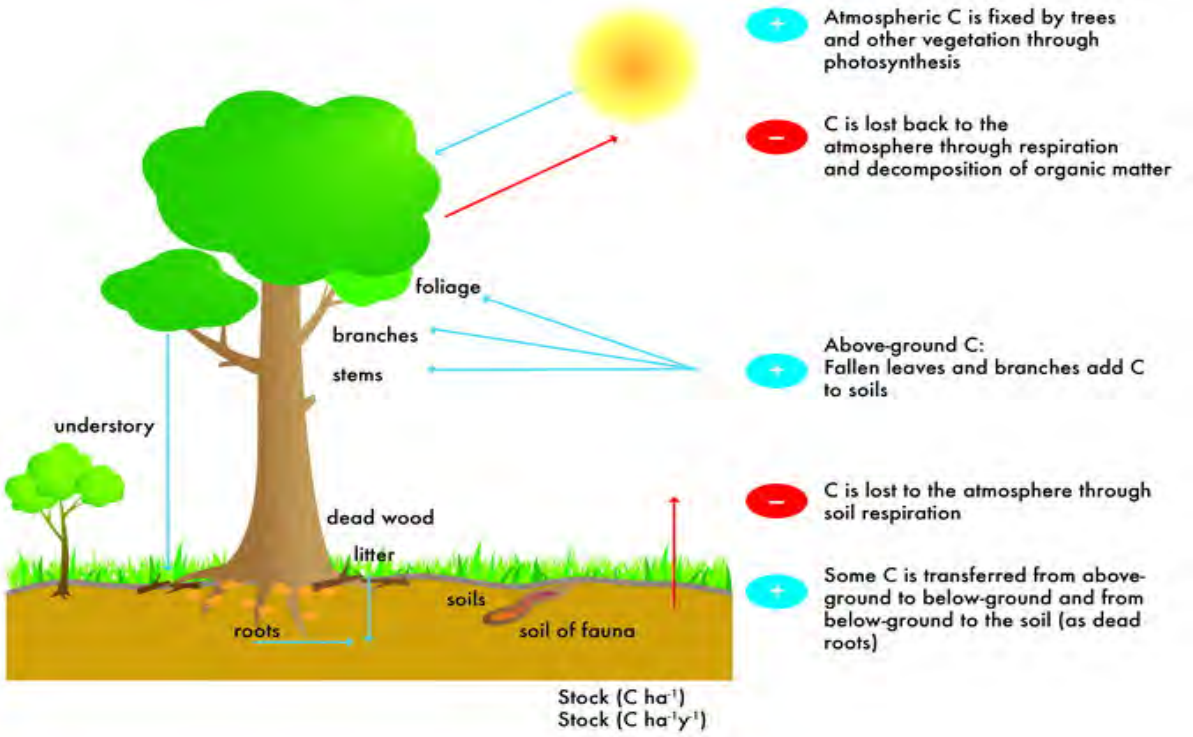
2. Carbon kept in the dead organic matter:

a) **Dead wood** includes all the dead biomasses, but not the litter. They are the dead standing trees, fallen trees, the trees buried under the ground with are at least 10 centimetres in diameter (measured at a person's breast height, i.e. ca. 130 cm from the ground or accordingly for fallen trees).
b) **Plant litter** includes the fallen branches (smaller than 10 centimetres in diameter), leaves, flowers, and fruits on the forest floor. They may be fresh or partly rotten.

3. Carbon kept in the soil: Normally, soil carbon is measured to a depth of 20 to 30 cm, and comprised:

a) Organic soil carbon (from decomposed biomass)
b) Inorganic soil carbon.

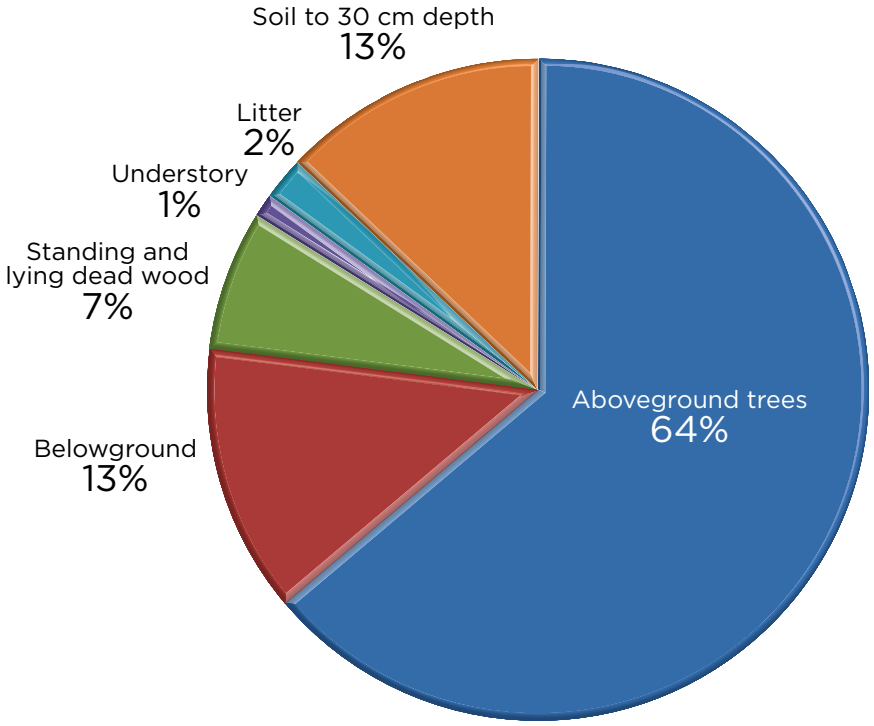
Graph 9: Forest carbon pools



The proportion of carbon of each carbon pool varies between different types of forests. Some have a larger share of below-ground carbon than others.

The graph below shows the proportion of carbon stocks of a tropical forest in Bolivia. The total carbon stock is 202 tons Carbon per hectare.

Graph 10. Proportion of carbon stocks of a tropical forest in Bolivia



Source: GOFC-GOLD 2009, p. 2-54

For each of the carbon pools, methods have been developed to measure carbon. We are providing here a short description of some of these methods. More details can be found in the source material provided.

1. Measuring trees

If we want to know the carbon content of a tree (or any other plant) we first need to know its biomass. Not all of the biomass is composed of carbon, and the share of carbon differs between different tree species. Also, the content of carbon is slightly different in the trunk, the branches or leaves. But in general, about half of the biomass is composed of carbon.

Now, in order to find out the biomass of a tree it can be cut, all its roots dug out, everything cut up and dried (to remove the water) and then weighed. This is in most cases of course not possible, but it has been done by scientists in order to find out the biomass of trees. Scientists then discovered that there is a fairly constant relationship between the biomass of a tree of a particular species, and its size (measured in heights and diameter at breast height). So if these measurements are known for a tree and a particular specie's wood gravity (the density of the wood), the biomass of the tree can be calculated. These formulas are called allometric equations and forest departments or forestry colleges usually have tables with these equations for the common tree species in their respective country.

You can obtain these equations from these sources, or use the ones included in this manual. However, what you will have to do is to provide the other information needed: the size of the trees.

When you make your measurements, you have to record the following information and note them down in the survey form you have prepared for each plot (see examples in annex 3):

- The basic information on the plot
- Name of the tree
- Diameter at breast height
- Circumference
- Height of the tree (if necessary; there are allometric equations which use only the diameter at breast height, so if you use those equations you don't need to measure the height)

Mark each tree and give it a number. It is important to mark and number each tree because you will have to measure them again in the future in order to know how much it grows and thus how much the carbon increases.

Every tree should be marked with oil colour or enamel paint at breast height. Let the paint dry before measuring the diameter. Rub off the dry outer bark that is easily detached before painting a 1-2 centimetre wide bar at breast height. Attach a small aluminium tag with the tree number with a 1 inch nail. Do not nail too deep all down to the tree trunk because the trunk will radially increase rather rapidly and as it grows will bend the tags. Also, you may not be able to remove the nail anymore which may cause a problem if you intend to use the wood of that tree later. Number tags should also not be placed at the 1.30 meter height because that is where you will measure the tree again in the future. The tree will respond to the wound by developing extra tissue, causing a swelling around the nail, so the measurement at this point will be inaccurate.

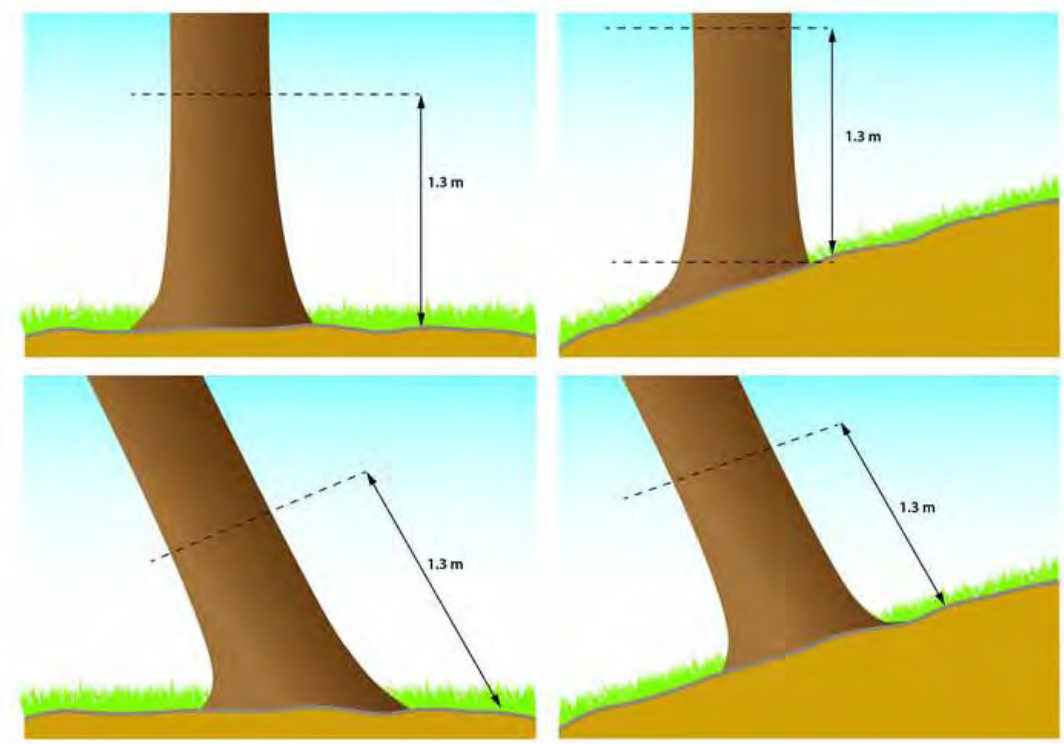
Trees whose branches are overhanging into the plot but whose trunks are outside the plot are excluded, trees whose trunk is inside the plot but parts of the branches outside are included. Trees standing at the border are included if more than 50% of their basal area (the cross-section of the trunk measured at breast height) lies within the plot, and excluded if more than 50% is outside the plot.

Measuring the diameter

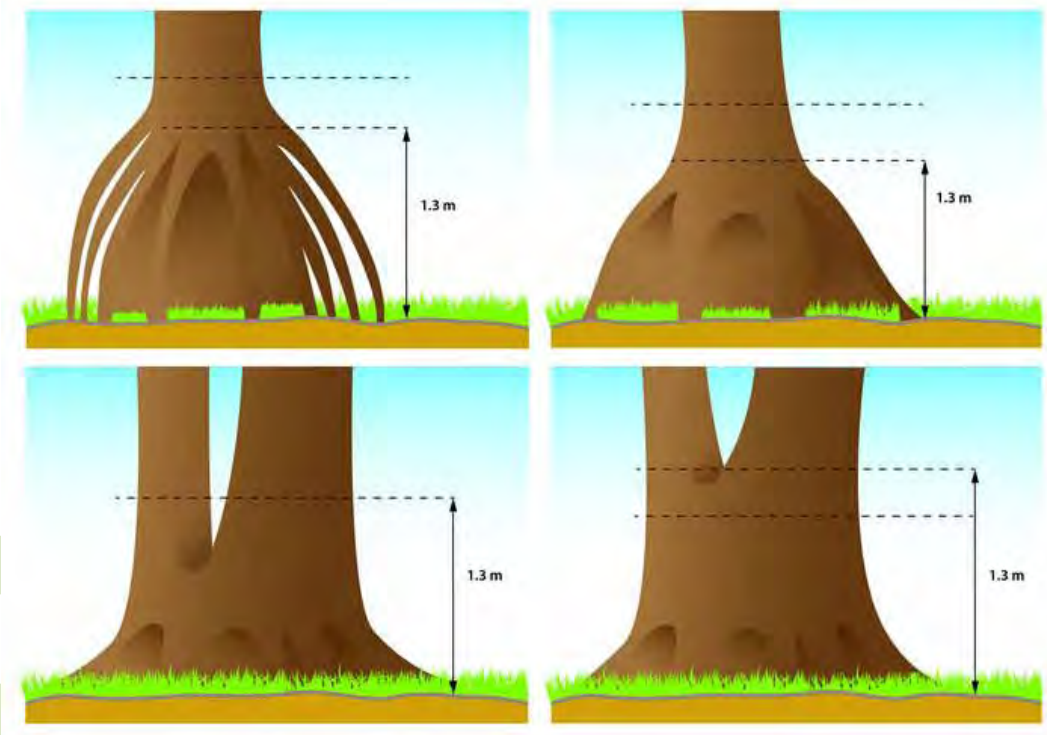
Measure all trees in the plot which are bigger than 5 cm diameter at breast height (130 centimetres from the ground).

It is easiest to use diameter tape for diameter measurement, which shows the diameter result on one side of the tape and the girth on the other side.

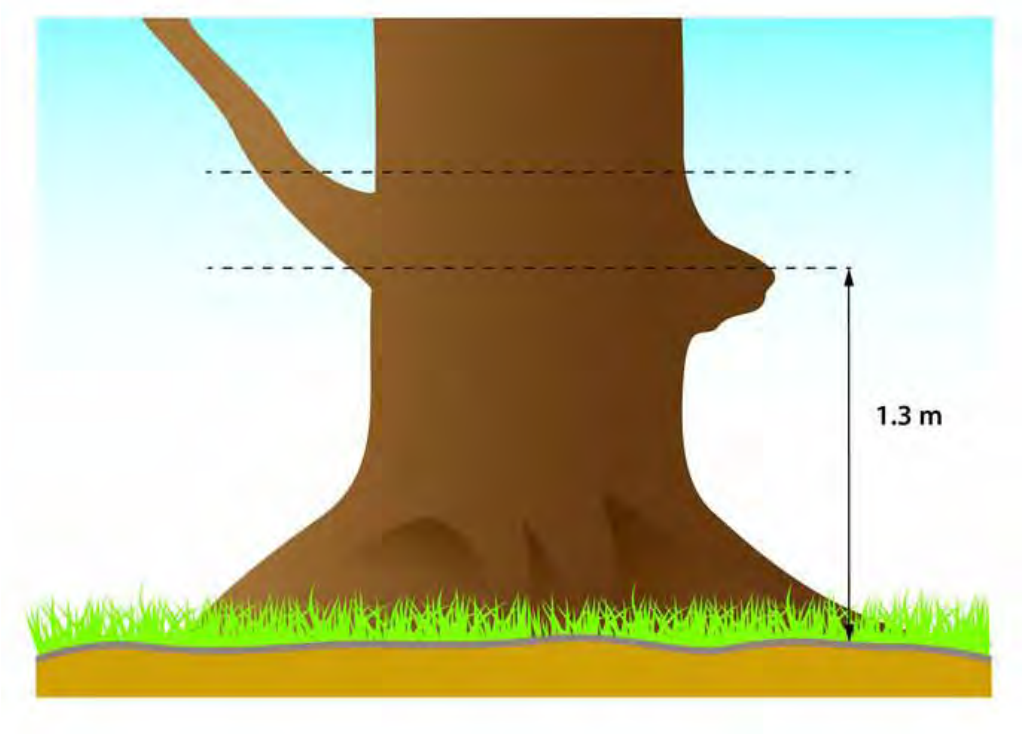
For irregularly shaped trees and on slopes, etc., use the following guidance for your measurement:



When trees have roots or bulky stems reaching up to 1.3 m, take the measurement a little above the 1.3 m mark.



When trees fork below 1.3 m, take separate measurements for each of the two stems. When trees fork just or a little above 1.3 m take the measurement a little below the 1.3 m mark (take only the measurement of the main trunk.



When a tree has a bulk or another irregular shape just at the 1.3 m mark, take the measurement a little above, where the stem has a normal shape.

Measuring the height

There are special instrument such as the hypsometer for recording the height of the trees, but they can be are rather expensive (several hundred US$). However, inexpensive applications have been developed for the iPhone, iPod touch and iPad (see box on the next page). So if one of your community members owns such an equipment or you can borrow one, you can install one of these apps for little money.

Measuring each tree height, however, takes a lot of time and in dense tropical forests it is very difficult even with such equipment since the top of the tree crown is not easy to see. Therefore, results are also often not accurate.

Due to this, it has been suggested that only the diameter at breast height is used because of what biologists call the "the law of allometry" – this means there is a regular relationship between the height of a particular tree species and its diameter.

As briefly mentioned, researchers have developed allometric equations which use only the diameter at breast height and the gravity/density of the wood to calculate the biomass. So whether you need to also measure the height of trees depends on which equation you are going to use. The method using only the diameter would of course be much easier, but for that you need the allometric equations developed for the specific types of forests found in your area. You will have to find out from government forest departments or universities whether such equations are available for your forests.

If you are using the more precise biomass allometric equations which require the height of trees, you can develop your own allmometric equation for the height of trees of a particular forest type or strata (see box "Developing your own allometric equation for height of trees" in paragraph g.

"Analyzing the data: Calculation of carbon stock"). You will only have to measure the height of a sample of trees to develop the equations. For all other trees you only need to take the diameter at breast height.

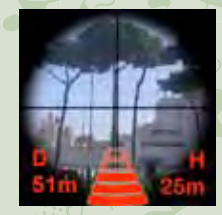
AFFORDABLE HYPSOMETERS FOR IPHONE, IPOD TOUCH AND IPAD

Two hypsometer applications have been developed for iPhone, iPod touch and iPad which allow fairly accurate measurement of the height of tree s and other tall objects.

Hypsometer (by Stefano Caschi) is costs US$ 3.99.

iHypsometer (by Takuyo ITOH) is available for free; its pro version iHypsometer Pro is available for version and available for US$2.99.

You will find link for downloading these apps at: http://itunes.apple.com, http://iphone-apps-search.com



2. Measuring bamboo

Many Asian forests have a lot of bamboo, and there are many species of bamboo.

In surveying the bamboo, you need to note down the name of the species of the bamboo and the number of the clumps of each species in the plot you are surveying. Then you choose some sample clusters of each bamboo species found in the plot and measure the diameter at breast height (DBH) of the largest, the medium, and the smallest bamboo stalks, and then calculate the average DBH of that particular bamboo species.

In order to be able to calculate the biomass with the help of the allometric equation, you also need to measure the height of the bamboo. Measure a few in each cluster and then calculate the average height for that cluster.

To sum up, for bamboo you have to:

1. Count the number of clusters of each species in a sample plot
2. Count the number of bamboo stalks of each cluster
3. Measure and calculate the average DBH of each bamboo species
4. Measure and calculate the average height of each bamboo species

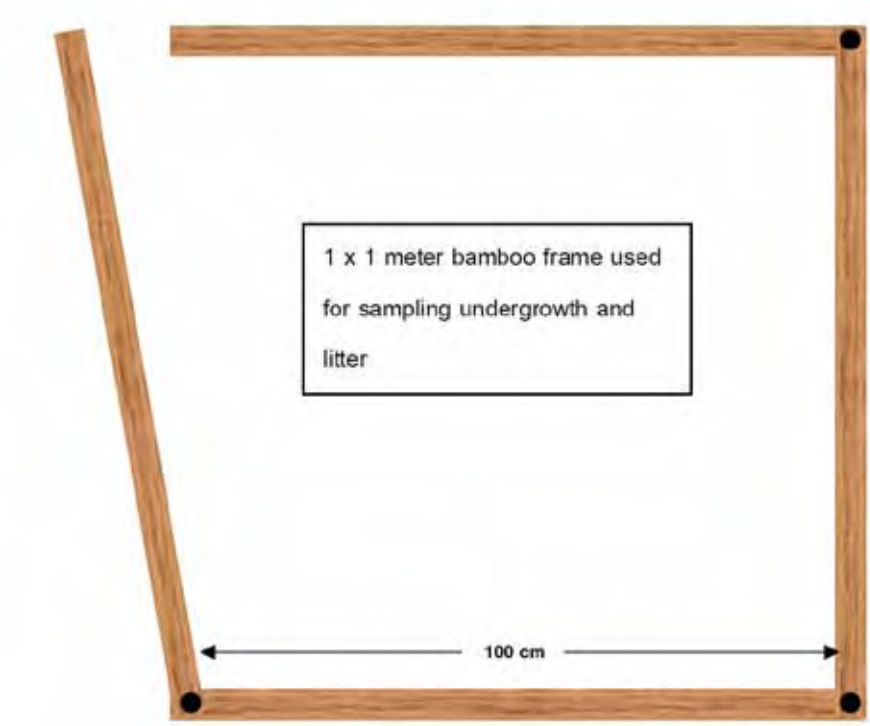
3. Measuring undergrowth and litter

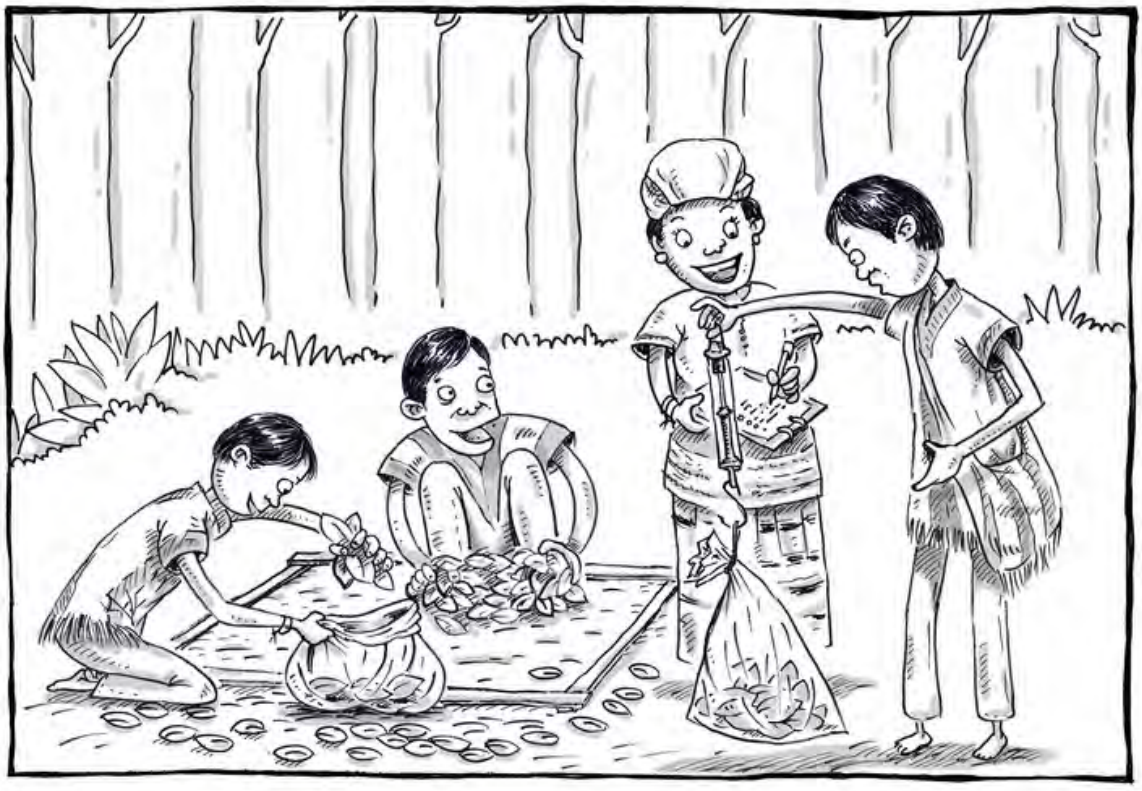
Most forests have **undergrowth** which is composed of small shrubs and herbs and other non-woody plants, such as wild banana, ginger, palm, fern, pigmy bamboo, and grass. Besides, there are tree seedlings which are smaller than 1.30 meters and have a smaller diameter than limit for trees to be included in the tree survey. However, if this is dense and thus contains a considerable amount of carbon, it should not be left out of the survey. Then the undergrowth should be measured in 4 to 5 sub-plots of 1 x 1 metre in size within the sample plots (see graph 5).

Each plot has to be given a name and its location and other information recorded in the survey form for undergrowth and litter.

The collection of the data is carried out using 1x1 meters wood or bamboo frame systematically placed on the forest floor. Keep one corner of the frame open so that you can place it on the floor more easily when the undergrowth contains tall tree saplings, shrubs or herbs.

Graph 11. Wood/bamboo frame for undergrowth and littler sampling





Cut all the plants inside the frame at the soil level and put them in a plastic bag to be weighed. Be careful not to include soil or rocks. Plants growing outside the frame but overhanging into the frame you cut at the point where they cross the fame (which means only the part overhanging into the frame is included; the rest is left out).

Obtain the fresh weight of the collected sample i with the help of a spring scale and record it for every sub-plot. A subsample of each of them is then collected to be oven dried to determine the dry weight. The sample of the plants is normally dried at 70 – 80 °C. It has to be repeatedly weighed while it is being dried until you get a constant weight. The difference between the weights of the sample before and after drying is used to calculate the dry-weight of all the undergrowth samples collected. You cannot dry the sample in the sun since some moisture will always remain due to the moisture contained in the air.

The term **litter** is used to refer to the parts of plants such as twigs, leaves, flowers, fruits, etc. that have fallen down and accumulated on the forest floor. They might be still fresh or partly decomposed. These litters are collected from the 1 x 1 meter plots as well, and the procedure is the same as for the undergrowth: collect all litter and weigh everything, and take a sub-sample from each plot for drying in an oven and measuring of the dry-weight, after which the dry-weight of all the litter can be calculated.

All measurements and other information need to be recorded on the survey sheet as well.

4. Dead wood and stumps

If there are many standing or fallen dead trees with a diameter larger than 5 cm, or stumps from logging, they need to be included since they are both a carbon pool and, as they decompose, a source of carbon emission.

Standing dead trees, fallen stems, and large fallen branches are measured like trees (diameter at 1.3 m and height/length) within the whole plot. Smaller branches are measured as part of the litter in the sample plots.

5. Taking soil samples

Carbon contents in soil have to be measured in special laboratories. Universities or forest departments have these facilities. It is best to consult the laboratory before you collect the samples for the amount of soil needed for each sample to ensure that it is big enough for a standard soil analysis.

For calculating the organic carbon accumulated in the ground, it is necessary to know the so-called bulk density of the soil as well. In general, where the soil is uniform, four samples of the soils are enough. The soil sample to be used to calculate the bulk density has to be collected in undisturbed soil and kept as it is. For that it is necessary to use the soil core (metal tubes of standard size of 100 or 300 cm^3) so that the soil is kept as it is (not compressed or loosened).

Soil samples are collected in hand-dug pits from four spots in the plot (see graph 5). Take the soil sample from each spot in clockwise direction. The collector uses a hoe or spade to dig a

V-shaped pit, with one side of the shape being vertical. Take the soil sample at the 0 to 10, at 10 to 20, and at 20 to 30 centimetres depths, respectively, using the soil core (soil-sampling tubes). You have to be careful not to disturb the soil in any way.

After you have dug the pit, use a brush to remove any material from the soil surface. Then insert the soil core at three depths as mentioned and remove it by pulling it outwards. Trim the top and the bottom of the core so that the soil is even with the rim. Close the tubes carefully with masking tape to prevent the soil from falling out.

Give each sample a number and write it clearly on the plastic bag containing the soil sample. Record the number and all other information in the survey form for soil samples.

DO WE NEED TO MEASURE SOIL CARBON?

Since you are monitoring carbon in order to measure change in carbon stock over time it may not be necessary to include soil carbon in your periodic carbon monitoring. Soil carbon changes not at all or only very little if the land remains under forest. Only when the land cover is changed into permanent agriculture will the soil carbon stock change. Measuring soil carbon is quite expensive so it may not be worth the expenses if the results simply confirm that nothing has changed. You can consider measuring soil carbon once, at the beginning of the project, in order to know the total carbon stock in your forest, but not afterwards.

THE IKALAHAN AND CARBON: MEASURING FOREST CARBON

The staff of the Kalahan Educational Foundation measured the circumference of every tree in the 190 sample plots above 10 cm diameter. The circumference and name of the species were noted on a report sheet that was returned to the office. A number was painted on each tree to make it easy to locate the tree when the time came for the next measurement. Unfortunately, when the workers returned on the third year many of the marks were missing. This was especially true in the pine forests because the bark had flaked off. That time the workers had difficulty identifying the trees. They finally succeeded but they learned their lesson and scraped the bark down to the bast fibers and painted again. This has been successful. Metal tags might have been better but they were too expensive and the outside funding had expired in the meantime.

It was decided to measure the trees only once every 3 years. The growth to be measured at yearly intervals would be too small and too difficult to analyze.

The field measurements can usually be done in 6 weeks if three teams of 3 persons each are deployed to do it. It would be faster if the area was somewhat flat but all of our forests are in steep areas and the undergrowth is usually thick.

To meet another recommendation by some of the REDD++ personnel, university students came recently set up 5 transect lines. They did not pay any attention to the previously identified blocks, although the staff believe that they should have done so. They counted the number of various species along the transect lines. The biodiversity in all three of the forest types is seen to be quite high. Five persons were able to do this in one week.

Another group of university students came earlier to take soil samples in several areas to measure the amount of soil carbon. The students spent about 5 days. They also taught some of the local staff how to do it. The two staff members spent an additional week getting samples which were delivered to the university for evaluation. The university laboratories did the measurements for the soil carbon.

Dr. Lasco has also done measurements in similar forests and is able to make a fairly accurate estimate of the amount of below-ground carbon as a percentage of the carbon above-ground. The staff feel comfortable with the data obtained. Some aspects might overestimate the carbon but other aspects will probably underestimate it so the two areas of possible error will cancel each other.

6. Monitoring carbon and verifying data collection

In order to know how much the carbon stock in your forest increases – or decreases – you have to make measurements in regular intervals. This will also be the basis for the calculation of carbon credits, if that's what you want, since credits will be given for carbon that has been prevented from being emitted, or for additional carbon that has been stored in your forest.

For that purpose, you have established the permanent sample plots and numbered the trees. The frequency of measurement for carbon monitoring depends on the growth rate of a particular forest, i.e. how quickly it grows and the costs. In tropical forests, carbon monitoring measurements are usually taken every three years. If you intend to sell carbon credits, you will have to make monitoring measurements as frequently as it is required by the carbon standard you decide to use. The frequency of measurement will also be included in the agreement with the carbon buyer.

As mentioned in the previous chapter, verification of methods used and measurements made by external experts is part of the requirement of carbon standards. Verifications is supposed to be done at the beginning, after the first measurement, and then in regular intervals throughout the project period.

Carbon standards require that an external expert verifies that the permanent sample plots have been established and that the measurements are taken correctly.

The "Good Practice Guidance" of the Intergovernmental Panel for Climate Change (IPCC) for example suggests:

- To re-measure independently every 8-10 plots, and to compare the measurements to check for errors; any errors found should be resolved, corrected and recorded. The re-measurement of permanent plots is to verify that measurement procedures were conducted properly.
- To check independently 10-20% of the plots at the end of the field work. Field data collected at this stage will be compared with the original data. Any errors found should be corrected and recorded. Any errors discovered should be expressed as a percentage of all plots that have been rechecked to provide an estimate of the measurement error (IPCC 2003: p. 4.111)

g. Analyzing the data: Calculation of carbon stock

Once you have collected the field data from all the sample plots, you can calculate the amount of carbon stored in your forest.

1. Calculating carbon in trees

A first step will be to calculate the biomass of the trees you measured. As mentioned, this is done with the help of the so-called **allometric equations.** Allometry is the study of the change in proportion of various parts of an organism as a consequence of growth. Like in other organisms, scientist found that there is regularity in the proportion of trees (height, diameter etc.) as they grow. Scientists also discovered that there is a fairly constant relationship between the biomass of a tree of a particular species, and some key dimensions (like diameter and height) of that tree species. So they were able to develop equations which express this regularity and which can be used to calculate the biomass of any tree of the species for which the equation has been developed if the key measurements (height, diameter and gravity or density of the wood) are known.

An important factor to be included is the gravity of the wood. Wood gravity refers to the density of the wood, or how heavy the wood is. A piece of heavy hard wood contains more carbon than a piece of soft and light wood of the same size.

Different allometric equations have been developed. They usually include the diameter at breast height (DBH), height and gravity (wood density). Some allometric equations have been developed for specific forest types which use an average wood density. Some also include separate equations for stems, branches and leaves.

In other allometric equations, only the diameter at breast height is used and the height is ignored because the height of trees is often difficult to measure and not easily available. These equations are based on the assumption that there is also a fairly constant relationship between height and diameter for any specific tree species. This can however be problematic in areas with specific climatic conditions. For examples, forests regularly affected by heavy winds and storms have shorter trees, so the calculation of biomass (and carbon) based on diameter only would lead to an overestimation.

Therefore, more precise allometric equations use height, diameter and wood gravity for the calculation of the biomass of a particular species.

ALLOMETRIC EQUATIONS FOR TROPICAL FORESTS

The following three equations have been developed by Chave et al. (2005) for three different forest types:

a) Dry forests $AGTB = 0.112 \times (pD^2H)^{0.916}$

b) Moist forests: $AGTB = 0.0509 \times pD^2H$

c) Wet forests $AGTB = 0.0776 \times (pD^2H)^{0.940}$

d) Moist mangrove $AGTB = 0.0509 \times pD^2H$

ABTG Above-ground tree biomass (in kg)

p Wood specific gravity (in g per cm^3)

D Tree diameter at breast height (in cm)

H Tree height (in m)

Source: Chave at.al. 2005: p. 92f

The most precise allometric equations are those developed for individual tree species. However, these equations exist only for a few commercially important tree species. Since trees growing in a particular forest environment have much in common with respect to the way they grow, allometric equations have been developed for different forest types. The most important factor in determining the type of forest found in an area in the tropics is the amount of rainfall. Therefore, separate allometric equations have been developed for different climates, such as for dry and moist forests in the tropics.

The allometric equation you will need depends on how precise your calculation has to be. For accurate calculations, you will have to measure diameter and height, and you have to obtain both the allometric equations developed for the forests in your area, and tables with the wood density of the tree species found in your forests. For that you can contact the government's forest department or forestry colleges or institutes at your universities.

If local allometric equations are not available for your area you can use the more general allometric equations like the ones developed by Chave et. al. provided in the box on the previous page. For wood densities you can consult the table in annex 2 or the web-site of the World Agroforestry Centre (see box below).

WOOD DENSITY DATA

A table with wood densities of tropical forest trees in Asia, Africa and Latin America is provided in the annex of the IPCC's "Good Practice Guidance for Land Use, Land-Use Change and Forestry". A copy of this table is also provided in annex 2 of this manual.

A comprehensive wood density database (including local names of trees) is accessible on the web-site of the Southeast Asia Regional Office of the World Agroforestry Centre: http://www.worldagroforestry.org/sea/Products/AFDbases/WD/Index.htm

A global database with over 16,000 wood densities is available as Excel file at: http://datadryad.org/repo/handle/10255/dryad.235

This Excel file has also been included in the CD enclosed.

If you cannot find the wood density data for some of the trees in your forests you can discuss with the most experienced community members the properties of these trees. They will know how hard and heavy the wood of these trees is and can compare it with trees of which you have the wood density. Then use that density for the tree of which you don't know the wood density.

Wood densities are given either in tons per m^3, kg per m^3 or g per cm^3. Depending on the allometric equation you are using you may have to convert the density value. For example, in the equations given above the wood density (gravity) has to be given in g/m^3. So you may have to convert t/m^3 or kg/m^3 to g/m^3, or vice versa.

Softwood trees have densities between below 0.49 g/cm^3

Hardwood trees have densities between 0.49 and over 1 g/cm^3

DEVELOPING YOUR OWN ALLOMETRIC EQUATION FOR HEIGHT OF TREES

If you have doubts about the accuracy of an allometric equation using only DBH and you want to include height, but want to avoid the trouble of measuring each individual tree, you can develop your own equation for the height of trees in the particular forest you are working in.

For that you measure the DBH and the height of 20 to 30 trees in the respective forest type/stratum,. The you alculate the ratio of DBH to height for each tree, and then the average ratio for all the trees measured. This will be your allometric equation for height of trees in this forest type. For all other trees to be measured in a sample plot you will only need to measure the DBH, and you can calculate their height using that equation.

Once you have found the allometric equations you want to apply for your area you can prepare an Excel spread sheet which you can use for the processing of the data gathered in your sample plots. Below we are providing a simple guide on how to set up and use such a spread sheet.

You can either use your own allometric equation in the Excel spread sheet or, if it is applicable to your area, you can use the carbon calculation software provided on the CD enclosed in this manual (see box below) and you just have to put the values generated by the software in a spread sheet.

In the following paragraphs, we are using an example in which the allometric equation is included in the Excel spread sheet, so the calculation is made with the help of the spread sheet directly and not with the help of the software. This we hope will help you in creating your own Excel spread sheets with your own allometric equations.

Preparing an Excel sheet for your carbon calculations

The following steps demonstrate how to prepare an Excel spread sheet to calculate carbon. For illustration we are using the Excel file "Carbon calculation exercise" on the CD enclosed. You can find it in the folder "Tools and exercises" in folder "Carbon measurement and monitoring". Activate the sheet "Trees" (by clicking on the respective tag at the lower left corner of the window).

Step 1: Compiling the equations

We intend to calculate the amount of CO_2 equivalents contained in a sample plot because it is the general practice to measure carbon in CO_2 equivalents (and not just carbon).

For that we need to measure the biomass, based on which we can calculate the carbon content, and then the CO_2 equivalents.

The following equations are needed:

1. The equation for calculating the height of the trees of the forest type in the respective sample plot (since we do not intend to measure the height of all the trees but only the DBH)
2. The allmoetric equation for the forest type in the respective sample plot
3. The equation for carbon content in biomass
4. The equation for converting the value for carbon into CO_2 equivalents

In this example, we are using an allometric equation for biomass calculation of trees in the dry evergreen forest for Thailand (Sukwong 2011: 4). It uses separate equations for stems, branches and leaves. Most likely, you will not have separate equations, but only one for the whole tree. We are including this example because it is more detailed.

W_S $=0.0509 (dbh^2h)^{0.919}$
W_B $=0.00893 (dbh^2h)^{0.977}$
W_L $=0.014 (dbh^2h)^{0.669}$

W_S, W_B, and W_L dried weight (in kg) of stems, branches, and leaves respectively
dbh diameter at breast height (1.30 meters above the ground) in centimeters.
h tree height in meters.

The equation for determining the height (in meters) is:

$$h = (85.6\ dbh^{0.916}) / (46.8 + 1.83\ dbh^{0..916})$$

You may have noted already that the equation does not include a variable for wood gravity (wood density). This is because an average density has already been included in the allometric equation.

Once you have calculated the biomass, you can calculate the carbon content. The amount of carbon contained in biomass varies slightly between different species and also between the different parts of trees (like the trunk, branches, leaves, etc.). But generally, about half of the biomass consists of carbon, so you just divide the amount of biomass measured in kg by two.

$$C = W_T/2$$

C Carbon (in kg)
W_T total weight of dry biomass (in kg)

Since carbon credits are calculated in CO_2 and one ton of carbon is equal to 3.57 tons of CO_2, you can multiply the amount of carbon you have calculated by 3.67 (or, more prices, by 44/12), divide it by 1000 and you will get the CO_2 equivalent. We need to divide the value by 1000 because so far we have calculated the weight in kg, while the CO_2 equivalents are measured in tons.

$$CO_2e = C \times 3.56/1000$$

CO_2e Carbon dioxide equivalent (in tons)
C Carbon (in kg)

Step 2: Preparing the Excel spread sheet

As next step, prepare an Excel spread sheet with the following columns:

1. Tree number. Here you enter the number of the tree. You find it on the survey data sheet which you prepared and in which you entered the measurement value, name of tree etc. during the sample plot survey.

2. Diameter at breast height (DBH): in this column you enter the measurement taken for the respective tree (in cm)

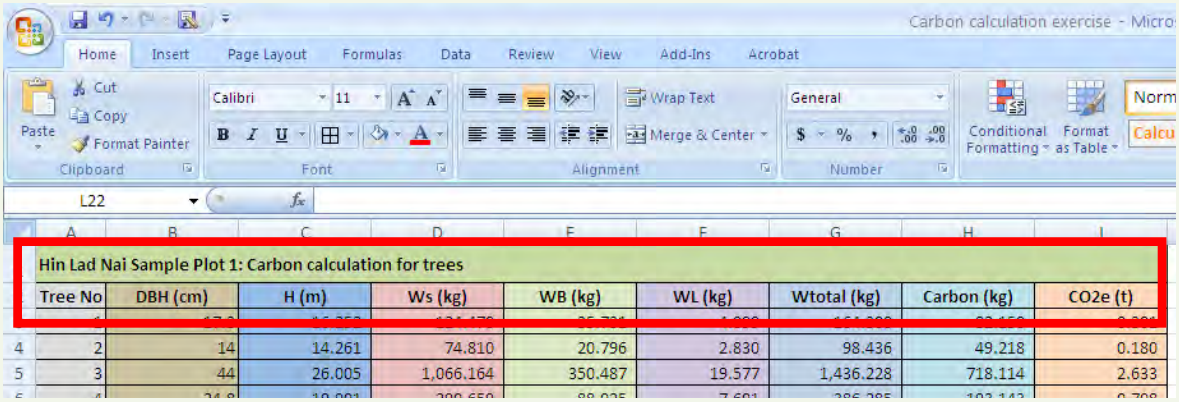
3. Height (H): here you will enter the equation for the tree height (in meters). Further below we will explain how to enter the equation.

4. Dry biomass weight of stem (WS): here you will enter the allometric formula for the tree stem (in kg)

5. Dry biomass weight of branch (WB): here you will enter the allometric formula for the branches (in kg)

6. Dry biomass weight of leaves (WL): here you will enter the allometric formula for the leaves (in kg)

7. Total dry biomass of tree (Wtotal): here you will enter the sum of WS, WB and WL (in kg)
8. Carbon content: here you will enter the equation for carbon content (in kg)
9. Carbon dioxide equivalent (CO_2e): here you will enter the equation for the calculation of CO_2e



Step 3: Entering tree no, DBH and the equation for height

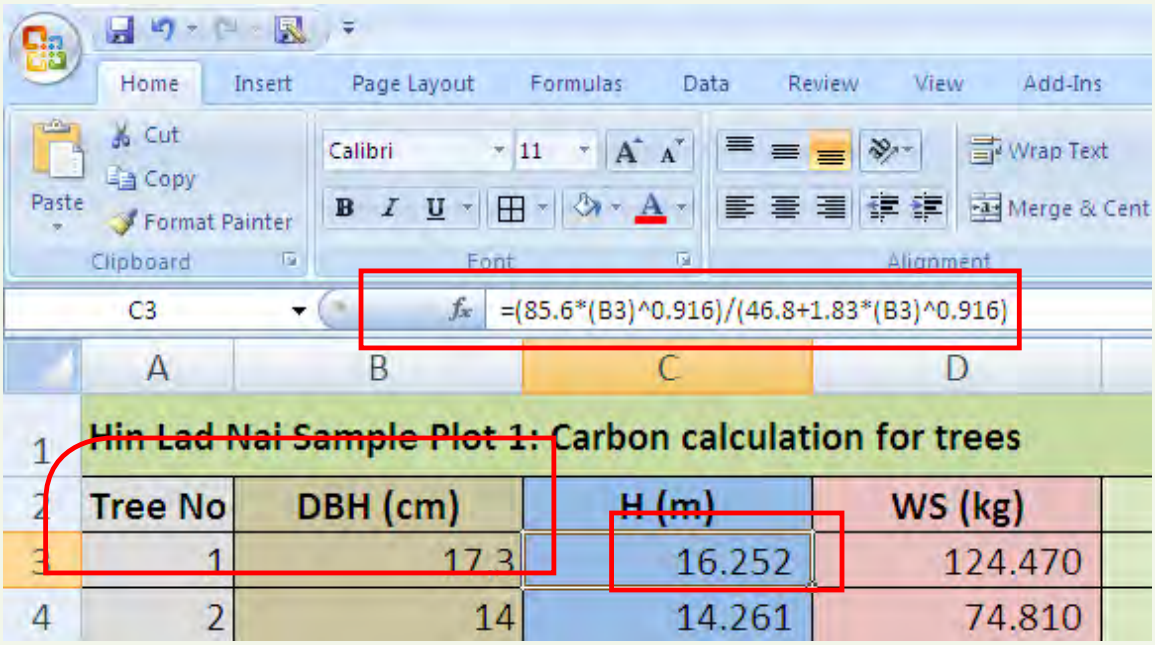
First enter the tree no and the corresponding DBH measurement taken for the respective trees (in cm). Next you need to enter the equation for height.

As we have seen, the equation for height is: $h = (85.6 \ dbh^{0.916}) / (46.8 + 1.83 \ dbh^{0..916})$

To enter the equation, you put the cursor in cell C3 and type the equation into the command field. Note that the way to write potencies in Excel is by using ^, so you will type": =(85.6*(B3)^0.916)/(46.8+1.83*(B3)^0.916)

B3 refers to the DBH (which have been entered in column B).

After that you can simply copy the field C3 and paste it in the fields below in column C. Excel will automatically adjust the reference to the DBH value in column B (i.e. it will use B4, B5, B6 etc.).



Step 4: Entering the allometric equations

For entering the allometric equations you proceed the same way as with the equation for height:

First enter the equation for dry weight of stems:

The equation is: $W_S = 0.0509 (dbh^2h)^{0.919}$

To enter the equation, you put the cursor in cell D3 and type the equation into the command field. Type the following: =0.0509*(((B3)^2)*C3)^0.919

B3 refers to the DBH (in column 3) and C3 to the height.

After you have done that you can simply copy the field D3 and paste it in the fields below in column D. Again, Excel will automatically adjust the reference to the DBH and height value in column B and C (i.e. it will use B4 and C4, B5 and C5, B6 and C6 etc.).

For the other two allometric equations (dry weight of branches, dry weight of leaves), you just do the same: enter the equation for WB in column E and the equation for WL in column F.

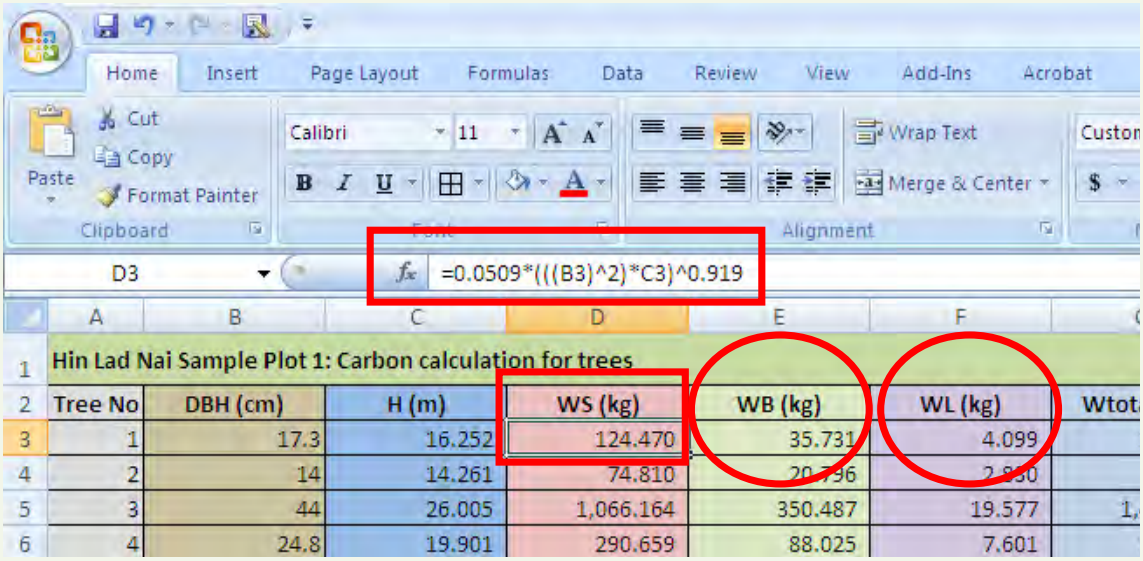
In both equations, you will have to refer to DBH and H, which means you will have to refer to the respective cells in columns B and C.

For WB, type the following equation in field E3: =0.00893*(((B3)^2)*C3)^0.977

Then copy the field E3 and paste it in the cells below in column E.

For WL type the following equation in field F3: =0.014*(((B3)^2)*C3)^0.669

Then copy the field F3 and paste it in the cells below in column F.



	A	B	C	D	E	F
1	Hin Lad Nai Sample Plot 1: Carbon calculation for trees					
2	Tree No	DBH (cm)	H (m)	WS (kg)	WB (kg)	WL (kg)
3	1	17.3	16.252	124.470	35.731	4.099
4	2	14	14.261	74.810	20.796	2.830
5	3	44	26.005	1,066.164	350.487	19.577
6	4	24.8	19.901	290.659	88.025	7.601

Step 5: Entering the equations for total biomass dry weight, carbon content and CO_2 equivalents

In the column G (Wtotal), you will calculate the total of the dry weight biomass, i.e. the sum of WS, WB and WL. Type the following in cell G3: =F3+E3+D3

Then copy cell G3 and paste it in the cells below.

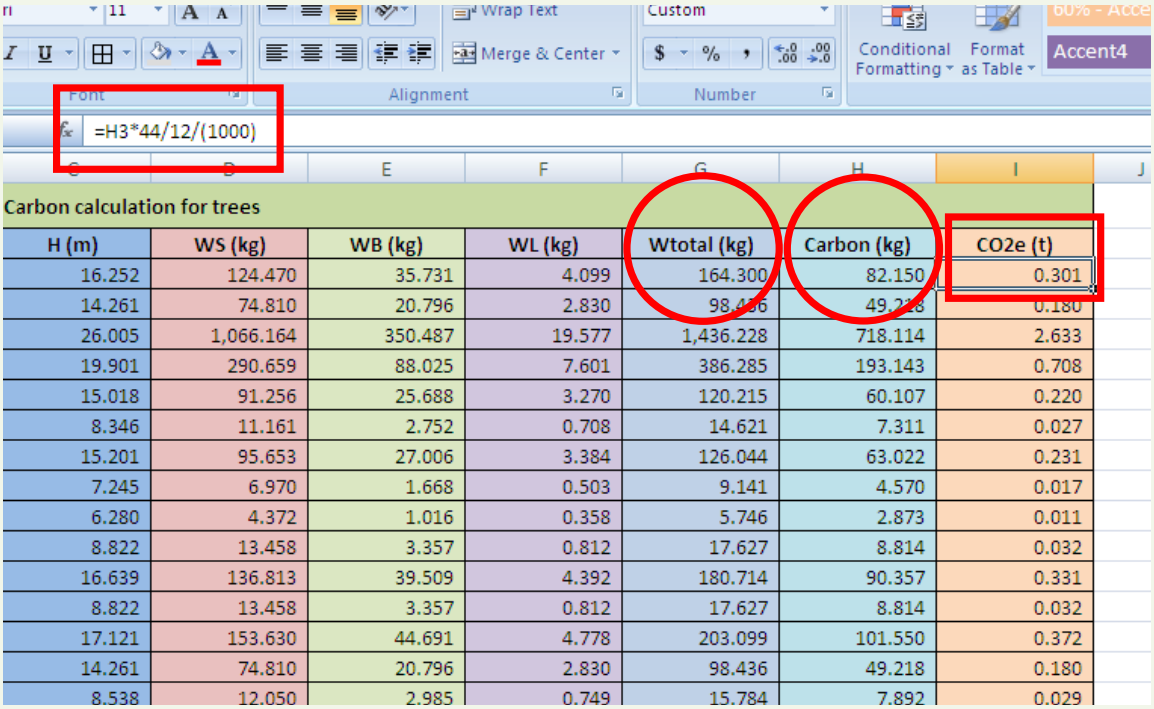
In column H (Carbon), you will calculate the carbon content of the biomass, which is around 50%. So in cell H3, type the following: =G3/2

Then copy cell H3 and paste it in the cells below.

Finally, in column I you will calculate the carbon dioxide equivalent of the biomass you have measured. As we have seen, this is about 3.66 times (more precise, 44/12 times) the amount of carbon. And since it has to be given in tons we will have to divide the amount by 1000.

So in cell I3, type the following: =H3*44/12/(1000)

Then copy cell I3 and paste it in the cells below.



Carbon calculation for trees

H (m)	WS (kg)	WB (kg)	WL (kg)	Wtotal (kg)	Carbon (kg)	CO2e (t)
16.252	124.470	35.731	4.099	164.300	82.150	0.301
14.261	74.810	20.796	2.830	98.436	49.218	0.180
26.005	1,066.164	350.487	19.577	1,436.228	718.114	2.633
19.901	290.659	88.025	7.601	386.285	193.143	0.708
15.018	91.256	25.688	3.270	120.215	60.107	0.220
8.346	11.161	2.752	0.708	14.621	7.311	0.027
15.201	95.653	27.006	3.384	126.044	63.022	0.231
7.245	6.970	1.668	0.503	9.141	4.570	0.017
6.280	4.372	1.016	0.358	5.746	2.873	0.011
8.822	13.458	3.357	0.812	17.627	8.814	0.032
16.639	136.813	39.509	4.392	180.714	90.357	0.331
8.822	13.458	3.357	0.812	17.627	8.814	0.032
17.121	153.630	44.691	4.778	203.099	101.550	0.372
14.261	74.810	20.796	2.830	98.436	49.218	0.180
8.538	12.050	2.985	0.749	15.784	7.892	0.029

Step 6: Calculating the total biomass, carbon and CO_2 equivalents

As a last step, you can calculate the total amount of biomass, of carbon and CO_2 equivalents contained in trees of that sample plot.

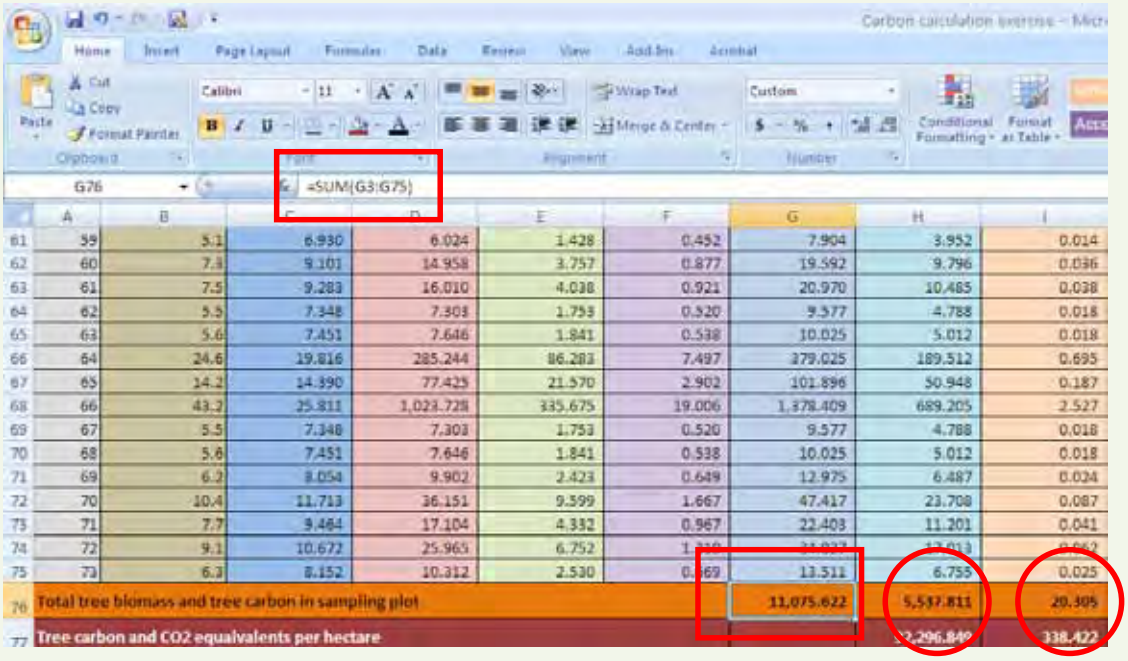
At the bottom of your table, create a row for "Total tree biomass and tree carbon in sampling plot" and a row for "Tree carbon per hectare".

In the row "Total tree biomass and tree carbon in sampling plot" you will enter the equations for the sum of the biomass of all trees, the sum of the carbon of all trees and the sum of the CO_2 equivalents of all trees of that sample plot.

So in the field below the last value of column G (Wtotal) – in our example it is field G76 – enter the equation for the sum of all values of this column. In our example this is the sum of all values of the fields from G3 to G75. The formula is: =SUM(G3:G75)

For the total of tree carbon you do the same: enter the equation for the sum of all values for tree carbon. In our example this is the sum of all values from field H3 to H75. The formula is: =SUM(H3:H75)

For the total of CO_2 equivalents you proceed in the same way again: enter the equation for the sum of all values for CO_2 equivalents. In our example this is the sum of all values from field I3 to I75. The formula is: =SUM(I3:I75)



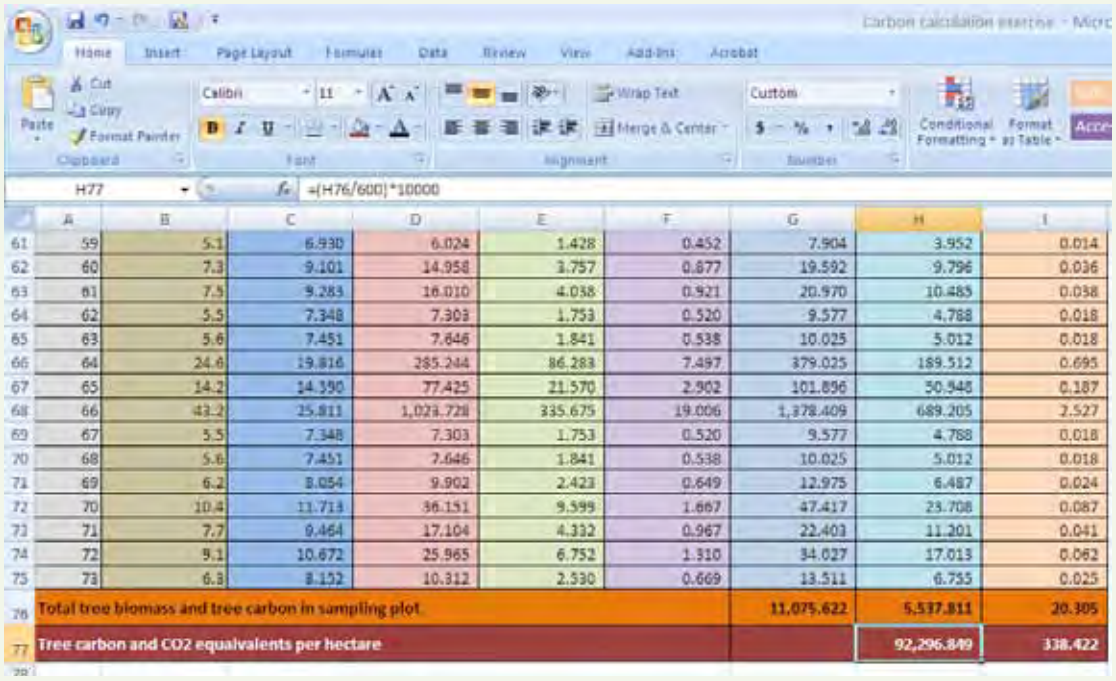
Step 7: Calculating the tree carbon and CO_2 equivalents per hectare

Finally, you can calculate the per hectare tree carbon and CO_2 equivalents of the tree of that sample plot.

You do that in two steps: first divide the total for carbon and CO_2 equivalents by the area of the sample plot (in square meters; in our example this is 600m^2). This will give you the amount of carbon and CO_2 equivalents per square meter. Then you multiply it by 10,000 (since one hectare has 10,000 m^2).

So for obtaining the tree carbon per hectare, enter in the row "Tree carbon and CO_2 equivalents per hectare" in column H the following equation: =(H76/600)*10000

And for obtaining the CO_2 equivalents of trees per hectare, enter in the row "Tree carbon and CO_2 equivalents per hectare" in column H the following equation: =(I76/600)*10000



CARBON CALCULATION SOFTWARE

Simple software has been developed and is provided on the CD enclosed for easy calculation of biomass dry weight and carbon content of trees and bamboo in tropical forests. You will find separate software for

- Dry Evergreen and Dry Dipterocarp forests found in North and Central Thailand and adjacent areas in mainland Southeast Asia (Laos, Burma, Cambodia, Vietnam)
- Different forest types according to rainfall: Dry, moist and wet tropical forests
- Mangrove forest
- Four most common bamboo species
- Bamboo growing in thick clumps so that measuring individual culms is impossible

The software provides the necessary instructions for its use.

Instead of making an Excel spread sheet that included the equations you can use this software for doing the calculation, and enter the results in a spread sheet.

The software has been developed by the Regional Community Forestry Training Centre (RECOFTC) in Thai language, and translated into English and made available to us. We herewith would like to express our deep appreciation to RECOFTC for its generous help.

Preparing an Excel sheet with an equation requiring wood densities

The example above as well as the carbon calculation software provided on the CD include average wood densities for the forest types they have been developed for. This means you do not need to look up wood densities for each tree species you are measuring.

However, you may want to use specific allometric equations which have been developed for your area, or one of the common equations for tropical forest types (like the ones developed by Chave et.al and given in the box above).

If you are using such an allometric equation you will have to include a column for wood densities of each of the trees measured.

As an exercise, we will guide you through the setting up of an Excel file using the allometric equation for the tree biomass of wet forests developed by Chave at.al. For illustration, we have prepared the Excel file "Carbon calculation exercise_wood density", which you also find on the CD in the same folder as the example used above.

The allometric equation for wet forests developed by Chave et.al. is:

$$AGTB = 0.0776 \times (pD^2H)^{0.940}$$

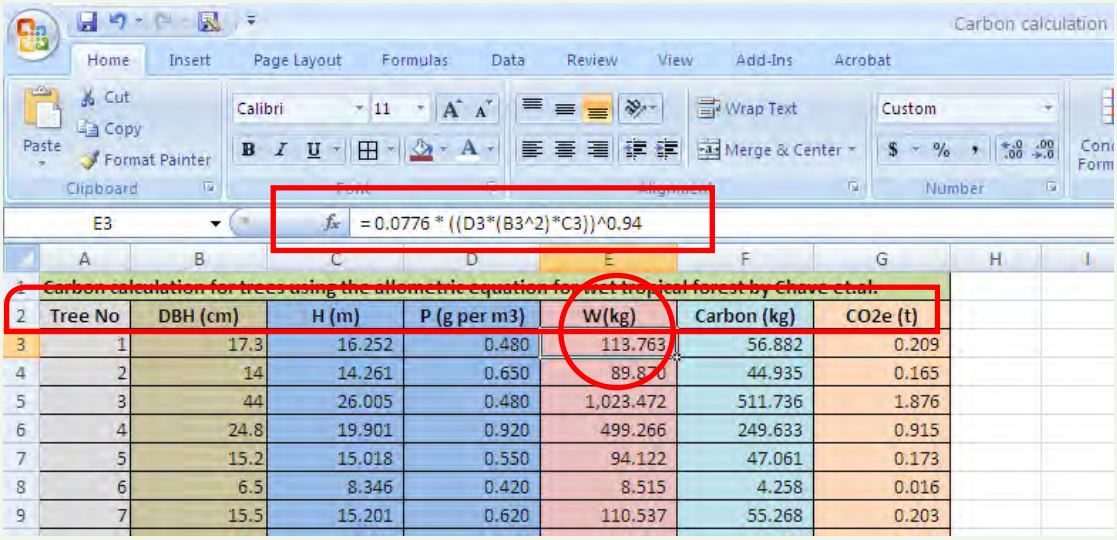
ABTG Above-ground tree biomass (in kg)
p Wood specific gravity (in g per cm^3)
D Tree diameter at breast height (in cm)
H Tree height (in m)

Unlike in the previous example, this equation does not include separate equations for stem, branches and leaves. It has been developed for the whole tree and its calculation requires data for the following variables: tree diameter (DBH, in cm), tree height (H, in m), wood gravity/density (P, in g per cm³).

So you will have to make a column for each of these variable, a column for the calculation of the biomass (W, where you enter the allometric equation), plus the columns for tree carbon and CO_2 equivalents, like in the previous example.

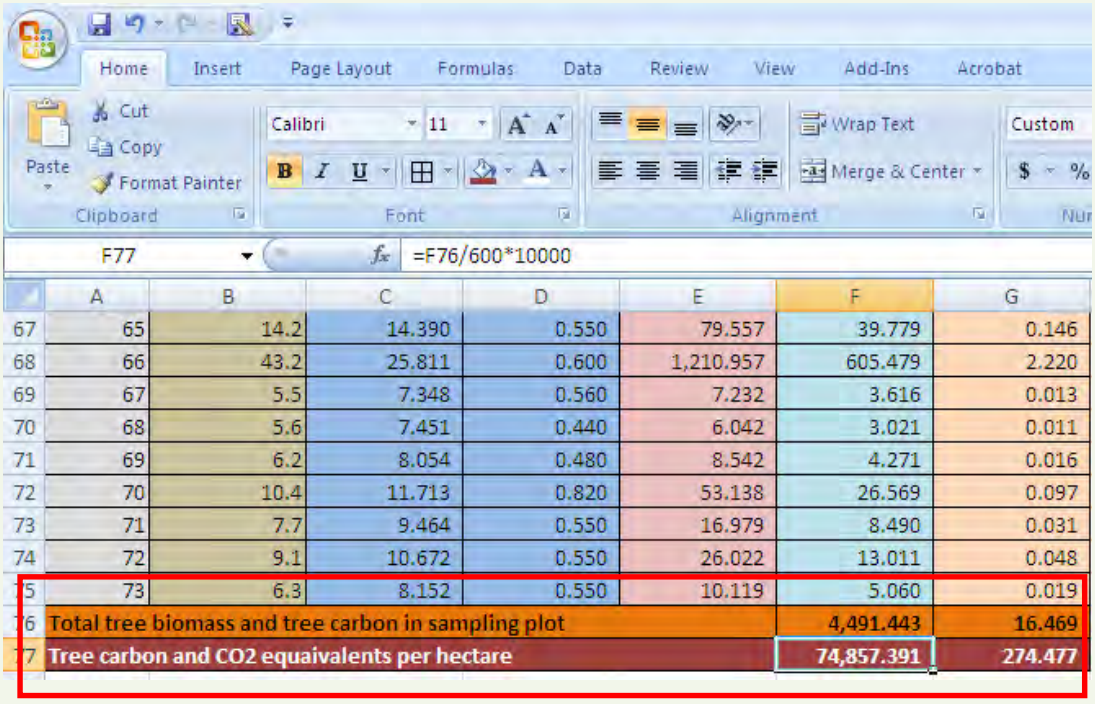
In the column for the biomass (W) enter the allometric formula: = 0.0776 * ((D3*(B3^2)*C3))^0.94

Enter it in the first cell (in the example below it is cell E3), then copy the cell and paste it in the cells below.



	A	B	C	D	E	F	G	H	I
1	Carbon calculation for trees using the allometric equation for wet tropical forest by Chave et.al.								
2	Tree No	DBH (cm)	H (m)	P (g per m3)	W(kg)	Carbon (kg)	CO2e (t)		
3	1	17.3	16.252	0.480	113.763	56.882	0.209		
4	2	14	14.261	0.650	89.870	44.935	0.165		
5	3	44	26.005	0.480	1,023.472	511.736	1.876		
6	4	24.8	19.901	0.920	499.266	249.633	0.915		
7	5	15.2	15.018	0.550	94.122	47.061	0.173		
8	6	6.5	8.346	0.420	8.515	4.258	0.016		
9	7	15.5	15.201	0.620	110.537	55.268	0.203		

At the bottom of the table make again a row with the totals for the biomass, the carbon, the CO_2 equivalents, and a row with the carbon and the CO_2 equivalents per hectare, as explained in the previous example.



	A	B	C	D	E	F	G
67	65	14.2	14.390	0.550	79.557	39.779	0.146
68	66	43.2	25.811	0.600	1,210.957	605.479	2.220
69	67	5.5	7.348	0.560	7.232	3.616	0.013
70	68	5.6	7.451	0.440	6.042	3.021	0.011
71	69	6.2	8.054	0.480	8.542	4.271	0.016
72	70	10.4	11.713	0.820	53.138	26.569	0.097
73	71	7.7	9.464	0.550	16.979	8.490	0.031
74	72	9.1	10.672	0.550	26.022	13.011	0.048
75	73	6.3	8.152	0.550	10.119	5.060	0.019
76	Total tree biomass and tree carbon in sampling plot					4,491.443	16.469
77	Tree carbon and CO2 equaivalents per hectare					74,857.391	274.477

2. Carbon calculation for bamboo

There are many species in Asian forests and we do not have allometric equation for all of them. However, for bamboos which have similar culm size (culm is the term for an individual "stem" of bamboo), you can use the available allometric equation of the bamboo which most closely resembles it.

ALLOMETRIC EQUATIONS FOR BAMBOO

The following four allometric equations have been developed for bamboo species found in Thailand (Source: Sukwong et.al. 2011):

Thyrsostachys siamensis *Gamble* (in Thai *phai ruak*):

Wt = 0.22187 (dbh)2.2749

Bambusa polymorpha (in Thai *phai hom* or *wa-khe*): WS = 0.0522 (dbh)2.58

WB = 0.0312 (dbh)1.6

WL = 0.0363 (1.36)1.36

Bambusa tulda (in Thai *phai bong* or *wa-sue*)

WS = 0.141 (dbh)2.48

WB = 0.0715 (dbh)1.9

WL = 0.125 (dbh)0.68

Cephalostachyum pergracile (in Thai *phai khao lam)*

WS = 0.089 (dbh)2.35

WB = 0.0273 (dbh)1.72

WL = 0.0415 (dbh)1.45

Wt = Biomass of stem, branches, and leaves (kg)

dbh = Diameter at breast height (1.30 m)

WS = Stem biomass (kg)

WB = Branch biomass (kg)

WL = Leaf biomass (kg)

The carbon calculation software for bamboo (on the CD enclosed includes the allometric equation for Bambusa told, and those of for four more species: Dendrocalameus giganteus, Cephalostachyum pergracile, Gigantochloa albociliata and Gigantochloa densa. The software calculates the biomass and carbon of an individual bamboo culm.

To calculate the biomass of the bamboo clumps (clusters) found in the sample plots, the biomass of an average bamboo stalk must be multiplied by the number of bamboo stalks you have counted in each cluster of that particular bamboo species. Combining the biomass of all the bamboo clusters in the plot will give you the overall biomass of all the bamboos in the plot.

The Excel file "Carbon calculation exercise" on the CD enclosed contains the sheet "Bamboo" which gives you an example of how to set up an Excel file for the calculation of carbon in

bamboo. You can find it in the folder "Tools and exercises" in folder "Carbon measurement and monitoring". Activate the sheet "Bamboo" by clicking on the respective tag at the lower left corner of the window.

The example uses the allometric equation for Bambusa tulda, which includes separate equations for stem, branches and leaves.

In the first column (A) enter the number of the bamboo clumps you measured, in the second column (B) the number of culms found in that cluster. In the third column (C) enter the average diameter at breast height (dbh) of the culms counted in that cluster.

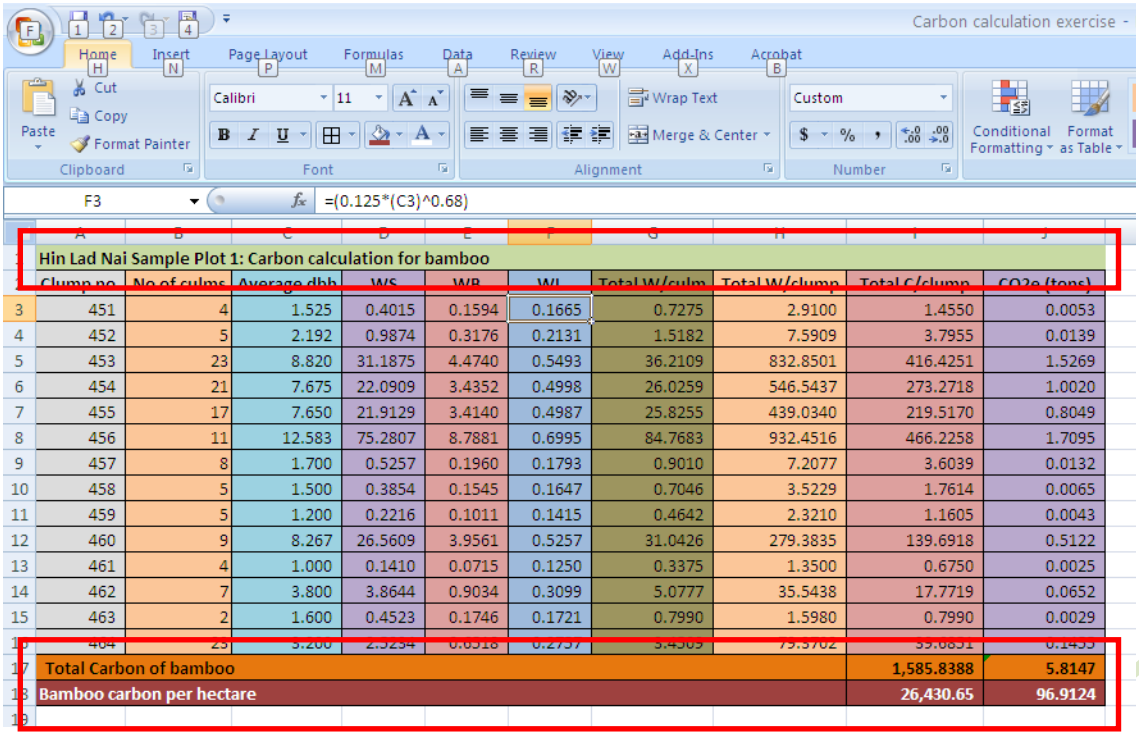
In column D, E and F enter the allometric equation for stems (WS), branches (WB) and leaves (WL) of an individual culm. In column G you will get the total biomass of an individual culm (W total/culm), by entering the equation for the sum of the results for stems, branches and leaves (D, E, F).

In column H (Total W/clump) you calculate the total biomass of the whole bamboo clump by multiplying the total biomass of a culm (W total/culm) with the number of culms per cluster (column B, "No of culms").

For the calculation of total carbon and CO2 equivalents you can proceed as explained in the example for tree carbon given before.

In column I (Total C/clump) you calculate the carbon content (biomass divided by 2) and in column J (CO2e (tons)) you calculate the CO_2 equivalents (the weight of carbon in column I multiplied by 44/12 and divided by 1000).

Finally, at the bottom of the table make again the row for the total amount of carbon in the sample plot and the row for the amount of carbon and CO_2 equivalents per hectare.



	A	B	C	D	E	F	G	H	I	J
1	Hin Lad Nai Sample Plot 1: Carbon calculation for bamboo									
2	Clump no	No of culms	Average dbh	WS	WB	WL	Total W/culm	Total W/clump	Total C/clump	CO2e (tons)
3	451	4	1.525	0.4015	0.1594	0.1665	0.7275	2.9100	1.4550	0.0053
4	452	5	2.192	0.9874	0.3176	0.2131	1.5182	7.5909	3.7955	0.0139
5	453	23	8.820	31.1875	4.4740	0.5493	36.2109	832.8501	416.4251	1.5269
6	454	21	7.675	22.0909	3.4352	0.4998	26.0259	546.5437	273.2718	1.0020
7	455	17	7.650	21.9129	3.4140	0.4987	25.8255	439.0340	219.5170	0.8049
8	456	11	12.583	75.2807	8.7881	0.6995	84.7683	932.4516	466.2258	1.7095
9	457	8	1.700	0.5257	0.1960	0.1793	0.9010	7.2077	3.6039	0.0132
10	458	5	1.500	0.3854	0.1545	0.1647	0.7046	3.5229	1.7614	0.0065
11	459	5	1.200	0.2216	0.1011	0.1415	0.4642	2.3210	1.1605	0.0043
12	460	9	8.267	26.5609	3.9561	0.5257	31.0426	279.3835	139.6918	0.5122
13	461	4	1.000	0.1410	0.0715	0.1250	0.3375	1.3500	0.6750	0.0025
14	462	7	3.800	3.8644	0.9034	0.3099	5.0777	35.5438	17.7719	0.0652
15	463	2	1.600	0.4523	0.1746	0.1721	0.7990	1.5980	0.7990	0.0029
16	464	23	5.200	2.5234	0.6518	0.2757	3.4509	79.3702	39.6851	0.1455
17	Total Carbon of bamboo								1,585.8388	5.8147
18	Bamboo carbon per hectare								26,430.65	96.9124
19										

MEASURING THICK AND THORNY BAMBOO CLUMPS

Some bamboos grow in thick clumps with and have big and thorny culms (such as Bambusa bambos) which makes it difficult to measure individual culms. For wild bamboo, the clump or thicket can be as big as 4.5 meters in diameter. For these cases an allometric equation has been developed which measures the diameter of the whole bamboo clump (not the individual stem or culm) at the height of 1.30 meter.

y	=	-322.5 + 1730.4 DBH
y	=	Total dried weight of both living and dead bamboos (kg per clump)
DBH	=	Diameter of the clump (m)

Source Sukwong et.al. 2011

3. Carbon calculation for understory and litter

We have already explained how you can calculate the oven dry weight of the understory and the litter. In order to get the total biomass of the understory and litter, you have to take the average of the understory and litter of all four sub-plots. This will give you the average amount of understory biomass and dry litter for1 m^2. Then you just have to multiply this with the number of square metres of the whole sample plot to get the total amount of understory biomass and litter. For understory vegetation, the carbon content is the same as for trees, i.e. 50% of the biomass.

However, for litter, the carbon content is only 37%, so you need to multiply the total biomass calculated by 0.37.

For the CO_2 content, make the same calculation as explained above for trees.

4. Carbon calculation for dead wood

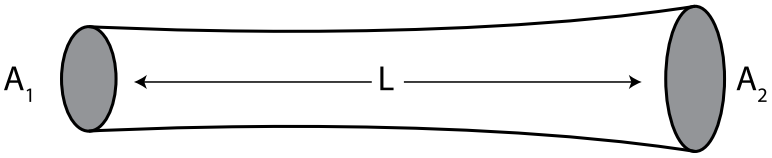
Standing and fallen dead trees, large fallen branches and stumps are calculated like trees, with the use of the diameter at breast height, the height or length and the wood density. Smaller branches are treated as litter.

There are special equations for large branches and for logs (often large fallen logs have hardly any branches left).

The so-called **"Smalian volume formula for large branches"** can be used for fallen large branches and fallen logs:

$$V = \frac{A_1 \times B_2}{2} \times L$$

V	=	volume of log(in m^3)
A1	=	area of small end (in m^2)
A2	=	area of large end ((in m^2)
L	=	length of log (in m)



The area of both ends is assumed to be circular, so the formula $A = \varpi r^2$ can be applied. Since the diameter (or radius) have been measured in cm, but the area is to be given in m^2 we have to

divide the result by 10,000. Thus the formula looks as follows:

$$V = \frac{(\pi r_1^2/10000) + (\pi r_2^2/10000)}{2} \times L$$

r	=	radius (half of the diameter, in cm)
π	=	3.1415
L	=	length of log (in m)

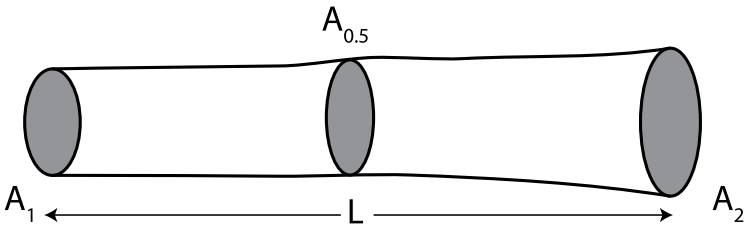
(Source: Sukwong at.al. 2011)

The Excel file "Carbon calculation exercise" on the CD contains the sheet "Dead trees" with an example of a calculation using this formula.

If it is difficult to measure the diameter of a fallen tree at both end, but the middle area is accessible, a simplified formula, the so-called **"Huber's formula**", can be used.

$$V = A_{0.5} \times L$$

$A_{0.5}$	=	mid point sectional area
L	=	length of log



5. Calculating below-ground biomass and carbon

Part of the biomass of living plants consists of the roots below the ground. To measure this directly is very difficult and time consuming and will of course destroy the plant. But biologists have done extensive research and have come up with tables that tell us how much the below-ground biomass is as compared to the biomass above ground in different types of forests.

The table below give you the average "root-to-shoot ratio" of different forest types in the tropics and sub-tropics. For example, the ration of 0.24 for a tropical rain forest with a biomass of over 125 ton per hectare means that the biomass below the ground is 24% of the above-ground biomass.

Table 7. Average root-to-shoot ratio in tropical and subtropical forests

Domain	Ecological Zone	Above-ground biomass	Root-to-shoot ratio	Range
Tropical	Tropical rainforest or humid forest	<125 t/ha	0.20	0.09-0.25
		>125 t/ha	0.24	0.22-0.33
	Tropical dry forest	<20 t/ha	0.56	0.28-0.68
		>20 t/ha	0.28	0.27-0.28
Subtropical	Subtropical humid forest	<125 t/ha	0.20	0.09-0.25
		>125 t/ha	0.24	0.22-0.33
	Subtropical dry forest	<20 t/ha	0.56	0.28-0.68
		>20 t/ha	0.28	0.27-0.28

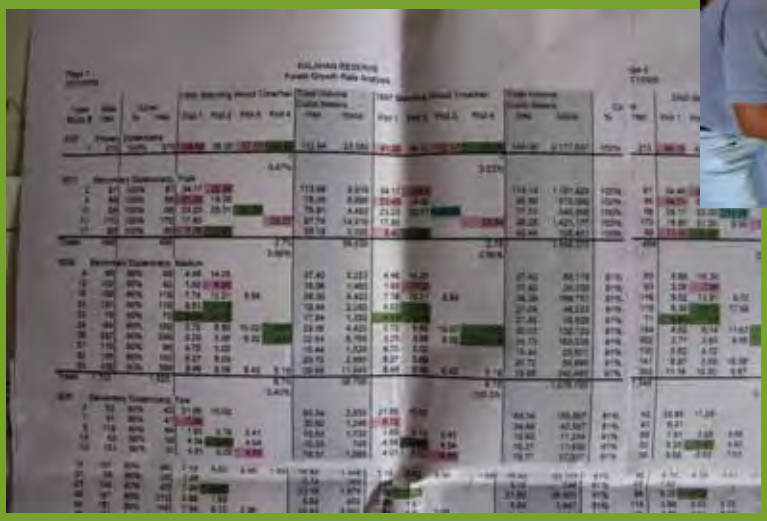
Source: GOFC-GOLD 2009: p. 2-56

Since it is difficult to assess what ratio to use, it has been suggested to use a general average ratio of 0.20. This means you can make a rough estimate of the below-ground biomass of the sample plots by multiplying the total above-ground living biomass (this means excluding the litter and dead wood) of each plot by 0.20.

THE IKALAHAN AND CARBON: ANALYSING THE DATA

The first calculations of carbon were based on the amount of lumber in each tree (this means only the trunk). This, however, was a serious underestimate because it did not include the limbs and tops. The KEF staff finally got assistance from Dr. Rodel Lasco, a forestry professor at the University of the Philippines. He gave the staff a formula which he had developed from research in many similar forests. The input into the formula is merely the diameter of the tree and the output is the number of kilos of biomass in the tree. The computations were clearly more accurate with the new formula.

That first formula, however, used an average figure for the specific weight of the wood in the trees. That, of course, introduced another problem because some of the trees found in the Ikalahan forests are very light (e.g., specific weight = 0.35) and others are so heavy that they cannot float (e.g., specific weight = 1.1). The staff returned to Dr. Lasco and obtained another formula which included the species as a variable. They are now revising all of the data to take species into consideration. It is not a difficult task because the species information is already in the spreadsheets. The new formula can be pasted into the spreadsheets and the new figures can be obtained rather easily.



An operator will probably require 3 months to put all of the data into the computer after the field measurements. It is good to have it done by a forester who would watch to make sure that the computations are reasonable. In a few cases, the operator did not watch the outputs and when the analyzer took over the operation, he discovered problems. In some cases the person who measured the tree had made a recording mistake. In other instances, there was a typographical error by the operator.

The analyzer then uses the plot data, already computed in the previous step, and puts it on a summary sheet to get the amount of carbon for each block and then the amount of carbon in the entire forest. From that, the amount of carbon being sequestered per year is obtained.

6. Writing a report

When you have collected all the data, analyzed it and made your calculations, you need to write it all down in a report. What all you need to include in the report depends on what you are going to use it for. If it is part of an agreement with someone who wants to buy carbon credits, you will have to make the report according to the requirements of the standard you are using.

This may include information on the methods used and how precise and accurate your measurements are. You may need to give a minimum, a maximum and the average of carbon (or rather CO_2 equivalents) estimated. There are guidelines available on how to do that (see for example in ANSAB et.al. 2010: p. 52-53).

7. Reporting on leakage

In Module 3 we have already mentioned that part of a REDD+ project is monitoring and addressing leakage. Leakage happens when deforestation or degradation is "moving somewhere else" because of a REDD+ project, and thus leads to an increase of carbon (or other greenhouse gas) emissions outside the REDD+ project area.

Carbon standards require that, to the extent possible, leakage is monitored and actions taken to prevent or reduce it. And we have seen when discussing the components of a REDD+ project that a REDD+ projects needs to identify possible leakages and develop a method on how to monitor and address them.

Therefore, your carbon reporting will have to include leakage. This includes information on the size and location area outside the REDD+ project which will be monitored (called the "leakage belt"). Information on leakage itself may include logging and other resource extraction that has been regulated or forbidden within the project area, which outsiders (who used to do it within the project area) or people from the community itself now conduct within the "leakage belt".

h. Timber harvesting and fields in the forest: A final word on forest use and carbon monitoring

Indigenous peoples not only depend on forests for survival but their culture and identity are closely connected to forest-based livelihoods. Thus, indigenous peoples have stressed that one of the conditions for agreeing to or cooperating in REDD+ project is that they can continue practicing their forest and land-use systems.

When you consider engaging in a REDD+ project, you must be willing to make changes and adapt some of your land and forest use practices. You will certainly continue collecting fuel wood and non-timber forest products, in addition, you will need to be able to get lumber and bamboo for house construction, and you may want to continue with shifting cultivation.

You can choose to restrict these activities to certain areas and include only the fully protected and unused forest in a REDD+ project. This may be possible for those communities who have large forests. However, most have only comparably small areas of forest which they do not use at all (like sacred forests) or where only the gathering of NTFP is permitted (like traditional watershed protection forests). They need to be able to continue using their forests also under REDD+.

For REDD+, the ultimate question is whether these forest-use practices cause any serious deforestation or forest degradation. As long as these practices do not lead to an overall decrease in carbon, and even allow for an increase in carbon, there is no problem. All this implies that there will be a bit less carbon in your forest and you will get fewer carbon credits. But that may indeed be worth it since the benefits you get from those forest products – which sometimes cannot be measured with money – may me much higher than the value of the carbon credit that you "lost".

Let's look at two examples: shifting cultivation and cutting timber.

1. Shifting cultivation

If you have good shifting cultivation land in the forest you want to include in a REDD+ project and you want to continue using that land, you will of course cut and partly burn the fallow forest every couple of years. When you do that you create carbon emission, and the carbon sequestered in the fallow forest you have cut is at least partly lost.

But the forest rapidly grows back once you let the field lie fallow, and carbon sequestration in young forest is particularly high. Overall, an area under shifting cultivation always has a large part under forest and the carbon stock in such a landscape is much higher than in other forms of land use.

A study recently conducted in a Karen community in Northern Thailand showed that the 254.4 hectares of land under shifting cultivation, which includes the field presently used and all the land under fallow forest, stored a total of 17,643 tons of CO_2 (including soil and biomass carbon). The annual burning caused carbon emission of 1,745.33 tons of CO_2 (only about 80% of the above-ground biomass is burned since many trees are just lopped and not killed during burning).

In addition, the community has 3,119.68 ha of community forests which store a total of 661,372.16 tons of carbon. So overall, the annual loss of carbon in shifting cultivation is only a very small fraction of the total carbon stored in the community forests and the fallow forests. (Northern Development Foundation (NDF) and Huay Hin Lad community 2011, p. 20)

When you practice shifting cultivation in parts of the forest that you intend to include in a REDD+ project, you have to account for the loss of carbon that happens when you clear a field. So in your carbon report, you have to deduct the amount of carbon lost due to shifting cultivation from the total carbon stock you have calculated for the total REDD+ project area.

2. Timber harvesting

When you cut trees for house construction or other uses, some part of the trees – the branches, twigs and leaves, etc. – will decompose and carbon will be emitted. Depending on what you are going to do with the timber itself, it may not decompose for a long time, like when you build a house or furniture which may last for many years, even generations, maybe as long as the life of a tree. So some argue that at least the carbon in the timber cannot be considered lost, it can be considered stored as if the tree was left standing. Ultimately, it all depends on how long the wood is preserved. Therefore, if you want to be on the safe side, you better also account for timber harvesting in your carbon report, and deduct it from the total carbon stock measured.

THE IKALAHAN AND CARBON: ACCOUNTING FOR WOOD EXTRACTION AND AGRICULTURE

The Ikalahan people continue to cull the forest from time-to-time in order to obtain lumber for housing. Whenever a tree is removed, it is recorded in the next measurement and a record is kept of the number of board feet of lumber obtained. The lumber is considered to be sequestered carbon but the difference between the biomass of the tree before cutting and the amount of lumber is considered to be leakage and reported as such. The staff were happy to discover that the occasional culling of the forest actually increased the rate of carbon sequestration because it enabled the wildlings to escape the deep shade caused by the old mother trees which were no longer growing rapidly.

Some of the blocks contain small fields of temporary agriculture. After two or three years, the fields are fallowed with forest so carbon is continuously being sequestered. All of this is included in the report.

The commonly used carbon standards require the reporting of any additional greenhouse gas emissions that are caused by REDD+ project activities, like fossil fuels burned for machines or vehicles, vegetation cut for fire breaks, etc.

If your carbon monitoring is part of a carbon credit sales agreement, you may be obliged to account in a similar manner for all carbon that is lost due to forest use, including fuel wood collection or larger amounts of other NTFP that are extracted.

However, this can be avoided if you make a carbon agreement which is limited to certain carbon pools only. It is fairly easy to account for timber cut, but doing it for all the bamboo, rattan, fuel wood, etc. can be very complicated and time consuming. Therefore, you may better exclude all or some non-tree carbon pools (understory, bamboo, etc.) if you use them a lot. This means you don't include them in your carbon stock measurement and monitoring. This of course reduces the carbon stock you can report on, but it will make carbon monitoring easier and especially reporting since you will not have to deduct everything you are harvesting in these pools.

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REDD+ seems to offer new opportunities for indigenous communities, both with respect to livelihood and the protection of their rights. However, they need to assess carefully what these promises hold and decide whether they find it worthwhile engaging in REDD+ and, if yes, on what terms. For most indigenous communities, REDD+ will in any case be an additional activity, something they integrate in their existing forest and resource management system. Therefore, community-based REDD+ will become just a new component of the overall Community-based Forest and Resource Management system of indigenous communities.

Indigenous communities have long since had their own resource and forest management systems. They have, however, also adopted new techniques and adapted and refined them as they experimented with them. Some of these forest management techniques may be very useful also in the context of community-based REDD+ and we have included here a short module on Community-based Forest Management. This module focuses on two forest management skills which the Ikalahan indigenous people of the Northern Philippines have practiced and refined since the past few decades, and which they have found very beneficial both for the forest and the people.

Chapter 1: Community-based Forest Management and Forest Improvement Technology

a. Community-based Forest Management as an alternative

Community-based Forest Management (CBFM) is a type of forest management that recognizes the capacity of the local community to be the best forest managers. Sometimes it is also called community forest management or community forestry.

Community forest management can generally be defined as a form of "participatory" forest management, which means a type of forest management in which communities participate. This

means that communities can manage a forest which is their own, or they manage a forest which belongs to the government which has given the communities some rights to use the forest. Or communities manage a forest on behalf of the government or a company who have the right over the forest, like under a contract, or there is a kind of joint management between communities and the government's forest department. There are many forms of forest management in which communities are somehow involved – in which they "participate" – and all these are or can be called "community forest management".

Community forest management basically pursues two goals at the same time, to conserve forests and to improve the well-being of the people living in and with the forests. To achieve this, the right of communities to the forest is at least to some extent recognized. But it does not necessarily mean that the communities are recognized as the owners of the forest; they may have some use rights or are just the managers of the forest.

However, for indigenous communities we prefer to call it community-based forest management because this puts a strong emphasis on the community as the foundation – the base – of forest management. This also means that the community is recognized as the rights-holder, this mean: the owner of the forest.

To recognize the communities as the owners of the forest is not easy for some governments, because this means that they lose some of their control and power over forests. Thereby, they also lose the benefits that they or private companies working with or for governments can get from forests. But still, there are governments that recognize and adopt this type of forest management because they understand how good it can be for forest conservation while at the same time benefitting the communities living in these forests.

While it is good that there are governments that employ CBFM as an alternative to outsiders' system of forest management, there are also important factors that the community should address so that the CBFM can be effective. The community should have a working organisation that will take on the responsibility of ensuring that the management of the forest and its uses is participatory, transparent, based on the indigenous knowledge systems and practices (IKSPs), and there is a clear benefit-sharing of the forest produce. There also may be a need to review, discuss and write the IKSPs, so that these can be analysed if still appropriate to the situation and thus can be properly addressed. For example, if the community is no longer practicing a certain IKSP on gathering non-timber forest products, those knowledgeable such as the elders in the community can provide trainings or demonstrations to other members of the community for capacity enhancement which can be later applied in their respective lots.

Besides government support, there are also NGOs and other support groups that can also provide trainings and capacity enhancement in organisational development, marketing of forest products and other needs.

It is important to note that the CBFM is not only a technical issue, but a political issue as well. It is clear that there is power being fought over forest resources, this is why it is important for the communities to consolidate, get organised, share information and develop campaigns, so that the governments adopt policies that will recognise the capacity of the communities, and return the power over the forest to the communities.

b. The Ikalahan and their forest management

The Ikalahan are an indigenous people living in the mountainous North of Luzon island in the Philippines. Most of them are subsistence farmers, practicing shifting cultivation and some wet-rice cultivation on terraces fields. However, they also depend in many ways on a broad range of forest products both for their own use and for cash income.

Faced with a situation of considerable forest and overall environmental degradation, the non-recognition of their land rights and lack of access to education, the tribal leaders had intensive discussions on how to resolve their problems, especially land rights and decided to register themselves as a Foundation which would help them to resolve their problems as a group. Eventually, in 1973, the Kalahan Educational Foundation, Inc. (KEF) was approved and registered.

Forest protection and management was one of the many tasks the KEF took up. They established nurseries for trees and other plants, including native coffee and native fruit trees. In addition to the zoning, management and protection of their forests, the KEF completed the reforestation of more than 400 hectares. Part of their forest was declared a protected area and surveys have found that in the reserve and other forests of the Ikalahan live more than 150 endangered species of mammals, birds, insects, trees, orchids and others.

KEF developed a number of innovative systems, strengthened and promoted traditional indigenous practices such as *pangomis* (intercropping tree crops in swidden to expedite fallow); *gengen* (ancient in-situ composting method); *day-og* (ancient in-situ composting method on level lands to restore fertility after earthquake); enrichment planting in forests; and FIT (a systematized cutting method patterned after indigenous processes to expedite forest growth). All these practices were found to be effective in improving the productivity of the land and enhancing the quality of forests.

Two of the technologies that are applied by the KEF in their forest management and have proven to be particularly beneficial are briefly described here. These two chapters were written by Delbert Rice and are based on his book "Basic Upland Ecology".

c. Forest Improvement Technology

Natural culling is taking place in the forests at all times. It is not unusual for large, over-mature trees to die and fall. Even live trees are sometimes toppled by a strong typhoon leaving an opening in the canopy. If the tree damages adjacent trees when it falls, the opening in the canopy could be quite large but not large enough to change the micro-climate in the forest. The increased sunlight through the newly opened canopy will naturally encourage the very young seedlings, whether of climax or pioneer species, to grow more rapidly.

Logging, on the other hand, is a very UNNATURAL process. It can be called a cycle but it is not a natural cycle. When a logger enters a forest, he needs to remove as much good timber as possible to enable him to make a profit from the operation. To ensure forest regeneration, the Philippine Government (DENR) has made rules for "Selective Logging" but even if the rules are followed carefully, which is not always the case, logging causes a drastic change in the forest. The mature trees which

remain after logging are too few to provide the shade needed for the next generation of climax trees. Roads, drag marks and soil erosion damage the soil. The removal of so much vegetation changes the entire ecosystem. Shade loving plants and animals can no longer survive because there is little or no shade. Even though mother trees of climax species are left in the area, their seedlings can seldom survive because the area lacks the appropriate micro-climate and the required shade. The available pioneer species must grow first to restore a suitable micro-climate before the climax species can grow. This will take many years even in the best managed forest.

After the proper micro-climate has been re-established by the various pioneer species, the ecosystem will slowly change and become suitable for the survival of climax species. As the climax species grow, the micro-climate will slowly improve and some of the original bio-diversity, both of flora and fauna, may recover except for those species that were forced over the brink into extinction. It will require several decades for the forest to recover from what the loggers did to it.

A forest area which is subjected to logging cannot be considered a good watershed because during the first decade following the logging, there is not enough protection so the rain causes erosion and the amount of water entering the aquifers (percolation rate) is small.

Timber Stand Improvement (TSI) is a technology promoted by the Philippine Department of Environment and Natural Resources (DENR) to improve the harvest of timber by loggers. However, the technology does not help much to restore the forest to its condition before the logging took place. In fact, it tends to change a forest into a plantation.

The **Forest Improvement Technology (FIT),** on the other hand, is more like the natural culling process. It is not limited to a single activity performed once in forty years. It is an on-going process performed almost every year by a local resident who can be considered a forest farmer.

The forest farmer first checks the forest for crooked or damaged trees that should be removed to improve the forest. When these are removed, they can be utilized as second class lumber. Only simple equipment is used in the forest and the sawdust, tops, slabs and limbs are left to rot in the forest to restore fertility, provide food for the microflora and microfauna and help maintain biodiversity. The forest farmer does not distinguish between Potential Crop Trees and other trees. His purpose is to improve the forest, rather than to merely improve his income although, in the long run, his income will also be improved.

Before the forest farmer removes a tree, he must be sure that there are other trees, even baby ones, of the same kind to take its place. He must also be sure that the tree is not needed to produce shade for the seedlings.

The forest farmer may later do enrichment planting to expedite the improvement of the forest. For this purpose, it is usually best to use high quality native trees that provide maximum benefit to the forest.

After waiting another one or two years, the forest farmer should again check the forest to determine if any more trees need to be removed to further improve the forest, if so, he removes them. If not, he checks to see if the canopy is closed. A closed canopy makes the forest so dark that the small tree seedlings cannot grow well. If the canopy has closed, the best way to stimulate new growth is to choose one or two mature tree that have stopped growing and remove them. That will open the canopy and the seedlings near the opening will grow faster. It will not change the micro-climate because it merely simulates a natural wind-fall. The tree that is removed, however, will produce first class lumber.

If the forest farmer does this regularly, the forest will continue to develop and improve. The removal of individual trees in this way is not traumatic to the forest or its environment.

If the forest farmer must start with an area that has already been severely damaged by previous logging or by bad pasture technology, of course, it will take him a few years to rehabilitate the area and he will probably need to plant pioneer species first. While the area is developing, he will still need to remove an occasional tree and usually, in so doing, will earn a little money. It is not usually recommended that agricultural crops be grown between the trees because they would interfere with the development of the under-story of the forest and inhibit the development of some of the tree seedlings.

As long as the forest contains less than 100 cubic meters of standing wood per hectare, the forest farmer will probably remove less than a third of the growth rate each year. However, as the forest develops, the trees will grow faster and the rate of removal will need to be increased until the forest is really full of trees, approximately 270 cubic meters of standing wood per hectare. After that time, the farmer should remove the total growth rate of 15 to 20 cubic meters per hectare each year. Even that much culling would not change the basic character of the forest if it is done properly.

The growth rate presently expected in Philippine forests, according to the Forest Master Plan of the Philippine Government, is about 4.5 cubic meters of new wood per hectare per year and the land is severely damaged whenever it is logged. However, under proper management using FIT, the forest can produce up to 20 cubic meters per hectare per year and the forest would still retain the proper forest characteristics without ever being damaged. It would still have high bio-diversity and be an effective watershed with a high percolation rate. It would likely be the

sanctuary for many wild animals, birds and insects but it would also produce lumber.

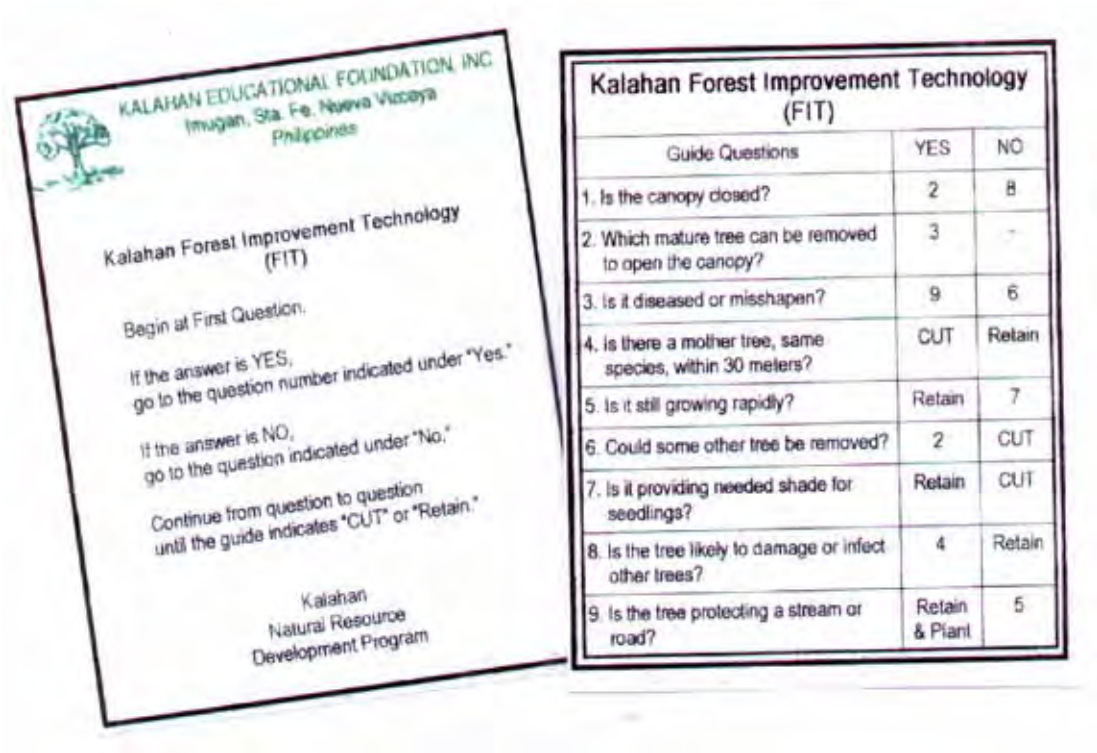
If a forest farmer cares for 5 hectares of good forest, he could conceivably harvest more than 70 cubic meters of first class lumber per year without damaging the forest. That would provide him with a higher cash income than many professionals and he would still have plenty of time to produce his own food on the farm. Once the forest has been developed, his cash income will be sustained indefinitely and his forest will also recharge the aquifers and sequester large amounts of carbon.


Diseased trees can infect the forest


Remove the diseased tree to improve the forest.
And use it to produce lumber (second class)


When the canopy is closed, young trees cannot grow


Remove a mature tree to open the canopy and let the young trees grow.
That improves the forest. And also produces first class lumber.
If such culling is done annually it will produce a good, healthy forest



KALAHAN EDUCATIONAL FOUNDATION, INC.
Imugan, Sta. Fe, Nueva Vizcaya
Philippines

Kalahan Forest Improvement Technology (FIT)

Begin at First Question.

If the answer is YES,
go to the question number indicated under "Yes."

If the answer is NO,
go to the question indicated under "No."

Continue from question to question
until the guide indicates "CUT" or "Retain."

Kalahan
Natural Resource
Development Program

Kalahan Forest Improvement Technology (FIT)

Guide Questions	YES	NO
1. Is the canopy closed?	2	8
2. Which mature tree can be removed to open the canopy?	3	-
3. Is it diseased or misshapen?	9	6
4. Is there a mother tree, same species, within 30 meters?	CUT	Retain
5. Is it still growing rapidly?	Retain	7
6. Could some other tree be removed?	2	CUT
7. Is it providing needed shade for seedlings?	Retain	CUT
8. Is the tree likely to damage or infect other trees?	4	Retain
9. Is the tree protecting a stream or road?	Retain & Plant	5

Community forestry is the best way to implement this FIT. Even though a forest farmer is capable of choosing which of the trees to remove at any given time, it is still wise to have the assistance of a forester of his own choice to be sure that the choice of which tree to cull is truly for the benefit of the forest and not just for the benefit of the pocket. One farmer alone could not support such a forester. A community, however, could easily afford to have one of its own members trained in forestry to serve the community as a whole.

With a forester to help the community, the community could either subdivide the forest into forest lots of 5 or 6 hectares each, one for each family, or the community could have its forester mark the trees that need to be removed and allow those who desire to be involved remove the trees when it is convenient for them to do so. Either way, the forest will develop as described above and the community as a whole will benefit.

The benefits of FIT and carbon

Regular and gentle culling of the forest by using FIT actually increases the growth rate of the forest. All trees reach a plateau in their rate of growth. When they get over-mature, they continue to live but they do not sequester as much carbon as they do during their period of growth. FIT chooses the mature trees that are not sequestering as much carbon as they were sequestering during their period of rapid growth. Those trees are removed in order to re-open the canopy and allow the wildlings to grow. They grow rapidly because they are no longer stunted by lack of sunshine. The result is that the forest sequesters more carbon more rapidly than it would if the over-mature trees were allowed to remain and shade out the wildlings.

The Philippine government statistics indicate that a forest managed by the official methods of "sustainable forestry" will produce about 4.5 cubic meters of wood per hectare harvested once in 30 years. FIT can probably produce 15 cubic meters of wood per hectare per year and that is harvested yearly. Therefore, sustainable logging, FIT in particular, helps to increase the capacity of a forest to sequester carbon.

When cutting a tree, the leaves, branches and parts of the trunk will not be used and left to decay and turn into humus, which means that while some carbon will be released in the process, part of it will be stored as soil carbon. However, by far, larger amount of carbon is stored in the

trunk which is removed as lumber and used for construction or making furniture. In that way the carbon is stored for many decades, even centuries, until the building or furniture is destroyed and burned. Only then is the carbon released.

Chapter 2: Forest Enrichment Planting

What is enrichment planting?

Forests include many different species of plants, animals, insects, mosses, fungi and many other things. Everything in a forest has a purpose. A plantation should not be called a forest because it has only one type of tree.

Sometimes a forest has been damaged and has very few trees. When that happens, it is best to choose the kind of trees that the forest needs and plant them in the forest. That is called 'Enrichment planting.'

When do we need enrichment planting?

In one forest in the Philippines, the people noticed that some species of birds were disappearing. They asked themselves what kind of food that bird ate and realized that they had cut many of the trees that the birds needed for food. They planted the seeds of those trees in a nursery and then planted many of those trees in the forest with the other trees that remained. When the trees grew the birds could multiply again because they had enough food to eat. That was 'enrichment planting.'

In another area, there had once been a good forest but many of the trees had been cut, some had been burned and many of the trees and shrubs that remained began to die because there was not enough shade. The people saw what was happening and began planting trees that do not need shade into the area. These are called 'pioneer species'. As they grew, the area became a forest again and the wildlife returned. That was also 'enrichment planting'.

Another community noticed that their springs were not producing water anymore. Then they noticed that there were very few trees on the neighbouring mountains. They realized that they had damaged their watershed so they began planting more trees on the slopes. When the forest was restored, the water returned to their springs. That is another kind of 'enrichment planting'.

How do we do enrichment planting?

When a community does enrichment planting it should choose the species which were originally in the area. It should also choose the species that are needed to improve the balance in the forest. Birds and bats need food to eat. It is the birds, bats and other wildlife that plant new trees. If there are enough birds and bats and other wildlife in a forest, it will be possible for people to harvest wood and non-wood products from the forest without having to plant any trees because the wildlife will plant the trees for them.

If the forest is needed for watershed, as most forests are, the community should plant *Ficus* species and other species that help develop the watershed. If the wildlife is disappearing, they should plant more fruit bearing trees and other trees that provide food for the wildlife. The different kinds of trees should be scattered in the forest and not planted in plantations.

It is often dangerous to use exotic species (species that are imported and not a part of the original forest). Exotic species will probably not provide the correct kind of food for the wildlife and so the wildlife will die. Some exotic species grow so fast that they kill the original species. Some species are allotropic. That means that they produce chemicals in the soil which purposely prevent other species from growing. Cogon grass, and *gmelina* seem to be allotropic.

Enrichment planting – what species to chose?

Frequently the forests in communities have been damaged to some extent. In that case, enrichment planting should be done. There can be no general statement of which species should be used for the enrichment of a particular forest. However, there are several criteria that have been found helpful.

1. The species to be planted should preferably be an indigenous species. If an exotic species is to be used, it should be chosen very carefully. It is usually not good to use exotic species for enrichment planting and it is best to restore the original biodiversity of native species.

2. We have found it valuable to choose species which will improve the food supply and nesting sites of the wildlife. This is called habitat improvement. The choice of species, of course, would depend on the type of wildlife which exists in your area.

3. If the existing forest is very sparse, the area is open and there exist only very few nurse trees or shade trees, the community should be sure to plant "pioneer species" first before it plants any climax species. Planting "climax species" too soon is a waste of labour and seedlings because they are not likely to survive. If the forest is more mature, of course, climax species could be used.

4. If pioneer species are needed, they should be fast growing species so that the future enrichment planting with climax species will not be delayed.

5. Care should be taken not to produce a plantation. Various species should be inter-cropped. It is expected that the forest will then continue to grow on its own and produce its own wildlings so that further enrichment planting will never be required.

6. A significant number of the trees in a forest should have economic value for the sake of the human population. Some may produce fruit, others resin or fibers. Some, of course, should produce lumber and others improve the habitat for the wildlife.

7. It should be noted that fast growing trees do not necessarily sequester more carbon than slow growing trees. It depends on the specific weight of the wood. A tree might grow slowly but if its wood is 'heavy' it probably has as much carbon as another tree that seems to grow quickly but has very light weight wood.

At Kalahan Foundation we have occasionally violated item 1 above by using Alnus nepalensis. It is a nurse tree with nitrogen fixation. It is not invasive (which means it does not spread rapidly and squeeze out native tree species). It is not an original part of the local forests but has been acclimatized over a period of 30 years. When the original climax species are planted with the Alnus, they soon grow higher than the Alnus and the Alnus can be removed and used for many other purposes. It is only a temporary nurse tree. It grows much faster than all of the other available indigenous nurse trees.

WHAT KIND OF FOREST DO WE WANT?

- A forest has many species. A plantation is not a forest
- A forest is home for wildlife. There should be many kinds of wildlife.
- A forest has mushrooms growing in it. They show that the proper mycorrhiza is in the soil to make the trees grow well.
- A forest has trees with deep roots and also trees with shallow roots. The deep roots help the forest to be strong and resist typhoon and earthquake damage. The shallow roots help to prevent erosion during heavy rains and winds.
- A forest has food supplies for all of the species that live in it.
- A forest has nesting places for all of the species that live in it.
- A forest produces lumber and non-wood products sustainably to provide livelihood for forest dwellers.

Sources and references

Rice, Delbert 2007. Basic Upland Ecology. Quezon City: New Day Publisher

Various publications of the World Rainforest Movement available at http://www.wrm.org.uy/subjects/CBFM/book.html

PART IV. DO WE WANT REDD+? STEPS IN ASSESSING READINESS FOR REDD+

PART IV. DO WE WANT REDD+? STEPS IN ASSESSING READINESS FOR REDD+

At the 17th Conference of Parties of the UNFCCC in Durban, in December 2011, an agreement will probably be reached regarding the funding mechanisms for REDD+. It is expected that different mechanisms will come into play, i.e. funds-based as well as market-based mechanisms. The latter means that carbon credits from REDD+ projects can be traded on the compliance market and are not confined to the voluntary market anymore.

Various scenarios of the implication of having REDD+ carbon credits on the compliance market are currently being debated. What is certain is that there will be an enormous increase in REDD+ projects, which is good news for the conservationists. Recently, REDD+ has been called "the last hope" for tropical forest biodiversity. Indeed, REDD+ may be able to help stem deforestation in the tropics and sub-tropics. However, whether it is good news for the indigenous peoples is still rather unclear. In any case, indigenous communities living in these forests will be confronted with a veritable flood of REDD+ projects as their governments, NGOs and companies will launch REDD+ projects all over the developing world.

Indigenous communities need to be prepared for all this in order to be able to prevent negative consequences of REDD+, as well as to make use of opportunities it may offer, both with respect to securing their rights and to improve livelihood security.

As we have tried to explain, REDD+ project do offer possibilities for supporting indigenous communities in protecting their forests and generating additional income. But if communities want to enter into agreements on selling carbon credits, there are also considerable costs involved, and REDD+ projects can be very demanding with respect to the technical and management skills needed or with respect to legal matters.

Some indigenous communities may have their own people with the expertise needed to fully participate in REDD+ projects, or to design and implement their own CB REDD+ projects. However, many lack this expertise. They have three options:

1. To refuse any participation in REDD+ projects
2. To build up the capacity needed to fully participate in a joint REDD+ project or to run their own CB REDD+ project,
3. To become part of an externally initiated REDD+ project run by NGOs, government agencies or private companies.

Indigenous communities need to carefully analyze not just projects proposed to them by outsiders, but also REDD+ project ideas that may be suggested by members of their own communities.

The first community guide "What is REDD?" and the manual "Community-based REDD+" which you are holding in your hand now have been produced with the purpose of helping indigenous communities make this analysis, based on which they can take a decision.

In the final module of this manual, we will provide some suggestions on how to make this final assessment. The first part will discuss how the principle of Free Prior Informed Consent (FPIC) can guide you in dealing REDD+ projects initiated by outsiders. The second part gives some guidance on how the readiness of your community to engage in REDD+ can be assessed.

MODULE 6
ASSESSING READINESS FOR REDD+

The previous five modules aim to help you gain the basic knowledge and skill needed to fully understand how REDD+ projects work on the ground, and, if your community decides to do so, to be better able to initiate or engage in a REDD+ project. With the knowledge and skills you have now acquired your community should be in a better position to have a discussion and to make a decision on whether to actually engage in REDD+ or not.

The last module of this manual intends to help you to assess whether REDD+ really is an interesting option for your community, and, if yes, whether you are ready for REDD+ or not. It provides some guidance on how to scrutinise REDD+ projects, a list of criteria you should apply in your evaluation of REDD+ as well as some suggestions on how to come to a decision.

Chapter 1: Scrutinizing REDD+ Projects Initiated by Others

a. Applying the principle of Free Prior Informed Consent

The UN Declaration on the Rights of Indigenous Peoples recognizes indigenous peoples' right to FPIC explicitly in six articles dealing with a range of crucial issue such as relocation due to development project, intellectual property rights, resource extraction, etc. The recognition of FPIC by the UNDRIP is a key legal instrument indigenous peoples can use to ensure their rights are not violated by any project of other intervention in their lands and territories.

The right to FPIC means that any activity planned to be undertaken on indigenous peoples' land and territories has to seek the prior consent of the indigenous peoples. The consent has to come about in accordance with their customary laws and practices before the activity starts ("prior" consent). It has to be reached without coercion or manipulation by outsiders ("free" consent) and it has to be reached on the basis of sufficient information on the respective project, its intentions, possible impacts on people and the environment, who is initiating, implementing and benefiting from the project, etc., and all this information has to be provided in a language and in a way that is understandable to the affected indigenous communities ("informed" consent).

It is important to emphasize that the right to FPIC means the right to withhold consent, which means: the right to say no to a project.

Therefore, whenever anybody approaches your community with the intention to get you involved in a REDD+ project, or when you hear about such plans without having even been informed yet, you should insist that you are not ready to negotiate before an FPIC process has been undertaken.

Consent has to be obtained by indigenous peoples at various stages of the REDD+ process, from the development of national REDD+ policies and laws to the different stages of a REDD+ project on the ground.

The table in the manual on FPIC in REDD+ published by RECOFTC and GIZ provides a good overview of the various stages in which FPIC has to be sought.

Table 8. Stages in the REDD+ process requiring FPIC

Consent Points	Consent to What?	Primary Responsibility to Seek Consent?
National legal and policy framework for REDD+ programs	Consent to REDD+ as a possible solution to the forestry-related drivers of climate change that will impact the forests of indigenous peoples and local communities.	Government
Sub-national project identification	Consent to REDD+ as a possible solution to the forestry-related drivers of climate change (if not already given as part of national readiness activities). Consent to enter negotiations in rights holders' forest area.	Government, project proponent
Baseline setting, local drivers of deforestation identification, preliminary forest management plan	Consent to the method of baseline development, and the analysis of local drivers of deforestation (particularly to which rights holders are said to contribute), preliminary forest management plan/ preliminary program design.	Project proponent
Socioeconomic, cultural and environmental impact assessment	Consent to the scope and content of the assessment design.	Project proponent
Project design including changed forest use and benefit sharing arrangements	Consent to all aspects and details that directly affect rights holders, especially benefit-sharing arrangements and forestry practices targeted for change.	Project proponent
Commercial agreement to purchase carbon credits	Consent to general framework of the commercial agreement and specifically to benefit-sharing arrangements.	Project proponent
Project implementation and monitoring	Maintenance of consent according to evolving implementation arrangements and issues arising at mutually agreed periods.	Project holder
Project cessation	Consent to the reasons for cessation and the arrangements for phasing out.	Government, project holder

Source: Anderson, Patrick 2011, p. 23

It is particularly important for you to know that any organisation of the United Nations is obliged to respect the UN Declaration on the Rights of Indigenous Peoples (UNDRIP) and apply its provisions in their work. This includes indigenous peoples' right to give or withhold FPIC. The UN-REDD Programme appears to take this seriously and has very recently conducted regional consultations with indigenous peoples, civil society organisations, and other stakeholders in Africa, Asia and Latin America to develop specific FPIC guidelines for countries participating in the UN-REDD Programme. You should follow up in your county on the progress of the development of these guidelines, and try to ensure that both in its content and in its implementation they uphold the original spirit of the UN DRIP.

Given the influence UN-REDD has on the way REDD+ will look like in the future, it is encouraging that they are taking this initiative. A critical engagement of indigenous peoples and their organisations is very much needed to keep UN-REDD on the right track towards a genuine implementation of the FPIC principle.

Once the guidelines are in place and have been found in line with the original intention of the UNDRIP, they can become a powerful tool in upholding your rights.

GUIDES ON FPIC

A guide on how to use FPIC in connection with REDD is currently being prepared in our manual series. It will be made available by AIPP, IWGIA and their local partner organisations. You can contact them through: www.aippnet.org and www.iwgia.org

Several other useful manuals and handbooks on FPIC have been published recently, one of them also focusing on FPIC in the context of REDD+ while the others deal with FPIC generally.

Anderson, Patrick (lead author) 2011. Free, *Prior and Informed Consent in REDD+: Principles and Approaches for Policy and Project Development.* Bangkok: RECOFTC and GIZ

Tamayo, Ann Lreto and Minnie Degawan 2011. *Handbook on Free, Prior and Informed Consent for Practical Use by Indigenous Peoples' Communities.* Chiang Mai, Thailand: International Alliance of Indigenous and Tribal Peoples of the Tropical Forest, South East Asia Region and the Indigenous Peoples Foundation for Education and Environment

Hill, Christina, Serena Lillywhite and Michael Simon 2010. *Guide to Free Prior and Informed Consent.* Victoria: Oxfam Australia

b. Using the community check-list on carbon projects and programmes

If your community is approached to be part of a REDD+ project or any other project of programme that will be funded by the carbon market, by carbon finance funds, or that will create carbon credits, then it is important to try to get as much information as possible before entering into any agreement. Having this detailed information is part of the FPIC process. We have prepared a check-list which may help you get all the information needed (it is also included in the manual "What is REDD" published earlier). This checklist intends to provide a minimum list of questions to which you should get answers. You should also access the advice of a trusted lawyer before signing anything.

Community check-list on carbon projects and programmes

INFORMATION ABOUT THE PROJECT

Basics

- Where is the project, how big an area does it cover, what are the names and number of affected people(s) or communities?
- What kind of land rights do your people or community hold over your lands and territories? Are your rights customary and untitled, customary and titled, individual and titled, individual and untitled, communal and titled or communal and untitled, or some other form of right?
- Are you being proposed as a party to the contract selling the carbon credits? If yes, who is the named seller? If no, what company, agency or other entity is the named seller?
- What is the length of time that the project covers? What are the different stages of the project and their respective durations?

The financing mechanism

- Is the project funded through the sale of carbon offset credits or through other funding or a mix of the two?
- If the project is funded by the sale of carbon offset credits, what kind of information has been provided to you pro-actively, and what information has been requested by the community during project and contract negotiations on:

    - Who is the buyer? Who pays for the carbon rights which the community is considering to sell and at what average price? What are the prices for comparable projects?

    - What are the possible legal implications of signing a carbon offset contract and what is the possible impact of such a (long-term) contract on ownership rights over the carbon in the forest, both for present and future generations?

    - What are the possible implications of both decreasing and increasing carbon prices for the specific project? For example, will the community benefit if carbon prices go up or do they receive a fixed sum payment irrespective of the price for which offset credits are traded? With regard to falling prices, will payments to the community be linked to the price of carbon on an international carbon market? Are contractual obligations linked to payments agreed on in the carbon contract signed?

- If the project is financed through a fund, has information been provided pro-actively or requested by the community during the presentation and negotiation of the project on the objectives of the fund, where the fund is located, who is providing the funding and whether those providing the funds are getting carbon emission offset rights in return for their contribution?

CONSULTATION AND NEGOTIATION PROCESS

- Who was the negotiating partner, if any?
- Who has negotiated for you or is proposed to negotiate for you? Will you negotiate by yourself?
- Who will be signing the contract on behalf of your people or your community? How has this been decided?
- Have you had independent legal advice and/or an opportunity to discuss the contract

and its implications on rights with a lawyer?
- Was there a lawyer representing or advising you during the negotiations?
- Were the national laws of the country discussed in terms of how they may affect the carbon contract?
- Has the contract been written and presented in the language of your people or the language spoken in the community, or at least a language that the community members can understand?
- Have women been involved in the consultation and decision making?
- Did the consultation process allow for feedback from community members? Was the consensus of the people of the community obtained in accordance with their custom and tradition? If not, why?
- Has the community been given a copy of the contract and other documentation related to the carbon offset project?
- Assuming there are restrictions on the use of the forest, how have these been negotiated within your community?
- Do the restrictions affect all members of the community equally? Who is affected the most and who the least?
- Is there a process to address unequal impact?
- Does the project create any new jobs? If yes, what are the kind of jobs and by what process are jobs allocated or provided?

THE CONTENT OF THE CONTRACT

- What is the time period of the contract? Is it the same as the length of the project?
- Does the contract limit or restrict your right of access and use of land and forests, or the right of use for other neighbouring communities? If yes, have these limitations been fairly negotiated and has fair compensation been provided under the contract?
- How are the payments being determined?
- If the selling of credits is part of the contract, how many credits are these?
- Is the payment received linked to the price of the carbon?
- Did you have your own financial analysis to assist in arriving at the agreed price? Is the payment made as one-off fixed sum or a continuous payment for as long as the contract lasts?
- What rules or regulations have been put in place to make sure the carbon remains in the forest during the contract period? Who has put these rules and regulations in place?
- Who carries the risk if something happens to the forest/trees? What happens if the carbon is lost through accidental events like a wildfire? Will you have to pay money back to the contract partner?
- Has sufficient information been provided/sought for you to understand both the responsibilities and benefits as agreed upon in the contract?

IMPLEMENTATION AND MONITORING

- Who is responsible for the implementation of the rules and regulations agreed on in the contract? Who is monitoring the implementation?
- What enforcement mechanism is in place to ensure that the contractual obligations are met?

This check-list is based on a community check-list developed by FERN and the Forest Peoples Programme

Chapter 2: Assessing Whether Your Community is Ready for a REDD+ Project

If your community considers participating in a REDD+ project or initiating your own community-based REDD+ project, you also need to assess whether your community is ready for that.

In this chapter, we are trying to provide some guidance on how you can make this assessment. We have compiled a checklist with some key questions to ask, followed by some advice on how to analyze the outcome of the community discussion, some guidance on partner assessment and the issue of benefit sharing, and finally a short guide on how to organise a meeting for decision making.

a. Assessing readiness for REDD+: Some questions you need to ask

We are providing you here with a list of some questions community leaders and representatives should discuss before making a decision on whether their community can agree to a REDD+ project or not. The questions take stock of the socio-cultural context of the indigenous group. They also consider the conditions that should be in place so that there is confidence that the rights of the indigenous peoples are upheld and supported within a proposed REDD+ project. The questions try to distinguish between an ideal situation (for example, how traditions should be) and the actual practice (how traditions are still being followed). The list certainly does not cover all questions that may be asked in any particular case, but may give you some ideas on what all should be included.

It is best if there is a consensus agreement on what the answers should be. The process of arriving at a consensus should be according to traditional ways that are still widely practiced, or according to a decision-making process that is widely accepted in your community.

Table 9. Criteria for evaluating REDD+

General Question	Specific Questions / Follow-up Questions	Answer	
		Yes	No
1. ON LAND SECURITY AND LAND USE			
Is your ownership of your forested areas recognized and protected? If you have only use rights, are they long-term?	This can be a land title or certificate, or a document attesting to access and use of the forested areas.		
Does the community have a clear system of assigning ownership and use of the lands within the territory?	If yes, which are traditional and which have been recently adopted?		
Is there documentation of the people (within and outside the community) who benefit from the forests located within the indigenous peoples territory?			
Will there be community members or outsiders who will be negatively affected if access to forest areas are restricted by a REDD scheme?	If yes, are there current possibilities of alternatives or support for them? If there are no current possibilities of alternatives or support for them, will their circumstances be included in the REDD+ project?		

General Question	Specific Questions / Follow-up Questions	Answer	
		Yes	No
2. ON COMMUNITY GOVERNANCE			
Does your community have a formal representation in the local government unit?	If yes, identify if representation is at the village level and/or at the town level. Also identify whether the representation is considered adequate or satisfactory?		
Does your community organisation have a legal entity (duly registered with a government body)?	If yes, is the registration respected by other stakeholders? If no, is the community organisation willing to register?		
Is the leadership system in your community stable?	Are the community leaders recognized by majority of the community members? Are the community leaders trusted by members to make decisions about their territory on their behalf?		
Are the consensus-building processes in your community well-established and broadly recognized by community members?	Were these consensus-building processes followed for this proposed REDD+ project?		
Does your community have an established and respected system of conflict resolution among its members?	Is there such a system particularly for resource ownership, access and use?		
3.a. ON COMMUNITY GOVERNANCE REGARDING FOREST MANAGEMENT			
Is the existing forest management in the hands of community members?	Are the benefits of forest management clear? Are penalties clear and enforced?		
Does your community have a community development plan that includes comprehensive forest management?	Are the benefits of the community development plan clear? Are penalties clear and enforced?		
Within your indigenous peoples territory, is there a clear mechanism for decision making regarding the use of communal forest areas?			
3.b. ON INDIGENOUS KNOWLEDGE, SKILLS AND PRACTICES ON FOREST MANAGEMENT			
Are the indigenous knowledge, skills and practices on forest management still *known* by a significant number of community members?	If yes, are there measures to share these knowledge, skills and practices with other community members who are not familiar with them and with other stakeholders? Is there a danger in sharing these measures with others?		
Are the indigenous knowledge, skills and practices on forest management still *practiced* by a significant number of community members?	If yes, are there measures to ensure that the younger generation are learning these?		
Are the indigenous knowledge, skills and practices on forest management documented?	If yes, in what form and who has access to the documents?		

General Question	Specific Questions / Follow-up Questions	Answer	
		Yes	No
4. ON HUMAN RESOURCES			
Are there members of your community who have the technical skills to be in charge of or participate in the recording of carbon stocks?	If yes, are they willing to share their skills for the community's benefit? If no, do you have partners (e.g. NGOs, government, business enterprises) outside the community whom you can trust to assist in this? If yes, what compensations do they expect? Are the compensations they expect acceptable to you?		
Are there community members who have the skills to negotiate with outsiders?	If yes, have they used these skills on behalf of the community members' interests in the past? If no, do you have partners (e.g. NGOs, government, business enterprises) outside of the community whom you can trust to assist in the negotiation? If yes, what compensations do they expect? Are the compensations they expect acceptable to you?		
5. ON PROJECTED BENEFITS FROM THE REDD+ PROJECT			
Are the projected benefits clearly understood?	Do the community members grasp the difference between the net benefits and the gross benefits? Do the community members understand fully under what conditions the benefits can be obtained (that these are not automatic once the project is agreed to)?		
Have the trade-offs to obtain these benefits been identified?	If yes, do the community members have a consensus on the acceptability of these trade-offs?		
Are the community members clear about who gets what benefits, when or under what conditions?	Is the benefit-sharing scheme equitable and acceptable to the majority of the community members? Is the system of distribution of the benefits clear to the community members?		
Have the needs and roles of the non-indigenous members of the community (if there are) been identified?	If yes, do the non-indigenous community members agree as well to the roles assigned to them and the projected benefits they may receive?		
Do community members have other stable sources of income, so that the proposed REDD+ project is not the only or major source of income?	Refer to II.c.		

Whenever a "yes" answer is given, look for specific instances that concretize the "yes" answer. It may help to have any existing documentation (e.g. ethnographies, project reports, feasibility studies, development plans and the like) that will help concretize the "yes" answers. This will also

help in speeding up the concretizing of the "yes" answers. It will likewise be an opportunity for updating or further validating the content of these documents.

Whenever a "no" answer is given, find out why "no" and whether there is a plan to fill in the gaps to eventually achieve a "yes" answer.

b. Analyzing your answers

If the community has checked more "no" than "yes" boxes, the community may want to think carefully again before making a "go-ahead" decision to engage in REDD+.

If the interest in REDD+ is still there despite the many "no" answers, you may at this point discuss how they intend to fill in the gaps (of information or of processes) so that the answers will transform into "yes".

If there are overwhelmingly more "yes" answers and the community expresses further interest in a REDD+ engagement, the questions in the following table may be asked. Be ready to discuss the pros and cons of each type.

Table 10. Types of REDD+ engagement

Sl. No	Question	Answer		Next Step(s) if Yes
		Yes	No	
1	Do you want to be part of a REDD+ project initiated by others?			Negotiate a contract (see Module 6) that protects your rights.
2	Do you want to undertake your own REDD+ project?			Ensure you have all the knowledge, skills and access for funding the preparation needed Seek advice and support from external experts
3	Do you want to undertake a REDD+ project with a partner organisation?			Look for a partner organisation that recognizes your rights. Then negotiate a contract (see Module 6) that protects your rights.
4	Do you prefer not to engage in a REDD+ project at the moment but may consider to do so in the future?			Work on the issues covered by the questions to which you answered "No" in the table above and after some time make a new assessment If you are quite sure you want to engage in REDD+ in the future, you may already make a carbon inventory (see Module 4).

Then think about the time frame you have in mind regarding the next step(s). An ad hoc committee or a focal person may be identified to coordinate and monitor the agreements reached.

If the community decides not to engage in REDD+, then the next discussion should be on how to ensure that their decision is respected by outsiders, how to prevent attempts by outsiders to undermine the community's decision, and maybe also what else can be done instead of REDD+ (see Module 2, especially sessions 5 and 6).

c. Can we do it alone? Partnering for REDD+

REDD+ projects are in some ways similar to other projects engaged in by the community. It could be small or large-scale, community-initiated or proposed by outside stakeholders. In any case, a REDD+ project is always a "multi-stakeholder" partnership, which means different people from different organisations, institutions or communities are involved. Some people will design, others will finance the project, some will monitor carbon, and others will buy carbon credits, evaluate the carbon emission reduction and so on. Multiple roles can be taken up by one stakeholder while others have only a single role. This will depend on the partnership agreement that has to be clear from the beginning of the project.

A REDD+ project can be seen as a livelihood project and at the same time a forest conservation project. We know that if a forest is protected and conserved, there are many benefits for forest-dependent peoples, and not just income from selling carbon credits. In this kind of project, as in other projects that affect the forest and the communities that are dependent on it, it is important that the community is involved and is part of the process from the very beginning and throughout the whole project.

Potential partners or actors involved differ from project to project and may have multiple or single roles to play, but for us to have an idea about the kinds of potential partners we will be working with, let us look into the common "who is who" in a carbon project (Kollmuss, et.al. 2008).

- **Stakeholders**
  The stakeholders would include the host community, the government and non-government organisations and other individuals or institutions. They are directly or indirectly affected in the project and shall not only be consulted and informed; but must also be fully engaged in the project especially in the case of the host community.

- **Project Owner/Proponent and/or Developer**
  The community can also be the project owner or developer. They can either develop it among themselves or with the assistance of others. However, in most projects conducted, individuals, companies or experts who are outsiders are normally the project owner or developers. They normally come in and request the community's consent to engage in the carbon project. It is important to be prepared and establish where the community stands in this matter, and if they give their consent to engage, where they are in the overall project design.

- **Investor**
  The investor is the one who provides the funding for the project. Since the project is a long process, capital is needed from the very beginning of the project until carbon is sold.

- **Auditors, Validators and Verifiers**
  The auditors, validators and verifiers conduct monitoring and evaluation to ensure that carbon emission is indeed being reduced. The project developer and standards organisation get third-party auditors, validators and verifiers who will conduct the audit, validation and verification separately to avoid conflict of interest.

- **Standards Organisation**
  The standards organisation provides the standards which will have to be followed by a project. Certain standards are needed in order to be able to have their carbon credits certified and registered and to sell them. Other standards (like the Climate, Community and Biodiversity Standards) certify that the project complies with the safeguards (doesn't do harm to local people or the environment) and produces co-benefits for communities and biodiversity. The organisation accredits third party auditors, validators and verifiers who will evaluate whether the projects complies with the respective standards.

- **Brokers, Exchanges, Traders and/or Offset Provider**
  "Brokers", "exchanges", "traders" and/or "offset providers" are the names of individuals or

groups who purchase and sell carbon offsets. Their functions may differ but overall they are intermediaries, which means make transactions between the seller and the buyer of the carbon offset.

- **Final Buyer**
  The final buyer buys the carbon offsets to compensate their greenhouse gas emissions. They register it without the intention of reselling.

Now that we have an idea about the kinds of potential partners we will be working with, let us look at the minimum technical skills that the community should have to fully engage in a carbon project.

- **Carbon counting and monitoring**: REDD+ as other carbon project lasts many year and normally (if the size of the project and the number of people are adequate) the local people are the ones left to measure, record and monitor the progress of the carbon sequestration. Depending on the standard used, carbon counting and monitoring are conducted in a specific timeframe, for example, every 3 or 5 years.

- **Conflict management**: Communities also need to design procedures in keeping the people informed about the project thus practicing transparency, as well as procedures in managing conflicts and addressing grievances. Indigenous peoples can employ their indigenous practices in all these procedures.

- **Finance management and bookkeeping**: This is essential in any project that involves money. Part of any project is responsible management of finances, as well as transparency with funds to avoid conflict within the community and with project partners. This will also help a great deal during the distribution of benefits by the time the funds come in.

- **Negotiation skills**: This is a requirement for the community to effectively send across what and how they want to be engaged in the project. This is also important so that the activities are culturally appropriate and the agreement between partners is fair.

- **Land-use planning**: The people in the community are the experts in their territory. Being able to identify the land uses and putting this up as a policy within their territory will help protect the sustainability of culturally significant areas such as forests, springs, burial grounds, etc. against possible land use conversions.

The community can study the skills mentioned above and see which of these they already have and which they do not. Traditional knowledge can be utilized and enhanced to acquire these skills or even be formulated into a written manual or policy especially on the land-use planning aspect. Those that are new to them and need further guidance may be acquired by tapping groups that can conduct capacity-building trainings like environmental NGOs, individuals, government, academic and other institutions.

In choosing partners, it is important for the community to first establish a uniform stand on what they want and need for their community. After having a clear stand, partners can be identified according to the role they can fit in to advance the identified needs of the community. It can also be seen in the light that community and the partner should complement one another's strengths and weaknesses, with mutual and fair benefits resulting from the partnership. For example, for the skills mentioned above, the indigenous peoples can seek support from partners that can provide them training to enhance their capacity and skills. The community in return may have helped the partner in realising their objectives to capacitate indigenous peoples and enhance their training modules.

In the case of individuals or groups that approach the community, it's the same. They should complement each other and all should benefit. The community has to know whether the individual or group can indeed help, and for that they must have as much information as possible. It is also useful to learn about previous projects these groups or organisations were involved in. It is necessary not to get information from a single source alone, for example, from the indi-

vidual or group that approached them. The community should also seek information from other sources such as the government, NGOs, academe and if possible, from communities that have been involved in these projects. The community must also internally discuss findings in order to reach the best decision that will meet their needs.

Following are some of the information that the community can seek to know about a potential partner:

- What is the name of the organisation?
- Who are the key people in the organisation?
- Where is the organisation based?
- What are the objectives of the organisation?
- What is their purpose in approaching the community?
- With whom have they transacted their business or delivered their services in the past?
- Why did they select your community and how did they get to know about your community?
- How long has the organisation been working with communities?
- What can they share about their previous projects? Best practices and aspects for improvement?

d. Making sure everyone benefits

The way money and other forms of benefits are channelled and ultimately shared in a project is called "benefit sharing". How much is paid when? Who all receives a share and how large is this share? When and how will it be paid out? What is the mode of payment to the community? Such questions need to be answered very clearly at the very beginning of a REDD+ project. It is important that there is a clear communication between partners and that there is a clear agreement on benefit sharing. This should be a part of the overall Memorandum of Agreement (MOA) prepared at the onset of the project. It is also important that benefit sharing should be allowed flexibility so that changes are possible when necessary.

As mentioned previously, a carbon project is a long process and income from carbon sales may come in only after several years after the project starts. But an agreement can be made which ensures that some benefit for the communities, such as support for community funds, land titling, scholarships, insurances, enterprise development and others, are paid earlier.

Learning from other REDD+ and other development projects, the community can use the following as a guide to ensure that benefits are properly shared among partners:

- **Participation in initial discussions**: The community should be directly involved in identifying how benefits are shared. This will help build trust among partners.

    - **What the community can do:**

        - Before signing an MOA and/ or a benefit-sharing agreement, the community should ensure that they participate in the discussion on benefit sharing. They will have to know how large their share will be and how much the other partners/stakeholder will get. They should also participate in the planning on how the benefits that will go to the government are used by the government.

        - The community can discuss the level and form of income and other benefits they are already getting from the forest, and to what extent a REDD+ project would reduce these incomes and benefits. This can guide them in the negotiations on payments from REDD+.

- **Deciding on the form of benefits and how they are used and shared within the community:** The project should very clearly define how and when the benefits should reach the communities. There should be a transparent reporting and accounting system which allows all partners to see how much has been paid to whom and when. And the community needs to discuss how benefits are to be shared internally.

    - **What the community can do:**

        - The community should discuss how they want to receive the payments and the community can come up with a schedule on the timing of the payments. They may need to consult the other stakeholders for this.

        - The community can decide if the benefit will be distributed per individual, per family or for communal usage (for community development, health and other projects). Since the exact amount of payment may not be known and may change over time, it is better to make allocations in percentages per recipient of per development need.

        - The community can come up with a plan where development needs are identified such as their basic needs on health, livelihood, education, environment and others. Prioritisation of these needs will also allow the community to allocate the benefits easily and accurately.

- **Ensuring transparency**: Information on the payments made to all partners/stakeholders should be publicly available. Transparency is needed from the project-level to the community-level to ensure accountability. This can also be a safeguard against corruption.

    - **What the community can do:**

        - The community can establish a mechanism on how they can ensure transparency of benefits among the community members. This can be for example done through a regular reporting in community meetings, and/or posting of reports in strategic areas within the community.

- **Dispute settlement**: The project needs a mechanism to deal with disputes if there are any changes in benefit sharing in the future. This will avoid costly conflicts, helps ensure partners live up to the responsibilities they have accepted, and reduce uncertainty.

- **What the community can do:**
  - The community can identify the key people who are knowledgeable in their internal and external dispute settlement procedures. Traditional dispute settlement and sanction procedures based on customary laws can be incorporated in the overall project dispute settlement mechanism. It is also necessary that the community provides clear policies to their partners to ensure culturally-appropriate activities within the ancestral domain.

e. Preparing a community meeting for decision making

Representativeness of Participants

When is the best time for a meeting to make a decision? The best-case scenario is that the REDD+ issue has been so widely discussed among the community members before this meeting so that anyone who attends already has a background on REDD+ and has already thought about it.

This will however not always be the case due to constraints of time, human resources or logistical concerns. If this is so, our suggestion is that participants to this community decision-making meeting should include both those who have been attending previous meetings and those who have not yet attended any. This contributes to ensuring the broadest possible representation of the community.

Take into account getting also the voices of women, youth and elders who are not part of the leadership structure. If the community culture does not allow for these sectors to hold a discussion together wherein each have a fairly equal voice, then consider holding a series of separate meetings, at least one meeting for each sector. Or if all are together in one meeting, hold group discussions wherein the participants are grouped together according to sectors.

What about other stakeholders (e.g. representatives of government personnel, indigenous peoples federations, non-indigenous support groups, private sector companies)? If there are internal community issues and stakeholders are closely identified with a specific viewpoint or a particular group, it is best if they are not present unless they are able to take on the role of impartial mediator. If their presence cannot be avoided, they may be asked to be observers, and they can form a separate group when there are group discussions or workshops.

Program Facilitation

Before the participants start the actual decision making, it is a good idea to present an overview of the previous meetings on REDD+ — the content and the responses so far of those who had attended these earlier meetings. This may be done by asking those who have attended previous meetings to recall what had transpired. A photo montage may be prepared. Encourage a narrative or story-telling style rather than a reporting style.

Then ask the participants what points are not yet clear, and discuss these points as concisely as possible so as not to take up too much time. If there are a few who remain vocal about points that are already clear to the majority of the participants, a co-facilitator may take them aside and discuss with them outside of the program (but make sure that this move is culturally acceptable and will not unintentionally insult these people).

If before the meeting it is already quite clear what the position on the REDD+ is, a draft community resolution may be prepared so that those who attended the meeting can already attest to the decision. This is especially useful if it is difficult to get together again the same composition of participants. There should be provision to revise the draft if necessary (e.g. rewrite the resolution on blank paper).

Preparation of Facilitation Aids

When there are several participants who are literate, the checklists above may be written out on poster paper and copies of the checklists can be given out to them. If there are to be several community meetings for decision making, for instance because the area or population coverage is large, the checklists can be printed on tarpaulins, and the boxes ticked off with a whiteboard marker during the meeting. The tarpaulins can then be reused again and again.

When there are several participants who cannot read, a culturally appropriate way of representing yes and no visually may be prepared. For example, there can be cut-out shapes or stones with a colour associated with happiness, and cut-out shapes or stones with a colour associated with negative thoughts (but avoiding colours associated with tragedy and horror). Then the major themes in the first checklist can be represented visually. The point is to devise a system whereby participants can visually keep track of their "yes" and "no" answers. Ensure that any visual representation is culturally appropriate; make the effort to pre-test it to check that the appropriate concept or message is put forth by the representation, and equally important, that the inappropriate concept or message is not delivered.

Documentation

It is important to document the answers given, and when and how the answers were arrived at. A single community meeting may not result in a clear consensus, and therefore, answers may vary as several meetings take place through time, even among the same community members. Those who will facilitate in the processes of consensus building, especially if they are not community members, should be familiar with such processes so that he or she is aware when a genuine and firm consensus has been reached.

Sources and references

IUCN Forest Conservation Programme 2009. REDD-plus and Benefit Sharing: Experiences in forest conservation and other resource management sectors. http://cmsdata.iucn.org/downloads/benefit_sharing_english.pdf accessed 15 June 2010

Erni, Christian and Helen Tugenhardt (eds.) 2010. What is REDD? Chiang Mai: AIPP, FPP, IWGIA, Tebtebba

Wollenberg, Eva and Oliver Springate-Baginski 2009. Incentives +: How can REDD improve well-being in forest communities? In InfoBrief, CIFOR. http://www.cifor.cgiar.org/Knowledge/Publications/DocumentDownloader?a=d&p=%5Cpublications%5Cpdf_files%5CInfobrief%5C021-infobrief.pdf

ANNEX

Annex 1. Contents of the Resource CD.

The resource CD contains the following folders and their contents:

Folder "Carbon measurement and monitoring"

Sub-folder "Field guides":

- "ANSAB et.al. 2010. Carbon Stock Measurement" is a PDF of the publication:
  - ANSAB, FECOFUN, ICIMOD 2010. Forest Carbon Stock Measurement: Guidelines for measuring carbon stocks in community-managed forests. Kathmandu, Nepal

- "Verplanke et.al 2009_Field Guide" is a PDF of the publication:
  - Verplanke, J.J. and E. Zahabu, Eds. 2009: A Field Guide for Assessing and Monitoring Reduced Forest Degradation and Carbon Sequestration by Local Communities

Sub-folder "Tools and exercises":

- Folder "Software for carbon calculation" contains carbon calculation software in English for: Bamboo, Bamboo clumps, dry Dipterocarp forest, Dry evergreen forest, for Forest types according to annual rainfall, and for Mangrove forests
- Folder "Standard deviation calculation" contains the two Excel sheets referred to in annex 3 "Calculating the standard deviation", on pages 200-201
- Excel file "Carbon calculation exercise": This is the Excel file referred to in the exercise "Preparing an Excel sheet for your carbon calculations" on pages 146-151
- Excel file "Carbon calculation exercise_wood density" is the Excel file used in the exercise "Preparing an Excel sheet with an equation requiring wood densities" on pages 152-153
- Excel file "GlobalWoodDensityDatabase" contains the database for wood densities of 16,468 tree species.
  - Reference: Zanne, A.E., Lopez-Gonzalez, G., Coomes, D.A., Ilic, J., Jansen, S., Lewis, S.L., Miller, R.B., Swenson, N.G., Wiemann, M.C., and Chave, J. 2009. Global wood density database. Dryad. Identifier: http://hdl.handle.net/10255/dryad.235.

- PDF file "IPCC Good Practice Guide_Chp3_Annex_Wood densities" contains table 3A.1.9-2 with wood densities for tropical forests of Africa, Asia and Latin America in the annex of the publication:
  - Intergovernmental Panel on Climate Change (IPCC) 2003. Good Practice Guidance for Land Use, Land-Use Change and Forestry. IPCC National Greenhouse Gas Inventories Programme. Edited by Jim Penman, Michael Gytarsky, Taka Hiraishi, Thelma Krug, Dina Kruger, Riitta Pipatti, Leandro Buendia, Kyoko Miwa, Todd Ngara, Kiyoto Tanabe and Fabian Wagner. Published for the IPCC by the Institute for Global Environmental Strategies (IGES), Hayama, Kanagawa Japan

- Excel file "Winrock_Sampling_Calculator" is the Excel file used in the exercise "Using the Winrock tool for calculating the number of permanent sample plots" on pages 123-125

Folder "Carbon offset standards"

- "CCB_Standards_second_edition_december_2008" is a PDF of the latest version of the CCB's project design standards:
  - CCBA. 2008. Climate, Community & Biodiversity Project Design Standards Second Edition. CCBA, Arlington, VA. December, 2008. At: www.climate-standards.org

- "Comparison of Carbon Offset Standards" is a PDF of the publication:
  - Kollmuss, Anja, Helge Zink, Clifford Polycarp. 2008. Making Sense of the Voluntary Carbon Market: A Comparison of Carbon

Offset Standards. Stockholm Environment Institute and Tricorona, WWF Germany. Accessed at: http://assets.panda.org/downloads/vcm_report_final.pdf

Due to copyrights restrictions it was not possible for us to include the VCS' standards "Agriculture, Forestry and Other Land Use (AFOLU) Requirements". A PDF of the publication can be downloaded at: www.v-c-s.org)

Folder "Other readings"

- "BAngelsen_Moving Ahead with REDD" is a PDF of the publication:
  - Angelsen, A. (ed.) 2008 Moving ahead with REDD: Issues, options and implications. CIFOR, Bogor, Indonesia. Accessed at: www.cifor.cgiar.org

- "REDD Plus, Governance and Community Forestry" is a PDF of the publication:
  - RECOFTC, IIED, REDD Net 2011. REDD+, Governance and Community Forestry. Highlights from the Forest Governance Learning Group Asia Expert Meeting. Accessed at: www.recoftc.org

- "The Greener Side of REDD" is a PDF of the publication:
  - Gregersen, Hans, Hosny El Lakany, Luke Bailey, and Andy White 2011. The Greener Side of REDD+ Lessons for REDD+ from Countries where Forest Area Is Increasing. Washington DC: Rights and Resources Initiative. Accessed at: www.rightsandresources.org.

- "World Bank 2011_Estimating OppCostsREDD_Manual" is a PDF of the publication:
  - The World Bank 2011. Estimating the opportunity costs of REDD+ A training manual. Washington: The World Bank. Accessed at: www.asb.cgiar.org/PDFwebdocs/OppCostsREDD_Manual_v1.3.pdf

Folder "Visual material"

- Graphs, comics and photos which are contained in the manual and can be used for PowerPoint and other visual presentations

Annex 2
Examples of survey forms

Tree Survey Form

Surveyor Name: .....Date:.....

Plot No.: ..... Plot Size (Radius): .....

Tree Type: ....Geographic Characteristics

( ) Foot of the Hill ( ) Mountain Range ( ) Plain ( ) River Diameter at Breast Height: .....Centimeters ( ) Rocks Mix Type of Rock.....Soil Characteristics:..... Traces of Erosion.....Undergrowth: ..... Number of Trees with DBH of.....Centimeters and up

Tree No.	Type of Tree	Circumference (Centimeter)	Diameter at Breast Height (Centimeter)	Note

Bamboo Survey Form

Surveyor Name: .....Date:.....

Plot No.: .....Plot Size (Radius): .....

Bamboo Type: .....Geographic Characteristics ( ) Foot of the Hill ( ) Mountain Range ( ) Plain ( ) River Diameter at Breast Height: ..... Centimeter Rocks Mix Type of Rock..... Soil Characteristics .....Traces of Erosion.....Undergrowth .....Number of Trees with DBH of.....Centimeters and up

Bamboo Cluster No.	Bamboo Type	Number (Trees)	Number of 1 or 2 years old or dead bamboo	Bamboo Tree No.	Diameter (Centimeter)	Diameter at Breast Height (Centimeter)

Survey Form for Carbon Sequestration of Undergrowth and Litters

Surveyor Name:.....Forest Type: ..... Geographic Characteristics
( ) Foot of the Hill ( ) Mountain Range ( ) Plain ( ) River Bank ( ) Rocks Mix: Type of Rock:....
..... Soil Characteristics:.....Traces of Erosion:.....
Undergrowth:..... Number of Trees with DBH of:.....Centimeters and up
Recording Date: .....

Geographic Type	Spot No.	Plot Code	Plot Size	Proportion of Surface Cover-up (%)	**Fresh Weight (kilograms)**			
					Leaves	Twigs and Trunk	Undergrowth	Litters

Annex 3
Calculating the standard deviation

The *standard deviation equation for samples*[1] is:

$$s = \sqrt{\frac{\sum(x - \overline{x})^2}{N - 1}}$$

Where
s = the standard deviation
x = each value in the sample (carbon per hectare of each sample plot)
$\overline{x}$ = the mean of all values (the mean of carbon per hectare of all the sample plots)
N = the number of values (the sample size, i.e. the number of sample plots)

Example: A hypothetical pilot survey of a lowland forest stratum

N (umber of sample plots) = 15 plots

Values of carbon per hectare of all the 15 sample plots: x_1 to x_{15}

Sample plot number	Value (C in t per ha)
x_1=	235.06
x_2 =	153.94
x_3=	268.00
x_4=	308.65
x_5=	181.46
x_6=	225.80
x_7=	188.69
x_8=	288.50
x_9=	254.66
x_{10}=	197.89
x_{11}=	254.47
x_{12}=	202.85
x_{13}=	280.55
x_{14}=	173.94
x_{15}=	232.26
Average (mean)	229.78

1 This is the equation for standard deviation of samples. A slightly different equation is used when the complete data has been collected, and not just samples.

Back to the formula:

$$s = \sqrt{\frac{\sum(x - \overline{x})^2}{N - 1}}$$

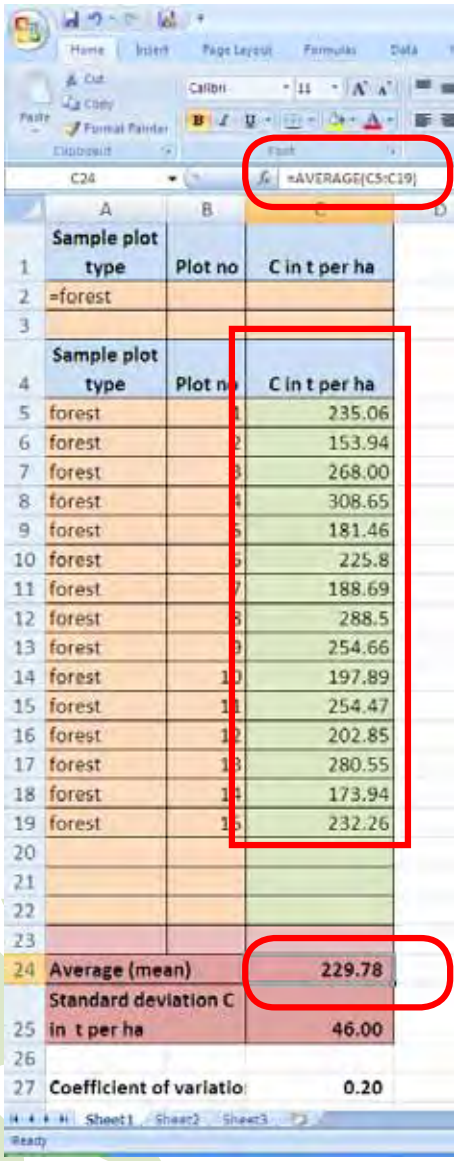
1. First we calculate $\sum$ **(x- $\overline{x}$)²:**

(235.06-229.78)² + (153.94-229.78)+(268.00-229.78)²+(308.65-229.78)²+(181.46-229.78)²+(225.80-229.78)²+(188.69-229.78)²+(288.50-229.78)²+(254.66-229.78)²+(197.89-229.78)²+(254.47-22-9.78)²+(202.85-229.78)²+(280.55-229.78)²+(173.94-229.78)²+(232.26-229.78)² = **29,620.58** 2. This is to be **divided by N-1**, where N is the number of values: So it is 15-1 = 14

29,620.58/14 = 2,115.76

Of this we have to take the square root: √**2,115.76= 46**

The standard deviation is 46



The Excel file **"Standard deviation exercise C per ha_ manual calculation"** on the CD contains the calculations made in this example.

The **Excel file "Standard deviation exercise C per ha"** on the CD provides the direct calculation based on the equation for standard deviation just explained. In this file all you need to do is enter the values of the 15 sample plots of your own pilot survey in the green fields.

1. Fill in your date in the green column (fields C5 to C19)

2. You get the average C per hectare and the standard deviation of the C per hectare of all 15 plots.

3. If you have fewer or more than 15 sample plots you need to adjust both formulas f

For the average in field C24: =AVERAGE(C5:C19)

Replace C19 with the field number of the last field in the green column. For example, if you have 17 sample plots the last field will be C21.

Do the same for the standard deviation equation in field C 25: =DSTDEV(A4:C19,"C in t per ha",A1:A3)

Replace C19 with the number of the last field in the green column in your file (see screen shots below).

You have to calculate the standard deviation for each stratum, and enter the values in the Winrock tool for calculation of the number of permanent sample plots.

GLOSSARY

Advocacy: A land-use system through which organized citizens strategically affect decision-makers for addressing a certain issue or interest. Active support of an idea or cause etc.; especially the act of pleading or arguing for something.

Afforestation: Developing a forest on land that has not been forested in recent times (compared with reforestation, or the replacement of a forest recently lost or logged, see below).

Agroforestry: An integrated approach of combining agricultural and forestry technologies and use the benefit of both to create more diverse, productive, profitable, healthy and sustainable land-use systems.

Anthropogenic: Something which is caused by human action. The term is used to distinguish naturally occurring greenhouse gas emission reductions from ones that result from human activity.

Aptitude: A natural ability to do certain things.

Baseline: When we seek to measure whether something has increased or decreased, we need to measure it relative to a level that it has had at some point. We often chose a level during a particular year or date to serve as this 'starting point' for our measurements. This starting point is called the baseline.

Bilateral donors: These are member States of the United Nations that provide development assistance directly to recipient countries. Major bilateral donors are among others Japan, Denmark, Germany, Switzerland, the United Kingdom, and the United States.

Bio-diversity: All the species living in a particular area, not only living organisms and their complex interactions, but also interactions with the abiotic (non-living) aspects of their environment.

Canopy: Any overhead covering to provide shade and other forms of shelter.

Carbon bio-sequestration: The storage of carbon by plants, trees and other flora, which absorb carbon dioxide from the atmosphere as they grow, releasing the oxygen, and storing the carbon both in themselves and in the soil.

Carbon market: Transactions for the sale of emissions permits, credits, reductions or offsets together comprise the 'carbon market'. In fact, carbon can be traded as carbon or as carbon dioxide, and other greenhouse gases (or emissions) can also be traded in some of the 'emission markets'. It is important to remember that at the moment there is not one carbon market, there are a number of emission trading markets of different types – some are geographical (the European market), some a purely voluntary and they all have different rules and regulations governing them.

Clean development mechanism (CDM): A facility created under the Kyoto Protocol, which allows Annex I countries to finance emissions reducing projects in developing countries that are party to the Kyoto Protocol then to use the resulting 'certified emissions reductions' ('CERs') to offset their own emissions (to count towards their own targets for emission reduction).

Climate change: This term refers to all the impacts on the earth's natural climate system that are resulting from human-caused global warming (see below). This includes rainfall patterns and ocean levels, the direction and speed of wind and ocean currents, seasonal cycles, and the likelihood and intensity of climatic disasters such as droughts, storms and floods (IPCC, 2007).

Compensation: Something, usually money, given to someone in order to cover for a loss.

Conference of the Parties (COP): The term used to describe the regular meeting of state parties to a UN Convention, such as the UN Framework Convention on Climate Change or the Convention on Biological Diversity. This is the body with authority to take decisions under the

Convention and to amend the Convention.

Consensus agreement: An agreement that has been approved by all the concerned people or groups of people.

Consultation: A process of discussion that is held to take the opinion of the experts or concerned people on certain things before coming to a conclusion.

Deforestation: The conversion of forested land to non-forested land.

Ecosystem: A biological environment that consist of all the organisms living in a particular area, as well as all the nonliving, physical components of the environment with which the organisms interact, such as air, soil, water and sunlight.

Emissions trading (or 'carbon trading'): The sale or purchase of: 'permits' or 'allowances' to emit greenhouse gases; or 'certificates' or 'credits' that prove a certain reduction in emissions from a particular activity beyond what would otherwise have been the case (i.e. 'business as usual' emissions); or certificates that indicate a certain amount of actual emissions have been 'offset' somewhere else, through for example, carbon sequestration.

Empowerment: The process of increasing the spiritual, political, social, or economic strength and capacity of individuals or groups to make choices and to transform those choices into desired actions and outcomes.

Endeavour: An earnest and conscientious effort and activity to do or accomplish something.

Forest degradation: This occurs when the structure or function of a forest is negatively affected, reducing the ability of the forest to provide services or products (FAO, 2004).

Fossil fuels: Gas, coal, oil and oil-derived products such as diesel. Fossil fuels are combusted to create electricity, to provide heating, to power all forms of transportation and to power industrial processes, like mining and manufacturing activities. They are formed by dead organic matter being pressed over millions of years, hence the term 'fossil'.

Global warming: An observed or expected rise in the earth's average temperature due to having more greenhouse gases in the atmosphere leading to more of the sun's warmth being trapped close to the earth.

Greenhouse gas: A gas in the atmosphere that contributes to the greenhouse effect by absorbing infrared radiation, such as carbon dioxide, methane, water vapour, etc.

Habitat: The environmental area of a particular species of animal, plant, or other organism.

Ikalahan: An indigenous people living in Nueva Vizcaya province in the Northern Philippines.

Land use, land-use change and forestry (LULUCF): This is an identified category of activities that can contribute to both greenhouse gas emissions and emissions removals. The other main categories are energy-related emissions (both production and consumption), agriculture and waste-related activities.

Leakage: The gradual lose or escape of anything through a hole or a crack.

Lobby work: An activity of a group of people who try actively to influence legislation, the decision of the government.

Mitigation: Any action taken with the intention of avoiding further climate change by lowering the total level of greenhouse gases released through human activity. Such actions might include reducing our use of fossil fuels and changing the way we use land – such as by reducing our rate of land clearing and deforestation, and increasing our rate of reforestation.

Culling: The term is usually used for in animal management. It refers to the removing animals from a group based on certain criteria in order to reinforce certain desirable characteristics or to remove undesirable characteristics from the group.

Negotiation: A dialogue intended to resolve disputes, to produce an agreement upon courses of action, to bargain for individual or collective advantage, or to craft outcomes to satisfy various interests.

Parties: The individual members of an agreement, such as the member states to an international law agreement.

Reforestation: The reestablishment or regeneration of a forest.

Regulated markets: A medium for the exchange of goods and services that is controlled by a government appointed body.

Renewable energy: This form of energy can be used to provide electricity, heating or fuel for transportation similar to the way we use fossil fuels for these purposes. Unlike oil, gas and coal, renewable energy sources are not finite. Key sources include wood, waste decomposition, geothermal activity, wind and solar energy. The use of renewable sources for generating energy usually involves lower emissions of greenhouse gases than the use of fossil fuels does.

Sequestration: This is the opposite of emitting greenhouse gas and occurs when greenhouse gases are removed from the atmosphere, for example, by trees during the process of photosynthesis.

Shamanistic rituals: Rituals that is associated with the belief and practices of communicating with the spirits.

Stakeholders: a person, group of persons or an organisation that has an interest (stake) in a project, a business or organisation and who can be affected by or have an impact on that project, business or organisation.

Sustainable use: Use anything in such a way that it is capable of being maintained at a steady level without exhausting natural resources or causing severe ecological damage.

UN Declarations on the Rights of Indigenous Peoples (UNDRIP):

United Nations Framework Convention on Climate Change (UNFCCC): An international agreement, which was reached in 1992 and entered into force in 1993, the UNFCCC, provides a framework for international cooperation on climate change.

Unprecedented scale: A change that happens at a rate that has never been seen or experienced before.

Watershed: the area of land where all of the water that drains off and goes into the same place (like a river or lake). In a watershed, all living things are closely linked by this common water course.

Wildlife sanctuary: Any area that is set aside exclusively for wild animals to provide them protection from hunting, predation or competition.

ACRONYMS

AGSB	Above-Ground Sapling Biomass
AGTB	Above-ground tree biomass
AIPP	Asia Indigenous Peoples Pact
ANR	Assisted Natural Reforestation
BGB	Below-Ground Biomass
CB REDD+	Community-Based REDD+
CBFM	Community-Based Forest Management
CCBA	Climate, Community and Biodiversity Alliance
CCBS	Climate, Community and Biodiversity Standards
CCX	Chicago Climate Exchange
CDM	Clean Development Mechanism
CERs	Certified Emission Reductions
CF	Community Forestry
CFI	Community Forestry International
CFM	Community Forest Management
CFMC	Community Forest Management Committees
CFUGs	Community Forest User Groups
COP	Conference of Parties
DBH	Diameter at Breast Height
DENR	Department of Environment and Natural Resources
DW	Dead Wood and Fallen Stumps
ERPA	Emission Reduction Purchase Agreement
EU ETS	European Union Emission Trading Scheme
EUA	European Union Allowances
FAO	Food and Agriculture Organisation
FIT	Forest Improvement Technology
FPIC	Free Prior Informed Consent
GIS	Geographic Information System
GPS	Geographic Positioning System
IKSPs	Indigenous Knowledge Systems and Practices

IPCC GPG	Intergovernmental Panel on Climate Change's Good Practice Guidance
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for the Conservation of Nature
IWGIA	International Work Group for Indigenous Affairs
KEF	Kalahan Educational Foundation
LHG	Leaf Litter, Herbs, and Grass
LULUCF	Land Use, Land Use Change and Forest
MOA	Memorandum of Agreement
MRV	Monitoring, Reporting, and Verifying
NDF	Northern Development Foundation
NES	Nucleus Estates and Smallholders
NPV	Net Present Value
NTFPs	Non-Timber Forest Products
OTC	Over the Counter
PES	Payment for Ecosystem Services
SLE	Structured Learning Exercise
SOC	Soil Organic Carbon
TNA	Training Needs Assessment
UNCTAD	*United Nations Conference on Trade and Development*
UNDRIP	Unite Nations Declaration on the Rights of Indigenous Peoples
VCS	Verified Carbon Standard
VCUs	Voluntary Carbon Units

In December 2010, after years of negotiations, an agreement on REDD was finally reached at the 16th Conference of Parties (COP 16) of the United Nations Framework Convention on Climate Change in Cancun, Mexico. The agreement includes references to indigenous peoples and their rights, and in paragraph 72 of the agreement, country Parties are requested to ensure "the full and effective participation of relevant stakeholders, inter alia, indigenous peoples and local communities" when developing and implementing their national strategies or action plans on REDD.

But what does "full and effective participation" mean? This question is the main motivation for writing this manual.

To ensure not just "participation", but community control and empowerment, REDD+ projects should be planned, designed and implemented in such a way that they fully comply with the safeguards referred to in the UNFCCC agreement on REDD, as well as the provisions of the United Nations Declaration on the Rights of Indigenous Peoples. We have chosen to call projects with such an approach "Community-based REDD+".

While the first community guide in our manual series, "What is REDD?", aims to help indigenous communities to understand what REDD+ is and what its implications may be for them more generally, this manual looks at REDD+ at the project level and tries to provide some guidance to finding answers to questions like: How does REDD+ fit into the overall livelihood and forest management systems of indigenous peoples? How does REDD+ work on the ground? What are the typical activities of a REDD+ project? Who is involved in a REDD+ project? What are the particular knowledge and skills needed for implementing a REDD+ project?

By assisting communities in finding answers to such questions, the purpose of this manual is to help indigenous communities acquire the knowledge and skills needed to take a decision on whether to join a REDD+ project, and if they do, to be able to fully and effectively participate in it.

This community manual is accompanied by a manual for community trainers, providing guidance on how to conduct a training on Community-based REDD+.

Both are being translated into several Asian and other languages, in order to make them more accessible and useful to indigenous communities and trainers in the region.

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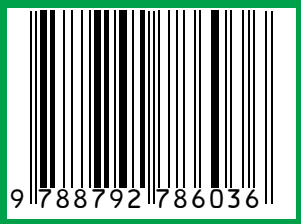

IWGIA

AIPP

Norad