



# Setting priorities for forests in adaptation to climate change

TroFCCA's first year report

Prepared by

Claudio Forner  
Johnson Nkem  
Heru Santoso  
Carlos Perez

Contract: EuropeAid/ENV/2004-81719

July 2006



# Setting priorities for forests in adaptation to climate change:

TroFCCA's first year report

Prepared by

Claudio Forner

Johnson Nkem

Heru Santoso

Carlos Perez

Contract: EuropeAid/ENV/2004-81719

July 2006

*Cover photos by Claudio Forner*

# Contents

Executive summary.....	5
1. Introduction.....	6
1. Introduction.....	6
1.1 Structure of the report.....	6
1.2 Overview of the project.....	6
1.3 Objectives of the project.....	7
1.4 Strategic approach.....	7
2. Project status and current progress.....	9
2.1 Priorities for forests in adaptation to climate change.....	9
2.2 Summary of products for the first year.....	10
2.3 Revised approach for the project.....	11
2.4 Recruitment and teams.....	12
2.4.1 Main staff.....	12
2.4.2 Research fellowships and projects.....	13
2.5 Methodology development.....	14
2.6 Regional Kick off meetings (KOMs).....	15
2.7 Communication and outreach.....	16
2.7.1 Website.....	16
2.7.2 Flyers and background papers.....	17
2.7.3 Participation in conferences.....	18
2.7.4 Actions for the visibility of the European Commission.....	18
2.8 Partners and collaboration with other institutions.....	19
2.9 Preparatory activities for the regional implementation of the project.....	20
2.9.1 Staff meetings.....	20
2.9.2 Country visits.....	21
3. Regional reports.....	22
3.1. West Africa.....	22
3.1.1 Introduction.....	22
3.1.2 Development issues for research.....	22
3.1.3 Main activities during the first year.....	23
3.1.4 Local partners and relations.....	25
3.1.5 Summary of preliminary research activities.....	26

3.2 Central America .....	27
3.2.1 Introduction.....	27
3.2.2 Development issues for research .....	27
3.2.3. Main activities during the first year .....	28
3.2.4 Local partners and relations .....	31
3.2.5 Summary of preliminary research activities .....	32
3.3 South East Asia.....	34
3.3.1 Introduction.....	34
3.3.2 Development issues for research .....	34
3.3.3 Main activities during the first year .....	35
3.3.4 Local partners and relations .....	37
3.3.5 Summary of preliminary research activities .....	38
4. Financial management for the first year .....	41
4.1 audit.....	42
5 . Action plan and budget for year 2.....	43
5.1 Budget for the second year .....	43
5.2 Plans for the second year in West Africa.....	44
5.3 Plans for the second year in Central America.....	45
5.4 Plans for the second year in Asia.....	46
Annex 1. Methodological framework .....	47
Annex 2. Working definitions.....	54

## Executive summary

This document contains the first annual report for the project “Tropical Forests and Climate Change Adaptation” (TroFCCA). The technical and financial sections cover activities from March 2005 – July 2006. A summary of regional activities is also included.

The objective of TroFCCA is to contribute to national processes of adaptation to climate change, in particular, efforts to streamline adaptation into development, through the assessment of vulnerability. The project is being implemented in three regions and eight countries, namely Burkina Faso Mali and Ghana in West Africa; Honduras, Nicaragua and Costa Rica in Central America; and Indonesia and the Philippines in South East Asia.

Main products and results for the first year of activities include the consolidation of regional teams, the redefinition of the methodological framework, the initiation of a working relation with partners and local contacts, the identification of development issues for research and the organisation of three regional kick-off meetings to initiate a regional policy dialogue.

From the substantial point of view, the main outcome resulted from the regional policy dialogues, where representative from governmental organisations from TroFCCA countries prioritised development issues linked to forest ecosystem goods and services. Focusing on specific development issues arises from latest developments in adaptation policy, which suggests that adaptation is best addressed as a matter of development. Furthermore, adaptation should be considered at the sectorial level, as impacts of climate change are likely to hinder sectorial goals. For this reason, the approach of TroFCCA to adaptation is to, first, identify sectors for which forest ecosystems are significantly important; second, to assess how impacts of climate change over forests are translated into sectorial vulnerability; and, third, to analyse how sectorial policies have, and could, incorporate adaptation, in particular relating to forest ecosystems. This approach was introduced during the kick off meetings, where participants assisted TroFCCA in identifying key development issues which will be the focus of the project as follows:

- For Central America: Water for human consumption and for hydropower. Representatives from Costa Rica also recommended the tourism sector, and those from Honduras non-timber forest products.
- For Southeast Asia: Increased risk of landslides and forest fires.
- For West Africa: Bioenergy (wood fuel), water conservation and food security. In addition, representatives from Burkina Faso and Mali recommended the project to undertake research on health, in particular, medicines from the forest.

During the second year of activities, methodologies relating to the assessment of the above issues will be developed and tested. Each region will work independently on their specific sectors and in close contact with governments to ensure that the inputs of TroFCCA are relevant for national adaptation processes. The regional-policy dialogue on adaptation will continue in the second regional meeting.

# 1. Introduction

This document contains the first annual report for the project “Tropical Forests and Climate Change Adaptation” (TroFCCA), in accordance with Article 2 of the General Conditions applicable to European Community-financed grant contracts for external actions. The information herewith included covers the period March 2005 – July 2006, and elaborates on the information contained in a progress report submitted to the European Commission in March 2006. The financial report, contained in section 4 and annex 3, covers the same period.

## *1.1 Structure of the report*

This report is divided into 5 sections. Section 1 presents a short introduction to the project and to the report. Technical information is included in sections 2 and 3. Section 2 contains a summary of the activities achieved by the project between the period March 2005 – July 2006. Section 3 contains individual reports from the activities implemented in each region (West Africa, Central America and Southeast Asia) during the same period. Financial information as of July 2006 and planned activities for the second year are contained in sections 4 and 5, respectively.

## *1.2 Overview of the project*

The importance of goods and services from forest ecosystems to development has been widely discussed. An identified need to protect forests through either conservation or sustainable management derives from the fact that forest loss can lead to negative costs to society resulting from foregone goods and services. On the other hand, anthropogenic pressures, like human induced climate change or high deforestation rates, substantially affect forest ecosystems and their ability to deliver goods and services.

Tropical forest ecosystems, in particular those on which the livelihoods of people across the world depend, are among the most vulnerable ecosystems to changes in temperature and rainfall. Potential and observed impacts of climate change over forests, added to other pressures like pests and land conversion, pose challenges to sustainably manage these systems. TroFCCA is an effort to contribute to the limited understanding of climate change impacts over forests, as well as to the scarcity of robust methodologies to assess vulnerability and plan adaptation for these systems in particular.

In line with latest developments on the science of adaptation and vulnerability, TroFCCA:

- Focuses its activities on **development issues<sup>1</sup> of regional/national priority** and for which forests play a substantial role; these topics were chosen in consultation with national governments as part of a policy dialogue that is being implemented through workshops.

---

<sup>1</sup> Development issues can include national development objectives, policies or broader interests linked to the process of development in a country. They could include processes for, or threats to, development on sectors or goals for which forest goods and services play an significant role.

- **Will develop methodologies** to assess vulnerability relating to the topics identified above.
- Will apply these methodologies to **assess vulnerability** and identify adaptation priorities.
- Will develop work on adaptation in **conjunction with national partners**, aimed at specifying adaptation needs and strategies in the context of the above development issues.
- Will seek ways to **mainstream adaptation into national policies**, including sectorial ones.
- Has initiated a **regional policy dialogue** to discuss and enhance regional cooperation on adaptation.

### ***1.3 Objectives of the project***

The goal of the project is to contribute to national processes of adaptation to climate change, in particular, efforts to streamline adaptation into development, through the assessment of vulnerability.

The specific objectives of the project are:

- To identify national and regional areas or topics of development for which impacts of climate change over forests can increase the vulnerability of society.
- To develop and test a set of methodologies to assess the vulnerability of relevant development issues resulting from impacts of climate change over forest ecosystems in selected sites.
- To contribute to current national and regional processes of assessment of vulnerability, and of development of adaptation strategies, focusing on tropical forest ecosystems.
- To develop and test criteria and indicators for adaptive management of tropical forests.
- To develop policy-oriented strategies for adaptation of tropical forests to climate change, taking into consideration the relevance of these systems to identified development issues.
- To facilitate a science-policy dialogue in and across the three pilot regions (South East Asia; West Africa, Central America) in order to trigger regional discussions that will lead to raise the interest in adaptation as well as the interregional cooperation in this topic.

### ***1.4 Strategic approach***

TroFCCA's approach to adaptation sets forest ecosystems in the context of development policies. The assessment of vulnerability will, therefore, be directed at specific development issues for which goods and services from forests play a significant role. More specifically, the activities of TroFCCA will be directed at understanding how climate change impacts over forests may hinder development in the identified issues.

The initial assessment of vulnerability will be designed to facilitate the later development of policy-relevant adaptation strategies for the local and national level (e.g. those that could be incorporated into the development process of each participating country).

## 2. Project status and current progress

Activities during the first year of the project were focused at enabling its regional implementation. These included the search, identification and recruitment of staff, adjustments to the original formulation of the project, adjustments to the methodological framework, regional preparatory research, the development of a communication strategy and the organisation of one kick off meeting per region. This chapter provides detail on the activities relevant for the global aspects of the project. Detail on the regional activities is contained in section 3.

Activities for the first year belong entirely to the first phase of the project, in accordance with the schedule included in section 1.9, Annex 1 of the contract (see table 1). Phase 1 has the objective of elaborating and completing global and regional methodologies and to identify priority areas/topics for each region (or country, where applicable).

**Table 1. Project schedule**

	year 1		year 2		year 3		year 4	
	Sem 1	Sem 2	Sem 3	Sem 4	Sem 5	Sem 6	Sem 7	Sem 8
Phase 1								
Phase 2								
Phase 3								

At the time of writing this report, development issues had already been agreed with local partners, the methodological framework had been completed and specific methodologies were under development. An approved extension of 6 months allows regional teams to finalise specific methodologies for the assessment of vulnerability during the second semester of 2006 and apply them during the first semester of 2007. It should be noted that this extension does not change the original schedule for the project, as the start of activities was delayed for an equivalent amount of time in order to advance in the recruitment of staff and reformulation of the project.

### *2.1 Priorities for forests in adaptation to climate change*

The main outcome from TroFCCA's first year was the identification of development issues on which the project will focus its regional research. These issues were identified as part of the regional policy dialogue undertaken in conjunction with the regional kick off meetings.

As expected, countries within each region showed an interest for similar issues. In some specific cases, representatives from countries recommended TroFCCA to undertake research on issues that were the interest of only one country.

Results from the science-policy dialogue on this particular are as follows:

- West Africa: Bioenergy (wood fuel), water conservation and food security. In addition, representatives from Burkina Faso and Mali recommended the project to undertake research on health, in particular, medicines from the forest (see section 3.1.2)
- Central America: Water for human consumption and for hydropower. Representatives from Costa Rica also recommended the tourism sector, and those from Honduras non-timber forest products (see section 3.2.2)
- Southeast Asia: Increased risk of landslides and forest fires (see section 3.3.2)

TroFCCA will undertake research on the issues that are common for the countries within each region. Research on individual topics (e.g. tourism and health) will be assessed in the course of the upcoming year.

## ***2.2 Summary of products for the first year***

In accordance with the workplan, the list of activities to be completed during the first year includes:

- Finding local partners & contact with governments
- Definition of regional research focus (including a literature review, background papers and discussions during the kick off meeting)
- Organisation of regional kick off meetings
- Start of the methodology development
- Initial identification of study areas
- Country visits; and
- Initial list of research activities

Following is a summary of the products for the first year:

***First***, the methodological framework, as explained in section 2.3 and 2.5, below, and contained in Annex 1 to this report.

***Second***, three consultancy reports compiled during the period June – December 2005 (available at the TroFCCA website). Such reports were commissioned to prepare background regional information while the recruitment of staff was ongoing. Namely, these reports are:

- Natural Resources, Communities and Climate Change in West Africa: Impacts, Vulnerability and Responses. A literature review and data base compiled for CIFOR's Tropical Forests and Climate Change Adaptation Project (TROFCCA) in West Africa, with special focus on Burkina Faso, Ghana and Mali, prepared by Justin Corbett.
- Climate, Climate Variability and Climate Change in Central America: Review of experiences, actors and needs in tropical forest climate change vulnerability and adaptation in Central America, prepared by Patricia Ramirez.
- Review on Forest and Hydrological Services, and its Perspectives for Climate Change, prepared by Raffaele Vignola as an input to the discussions on the link between forests ecosystems and water in Central America.

*Third*, a list of partner organisations, included in the proceedings of the kick off meetings

*Fourth*, agreed development issues for the focus of TroFCCA in the different regions. This constitutes the most important product of the first year, as it sets the focus for the development of methodologies and assessment of vulnerability. They were selected during the kick off meetings following a methodology specific for such purpose.

### ***2.3 Revised approach for the project***

During May – October 2005, and parallel to recruitment activities, the staff dedicated most of its efforts to adjust the conceptual framework of the project in order to incorporate within TroFCCA latest developments on the science and policy for adaptation.

The United Nations Framework Convention on Climate Change has been fundamental in triggering these developments. The international interest on the topic has been partly fuelled by the increasing occurrence of climate-related disasters (e.g. hurricanes and drought) and by the increasing evidence on climate change, provided by organisations like the IPCC. For this reason, work on adaptation and vulnerability has advanced at a fast pace since the inception of the UNFCCC.

The original conception of TroFCCA followed the traditional impact oriented approach (e.g. focusing on how climate change will impact a specific system). This approach has been, and still is, used by national governments in the preparation of national communications to the UNFCCC. Between the time of formulating TroFCCA, the deadline for submission to the EC and the time when the coordinator was hired, climate change talks have stressed the strong links between adaptation and sustainable development and, hence, climate change is seen more from a “vulnerability” perspective than from the mere analysis of impacts. The relevance of the project was, therefore, subject to changes in the scope of its analysis so that it would directly tackle vulnerability in the context of development policies.

In December 2005, a revision was submitted to the European Commission. It was finally received and signed by CIFOR’s Director General in February 2006 after approval. In practical terms, the former emphasis on impacts of climate change has been redirected to work on vulnerability assessment and planning for adaptation in a development context. With a view to having a better coverage of issues and regions, a general methodological framework was designed to allow flexibility in the regional implementation of the project. Specific changes underlying the new methodological framework include:

- Each region will focus its activities on a development topic that is a priority for the participating countries.
- The project will develop methodologies specific to assess the vulnerability of selected topics.
- Three regional workshops to facilitate a policy dialogue and to give direction to the project will be organised on an annual basis. Funded invitees will be limited to four representatives from each country. A common framework for the organisation of these workshops was developed.

- National workshops will be undertaken to advance work on specific national priorities. These will take place at least annually.
- Work packages have been redefined as components of the three phases of the project to allow regional flexibility.
- The policy dialogue has been linked to the activities of the project.
- The budget was redefined to accommodate the above changes.

## ***2.4 Recruitment and teams***

During the period May 2005 - September 2005, intensive work was undertaken to fill in the positions specified in the description of the action (Annex 1 to the contract). This was a challenging task as work on adaptation is a relatively new field that requires professionals with knowledge on climatology, ecology, economics and social science. In addition, the regional implementation of the project also demanded that professionals had policy and scientific knowledge of the regions. By the beginning of 2006 all positions had been filled.

Following is a summary of the teams.

### **2.4.1 Main staff**

#### Global

TroFCCA is being coordinated from CIFOR's headquarters in Bogor (Indonesia). The global team is composed by the following members:

- Programme coordinator: Markku Kanninen (Finland)
- Project coordinator: Claudio Forner (Colombia)
- PhD research fellow: Yazhen Gong (China)
- Secretary: Rosita Go (Indonesia)
- Accountant: Rina (Indonesia)
- Webmaster: Isnan Franseda (Indonesia)

#### West Africa

Activities for the implementation of TroFCCA in Burkina Faso, Mali and Ghana are coordinated from CIFOR's regional office in Ouagadougou (Burkina Faso). The team is composed by the following members:

- Regional coordinator: Johnson Nkem (Cameroon)
- Principal scientist: Monica Idinoba (Nigeria).
- Research Fellow: Elke Verbeeten (Netherlands)
- Research Assistant: Yacouba Noël Coulibaly (Burkina Faso)
- Post doctoral fellow: Maria Brockhaus (funded by the government of Germany)
- JPO: Fobissie Kalame (funded by the government of the Netherlands)

Two research fellows will join the team during the second half of 2006.

## Central America

Activities for the implementation of TroFCCA in Costa Rica, Nicaragua and Honduras are coordinated and managed by the global change group of Centro Agronomico Tropical de Educacion y Esenanza<sup>2</sup> (CATIE), in Turrialba (Costa Rica). The team is composed by the following members:

- Regional coordinator: Carlos Perez (Nicaragua)
- Principal scientist (1): Bruno Locatelli (France)
- Principal scientist (2): Raffaele Vignola (Italy)

This team is supported by “Grupo de cambio global”, which includes Lucio Pedroni (Switzerland), Marcos Tito (Brazil), Pablo Imbach (Argentina) and Patricia Ramirez (Costa Rica).

## South East Asia

Activities for the implementation of TroFCCA in Indonesia and the Philippines are coordinated from CIFOR’s headquarters in Bogor (Indonesia). The team is composed by the following members:

- Regional coordinator: Heru Santoso (Indonesia)
- Principal scientist: Daniel Murdiyarso (Indonesia)
- Postdoctoral fellow: Enrique Ibarra (Costa Rica)
- Research Assistant: Hety Herawati (Indonesia)

A partnership with ICRAF was established in order to include the Philippines within TroFCCA activities in Southeast Asia. The following staff are participating in the project:

- Coordinator: Rodel D. Lasco (Philippines)
- Research Assistant: Patricia Ann J. Sanchez (Philippines)

### **2.4.2 Research fellowships and projects**

Two proposals for Post-doctoral Fellows and Junior Professional Officers were approved by the technical cooperation offices from two countries. The objectives of such proposals were, first, to offer the opportunity for young scientists to undertake research in an on-going project; and, second, to strengthen regional teams. Fellows will conduct research for a period between 2 – 3 years on a topic relevant for TroFCCA regions as follows:

- *Post doctoral fellowship*, presented by Dr. Maria Brockhaus to the German Federal Ministry for Economic Cooperation and Development (BMZ). This proposal focuses on the valuation of forest goods and services that are likely to be affected by climate change in West Africa, and how marketing of environmental services can contribute to adaptation. The objective is to undertake research relevant to the establishment innovative mechanisms for the marketing of environmental services as part of local climate change adaptation strategies.

---

<sup>2</sup> <http://www.catie.ac.cr/>

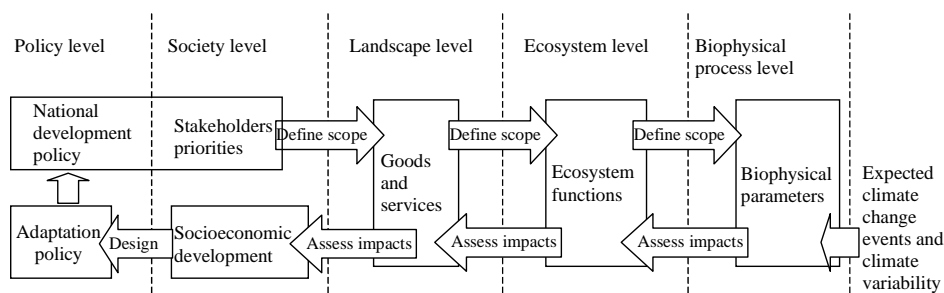
- *Junior Professional Officer*, presented to the Netherlands Funded JPO Programme. This proposal focuses at analyzing policies for the water, bioenergy and non-forest timber products, identified for TroFCCA West Africa. Its objective will be to identify gaps and opportunities to mainstream adaptation into sectorial policies. The candidate will undertake a policy assessment on how climate change has been and/or could be incorporated into the policies on the identified development issues.

## 2.5 Methodology development

A global project with the participation of three regions and seven countries presents the challenge to implement a top down methodology. Methodological flexibility is essential so that differing environmental, social and economic realities are gathered under a single analysis. Taking this into consideration, and as a starting point for the development of specific methodologies, a methodological framework was developed. It provides top down guidance to ensure that all regions follow the same objectives and will obtain similar products. At the same time, the framework allows flexibility for bottom up (or regional specific) methodologies to be incorporated in accordance with regional and national circumstances.

The framework describes steps, actions and possible tools to be used in order to assess vulnerability to climate change. It has been designed to link vulnerability-related variables across different levels (policy, landscape, ecosystem and species levels), so that a streamlined assessment of vulnerability can take place. In other words, the methodology can be seen as a chain of elements which starts from the policy level and returns to it with the idea of incorporating adaptation as a component of development. This is illustrated in figure 1.

**Figure 1. Linking variables across different levels**



After the application of the methodology, phase 3 will answer to the following questions:

- Which forest systems need to be managed in what way to reduce vulnerability in for a specific development issue?
- What policy options are there to adapt?
- How could adaptation be incorporated in national policies?
- Which would be the role of different actors, in particular, for the national government and the private sector?

- What message can be sent to the international community, in particular, relating to vulnerability of biodiversity and feedbacks of climate change into carbon storage and sequestration?

A detailed description of the steps for the methodological framework is available in Annex 1. In addition to the methodological framework, the staff agreed on a set of working definitions to guide the development and application of the methodologies. These definitions are contained in Annex 2.

## ***2.6 Regional Kick off meetings (KOMs)***

The regional implementation of the project started with one kick-off meeting per region. These meetings had the following objectives: first, to initiate and formalize the activities of TroFCCA in each region; second, to identify regional and national development priorities and define the regional focus of TroFCCA; and, third, to initiate a regional policy dialogue where participating countries will share experiences and interests toward working on adaptation to climate change.

Specific objectives of the meetings included:

- To inform partners about TroFCCA and have an open discussion on the opportunities for regional synergy deriving from its implementation
- To discuss the implementation of TroFCCA in the light of initiatives and activities that have been already implemented (or are currently being implemented) at the national level
- To draft national agendas for the implementation of TroFCCA
- To agree on means to interact between the project teams and partners

Three kick off meetings were successfully organised according to the planned schedule. As a general remark, it was possible to witness the interest that the project has triggered among government officials and regional and international experts. Table 2 contains information on the place and date of each kick off meeting.

**Table 2. Kick off meetings**

<b>Region</b>	<b>Dates</b>	<b>Place</b>	<b>Participants</b>
<i>Central America</i>	4 – 5 April 2006	Turrialba (Costa Rica)	Project staff, focal points, international experts and scientists
<i>South East Asia</i>	29 – 30 May 2006	Bogor (Indonesia)	Project staff, Indonesian national focal point, government officials, national scientists, practitioners and NGOs.
<i>West Africa</i>	6 – 8 June 2006	Ouagadougou (Burkina Faso)	Project staff, international experts, regional scientists and representatives from international organisations.

Main outcomes included: agreed development issues for the regional implementation of TroFCCA; a list of partners for the project; an assessment of national adaptation activities and needs; and a description of the possible contribution from TroFCCA to national adaptation activities. Detailed information on these is provided within each regional report in section 3.

The kick-off meetings were fundamental to define the direction of the project. They also served as a platform for the coordination of climate change related projects in the region, as several organisations and projects attended the meetings. In particular, it is worth mentioning the interest of UNDP/GEF in using TroFCCA as a platform for the formulation of projects on adaptation with funding from the UNFCCC. Representatives from UNDP attended most kick off meetings and delivered a presentation on funding opportunities. This opens an opportunity for TroFCCA to engage in the formulation of adaptation projects that fall within its general framework.

It is also worth to highlight that international experts were invited to the kick –off meeting with a view to establishing a panel for the review of all inputs of TroFCCA. These were:

- Habiba Gitay, The World Bank Institute, participated in the kick-off meeting in West Africa.
- Ian Burton, University of Toronto, participated in the kick-off meeting in Central America.
- Professor Emil Salim was invited to participate in the kick off meeting for South East Asia; unfortunately he could not make it.

## ***2.7 Communication and outreach***

The communication strategy was designed together with the development of the methodological framework. Its objectives are to disseminate information on the activities and results of TroFCCA; to give visibility to the project, its organisations (CIFOR and CATIE) and funding agencies (the European Commission); and to increase awareness on the importance of forests for adaptation to climate change. Following is a description of its elements.

### **2.7.1 Website**

The main component of the communication strategy is the TroFCCA website (see Figure 2). It was formally launched in February 2006 as the main channel of information about the project, including its objectives, approach, activities, meetings and products. Its opening page presents generic information about the project and contains tabs that allow the reader to select a specific region or to consult the calendar of events (see below). Finally, latest news and events are announced on the right hand side of the page under “what’s new”.

**Figure 2. TroFCCA website**



As stated above, regional tabs direct the reader to the different regional sections. Each regional site contains a menu with information on climate and climate projections for each country, regional priorities for development and adaptation, regional and national meetings, regional methods, partners and institutions, and related documentation.

The last feature of the website is the “calendar of events”, which can be reached by clicking on a special tab. It compiles workshops, conferences and other meetings that are relevant for the project.

The website has been important to disseminate announcements for research fellowships; to provide information about TroFCCA meetings, including agendas, list of participants, logistics, proceedings and background documents; and to disseminate the first research products.

The website can be reached at:

[http://www.cifor.cgiar.org/trofcca\\_ref/home/index.htm](http://www.cifor.cgiar.org/trofcca_ref/home/index.htm)

### **2.7.2 Flyers and background papers**

Brief documents containing general and specific information on the project have been prepared with different objectives.

First, a flyer in three different languages (English, Spanish and French) provides information on the objectives, expected results and methodological framework of TroFCCA. The flyer was first distributed during the eleventh session of the Conference of the Parties to the UNFCCC, held in Montreal in November 2005. It has also been added to the TroFCCA website.

Second, several briefing papers have been developed to support substantial discussions during the kick off meetings. These papers summarise preliminary research on adaptation and vulnerability concepts (mainly literature reviews). The

background papers also provide information on the link between forests and climate change in the context of the development issues selected during the kick off meetings. Following is a list of background papers (all available at the TroFCCA website):

For Central America (in Spanish):

- Vulnerability to climate change of forests and their environmental services
- The importance of forests for adaptation to climate change
- How to include forests in adaptation?

For South East Asia (in English):

- Climate change projections for Indonesia
- An introduction to the impacts of climate change and vulnerability of forests
- Forest Fires and climate change in Indonesia

For West Africa (in French and English):

- An introduction to the impacts of climate change and vulnerability of forests
- Livelihoods, tropical forests vulnerability and adaptation to climate change in West Africa
- Desertification, climate change and forests in the Sahel
- Climate change projections in West Africa

### **2.7.3 Participation in conferences**

In an interest to both share information on the project and learn from other research initiatives, the staff has been actively participating in seminars and congresses relevant for TroFCCA's activities. Participation to these meetings has included a presentation of the project and its preliminary activities. The most important meetings are:

- Second meeting of the inter centre working group on climate change (ICWG) of the consultative group on international agricultural research (CGIAR), Nairobi (Kenya), October 2005. This meeting was attended by representatives of all CG centres. TroFCCA was formally presented to the CG system and, as a result, ICRAF Philippines expressed its interest in joining the project.
- Eleventh session of the Conference of the parties to the UNFCCC, Montreal (Canada), November 2006. TroFCCA was introduced in a special side event of the CGIAR.
- During the 2005 Annual CGIAR meeting, the inter-center working group on climate change organised a session to inform other centres about their activities on climate change. TroFCCA was introduced to a broader CGIAR audience.

### **2.7.4 Actions for the visibility of the European Commission**

Visibility of the European Commission, as the funding agency, has effectively been ensured within TroFCCA activities. In accordance with Article 6 of the General Conditions applicable to European Community-financed grant contracts for external actions, the following actions have been undertaken:

- Inclusion of the EU logo in the website, other web-based material, flyers and all publications;
- Inclusion of the EU logo in all presentations given by the project staff to several forums (conferences, seminars and others);
- Explicit statements on the funding sources during presentations and within most public written material; and
- Display of the EU logo in all the meetings organised in the context of the project (e.g. internal meetings and regional kick off meetings)

Media coverage was provided for the kick off meetings in West Africa and Southeast Asia. In the first region, the project was covered by the national broadcasting corporation. In the second, the project was released through a note in the Jakarta post, it was covered by ANTARA (the national news agency) and radio-broadcasted in Elshinta and Voice of America. A reference to funding from the European Commission was made in all of them.

In addition to the above, regional meetings have count with the participation of a representative from the European Commission. A space for a statement by the Commission was allocated in the agenda for all kick off meetings.

## ***2.8 Partners and collaboration with other institutions***

Current interest in climate change has triggered several research and development initiatives throughout the world. In an interest to promote synergy and work constructively to increase the capacity of developing countries to adapt to climate change, the project staff have searched for partners. Following is a list of institutions and projects whom which the project has established a working relation for global activities. Additional information on local and national partners at the regional level is available in each regional report within section 3.

- *GEF/UNDP*: The activities of UNDP/GEF on adaptation to climate change range from support to non-Annex I national communications to the UNFCCC, to the administration of the Convention's funds for adaptation. Currently, UNDP/GEF is in the process of pipelining projects on adaptation, some of which overlap with TroFCCA's activities. UNDP/GEF contacted TroFCCA with an interest to benefit from TroFCCA's work on the assessment of vulnerability and related methodologies. During the kick off meetings, participants stated that TroFCCA could support the formulation of projects on adaptation as part of the third phase of the project. UNDP/GEF will closely collaborate on this process.
- *FAO, IUCN, IISD, SEI and Intercooperation*: FAO contacted TroFCCA with a proposal to develop a rapid vulnerability assessment tool to be applied to forest ecosystems. Resources were offered by this organisation with an view to use TroFCCA as a platform for the application of the tool. The development of a rapid assessment tool was in line with an initiative by IUNC/IISD/SEI/Intercooperation called "Community-based Risk Screening Tool - Livelihoods & Adaptation" (Crystal) which, as the name suggests, is a tool for the rapid assessment of vulnerability of local communities. Terms of reference were drafted so that Crystal is adapted to assess the vulnerability of specific economic sectors deriving from the impacts of climate change over forests. The tool will be applied in two or three TroFCCA countries.

- *Carboafrica*: it is a research initiative by the University of Tuscia and other 14 organisations, funded under the sixth framework programme priority 1.1.6.3 of the European Commission. Its objective is to set up a first attempt of a GHG fluxes monitoring network of Africa, in order to quantify, understand and predict greenhouse gas emissions in Sub-Saharan Africa and its associated spatial and temporal variability. Tasks for Carboafrica and CIFOR include the assessment of the carbon balance from the biosphere in several countries in Africa. While Carboafrica is interested on the carbon balances alone, TroFCCA is more interested in the vulnerability of future carbon balances. A collaborative link to Carboafrica has been established, given the benefit from joining efforts to assess the future carbon balance in a selected number of countries in Africa.
- *ICRAF Philippines*. As stated above, a partnership with ICRAF has been established to extend the activities of TroFCCA in the Philippines. An initial stage of one year was put in place with the objective of reviewing former studies on vulnerability and the impacts of climate change on water resources. It also supported fund raising activities needed for the implementation of TroFCCA in that country, including proposals presented to the ACCA project, also being funded by the European Commission, to GEF and to the Asia Pacific Network on Global Change Research (APN).
- *Joanneum/INSEA/GCP and UCS*: COP 11 to the UNFCCC initiated a process to reduce emissions from deforestation in developing countries. Combating deforestation has the potential of offering alternatives for adaptation thus bringing the possibility of synergy between adaptation and mitigation. As a first step, CIFOR, through TroFCCA, organised a workshop on the topic in conjunction with Joanneum research, the Union of Concerned Scientists, the Global Carbon Project and INSEA. It took place in Bad Blumau from 10 – 12 May 2006 and served as an initial exchange of scientific and policy aspects of reducing deforestation rates, including possible benefits from the climate point of view.

In addition to the above, the team is currently preparing two proposals for additional funding to expand on specific topics within the project. These include:

- Resources from the MacArthur foundation to undertake research specific to the links between biodiversity conservation and climate change adaptation in West African countries. The proposal was submitted in June 2006.
- Resources from IDRC (International Development Research Centre, Canada) to add to TroFCCA 2 to 3 countries from the African continent.

At the time of writing these report, no indication of funding from the above organisations had been received.

## ***2.9 Preparatory activities for the regional implementation of the project***

### **2.9.1 Staff meetings**

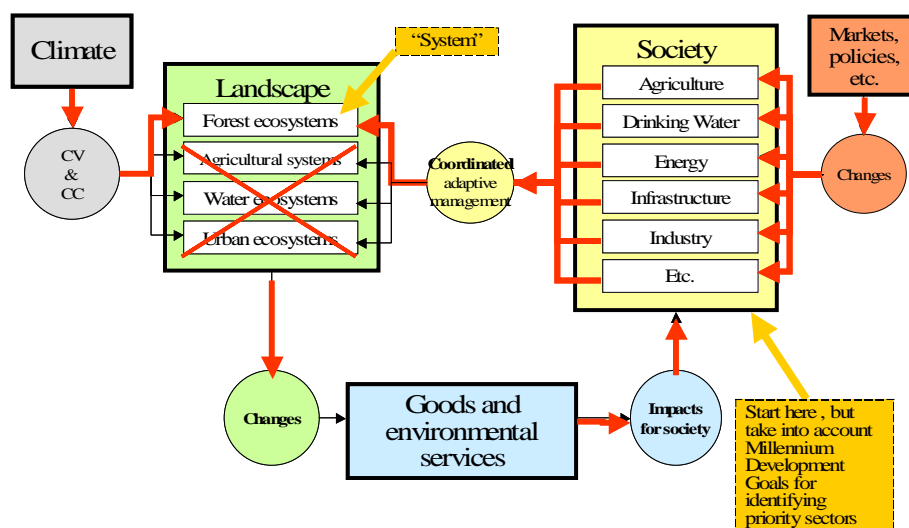
Two preparatory meetings were held with the objective of discussing the framework for the project (reports of these meetings are available upon request).

The first meeting was held in Turrialbla (Costa Rica) on August 7 – 9 2005. As the first meeting, it was used to introduce the project to the staff and to discuss its original

formulation, including the need to adjust it in order to accommodate current developments on climate change science. This meeting was attended by the coordinator of the project and the staff of CATIE. The main result was an agreed new approach to the methodological framework (see figure 3) and a list of initial activities. This meeting led to a request to the European Commission for changes in the formulation of the project, as stated in section 2.3 above.

The second meeting took place in Bogor (Indonesia) between 24- 26 October 2005. The objective of the meeting was to introduce the new framework to the staff of the project and to finalise the formulation of the changes to be submitted to the European Commission. It was attended by all coordinators, all scientists and CIFOR staff. During this meeting, an initial exchange of views on the regional focus for the project took place, together with a revision of available tools for climate change research. Regional teams elaborated work programmes for 2006.

**Figure 3. Conceptual approach for the formulation of a methodological framework**



### 2.9.2 Country visits

Between December 2005 and June 2006, the staff visited those countries where TroFCCA will be implemented, in an aim to initiate contacts with national partners. Regional coordinators met UNFCCC focal points, officials from the forestry agencies and experts from universities and national research centres. This activity was fundamentally important for the regional implementation of the project, as the participation of the host governments in the project will influence the relevance of the project to national processes of adaptation and, hence, the extent to which governments will benefit from the project. On the other hand, visits were also conducted to find potential collaborators and to engage national institutions in the work of TroFCCA. As of June 2006, at least one visit per country was completed. More information is available in section 3.

## **3. Regional reports**

### **3.1. West Africa**

#### **3.1.1 Introduction**

TroFCCA's activities in West Africa are being implemented in Burkina Faso, Mali and Ghana. They are coordinated from CIFOR's regional office in Ouagadougou (Burkina Faso). Three full time staff are working for the project: Johnson Nkem (regional coordinator), Monica Idinoba (principal scientist) and Yacouba Noel Coulibaly (research assistant). Ms. Maria Brockhaus, a postdoctoral fellow, and Mr. Fobissie Kalame, a JPO, will take part on the project for a period of two and three years respectively. Finally, Elke Verberdeen, an hydrological modeller, partially works for TroFCCA.

The region presents a wide range of biophysical, ecological and socio-economic conditions, which vary along a precipitation gradient stretching from the lower Sahara desert (north of Mali) to the sea coastal zone of Ghana. Regional climate is dominated by the seasonal movement of the West Africa monsoon. Annual rainfall distribution, like other climatic parameters, is zonal and ranges from 2200 mm in South West Ghana to less than 50 mm in the desert of Northern Mali.

Temperatures in Ghana range from 18° C to 40° C, where climatic conditions are relatively stable. Variability increases north-wards to Burkina Faso and Mali who share similar climate conditions. Temperatures are relatively high for most part of the year, with maximum temperature ranging between 45° C to 48° C (peaks in May to October, when humidity and cloud cover are highest). During the low-sun period (from November to March), drier air is brought by the North-East Harmattan winds laden with dust, with a clear decline in temperatures in January from the South to the North and low night temperatures (average 10<sup>0</sup> C).

Global circulation models (GCMs) project increases in temperature for the whole region, ranging from 2°C to 6°C by 2100. Although precipitation projections are less consistent, there are indications of a progressive increase (between 10 and 35%) for December, January and February period, which is normally dry. A similar trend is predicted for the September, October and November period (between 7 and 28%).

The distribution of natural vegetation follows more or less agro-ecological zonation. The southern part of Ghana presents mostly equatorial forest, which comprises salt and fresh water forest swamps, lowland rain forest, and the derived savannah. From the North of Ghana to the South of Burkina Faso and Mali, vegetation is characterised by open woodland Savannah with an open stand of trees and a sparse vegetation of savannah shrubs and grassland. The floristic composition of the forest is mostly determined by the amount and distribution of rainfall, soil types, physiography and hydrology.

#### **3.1.2 Development issues for research**

Research activities in the region will focus on addressing major issues considered to be of national development importance. These were selected together with national stakeholders during the kick-off meeting and include:

Bioenergy: Over 90 % of the population in the three countries depend on fuel wood and charcoal for their domestic energy supply. Forests are a major source of energy, however, constant pressures over the resource are already threatening fuelwood production. Climate change and an increasing population further pose challenges for a sustainable supply of energy.

Water: Water (for human consumption, irrigation and others) is a limiting resource, particularly in the Sahel where drought is prevalent. Most major water sources are located in catchments under forest cover that are severely affected by degradation and deforestation. As climate changes, forests further degrade and so does the water resource.

Non-timber forest products (health and food): Forests are direct providers of health and food products. About 90% of the population in the region depends on forest herbs and tree products for primary healthcare. Likewise, forest also play important role in food security, especially during periods of food shortages that coincide with drought.

### **3.1.3 Main activities during the first year**

Following is a report of activities undertaken between the period March 2005 and July 2006. Most activities were implemented after January 2006, once all staff were on board.

#### ***3.1.3.1 Finding local partners and contacts***

Between January and March 2006, the regional coordinator and scientist devoted time to finding local partners in the region. The list of partners and their interest is covered in section 3.1.4.

TroFCCA started activities with the introduction of the project to several stakeholders and potential partners, including the regional office of the European Commission in Ouagadougou. Visits had the objective of disseminating information on the project, in particular, its objectives, planned activities and expected outcomes. A regional visit was made to Mali, Burkina Faso and Ghana, where the staff met with various stakeholders and actors (governments officials, academic and research institutions, international and local non-governmental organisations, regional organisations, international representations, community groups etc). Discussions enabled the staff to understand their perceptions of climate change and climate change impacts in their livelihoods and communities, and learn of selected local responses in adapting to these changes.

It is worth highlighting the role of AGRHYMET in the region. It was established by the permanent Interstate Committee for Drought Control in the Sahel (CILSS) to build local capacities in providing early warning mechanisms and facilitating adaptation to drought and desertification. Over the years, AGRHYMET has been conducting research on adaptable agricultural management practices to Sahelian conditions, on enhancing water use efficiency of crops, on breeding drought tolerant seeds and on using meteorological data in providing early warnings of drought.

### ***3.1.3.2 Supporting the definition of the regional research focus***

Developing areas of research constituted another major activity during TroFCCA's first year. This commenced by reviewing existing literatures on climate change, vulnerability and adaptation and, in particular, the characterisation of the region through existing climate change, land use and land use change information, regional scenarios and projections, and natural resource management strategies.

One of the main sources of information constituted the first national communication to the UNFCCC by each country, and the preliminary draft reports of Burkina Faso and Mali for the preparation of the National Adaptation Plans of Action (NAPAs). The revision allowed the staff to identify major sources of resource materials like satellite images, models and other projection tools used by regional institutions like AGRHYMET.

### ***3.1.3.3 Regional Kick off meeting***

The kick-off meeting served as the first meeting of partners and stakeholders. It took place in Ouagadougou from the 7<sup>th</sup> to 8<sup>th</sup> June 2006 and counted with the participation of the Burkinabe Minister of Agriculture, Water Resources and Fisheries who officially launched TroFCCA's activities in the region. Participants to the workshop included representatives from governments, international and regional organizations, NGO's, scientists, academics, and local community group leaders.

A regional policy dialogue was initiated on how to prepare for, and cope with, climate change. Stakeholders identified and prioritized forest-based sectors on the basis of their importance to national development and their related vulnerability to climate change impacts. The meeting also discussed gaps in the accessibility and utilization of scientific information for the formulation of climate change adaptation policies, and proposed some adjustments to improve policy dialogue process in the region. The meeting also discussed on the opportunities for transboundary initiatives for climate change adaptation, setting future milestones and follow up mechanisms. A meeting report will be uploaded in the TroFCCA website as soon as it is available.

### ***3.1.3.4 Recruiting graduate students***

Activities for the recruitment of students have experienced a delay deriving from the late start of regional activities. TroFCCA–West Africa has advertised graduate research fellowships (12 months for M.Sc., and 24 months for PhD) for the academic year 2006/07 on topics related to the main objective of TroFCCA project in the region. Students from the region were strongly encouraged to apply. The deadline for application was May 31, 2006.

### ***3.1.3.5 Participation in regional workshops and meetings***

The staff of the project participated in the following meetings:

- Building capacities for African based research (Nairobi-Kenya, 26-28-March 2006): This workshop gathered regional experts working on climate change adaptation to exchange ideas and share their experiences. It was used as a space to discuss adaptation initiatives in the region and allowed the staff to identify potential collaborators.
- Workshop on PRECIS Model (Accra-Ghana 18-22 April 2006): This meeting was organised by the Hadley Centre UK Met Office and hosted by the Institute of

Mathematical Sciences, University of Ghana. It brought together regional climate experts in order to train them on the PRECIS Model to generate climate data for the region. TroFCCA is likely to use outputs from PRECIS in the assessment of vulnerability.

- TroFCCA staff also participated in the meeting of the national committee responsible for the development of the National adaptation plans of action (NAPA) for Burkina Faso, in Ouagadougou on April 28 2006. Participation had the objective of linking the project to national processes on climate change.

### **3.1.4 Local partners and relations**

TroFCCA has initiated collaborations with partners in both national and regional programs and institutions, which share common interest with TroFCCA's objectives. The most important partners include:

#### Regional Initiatives

- Economic Commission for West African States (ECOWAS) – ECOWAS is developing a climate change adaptation policy for the region, which will soon be ratified by the conference of head of states. This organisation has the mandate to develop water policy as well as to facilitate and enforce compliance. Water and water-catchment management are very important for climate change adaptation and food security, especially in a region that experiences extreme climate variability.
- Comite permanent Inter Etats de Lutte contre la Secheresse dans le Sahel (CILSS). CILSS is a regional institution to assist countries in the Sahel to adapt to, and combat, drought and desertification. It directly deals with policy, but has established AGRHYMET as its research arm. CILSS and TroFCCA plan to explore synergy between the ongoing CILSS's activities of combating drought and desertification under the UNCCD, and TroFCCA's climate change adaptation activities.

In addition to the above, a wide range of organisations from different levels will provide specific inputs for the research. These include:

#### National Institutions

- Ghana Environmental protection agency (EPA)
- Forestry Research Institute of Ghana
- Kwame Nkrumah University of Science, Kumasi Ghana
- International Water Management Institute (IWMI) Regional Office in Accra, Ghana
- AMADER, Bamako Mali which is involved in looking into alternative efficient household energy

#### NGO's

- IUCN Bamako Mali, working in climate change adaptation in Mali
- SNV Bamako Mali- integrating climate change adaptation activities into their current activities on natural resource management in various locations in Mali.

- Mali Folk Centre Bamako, Mali: This is a local NGO working on MDP, and enhancing local capacities in self-evaluating forest carbon stock for eventual trading. As a synergy, TroFCCA plans to incorporate adaptation strategies into mitigation activities of Mali Folk Centres using the same communities
- SNV Ouagadougou: TroFCCA and SNV plans to work together integrating and exploiting the dual benefits of mitigation and adaptation to climate change in the region.

#### Collaborations on climate change projections

- INERA (Institut de l'Environnement et de Recherche Agricole) Burkina Faso
- Meteorological department, Burkina Faso
- Meteorological department, Ghana
- Meteorological department, Mali
- Hadley Centre, UK

### **3.1.5 Summary of preliminary research activities**

Preliminary research has involved mostly literature reviews in order to define research themes for the region. Results from initial research stage have been compiled in a series of background papers, whose main message is summarised below:

Climate and climate projections for West Africa. Activities for the prediction of future climate in West Africa have, above all, indicated the high degree of uncertainty of applied models. For example, results from several studies reveal the difficulty in projecting future climate as some climate models indicate that, by 2050, the region will become hotter and wetter, while other models that it will become hotter and drier. An additional uncertainty is the sub regional distribution of such changes. This situation limits the application of regional models in vulnerability assessments. However, several initiatives are currently on the way; for example, the Hadley is guiding the run of PRECIS for West Africa through a series of workshops which have counted with the participation of TroFCCA.

Climate change and forests. As indicated in the introduction, the distribution of ecosystems in West Africa changes along with the precipitation gradient. Species diversity and life forms change from the sparse Saharan vegetation cover, through thorny shrubs interspersed between annual and perennial grasses, to the Sudanian and Guinean biomes. These last are characterized by woody species with greater ground cover and taller vegetation. The vegetation pattern is largely driven by climatic factors, which are marked by strong seasonality with decreasing dry season and precipitation from the northern part of Mali, towards the southern coastal regions of Ghana. Rainfall is not alone the only determinant of vegetation, but the variability of its distribution both in terms of space and time. Variability and unpredictability increases from south to north and constitutes a major controlling factor for the Sahelian ecosystem as well as for the direction of shift in vegetation.

Use, importance and Pressures over forests in West Africa. Use and sustainability of the forest resource in the region is severely threatened by several degrading processes. Deforestation, for example, is a major cause of the vulnerability of forests in the region; the loss of vegetation cover in the riparian zones increases the vulnerability of water catchments, river and stream ecosystems. Another source of pressure is the

extensive use of fire as a management tool, which is conducive to forest degradation. Fire is used for various livelihood activities like slash-and-burn, hunting, grazing, traditional rituals and cultural ceremonies. Forest and savannah fire provoke land and soil degradation, habitat and biodiversity loss and others. Finally, continuous forest fragmentation is the result of activities such as wood collection.

## **3.2 Central America**

### **3.2.1 Introduction**

TroFCCA activities in Central America are being implemented in Nicaragua, Costa Rica and Honduras. They are coordinated from CATIE in Turrialba (Costa Rica). The team is composed by Carlos Perez (regional coordinator), Bruno Locatelli (economist), Raffaele Vignola (Scientist), Patricia Ramirez (senior scientist), Lucio Pedroni (senior scientist), Pablo Imbach (Agronomist), Marcos Rungitz (forest engineer) and Thomas Koellner (Biologist).

Central America has a very peculiar geographical position connecting North- and South America through a narrow isthmus which presents mountainous territory reaching up to 4000 meters above sea level. The geography and topography has favoured, according to the information presented by the Mesoamerican Biological Corridor<sup>3</sup>, the configuration of a variety of peculiar ecosystems with a total amount of 3 Biomes, 20 life zones and 33 ecoregions. One of the most important features is the proximity of the Pacific and the Atlantic Oceans. This configuration makes the region prone to extreme weather events, in particular, hurricanes that have caused lives and economic loss. The Caribbean region of Honduras, Nicaragua and Costa Rica is characterized as humid tropical, while the Pacific presents dry conditions.

In Central America, forests are key factors for socio-economic development and, for this reason, most countries are integrating forests and forestry into their national development strategies. Besides the provision of timber for export, wood for local construction, firewood and processing, forests are providers of other goods and environmental services from which several socio-economic sectors are highly dependent. Forests, specially those located in mountain regions, play a significant role in the hydrology and provide environmental services for power generation, the industry and water for domestic consumption and agricultural production.

### **3.2.2 Development issues for research**

Research activities in the region will focus on addressing major issues considered to be of national development importance. These were selected together with national stakeholders during the kick-off meeting and include:

Water for human consumption. Increasing the access to safe drinking water is one of the objectives of the Millennium Development Goals. Although Central America has sufficient sources of fresh water, episodes of water shortages are increasing particularly in the Pacific Basin. This situation is exacerbated by an increasing population and the deterioration of ecosystems that protect watersheds. Moreover,

---

<sup>3</sup> Mesoamerican Biological Corridor. 2002. Naturaleza, genete y bienestar: Mesoamerica en cifras. Project Report, San Jose, Costa Rica. Available at [http://www.biomeso.net/documento.asp?Id\\_CategoriaDocto=1](http://www.biomeso.net/documento.asp?Id_CategoriaDocto=1).

climate change projections for the region indicate a reduction in rainfall in areas populated by rural communities and low-income urban populations.

Hydroelectric Power Generation and forest ecosystems. Power generation, particularly renewable energy, is of major concern nationally and regionally in Central America. The contribution of hydroelectricity to national supply varies across countries; for instance, 81% of the power generated in Costa Rica derives from hydroelectric sources, whereas in Nicaragua and Honduras the figure is 12% and 28.6%, respectively. The increase in oil prices during the last two years has increased the cost of power generation and has severely affected Nicaragua and Honduras. For this reason, national and regional energy policies are currently oriented toward promoting renewable sources of energy, particularly hydroelectric power generation. Forest ecosystems and hydroelectric power generation are related since hydrological services provided by forests contribute to water quality and quantity regulation.

Ecotourism. This sector was recommended by participants to the regional kick off meeting. Ecotourism is one of the most important economic sectors to Costa Rica and the one in which forests play the most significant role.

### **3.2.3. Main activities during the first year**

Following is a report of activities undertaken between the period March 2005 and July 2006. Most activities were implemented after January 2006, once all staff were on board.

#### **3.2.3.1 Finding local partners and contacts**

During the first semester of 2006, one of the main activities of TroFCCA in Central America was the regional launch of the project and the establishment of links and partnerships at the national, regional and international levels. These activities have brought to the attention of the project different efforts being conducted in the region. It is worth highlighting a regional project on adaptation, being executed by CATHALAC<sup>4</sup> in seven countries. The list of partners and their interest is covered in section 3.2.4.

Institutional relations will be important for TroFCCA and will contribute to reaching project goals and products. Activities for which contacts have been established include the following:

- Support for the preparation of the II National Communication to the United Nations Framework Convention for Climate Change. The Project will contribute with research results in two sectors: drinking water and hydroelectric power generation. This task will be undertaken in conjunction with the National Meteorological Institute in Costa Rica; the Secretariat for the Environment and Natural Resources in Honduras; and the National Office for Clean Development and Climate Change, within the Ministry of Environment and Natural Resources of Nicaragua.
- Exchange of information, including on climate data and climate change projections using regionalized climate models. Relevant institutions include the

---

<sup>4</sup> Centro del Agua del Trópico Húmedo para América Latina y el Caribe

Regional Committee for Hydraulic Resources in Central America; CATHALAC, the University of Costa Rica and the meteorological institutes from each country.

- Policy analysis and identification of relevant forest ecosystems for the drinking water and hydroelectric power generation sectors. This task will be undertaken in conjunction with the water institutes from each country; the National Energy Commission in Nicaragua; the Costa Rican Institute of Electricity; the Ministries for the Environment and Natural Resources; and the National Forest Institutes from the three countries.
- Design of adaptation projects. This task will be undertaken in conjunction with the United Nations Development Program; the Global Environment Fund; and the Swiss Development Agency for International Development and Cooperation;

### *3.2.3.2 Consultancies*

TroFCCA in Central America commissioned initial studies in order to compile available information for its strategic orientation. These reports are available on the Project's website and include:

Climate, Climate Variability and Climate Change in Central America: Review of experiences, actors and needs. This study consists of an assessment of the information available on climate change detection, vulnerability assessments and related stakeholders. It indicates that the region is extremely vulnerable to climate variability (specifically rainfall), which is the cause of frequent droughts and floods. In the last 50 years, nine drought events related to El Niño South Oscillation (ENSO) have been recorded. In the same period, 63 events of heavy rainfall or tropical storms were also recorded. The report also concludes that available climate scenarios have coarse resolution, which makes it difficult to predict climate change scenarios in specific sites. Models indicate that the Pacific Basin is expected to experience higher temperatures and less rainfall, in contrast with the Caribbean which is susceptible to flooding. No information was found on climate change impacts on forest ecosystems.

Review on Forest and Hydrological Services, and its Perspectives for Climate Change. This study was undertaken during the second semester of 2005. It presents an extensive review of the relationship between forests and water, stressing the importance of these ecosystems for maintaining hydrological and other related environmental services. Flood control, water infiltration, erosion control or reduction, water quantity and quality, seasonal water availability, nutrient cycle, and biodiversity are some examples. Of these environmental services, water infiltration, erosion control and enhancement of water quality are the most documented.

The Role of tropical forests in mitigating economic risks of climate change. The objective of this study was to explore the potential benefits of integrating economic risk management and ecosystem attributes into an ecological insurance model. The study highlights the linkages between ecosystem's management and financial risks due to potential loss of economic values when an extreme weather event occurs. A framework for developing a Module on Economic Risk was proposed, which addresses the importance of ecosystem management to reduce vulnerability towards flooding and/or droughts in a changing climate. The conceptual framework states that economic systems reduce risk through technology, diversification, financing and through ecological strategies

### ***3.2.3.3 Regional Kick off meeting***

The Kick off meeting of TroFCCA in Central America took place from 4 - 5 April 2006 in CATIE, Turrialba (Costa Rica). About 30 participants attended the meeting, including representatives from national meteorology, forestry and climate change institutions from Costa Rica, Nicaragua and Honduras. The KOM served as a means to introduce the project to local partners and to strengthen the working relationship between national institutions and the project staff.

In line with the objectives of the meeting, several outcomes were achieved:

- Firstly, links to local partners were established as well as the objectives and coordination of these links.
- Second, an exchange of climate change activities and experiences so far in the region provided the background for the planning and focus for the project. It is in the interest of national partners and the project staff that TroFCCA complements what is already taking place in each country.
- Third, and most important, participants engaged in an exercise of identifying the development topics on which TroFCCA will focus its activities in the region. The meeting identified two broad sectors: water (collection and distribution), and energy (bioenergy and hydropower). TroFCCA will assess the vulnerability of these two sectors deriving from the impacts of climate change over forests.
- Fourth, it was agreed that the project will link its activities to the process of the second national communication to the UNFCCC (2006-2009), which is being initiated in all three countries.
- Finally, the project will seek cooperation with UNDP/GEF for supporting the formulation of adaptation projects in the areas relevant to TroFCCA.

The meeting report is available at the TroFCCA website.

### ***3.2.3.4 Methodological development***

In order to facilitate discussions during the kick off meeting, the team in Central America directed its research at the identification of economic sectors that depend on forest ecosystems. The general approach was demand driven, whereby society recognizes important goods and environmental services provided by forest ecosystems. Setting forest ecosystems in context meant that identifying important forests needed to be done from the perspective of a determined socio-economic sector.

A preliminary analysis was made with a matrix that crossed economic sectors with environmental services, thus being possible to grade the interaction of individual sectors with individual services (see figure 4). The grading followed an index from 1 to 6 (6 indicating a stronger degree of dependence of a sector on an ecosystem good or service).

**Figure 4. Prioritizing sectors and ecosystem goods and services**

	Timber	Fuelwood	Water regulation	Biodiversity	Soil	[...]	Total
Electricity	0	6	6	0	4		16
Water	0	0	6	3	3		12
Manufacturing	5	3	2	4	2		16
Health							
Education							
Agriculture							
Transport							
Tourism							
[...]							

The exercise revealed that the grading of the matrix depends on which region is being analysed. Results from Central America indicated the importance of the regulatory services of forests (primarily water), some goods and services (wood and non timber forest products) and tourism. The methodology was validated during the kick off meeting where participants arrived at similar conclusions following the approach designed by the staff.

### **3.2.3.5 Participation in regional workshops and meetings**

Meeting of the Iberoamerican Network of National Offices for Climate Change (Antigua – Guatemala, October 2005). The meeting joined representatives from all Latin American climate change offices to discuss strategies for the future including CDM, adaptation and others. The approach, objectives and methodology of TroFCCA was introduced with an aim to establishing first contacts with key stakeholders from the region.

### **3.2.4 Local partners and relations**

Effort was made to establish links with representatives from the offices and programs of climate change, forestry and meteorological institutes from the three countries. During February and March 2006, country visits were performed to Honduras, Nicaragua and within Costa Rica. Meetings were organized with different groups of professionals to introduce TroFCCA and to build an initial list of potential participants to the kick off meeting.

In Honduras, TroFCCA will collaborate with the Secretariat for the Environment and Natural Resources to prepare the II National Communication to the United Nations Convention for Climate Change due in 2008 and early 2009. In Nicaragua, the Project will undertake a similar task with the National Office for Clean Development and Climate Change, within the Ministry of the Environment and Natural Resources. In Costa Rica, the National Meteorological Institute will be the counterpart for the II National Communication. Designing strategies and plans for adaptation in selected socioeconomic sectors will also be part of the agenda with national institutions. National contacts also include research institutions and professors that are engaged with developing international policies on climate change adaptation.

At the regional level, relevant contacts have been established with the Regional Committee on Hydrological Resources, the Regional Project on Climate Change Adaptation and the United Nations Development Program offices in Costa Rica, Nicaragua and Honduras. Meetings have also been organised with the representatives

from the European Commission in Nicaragua and Costa Rica, and the regional office of the Swiss Agency for International Development and Cooperation located in Managua (Nicaragua).

At the international level, personal contact with Professor Ian Burton, from Toronto University, was established during the eleventh session of the Conference of the Parties to the UNFCCC, as well as with representatives from Munich Re (a reinsurance company). In Switzerland, TroFCCA has been in contact with Swiss Re and the Zurich Polytechnic Institute (ETH), through one of its consultants. These contacts will contribute to understand the trends in international policy and funding relevant for climate change adaptation. For instance, re-insurance companies, such as Munich Re and Swiss Re, have placed climate change and climate related disasters into their agendas due to the increase in insurance claims coming from regions that have been hit by extreme weather events (i.e.: Hurricane Katrina in New Orleans, USA).

Also at the international level, an agreement has been established between CATIE / TroFCCA and The Nature Conservancy. This agreement seeks the elaboration of maps from Costa Rica, Honduras and Nicaragua aimed at providing information on hydrological systems and populations demanding water resources.

### 3.2.5 Summary of preliminary research activities

The team for TroFCCA in Central America was the first to be consolidated and, hence, the region has advanced considerably in comparison to the other two. Highlights of preliminary research activities are summarised below.

Climate and climate change projections for the region. Climate change scenarios for the region have been built based on historical trends (1961-1990) of meteorological data and by using the HadCM2-IS92a pessimistic scenario. Projected changes in annual mean temperature to the year 2100 range from 1 to 3°C. On the other hand, a decrease in average precipitation between 10 to 36% has also been projected. It should be noted that such trends do not distinguish sub regional variability and variability between countries. Expected impacts of climate change over forest ecosystems include an increased risk of fire, shift in ecological life zones, forest cover changes and others. There is increasing evidence that combined effects of social pressure and climate change will impact several ecosystem services, particularly hydrological services.

Review on forest cover and uses. Forestry is an important source of employment and income for a large proportion of society in Central America. The market for wood and timber in TroFCCA countries is presented in Table 3.

**Table 3. Economic figures for the forestry sector in TroFCCA countries**

	Wood Fuel (000 m3)				Industrial roundwood (000 m3)				Sanwood (000 m3)			
	Production	Imports	Exports	Consumption	Production	Imports	Exports	Consumption	Production	Imports	Exports	Consumption
Costa Rica	3,486		0	3,486	1,687	5	0	1,692	812	30	3	838
Honduras	8,732	0	0	8,732	759	0	40	719	437	6	139	304
Nicaragua	5,756	0	0	5,756	228	0	2	228	148	1	47	103

Source: Food and Agriculture Organization (2003): World Forest Assessment.

The total forest cover in Costa Rica, Honduras and Nicaragua is 38.5, 48.1 and 27%, respectively (see table 4). Forest cover trends are negative for all countries, Costa Rica being the one with lower net deforestation rates, primarily due to the establishment of plantations.

**Table 4. Forest resources in TroFCCA countries**

	Land Area (000 ha)	Forest area			Forest cover change (1990-2000)		
		Total forest (000 ha)	% land area	area per capita (ha)	Forest plantations (000 ha)	Annual Change (000 ha)	Annual rate of change (%)
Costa Rica	5,106	1,968	38.5	0.5	178	-18	-0.8
Honduras	11,189	5,383	48.1	0.9	48	-59	-1
Nicaragua	12,140	3,278	27	0.7	46	-117	-3

Source: Food and Agriculture Organization (2003): World Forest Assessment.

There are positive and negative factors affecting forest ecosystems and forestry in the region. A positive element for the increase in forest cover is certification, which is being promoted by the Forest Stewardship Council (FSC). The World Wildlife Fund, for the year 2004, reports for Costa Rica a total of 96,083 ha of forests certified. The figures for Nicaragua and Honduras are 16,727 ha and 37,277 ha, respectively.

The main negative factor affecting forest ecosystems is land cover change, as illustrated in table 4 above. The next is forest fires and it is estimated that between 1990 and 1995 approximately 500,000 ha were burnt in the region. ENSO induced drought increases the risk of forest fires as demonstrated by the high number of hectares burned in 1998 (2,5 million ha), which affected Honduras, Nicaragua and Guatemala.

Forest ecosystems and the vulnerability of socio-economic sectors. Results from preliminary studies are available for the three countries. Students at CATIE are working on a research study entitled “Provincias y sectores impactados por eventos climáticos en Costa Rica” (Provinces and sectors affected by climate events in Costa Rica). This study was conducted during the first Trimester 2006. It provides a historical background on the occurrence of weather events and how have they affected socio-economic sectors. The research found a well-organised data base on climatic events and damages available in Costa Rica. Economic loss due to extreme events are reported for the infrastructure (i.e.: roads, bridges, etc.) and agricultural sectors. Floods represent 57% of the effects of climatic events between 1968 and 2002.

A similar study was conducted for Nicaragua during the first trimester of 2006. The study entitled “Vulnerabilidad de sectores socioeconómicos de Nicaragua a eventos climáticos” (Vulnerability of Nicaraguan socio-economic sectors to climate change), also summarises the historical occurrence of extreme weather events in that country. Hurricanes and tropical storms have caused a large amount of lives and are the major causes of floods in the Caribbean (e.g. Hurricane Mitch in 1998). In contrast, the Pacific basin is characterised by recurrent drought, also leading to high economic loss as agriculture is an important sector in that region.

In Honduras, initial research indicates that flooding and droughts are the most common extreme climate events. The inventory on natural disasters compiles data from 1961 to 2005 and registers 11 tropical storms and hurricanes, two periods of drought and three floods. Human losses are estimated at 14, 921, while 2,155,616 people have been directly and indirectly affected.

### ***3.3 South East Asia***

#### **3.3.1 Introduction**

TroFCCA activities in South East Asia are being implemented in Indonesia and the Philippines. They are coordinated from CIFOR's headquarters in Bogor (Indonesia). Activities in the Philippines are being implemented by ICRAF's regional office in Los Baños. The team is composed by Heru Santoso (regional coordinator), Daniel Murdiyarto (Senior scientist) Hety Herawati (research assistant), Patricia Jaranilla Sanchez (scientist- Philippines) and Rodel Lasco (ICRAF's regional coordinator).

Indonesia is the largest and widest archipelago in the world and is the fourth most populous country. It consists of more than 17,000 islands that spread between Asia and Australia in the Indian and the Pacific Oceans. The Philippines is also an archipelagic country consisting of 7,107 islands that stretch over more than 1,840 km.

South-East Asia experiences a tropical climate with high temperatures and humidity as a consequence of its geographical position and by the fact that it is surrounded by oceans. The region is influenced by monsoonal winds that cause seasonal intensity of rainfall and is also affected by inter-annual climatic events such as El Niño and La Niña. The IPCC's Third Assessment Report (TAR) shows that Southeast Asia will become warmer and wetter in all seasons relative to current conditions.

Regarding the state of forests in the region, assessments from 2004 show that about 45.8% of Indonesia is forested, representing a 25% decline in comparison to 10 years ago. Deforestation is mainly due to increasing demand for cultivation. Forest fires are also a major cause of forest loss and degradation, although there has been a slight decrease in the last years. The situation with forest area loss is similar in the Philippines. Forested area in that country is approximately 7.168 million hectares (roughly 23.9% of the total land area).

#### **3.3.2 Development issues for research**

Research activities in the region will focus on addressing major issues considered to be of national development importance. These were selected together with national stakeholders during the kick-off meeting and include<sup>5</sup>:

Forest fires: Forest fires in Indonesia cause significant social economic and environmental impacts. Those occurring in 1997-1998 resulted in an economic loss between US\$ 8.7 to 9.6 billion. The interest in undertaking research in this particular topic derives, first, from the significant negative socio-economic and environmental impacts that transcend the local and national levels. Second, and most important, because there is a direct link between climate change and forest fires, as exacerbated dry conditions due to inter-annual climate variability are likely to increase fire risk in the region.

Landslides: Research on landslides and climate change was introduced by the Indonesian government during the kick-off meeting. The occurrence of landslides on disturbed and undisturbed land has increased in recent years. Human and economic

---

<sup>5</sup> The process within the Philippines has not yet arrived at defining issues for research, as the partnership with ICRAF started late. A kick off meeting will be taking place in Los Baños during July 2006 for this purpose.

loss from landslides are likely to increase due to increases in population, changes in rainfall patterns and deforestation. Given the role of land use management in preventing landslides, a need arises to better comprehend how land-use and climate change interact to increase the risk of landslides.

### **3.3.3 Main activities during the first year**

Following is a report of activities undertaken between the period March 2005 and July 2006. Most activities were implemented after January 2006, once all staff were on board.

#### **3.3.3.1 Finding local partners and contacts**

Between February 2006 and April 2006, the regional coordinator devoted time to finding local partners. A series of interviews with selected stakeholders was undertaken with the objective of presenting the project and gain the interest of various organisations on its activities. The list of partners and their interest is covered in section 3.1.4.

Most contacts made in the initial phase of the project were related to the issue of forest fires, as landslides was raised during the kick-off meeting. Contacts and partners include experts and practitioners from national governmental organisations, research and academic institutions, non-governmental organisations and field practitioners. Governmental organisations included the Ministries for the environment, forestry, home affairs and national planning agency.

The following interviews were held during the first semester of 2006:

- *Mr. Dadang Hilman, Head of Climate Change Division, Ministry for the Environment (7 March 2006).* This meeting was important as an introduction of the project to the host country and to link the project to the process of the development of the second national communication to the UNFCCC.
- *Dr. Saleem-ul Huq, leader of South South North (SSN) Adaptation team (13 March 2006).* This interview had the objective of linking TroFCCA to the work of the SSN Adaptation team, as both projects focus on mainstreaming adaptation into sustainable development.
- *Indonesian Climate Change Adaptation Network (16 March 2006).* The Ministry for the environment organised this meeting with the objective of presenting sectorial needs on adaptation and identifying national adaptation priorities. Several contacts were made, including the Ministry of Forestry, the space agency (LAPAN), the Ministry of Agriculture and WWF – Indonesia.
- *Ms. Masnellyarti Hilman, Indonesian National Focal point to UNFCCC and Deputy Minister for the Environment (17 March 2006).* This interview was used to explore in detail the possible contribution of TroFCCA to the national process of adaptation. Ms. Hilman explained that Indonesia has four priority areas on climate change which include public awareness on climate-related hazards; agriculture and food security; forestry, in particular forest fires; and health. These were further discussed during the kick off meeting.
- *Meeting with CGE (Consultative Groups of Experts) of the UNFCCC on improving the National Communication (23 March 2006).* One of the main results from the first year of activities is the link that the project has established to the process for the elaboration of the second national communication to the UNFCCC.

Adaptation is a new issue for the National Communication and, hence, the government is interested in receiving support.

### ***3.3.3.2 Regional kick-off Meeting***

The regional kick-off meeting took place on May 29-30, 2006 in CIFOR's headquarters. It was attended by the Indonesian National Focal Point to the UNFCCC; representatives from the ministries for the environment, forestry and home affairs and the National Planning Agency; the ASEAN Secretariat; a representative from UNDP; scientists working in the areas of forest fires and climate change from the National Meteorological Office (BMG), the National Institute for Space and Aeronautics (LAPAN), the National Forestry Research and Development Centre (FORDA), Bogor Agricultural University and CIFOR; NGOs including Pelangi and Konphalindo; and the South Sumatra Forest Fire Management Project.

Participants to the meeting indicated the strong interest of the Indonesian government in adaptation, but highlighted that capacity and awareness on the issue is still low. They also stressed the importance of mainstreaming adaptation into sustainable development, task that needs to be approached cross- and inter sectorially. The meeting served as a forum for different stakeholders to discuss technical and policy aspects of climate change adaptation, including methodologies, availability of data and studies, and other issues. It was fundamental in identifying the research focus of the project, set to, as stated above, forest fires and landslides.

Regarding the implementation of the project, the following aspects were agreed:

- TroFCCA will primarily translate existing knowledge into information that is policy relevant.
- In line with the above, TroFCCA will undertake policy analysis to assess how adaptation can be incorporated into existing policies on fire control and landslides.
- Project staff will have continuous contact with governmental organisations to ensure that the products of TroFCCA will be relevant for national climate change activities. In particular, TroFCCA will liaise with the government to provide inputs for the Second National Communication.

A meeting report is available at the TroFCCA website.

### ***3.3.3.3 Participation in regional workshops and meetings***

The following meetings were attended by the staff of the project in Southeast Asia:

- Workshop on Vulnerability of Carbon Pools of Tropical Peatlands in Asia (Pekanbaru–Riau, 24 – 26 January 2006): The workshop reviewed several issues relevant to peatlands, including the extent and distribution of carbon storage, trends of conversion, fire risk, vulnerability to future climate change and adaptation needs. TroFCCA was introduced in the plenary session. Discussions on adaptation were focused on various needs including to design policies that can be effectively implemented; to consider key stakeholders; and to approach adaptation in a comprehensive manner.
- Workshop on Studies of Water Resources and Land Management in the Bandung Basin (Bandung–West Java, 22 February 2006): Water resources in the Bandung Basin are under continuous degradation due to overexploitation of surface and groundwater. The workshop showed that climate change is not yet well accepted

nor understood by the water and land management community in the region. Many stakeholders focus on land management aspects since this is considered as the main cause of water resource degradation. However, some participants agreed that climate change may cause further stress in water resource problems.

- International Workshop on Client-oriented Agro meteorological Services to Support Agricultural Development Jakarta, 9–10 March 2006: Its objective was to provide inputs relating to the development actions and approaches for dealing with climate variability and climate risk. TroFCCA benefited from the discussions as several practitioners shared their experiences and approaches on dealing with adaptation, in particular, the management of climatic risk. The workshop highlighted the importance of climate information and weather forecasts for farmers, and the need to strengthen national capacity in transferring this information to users.
- Indo-Malay and Australasia Workshop on Global Fire Assessment (Bogor–West Java, 26–28 April 2006): In line with the research focus of TroFCCA in Indonesia, this workshop discussed the existing assessments of global ecological conditions of fire regimes in Southeast Asia and Australia. The workshop highlighted that fires are causing changes in the ecological fire regime. This is particular to Indonesia where the Indian Ocean Dipole Mode (IODM) and El Nino have increased the risk of forest to fire. In general, the workshop concluded that awareness on climate change is still low and that enormous efforts on capacity building need to be made in the future if a process of adaptation is to be implemented in the country.

### **3.3.4 Local partners and relations**

This section lists the organisations and partners that we have contacted and whom we have established a working relationship. They are classified into three groups: governmental organisations dealing with development programmes, policies and regulations; research organisations dealing with scientific services and development of science and technology; others including projects or field practitioners and NGOs.

#### Governmental organisations

Governmental organisations have shown great interest in the project. This is due to the fact that forestry issues in general are a priority for Indonesia and that CIFOR is a highly respected organisation. Institutions that have been contacted and have expressed an interest in taking part of TroFCCA include:

- *Ministry of Environment, Government of Indonesia*: This ministry holds the main responsibility for dealing with climate change within the country. The office of the national focal point to the UNFCCC, the coordinator of the National Communications and coordinator of National Committee on Climate Change belong to this ministry.
- *Ministry of Forestry, Government of Indonesia*: It develops policies and regulation on commercial uses and conservation of forests, and has responsibility in preventing and controlling forest fires. In addition, the ministry has a working group on CDM and other climate change issues relating to the forestry sector.
- *Ministry of Home Affairs, Government of Indonesia*: This ministry is responsible for supervising and guiding provincial development.

- *National Planning Agency (Bappenas)*: This agency is responsible for planning and budgeting national development programmes. If adaptation is to be solved through mainstreaming into sectorial development policies, the role of BAPENAS in this process is significant.
- *National Coordinating Agency for Disaster Relief (Bakornas)*.
- *The ASEAN Secretariat* is conformed by ten countries from Southeast Asia. As a multilateral organisations, it develops policy for the region, which has to be ratified by the Parties. Relevant to TroFCCA, ASEAN has established a regional agreement on haze pollution.

#### Research organisations

- *National Meteorological and Geophysical Agency (BMG)*: It collects and archives meteorological data, conducts research on meteorological science and weather forecast, and gives early warning on possible extreme events.
- *National Institute for Space and Aeronautics (LAPAN)*: It processes and archives satellite photos for monitoring land cover change, including forest fires, using remote sensing technology. It also conducts research and modelling on climate science.
- *The Indonesian Institute of Sciences (LIPI)* has a working group on geo-hazards. This working group conducts research on landslides, develops related models and collects and archives relevant data on this hazard.
- *The Bogor Agricultural University (IPB)* has two centres that are important for climate change research. First, the Laboratory of Climatology conducts research on impacts of climate change in several sectors (water resources, agriculture, etc.). Second, the Forest Fire Laboratory conducts research on biophysical aspects as well as regulations and policies in relation to forest fires.

#### Others (including projects or field practitioners and NGOs)

- *The South Sumatra Forest Fire Management Project (SSFFMP)* is funded by the EC for conducting forest fire control in the field. It has done research on the integrated management of forest fires with community involvement.
- *PELANGI* is an NGO that has established links to the South South North (SSN) Adaptation project for conducting research on mainstreaming adaptation with a community base approach. The adaptation stage of the project begins this year (2006).
- *Wetland International* promotes conservation and conducts rehabilitation activities on wetland ecosystem, including peatlands.

### **3.3.5 Summary of preliminary research activities**

Preliminary research has involved mostly literature reviews in order to define research themes for the region. This activity has intensified after the kick off meeting. Results from initial research have been compiled in a series of background papers, whose main message is summarised below:

Climate change scenarios for South East Asia. The IPCC's Third Assessment Report (TAR) is probably the most comprehensive report on future climate changes for Asia. It shows that Southeast Asia will become warmer and wetter relative to current conditions, and that the changes will happen at a lower rate than in the rest of the world. Under the IPCC scenario IS92, the mean air temperature for Southeast Asia is projected to increase by 3.03°C in 2080s. The analysis also shows that the seasonal variation over Southeast Asia is likely to change, with warming in winter being higher than warming in summer. Annual precipitation is also expected to increase by 8.5% in the 2080s.

Regarding Indonesia, results from seven different models have been compiled and analysed by the government. This analysis indicates that temperature will increase rather slowly compared to the global average, with a rate between 0.1°C and 0.3°C per decade. Annual average precipitation is expected to increase across most of Indonesia, except in the southern part of the region including Java. During the high rainfall season (December-February), major parts of Sumatra and Kalimantan will become 10-30% wetter by 2080. Annual precipitation in the southern part of Indonesia may decrease by 5-15%. Regarding climate variability, two phenomena are particular to Indonesia: seasonal (monsoonal) variability that contrasts rainfall patterns between the rainy season and the dry season; and the inter-annual climate variability of rainfall patterns such as El Niño (ENSO) and its opposite, La Niña, including the Indian Ocean Dipole Mode (IODM). When a positive IODM and ENSO occur at the same time, severe drought may result. Based on Southern Oscillation Index (SOI) values, the frequency of El Niño increased from once in 8 years (1876-1976) to once in every 4 (1977-2000).

Forest state and use: Tropical forests of Indonesia are second to those in Brazil. They are characterised for their great diversity which can be classified into 10 groups based on their ecological characteristics: coastal forest, tidal forest, heath forest associated with sandy infertile soils, peat forest, swamp forests, evergreen forests, forests on basic rocks, mountain forest at elevation over 2,000 m, bamboo forest, and savannah forest. According to its forest land-use by concession (*Tata Guna Hutan Kesepakatan*), the Indonesian government classifies its forests into four types: 1) Protection forests, located in slopes of more than 45% intended to maintain watersheds; 2) Sanctuary reserve and nature conservation areas; 3) Conversion forests, which can be cleared for agriculture; 4) Production forests, which can be exploited for timber. Indonesian forests cover about 45.8 percent of the total land area. Protected areas cover about 25.7 percent of the total forest area, sanctuary and conservation areas about 16.7 percent, convertible production forests about 12.4 percent, and production forests about 45.14 percent. Deforestation is mainly due to increasing demand of land for cultivation, however, transmigration programs and the development of agro-industries are the main causes of the rapid forest conversion.

Vulnerability to forests fires: Forest fires cause significant social and environmental impacts. For example, it is estimated that the total economic loss caused by fires in 1997 -1998 was between US\$ 8.7 to 9.6 billion. These fires had significant impacts on health, livelihoods, biodiversity, forestry and agriculture, tourism and others. A substantial number of fires are human-induced, either directly for land clearance or indirectly by opening the canopy of closed forests. In combination with human causes, climate change and climate variability are likely to increase the extent and intensity of forest fires. The linkage between forest fires and climate change is twofold: first, changes in climate have significant implications on the humidity of a

region (e.g. they can lead to drier conditions) and, second, they could increase the production of biomass, resulting from more rain, higher temperatures and a higher concentration of CO<sub>2</sub> in the atmosphere. Future climate change scenarios indicate that Indonesia will be at a higher risk of fires resulting from drier conditions during the dry season and due to climate variability (despite increasing annual precipitation averages). More precisely, climate change and climate variability are likely to increase the risk of more seasonal and forest fires in the southern part of Indonesia (south Sumatra, south Kalimantan, south Sulawesi, Java, Bali and Nusatenggara). In the northern part of the country (central and northern Sumatra, most of Kalimantan, northern Sulawesi and Papua), the risk of big fires will be influenced by inter-annual climate variability. Although this is likely to become wetter, in the events of extreme dryness caused by ENSO and IODM can expose large quantities of biomass, increase dry conditions and hence, increase the risk of fire. Future combinations of ENSO and IODM, as happened in 1992/1993 and 1997/1998, will likely cause severe droughts and lead to an increase in the number of hotspots of forest fires in Indonesia.

## 4. Financial management for the first year

The financial management report covers the period March 2005 – July 2006.

Activities for the regional implementation of the project did not start until the end of 2005, as explained in section 2 above. For this reason, the level of expenditure until July 2006 remained relatively low. However, it should be noted that the granted extension of six months is intended to cover the delay in starting regional activities. Finance for these six months will be covered by the delay in expenditure during the first eight months of the project.

Between March 2005 – July 2006, a total of Euro 696,103 has been spent in the activities of the project. A total of Euro 522,994 were taken from EC funding while Euro 173,109 were contributions of CIFOR and CATIE (table 5).

**Table 5. Sources of expenditure (in Euro)**

Budget Line	EXPENDITURES		
	Total	Commission Contribution	Own Contributions
1. Human Resources			
1.1 Salaries (gross amounts, local staff)	492,005	347,044	144,961
1.2.1-2 Per diems (staff)	10,907	10,907	-
1.2.3 Workshop participants	930	930	-
<i>Subtotal Human Resources</i>	<i>503,842</i>	<i>358,881</i>	<i>144,961</i>
2. Travel			
2.1 Staff Travel	34,376	34,376	-
2.2 Workshop participants travel	21,540	21,540	-
<i>Subtotal Travel</i>	<i>55,916</i>	<i>55,916</i>	<i>-</i>
3. Equipment and supplies	51,428	46,830	4,598
4. Local office/Action costs	14,622	8,489	6,133
5. Other costs, services	24,755	18,662	6,092
6. Other	-	-	-
<i>7. Subtotal direct costs of the Action (1-6)</i>	<i>650,564</i>	<i>488,779</i>	<i>161,784</i>
8. Administrative costs (maximum 7% of 7, total direct eligible costs of the Action)	45,539	34,215	11,325
<i>9. Total eligible costs of the Action (7 + 8)</i>	<i>696,103</i>	<i>522,994</i>	<i>173,109</i>

A summary of major budget lines is presented in table 6. In accordance with the established budget, a large percentage of this sum (approximately 70%, equivalent to Euro 492,005) has been used to pay salaries of staff, including the targeted consultancies explained in section 3. Funds have also been used for staff travel and per diems, used to establish initial contacts with partners and cover regional and international meetings. Logistic budget lines have been used to buy one vehicle for the regional office in Burkina Faso, laptops for the staff and computer equipment (printers and docking stations), and for local actions costs.

**Table 6. Summary of expenditures for the period March 2005 – July 2006  
(in Euro)**

Budget Line	Budget	Expenditures	Balance
1. Human Resources			
1.1 Salaries (gross amounts, local staff)	2,498,293	492,005	2,006,288
1.2.1-2 Per diems (staff)	82,275	10,907	71,368
1.2.3 Workshop participants	45,038	930	44,108
<i>Subtotal Human Resources</i>	<i>2,625,606</i>	<i>503,842</i>	<i>2,121,764</i>
2. Travel			
2.1 Staff Travel	336,200	34,376	301,824
2.2 Workshop participants travel	134,500	21,540	112,960
<i>Subtotal Travel</i>	<i>470,700</i>	<i>55,916</i>	<i>414,784</i>
3. Equipment and supplies	259,200	51,428	207,772
4. Local office/Action costs	133,344	14,622	118,722
5. Other costs, services	423,510	24,755	398,755
6. Other	-	-	-
<i>7. Subtotal direct costs of the Action (1-6)</i>	<i>3,912,360</i>	<i>650,564</i>	<i>3,261,796</i>
8. Administrative costs (maximum 7% of 7, total direct eligible costs of the Action)	273,865	45,539	228,326
<i>9. Total eligible costs of the Action (7 + 8)</i>	<i>4,186,225</i>	<i>696,103</i>	<i>3,490,122</i>

Detailed expenditure for the above budget lines is included in Annex 3. As a first instalment, CIFOR received from the EC an amount of Euro 562,694. Utilized resources from the EC (as stated above, Euro 522,994) are equivalent to approximately 93% of the first instalment.

#### **4.1 audit**

KPMG Indonesia & Costa Rica have been appointed by the management of CIFOR & CATIE to perform financial audits of the TroFCCA project.

The consolidation of the audit reports for CATIE and CIFOR and is currently being undertaken by KPMG Indonesia. We expect to receive the audit report by the end of November 2006 and submit it to EU in December 2006, together with a request of payment.

## **5 . Action plan and budget for year 2**

In accordance with the timetable for the project, activities for the second year will be focused at elaborating and testing methodologies to assess the vulnerability of the sectors identified in section 2 and 3 above. Each region will work independently on their specific sectors.

Main tasks to complete the products for the second year include:

- A diagnosis of the forest ecosystems in each region, in particular, those linked to the development issues identified for each region.
- Conceptualisation of the link between climate change and the development issue in accordance with the methodological framework (see section 2). This task includes the identification of variables at different levels (political, landscape, etc.) and the analysis of the link between them.
- Development and testing of methodologies on the basis of the previous task.
- Literature reviews and compilation of data needed for the development and application of the methodologies
- National meetings to advance on work

In addition to the above, two main workshops will be organised in the course of the second year: first, one all-staff meeting to advance work on the development of methodologies. This meeting will have the objective of sharing experiences and commonly solving problems encountered by each team during development the methodologies. The meeting is expected to take place before the end of 2006. Second, one regional workshop per region will be organised in the first half of 2007 with the objective of presenting the methodologies to partners and to continue the science-policy dialogue on adaptation. The budget for these resources is presented below.

### **5.1 Budget for the second year**

For the second year, it is expected that one-fourth of the resources from the budget will be used, as shown in table 7 below. These resources will cover salaries for the staff, student packages, regional and international travel and the organisation of regional meetings to continue the science-policy dialogue.

Total resources needed for the implementation of the project during the second year are equal to Euro 1,034,769.18. Resources from the European Commission will be equal to Euro 813,080.15.

**Table 7. Budget for the second year of TroFCCA**

Budget line	Total in budget	Budget for second year	Total requested from the EU
<i>1. Human resources</i>			
1.1 Salaries	2,498,293.20	624,573.30	486,637.00
1.2.1 and 1.2.2 Per diems (staff)	82,275.20	20,568.80	18,393.80
1.2.3 Per diems (Workshop participants)	45,037.50	11,259.38	3,112.65
sub total Human resources	2,625,605.90	656,401.48	508,143.45
	-	-	-
<i>2. Travel</i>			
2.1 Staff travel	336,200.00	84,050.00	69,043.25
2.2 Workshop participants travel	134,500.00	33,625.00	30,369.75
Sub-total Travel	470,700.00	117,675.00	99,413.00
	-	-	-
<i>3. Equipment and supplies</i>	259,200.00	53,784.00	41,951.52
	-	-	-
<i>4. Local office/action costs</i>	133,344.00	33,336.00	26,947.50
	-	-	-
<i>5. Other costs/services</i>	423,510.10	105,877.52	83,432.52
	-	-	-
<i>6. Other</i>	NA	N/A	N/A
	-	-	-
<i>7. Subtotal direct costs of the Action</i>	3,912,360.00	967,074.00	759,887.99
	-	-	-
<i>8. Administrative costs</i>	273,865.20	67,695.18	53,192.16
	-	-	-
<b>9. Total eligible costs of the Action</b>	<b>4,186,225.20</b>	<b>1,034,769.18</b>	<b>813,080.15</b>

## 5.2 Plans for the second year in West Africa

Elaboration of specific methodologies: the period June 2006 to March 2007 will be devoted to the development of specific methodologies to assess the vulnerability of the energy and water sectors, and of the provision of non timber forest products. These methodologies will be limited to the impacts of climate change over forest ecosystems and the related sectorial vulnerability. The process will start with the review of key methodological papers and other literature. A technical committee of partners will be conformed by experts from national meteorological services of Ghana, Burkina Faso and Mali, GIS and spatial imagery specialists from AGRYHMET, CILSS, and various universities, local experts on climate change adaptation activities like IUCN, SNV. A draft version of the methodologies is planned to be ready by mid August 2006, for circulation to the technical committee.

Training for graduate students: the recruitment process for graduate students will end on the 30<sup>th</sup> of July 2006. Three selected students will undertake research projects relevant for the development issues identified during the kick off meeting. Research is planned to start in September 2006 with the beginning of the 2006-2007 academic year.

Climate modelling: TroFCCA West Africa will work with national partners on the validation of the PRECIS model. The model is currently being run in Ghana and first results are expected by September 2006. A planning meeting has been organised for October 2006 in order to evaluate the output of the run and further conduct country-base assessments.

Regional Meeting: A second regional meeting of partners has been planned for May 2007 in Bamako (Mali). This meeting will continue the science-policy dialogue and will also be used to review the activities of TroFCCA and to evaluate the implementation of the second phase of the project. The outcome of this meeting will

set the stage for the implementation of adaptation strategies preceding the vulnerability assessment of the three selected development issues.

### **5.3 Plans for the second year in Central America**

Four main lines of action have been planned for the second year of TroFCCA in Central America.

The first aims at identifying forest ecosystems that are important for the drinking water and hydroelectric power generation sectors. These sectors will be characterized by obtaining data on current situation, relevant policies and future trends. Once information on this sectors has been compiled, the next step will be to characterise goods and services on which these sectors depend. Variables at different levels will be identified and linked in accordance with the methodological framework. Three M.Sc. level students will participate on this research and will publish their results in journal articles. It is expected that preliminary products will be available by the end of 2006.

The second line of action is determining the vulnerability of forest ecosystems to climate change in the three countries. A bioclimatic approach will be used, by which changes in climate are linked to changes in life zones. The main challenge will be to incorporate current pressures over forest ecosystems, such as forest fires, forest conversion and insect pest attacks. This activity will start by the third semester of 2006 and it is expected that results will be available by the beginning of 2007.

A third line of action involves the selection of three sites, one per country, to conduct an in-depth analysis of changes in the provision of forest goods and environmental services to people. The selection of sites will proceed through a series of criteria and will be conducted by M.Sc. level students. The activity will commence by the end of the year; preliminary results will be available by mid 2007, before final products (thesis and journal articles) by the end of 2007.

The last line of action aims at strengthening the participation of society in adaptation processes at the national level. This line entails the analysis of existing policies linked to the identified sectors and how adaptation to climate change has been or could be mainstreamed. This task will be undertaken in close collaboration with national governments (e.g. ministries, national focal points to the UNFCCC and climate change offices). It will start during the last trimester of 2006 and will run until the first semester of 2008. Preliminary results will be made available for the second annual report by March 2007.

On the policy side, TroFCCA will undertake initial research on energy and climate change in Central America and related realities, trends and adaptation needs. The potential of “Payment for Environmental Services” will be assessed as an innovative financial mechanism. Second, a brief analysis of policies for the water sector in Honduras, Costa Rica and Nicaragua will be conducted jointly with the Regional Committee on Hydrological Resources. The results of this assessment will be available during the first trimester of 2007.

## 5.4 Plans for the second year in Asia

The next year plan will concentrate primarily on the development and testing methodologies specific for assessing the vulnerability relating to forest fires and landslides.

Elaboration of specific methodologies: The development of specific methodologies to assess the vulnerability to forest fires and landslides is at a preliminary stage. Between June and July 2006, research will concentrate on the identification of clusters of vulnerability issues (e.g. ecosystem variables and processes that increase the risk of fire, the role of root structure in preventing landslide and others). Comprehensive literature reviews will proceed between August 2006 – December 2006 to assemble the conceptual methodology before compiling data for their application. Draft methodologies will be ready by January 2007 and will be tested between February 2007 – May 2007.

Policy oriented research: Policy research will concentrate on analysing the institutional framework identified during the kick off meeting, in particular, how climate change is, or could be, incorporated in policies for fire suppression and those related to landslides. Policy challenges arise from decentralisation, that is, what sort of policies best fit sub national and local level in terms of their implementability and impact. Comprehensive policy analysis on forest fires and landslides will concentrate on gaps as well as on how science has or could be used to better address climate change within the existing institutional setup.

Identifying geographical areas for testing methodologies: The above-mentioned methodologies will be tested and applied in specific sites. As opposed to work being undertaken in other TroFCCA regions, fires and landslides are site specific and respond to a determined combination of climatic, land cover, geomorphological and socio-economic conditions. The main objective of this activity would be to identify those areas in Indonesia where forest fires and landslides are likely to have the greatest socio-economic impacts, in order to limit the assessment of vulnerability to those areas. Other aspects that will be taken into consideration for the selection of sites include accessibility, data availability, potential impacts on society (e.g. landslides in remote areas have less impact than in populated ones) and representation. This exercise will be undertaken between November 2006 – February 2007

Students: During July-August 2006, the regional coordinator will design research packages for the elaboration of the specific methodologies and for the policy analysis. Postgraduate students at the masters' and PhD level will be identified by September 2006.

## Annex 1. Methodological framework

The methodology to assess vulnerability of tropical forests to climate change is comprised by a set of twelve. It acknowledges the close link existing between the processes of adaptation and development and, hence, it departs from the identification of the development priorities where the assessment will be focused.

This generic methodology sets the framework for the development of specific methodologies for each of the topics selected by each region and for the assessment of carbon (link between adaptation and mitigation) and biodiversity. The methodologies will be implemented through a period of two years in each region. The following box summarises the type of tools that will be used in the methodology.

### Box 1a. Tools

Scenarios: Representation of the future state of a system, including a projection of selected variables that determine that state. The project will use climate, social and biophysical scenarios, which will be developed primarily through modelling.

Models: A model is a representation of reality. The project will use models for several purposes, including for the development of scenarios, to relate climatic variables to biophysical parameters and to assess changes in the provision of goods and services from the changes in biophysical parameters. Models to be used in the different steps of the project range from allometric equations to economic models.

GIS: Geographical information systems will assist in the selection and analysis of case studies.

Data bases: Climatic data bases will be used to develop climate scenarios and to analyse current and past climate changes.

Expert judgement: The opinion of experts, primarily scientists from the project and from the scientific advisory panel, will be used as a means to elaborate scenarios and to relate climatic variables with biophysical parameters and the provision of goods and services from forests.

Literature reviews: Although adaptation is a relatively new topic, it is nothing else than a specific application of knowledge that has been developed by several disciplines for other reasons. A thorough literature review will serve as a basis for the identification of models, for the support of expert judgement and, in general, to fill in gaps whenever inputs needed for the project have already been produced.

Following is a description of the 12 steps that comprise the methodology:

### 1. Definition of the areas/topics from the national development policies:

Forests in context: The project will depart from the traditional assessment of impacts of a specific system by linking impacts on forests to social vulnerability. TroFCCA will raise the importance of social vulnerability and the role that forests play within it.

In conjunction with national governments, the project will identify the areas/topics from the development policy where forests could play a significant role. These areas/topics will be identified according to the expectations on how climate change impacts over forests are related to social vulnerability. Departing from this

information, the idea is that the project will be focused at goods and services from forests that may be affected by climate change and, hence, increase the vulnerability of society.

**Main output of Step 1:** A clear definition of the topic(s)/area(s) of the development policy in which forests play a significant role and where impacts of climate change may hinder development.

*Example:* Forests play a significant role in the water cycle and could be crucial in determining the quality and quantity of water in a given watershed. Hence, TroFCCA could make an emphasis on how climate change impacts over forests are related to future plans on water and development.

*Tools and means:* Contacts with governments, regional kick off meetings, literature review.

## **2. Specification of the goods and environmental services (G/S) that support / relate to the areas/topics identified in the previous step**

Once the areas/topics of work have been identified, the next step will be to identify those goods/services from the forests that relate to the identified area. This step will be mainly undertaken through the revision of literature.

**Main output of Step 2:** The description of the goods and services from forests that relate to the topic(s)/area(s) selected.

*Example:* in some cases, forests contribute to increasing the quality of water. This step will be the specification of which services are relevant for the region/country under study, as not all forests will provide the same services in the same regions

*Tools and means:* Contacts with governments, regional kick off meetings, literature review, national studies and surveys, maps.

## **3. Assessment of the ecosystem functions underlying the goods and services identified in the previous step**

Goods and services from forests derive from specific ecosystem functions. This step comprises the identification of those functions important for the goods and services that contribute to the areas identified in the first step.

**Main output of Step 3:** A detailed description of the ecosystem functions that support the provision of the goods and services described in step 2; indicators to link ecosystem functions to the provision of specific goods and services and, to the extent possible, the type of relation (e.g. an algorithm that shows changes in ecosystem functions vs. changes in the provision of goods and services).

Following the above example, the project will describe the goods and services from forests that relate to the topic under study. If water is the topic(s)/area(s) under study, this step will develop a thorough description of, for example, the role of forests in regulating the water cycle or in improving its quality, as appropriate. Literature will indicate the types of forests as well as the landscape configuration, including geology, that define the provision of the specific good/service.

*Tools and means:* This step deepens strongly on a literature review and the search for local case studies.

#### **4. Assessment of the biophysical processes and parameters that control the functions identified in the previous step**

This step comprises the identification and analysis of those biophysical processes and parameters that determine the ecosystem functions specified in the above step. The assessment will identify those parameters relevant for adaptive management and which are likely to be influenced through policy and through the implementation of specific adaptation activities.

**Main output of Step 4:** A detailed description of the biophysical processes and parameters that support the ecosystem functions described above. Indicators to link biophysical parameters to ecosystem functions and, to the extent possible, the type of relation (e.g. an algorithm that shows changes in biophysical parameters vs. changes ecosystem function).

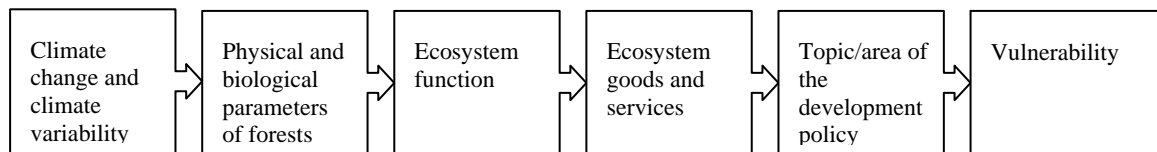
For example, factors such as evapotranspiration and root structure play a fundamental role in defining water cycle regulation and water quality. The study will aim at establishing the relation between changes in these parameters and changes in the provision of goods and services from a theoretical point of view. An example would be the development of a model that, having identified the appropriate indicators, will relate changes in root structure to changes in water quality.

*Tools and means:* literature review, models and expert judgement.

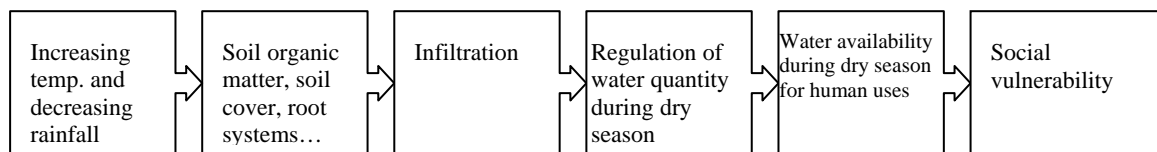
#### **5. Assessment and analysis of the climatic variables/parameters that can have a direct effect in the parameters assessed in the previous step.**

The connection between the ecology of forests and vulnerability to climate change will be assessed through an analysis on how changes in climate, climate variability in

particular (temperature, rainfall and extreme events), will affect the ecological parameters that control ecosystem functions underlying goods and services. The project aims to make a thorough assessment of how positive or negative changes in climatic variables are related to the vulnerability according to the following chain:



## EXAMPLE



Depending on the quality and quantity of literature and available studies, this step should aim to relate changes in climate variables (rainfall and temperature mainly) to changes in the biophysical parameters identified in the previous step.

**Main output of Step 5:** A detailed description of how climatic variables like rain and temperature can have an effect on the biophysical parameters identified in the previous step. The study will include, where relevant, the effects of extreme events. Indicators to link climatic to biophysical parameters and, to the extent possible, the type of relation (e.g. an algorithm that shows changes in climate to changes in biophysical parameters).

This step is the final step of the theoretical part of the study, which is intended to provide the scientific information for a thorough analysis of vulnerability applied to case studies.

*Tools and means:* literature reviews, expert judgement, models.

## 6. Selection of case studies

Case studies from each region and country will be selected taking in conjunction with the previous steps. In particular, vulnerability will be assessed by selecting forest ecosystems that are relevant to the areas of work and that provide the goods and services for these areas. The selection of case studies will also take into consideration the fact that findings could be extrapolated to the countries/regions.

**Main output of Step 6:** The selection of case studies for each country/region on the basis of their relevance for the topic(s)/area(s) and for which information is available.

*Tools and means:* Maps, forest inventories, GIS, expert judgement, contact with governments and national experts.

## **7. Development of climate scenarios**

In order to understand the likely future situation of the climatic variables identified in step 5 (such as rain and temperature), there is a need to develop climate scenarios. Some of them have already been developed for individual countries in the past to serve as an input to national communications. Some others are in the process of being developed. The project will benefit from the existing climate models and will develop, if needed, specific scenarios relevant for the chosen case studies.

Two sources for the climate change scenarios will be used:

- First, regionalized climate change models, where available.
- Second, past and current climate changes from climate databases

**Main output of Step 7:** Climate scenarios that are applicable to the case studies, regions and countries. The scenarios will be taken from other studies if available.

*Tools and means:* existing climate data bases, statistical tools, GCMs and regionalized climate models, and expert judgement

## **8. Identification of current and future biophysical impacts**

This step will identify what are the likely effects of climate change over the physical and biological parameters identified in step 5 for the case study areas and having as a basis the climate information derived from the climate scenarios developed in the previous step. The study will assess the likely effects of temperature and rainfall variability as well as the increase of the frequency and intensity of extreme events such as hurricanes and drought in the regions where these are relevant.

The parameters identified in step 5 will be used as indicators of vulnerability. Step 5 has already indicated the relation between changes in climate and changes in biophysical parameters from a theoretical point of view. This step will use the theoretical assessment of step 5 and apply the climate scenarios so that an assessment of possible effects of climate change over the selected case studies can be developed.

**Main output of Step 8:** An assessment of the possible impacts of the current and expected climate variability and extreme events over the biophysical parameters and ecosystem function for the selected case studies.

*Tools and means:* Information from literature reviews, expert judgement, models, GIS.

## 9. Assessment of the derived impacts

Following from the previous step, this one will assess how the expected changes in the biophysical parameters are translated into changes in forest functions (identified in step 3) and then in the provision of the goods and services (identified in step 2) for the selected case studies.

**Main output of Step 9:** An assessment of the implications on the provision of goods and services in measurable terms (i.e. through criteria and indicators).

*Tools and means:* Information from literature reviews, expert judgement, models, GIS.

## 10. Vulnerability assessment

The assessment of vulnerability will be focused at the policy topics/areas identified in step 1. Changes in the provision of goods and services as the edge of the impact chain will be assessed in the broader context of other processes that may affect the topic(s)/area(s) under study and any implications relevant for the development policy.

The step will provide a thorough assessment of the importance of forest ecosystems in the respective topic(s)/area(s) as well as how and how likely are impacts from climate change over forests affect the topic(s)/area(s). The assessment of vulnerability will be undertaken at the environmental and socioeconomic levels.

**Main output of Step 10:** An assessment of the vulnerability, including possible costs to society, of the specific topic(s)/area(s) selected specifically deriving from impacts of climate change over forests. The analysis should incorporate other processes and pressures (such as deforestation) and will identify priority areas that can be addressed through policy instruments and through the participation of the private sector and other relevant actors.

*Tools and means:* Policy analysis, economic modelling, expert judgement, contact with governments.

## 11. Vulnerability mapping

After having assessed the vulnerability of the specific case study and whenever data permits, the project will extrapolate the case study results to the country/region level. The objective of this step is to have a “big picture” overview of the vulnerability. This step will make use of social scenarios whereby the results of the previous step are superposed on social and climate scenarios.

**Main output of Step 11:** A map of the vulnerability related to the topic(s)/area(s) for the country level.

*Tools and means:* Social and climatic scenarios, GIS.

## **12. Adaptation pre-screening**

Step 11 is the formal initiation of the work on adaptation and the last step of the methodology. A policy dialogue will have the objective of assessing the priorities and national interests for reducing vulnerability. The results of the application of the previous steps will be presented to several actors, including government agencies and the private sector. The sub steps include:

- Identification of relevant actors
- Definition of possible response options with experts of concerned sectors
- Analysis of the interest of society to respond to the identified vulnerability and to use the proposed options.
- Prepare analyses of the costs and benefits of the response options that the concerned sectors have selected.

The results of the application of the methodology will be the main input to the work on adaptation. Planning adaptation will be undertaken directly with the government and other actors through 1 or 2 workshops per region. The specific work will be elaborated at a later stage.

## **Annex 2. Working definitions**

### **Adaptation**

A process by which strategies and actions to avoid, moderate, cope with and/or take advantage of the consequences of climate events are developed, enhanced and implemented.

### **Vulnerability**

The degree to which a system is likely to be affected by climate change or climate variability; this degree is expressed as diminishing values for specified indicators linked to a probability.

### **Adaptation strategy**

A broad plan of action that is implemented through policies and measures and whose objective is to reduce the vulnerability of society. Strategies can be comprehensive (i.e. focusing on national, cross-sectorial scales) or targeted (i.e. focusing on specific sectors, regions or measures).

### **Adaptation action**

A planned activity developed and implemented on the ground with the objective of moderating, coping or taking advantage of a specific climate change impact. Adaptation actions include those designed to cope with an impact, share or compensate any loss, modify the circumstances of the system to prevent an impact, search for alternatives, change the location of a given system/activity, or research, educate and create awareness.

### **Adaptation policy**

The explicit intention of a government to enhance the capacity of society to respond to climate change by, *inter alia*, setting national objectives, identifying and delegating responsibilities, enabling the building of capacity and identifying and distributing resources for the assessment of vulnerability and the design and implementation of adaptation actions. *Policies* typically refer to instruments that government can use to change economic and other behaviours. Policies are usually composed of taxes, command-and-control regulations (e.g. performance specifications for technologies), market mechanisms such as trading schemes, incentives such as subsidies for new management techniques, and information gathering (e.g. on the likely impacts of climate change) or dissemination (e.g. on the merits of new technologies or behaviour changes).

*TroFCCAs approach to an adaptation policy follows the adaptation policy framework, by which adaptation is incorporated into the existing institutional setup of a country, rather than having a separate institutional adaptation arrangement.*

**Policy oriented strategies:**

A broad plan for adaptation which focuses primarily on institutional development. Policy oriented strategies include elements of capacity building, finance, technical assistance, dissemination of information, cooperation and others.

**Adaptive capacity**

The potential or capability of a system to adjust, via changes in its characteristics or behaviour, in order to cope better with existing climate variability and change. It is possible to differentiate between adaptive potential, which is a theoretical upper boundary of responses based on global expertise and anticipated developments within the planning horizon of the assessment, and adaptive capacity, which is constrained by the existing information, technology and resources of the system under consideration

**Climate change**

Any change in climate over time, whether due to natural variability or because of human activity.

**Climate variability**

Variations in the mean state and other statistics (such as standard deviations, the occurrence of extremes, etc.) of the climate on all temporal and spatial scales beyond that of individual weather events. Variability may result from natural internal processes within the climate system (internal variability) or from variations in natural or anthropogenic external forcing (external variability).

**Climate risk**

The result of the interaction of physically defined hazards with the properties of the exposed systems – i.e. the systems' sensitivity or (social) vulnerability. Risk can also be considered as the combination of an event, its likelihood and its consequences – i.e. risk equals the probability of climate hazard multiplied by a given system's vulnerability.

**Impacts**

Changes induced in a system (physical ecological or social) resulting from climate change or climate variability which have significant deleterious effects for its composition, resilience and/or productivity (based on UNFCCC)

**Development topics**

In the context of TroFCCA, development topics are sectorial development goals for which forests play a substantial role by providing goods and services, including alternatives for enhanced adaptive capacity, and for which climate change and climate

variability increased the vulnerability of these goals specifically by affecting the provision of goods and services from forests.

### **Adaptive management**

The act, manner, or practice of managing, handling, or controlling a specific system in a way in which its adaptive capacity is increased. Adaptive management is achieved by the implementation of adaptation actions.



