

## VII. Assessment of Investment & Financial Flows for Adaptation in the Forest Sector



### 7.1 Introduction

Adaptation is a dynamic process that takes place over time. Similar to the development process, it must be focused towards continuous improvement; in other words, it must aim to diminish vulnerability to climate change over time. The adaptation process includes three essential stages: 1) vulnerability assessment; 2) capacity building; and 3) implementation of adaptation measures. In some developing countries adaptation measures are being leveraged through development cooperation. Whenever possible this tendency should be actively promoted as it increase cost effectiveness of the development process.

The vulnerability assessment identifies potential impacts, characterizes the affected system (i.e. in a country, biophysical region or forest) and identifies priorities for action. Capacity building enables the social system, especially its institutions, to implement actions to adapt to climate change. The implementation of adaptation measures is aimed at directly improving the adaptive capacity of a system (natural or social).

The impacts of climate change are likely to affect all forest landscapes. Indeed, the predicted change in climate variables will place severe pressure on forests' ability to adapt to these and to survive. With rising temperatures, changes in water availability and the expected double level of carbon dioxide, it is anticipated that forests will change at two levels: Structure (physiology and metabolism); and ecosystem functioning (see Table 7-1). These changes will impact on the availability and quality of both forest goods and services.

Also, the projected potential positive effect of climate change, as well as the estimated carbon sink in mature forests, may be substantially threatened by enhancing or changing the regime of disturbances in forests such as fire, pests, drought, and heat waves, affecting forestry production including timber. Global climate change can affect the mitigation potential of the forestry sector by either increasing or decreasing potential for carbon sequestration.

**Table 7-1: Summary of climate change impacts on forest ecosystems**

Climate Factor	Cell level	Organism level	Species level	Ecosystem level
CO <sub>2</sub> increase	Photosynthetic rate increase Stomatal conductance reduction	Growth rate increase Water use efficiency increase  Seed production increase	Decreased seed mortality  Increased recruitment  Period for individuals to reach maturity Changes in individual population density	Biomass production increase Alterations in species competitiveness  Changes in species composition
Temperature increase	Photosynthesis increase or decrease  Photosynthetic period can increase Transpiration increase	Primary production positive or negative changes  Seed production changes	Regeneration rate changes  Possible increase in tree mortality  Negative consequences for species sensitive to temperature changes	Alterations in species competitiveness  Species' composition changes  Soil mineralization increase
Rainfall regime changes	Growth rate reduction due to lower rainfall	Increase in seed mortality rate due to lower rainfall	   Increase of mature individuals' mortality rate	Alterations in species competitiveness  Species composition changes

Source: Meer, Kramek and Wjik, 2001 adapted by Robledo, C. and C. Forner, 2005. Adaptation of forest ecosystems and the forest sector to climate change. Forest and Climate Change Working Paper 2. FAO. Rome.

The socioeconomic impacts of these changes are slowly starting to be understood. In general, the following potential impacts on trade of forest goods and services can be listed:

- Decrease in timber production as a result of increased extreme events such as forest fires, hurricanes, flooding and droughts;
- Decrease in timber production due to changes in ecosystems and increased pests;
- Changes in the quality of timber and non-timber forest products (NTFP);
- Changes in the regional distribution of timber species;
- Impacts on the ability of some species designed for productive plantations to maintain growth rate and wood quality over the next 30 - 50 years;
- Indirect impacts on the timber chain due to changes in quantity and quality of offered timber;
- Impacts on the availability and quality of forest ecosystem services;
- Impacts on forest-dependant livelihoods (including reduction in food and shelter);
- Changes in land use patterns due to an increasing demand for agricultural land;
- Impacts on other sectors, especially agriculture, energy and water; and
- Increments on disaster risks due to reduced functions of the forest (e.g., increments of landslides due to degradation).

Ideally, adaptation to climate change should be based on a cross-sectoral policy. Domestic institutions responsible for the forest sector, forest ecosystems and climate change must create

mechanisms that allow them to coordinate actions with other sectors. Coordinating activities would include *inter alia*, identification and reduction of conflicts, use of synergies, and exchange of knowledge and experiences.

A coordination process among sectors constitutes a true challenge in the design of adaptation policies, or the mainstreaming of adaptation components into sectoral policy development. The preparation of a specific policy or of the elements to be added to sectoral policies depends entirely on the situation and priorities of the country concerned.

Given that the objective of adaptation is to reduce the vulnerability of social and natural systems, many potential actions can be taken. Adaptation options can generally be divided into two categories: policy options and management options. Table 7-2 presents a summary of the main adaptation options in the forest sector.

**Table 7-2: Management adaptation options**

<b>Forest Management options</b>	
<b>Management options for maintaining and providing forest ecosystem services</b>	Maintaining the Extent of forests
	Facilitating natural adaptation of biological diversity
	Maintaining forest health
<b>Management options for maintaining and providing provisioning services</b>	Maintaining the productivity of forest ecosystems
	Maintaining the tangible socio-economic benefits
<b>Management options for maintaining and providing regulating services</b>	Maintaining soil and water resources
	Maintaining and enhancing forestry's contribution to global carbon cycles
	Regulating human diseases and reducing disasters
<b>Management options for maintaining and providing cultural services</b>	Maintaining cultural values and local knowledge
	Maintaining aesthetic services (scenic beauty)
	Maintaining spiritual services
	Maintaining educational services
	Maintaining recreational services
<b>Forest Policy options</b>	
Including adaptation issues into international forest policy making and its related programs	
Including adaptation in forest into multilateral environmental funds (i.e. GEF, climate change funds)	
Including vulnerability and adaptation issues into national forestry plans	
Including vulnerability and adaptation issues into decentralization in the forest sector	
Promoting clarification of tenure, use and access right of forest ecosystem services related to vulnerability and adaptation	
Promoting inter-sectoral dialogue and dialogue among forest stakeholders	

Source: Seppälä et al (eds), 2009 and author compilations

## 7.2 Application of I&FF Methodology to Adaptation in the Forestry Sector

This section describes how the I&FF methodology in Chapter II would be applied to adaptation in the forestry sector. Some of the information provided in Chapter II that is relevant to all sectors is not repeated here, so the reader should read Chapter II before reading this chapter.

### **Step #1: Establish Key Parameters of Assessment**

*>>> Define detailed scope of the sector*

The question here is which forest ecosystems are relevant for adapting to climate change in a given country. “Adapting” includes the consideration of forest ecosystems and other ecosystems that rely on ecosystem services as well as the consideration of forest dependent people. For answering this question it is important to clarify:

- a) The vulnerability of forest ecosystems to climate change: Which forest ecosystems are vulnerable to which climate variables? How vulnerable are these?
- b) Which are the ongoing coping strategies from forest ecosystems and depending people to changes in climate?
- c) Are forest ecosystems relevant as coping strategy or increase resilience to other sectors?

In the following you find a guidance to schematically answer the above presented questions and to convert these findings into investments and financial flows. Please be aware that you should base your conclusions on the existent and available knowledge. It is always an uncertainty when planning for adaptation. When uncertainty is considered too high we recommend to:

- 1) flag the issue
- 2) make assumptions based on local expertise or available literature and
- 3) see for resources for clarifying the subject

Calculations can be reviewed over time according to new findings. The first step for clarifying the questions a) to c) is to define the subsectors that are relevant for your country. Fulfilling the matrix presented in Table 7-3 allows the I&FF team to identify which forest ecosystem should be included in the assessment.

**Table 7-3: Identification of the subsectors**

Sub-sectors	Primary forest		Secondary or degraded forest		Plantations		Other forest lands (e.g., cerrados, bushland)
	Managed	Unmanaged	Managed	Unmanaged	Managed	Unmanaged	
Vulnerable forest ecosystems							
Forest ecosystems relevant for reducing vulnerability of forest depending people							
Forest ecosystems relevant for reducing vulnerability of other sectors or land uses (e.g., water sector or agricultural land)							

As far as possible it is recommended that the national team includes the name or geographical location of the specific ecosystem, when fulfilling Table 7-3. The more accurate table three is, the more accurate the I&FF calculation for adaptation in the forest sector will be.

Once the forest ecosystems to be included in the assessment have been identified, the key stakeholders related to the use/management of these forest ecosystems and the sources of investment will be identified. Be aware that many activities related to adaptation and forest ecosystems are not quantified in monetary terms (e.g., gathering food during drought periods), neither in terms of investment or financial flows.

At the end of this step the national team will have a list of subsectors and forests stakeholders relevant for adapting to climate change as in Table 7-4.

**Table 7-4: Subsectors and forests stakeholders relevant for adapting to climate change**

Name and location of the ecosystem	Type of ecosystem (primary forest; secondary/degraded forest; plantation; other forest land)	Role in adaptation to climate change (Vulnerable forest ecosystem; Forest ecosystems relevant for reducing vulnerability of forest depending people; Forest ecosystems relevant for reducing vulnerability of other sectors or land uses)	Stakeholders involved (Indigenous peoples, local communities, local or national government, management companies)

>>> *Specify assessment period and base year*

The assessment period and base year need to be selected for the I&FF analysis. Selection criteria should include the forest sector scope, national and sectoral planning horizons and data availability. In general terms, in forestry, an assessment period of 2005 (the base year) through 2030 is possible and appropriate. 2005 as the base year is also suitable as 2005 is a default year of the 5-years global forest resource assessment of FAO.

>>> *Identify preliminary adaptation measures*

Based on available knowledge and using the information gained in Table 7-4, the project team will now identify preliminary adaptation measures, using the options provided in Table 7-2. For fulfilling this step the national team will fulfil Table 7-5.

The project team is asked to go into a further level of detail and to propose a specific kind of management following the management options given in the forest mitigation option

**Table 7-5: Specific management options**

Specific Management option (as in the chapter on forest mitigation options)	Abbreviation
Sustainable forest management, including conservation (REDD)	SFM
Forest restoration	FR
Plantations (afforestation/reforestation)	A/R
Plantations for Substitution through harvested wood products	S-HWP
Plantations for Substitution through non-wood products (S-NWP) (bioenergy)	S-NWP

Source: Elaboration by the authors

An example is provided here:

In a country X exists a forests reserve called “La Castellana”. This reserve conserves biological diversity and protects downstream settlements. Due to its level of degradation and climate induced increments in rain patterns this ecosystem is highly vulnerable. In order to increase adaptation capacity of the ecosystem, following adaptation options have been identified (from Table 7-2):

- Maintaining extend of forest
- Facilitating natural adaptation
- Maintaining forest health
- Maintaining socio-economic benefits
- Maintaining soil and water resources
- Enhancing carbon cycles
- Maintaining educational and recreational services
- Including vulnerability and adaptation issues into decentralization processes in the forest sector
- Promoting clarification of tenure, use and access right of forest ecosystem services related to vulnerability and adaptation

In order to fulfil these management objectives the following specific management options have been proposed:

- Sustainable forest management including conservation
- Forest restoration

Additional funds for e.g., educational purposes will be required. These costs appear in the I&FF as financial flows. In Table 7-6 we present how to fulfil the required data for the example provided.

Table 7-6: Preliminary adaptation options

		ADAPTATION OPTIONS																		
		Forest Management options												Forest Policy options						
		<i>Management options for maintaining and providing forest ecosystem services</i>			<i>Management options for maintaining and providing provisioning services</i>			<i>Management options for maintaining and providing regulating services</i>			<i>Management options for maintaining and providing cultural services</i>			Including adaptation issues into international forest policy making and its related programs	Including adaptation in forest into multilateral environmental funds (i.e. GEF, climate change funds)	Including vulnerability and adaptation issues into national forestry plans	Including vulnerability and adaptation issues into decentralization in the forest sector	Promoting clarification of tenure, use and access right of forest ecosystem services related to vulnerability and adaptation	Promoting inter-sectoral dialogue and dialogue among forest stakeholders	
Specific management option (SFM, FR,, A/R,, S-HWP ,S-NWP)	Maintaining the Extent of forests	Facilitating natural adaptation of	Maintaining forest health	Maintaining the productivity of forest ecosystems	Maintaining the tangible socio-economic benefits	Maintaining soil and water resources	Maintaining and enhancing forestry's contribution to global carbon cycles	Regulating human diseases and reducing disasters	Maintaining cultural values and local knowledge	Maintaining aesthetic services (scenic beauty)	Maintaining spiritual services	Maintaining educational services	Maintaining recreational services							
Reserve "La Castellana" Country X, province J	SF	X	X	X		X	X	X					X	X				X		
	FR	X	X	X		X	X	X						X					X	



>>> *Select analytical approach*

There are several analytical options available for the assessment of I&FF in the forestry sector, including using a sectoral model or plan to assess current situation (assuming no change) or projections and models combining vegetation and climate variables. Approaches range from simple spreadsheet models that can be applied by members of the project team to sophisticated dynamic forest management models that are designed to provide a detailed tracking of annual investment costs across multiple scenarios (e.g., COMAP/GCOMAP; GORCAM). An overview of the range of models that are available is included in Table 7-6. More details are presented in Part III of this Guidebook.

A useful starting point for the analysis could be a sectoral plan (e.g., a national forest programme, a forest master plan) which typically includes description of the current situation applying relevant indicators (assuming no change) and projections of trends in forest area by type, production and consumption of forest products etc. In this regard two sources are especially relevant for selecting the analytical approach for the forestry sector in developing countries; the information provided in climate change reports at the national level (e.g., National Strategy Studies<sup>1</sup> or the National Communications) or national plans in the forest sector, e.g., the National Forest Programmes<sup>2</sup> and particularly forest investment plans that are often associated to them; the national action plans for the Forest and Law Enforcement and Governance Programme (FLEG)<sup>3</sup> that look into a specific subset of I&FF.

NB: In a lot of developing countries forestry data are disparate from one service to another and present big differences. In this case it would be interesting to refer to the FAO data base.

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<sup>1</sup> <http://www.fao.org/forestry/nfp/en/>

<sup>2</sup>

<http://WEB.WORLDBANK.ORG/WBSITE/EXTERNAL/TOPICS/EXTARD/EXTFORESTS/0,,CONTENTMDK:20636547~MENU PK:1605862~PAGEPK:148956~PIPK:216618~THE SITEPK:985785,00.HTML>

<sup>3</sup>

<http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTARD/EXTFORESTS/0,,contentMDK:20636546~menuPK:1606203~pagePK:148956~piPK:216618~theSitePK:985785,00.html>

**Table 7-7: Forestry sector analytical tools and methods**

Name	Developer	Platform	Methodology	Web Site/Contact	Description
COMAP, GCOMAP	Lawrence Berkeley National Laboratory	Windows	Tool/Model	<a href="http://ies.lbl.gov/gcomap">http://ies.lbl.gov/gcomap</a>	Three models evaluate forest sector options, as well as carbon sequestration. Recommended by IPCC. COMAP is a spreadsheet tool and GCOMAP is a partial equilibrium global model.
Dynamic Global Vegetation Models	Various	Mainly as a computer program available	Models	Several DGVMs have been developed by various research groups around the world: LPJ - Germany, Sweden IBIS - U.S. MC1 - U.S. CASA and NASA-CASA - U.S. HYBRID U.K. SDGVM <sup>1</sup> U.K. TRIFFID - U.K. VECODE - Germany CLM-DVGM - U.S.	A class of computer programs that simulate shifts in potential vegetation and its associated biogeochemical and hydrological cycles as a response to shifts in climate. DGVMs use time series of climate data and, given constraints of latitude, topography, and soil characteristics, simulate monthly or daily dynamics of ecosystem processes. DGVMs are used most often to simulate the effects of future climate change on natural vegetation and its carbon and water cycles.
FAO Forest Plantation profitability model	FAO	Windows	Model	<a href="http://www.fao.org/forestry/1867/en">http://www.fao.org/forestry/1867/en</a>	Long rotation forest plantation model that generates account price sized curves and yield models. Data can be adapted for any country.
CRISTAL Community based risk assessment tool	IISD, Intercooperation, IUCN, SEI-B	Windows	Model	<a href="http://www.cristaltool.org/">http://www.cristaltool.org/</a>	The Community-based Risk Screening Tool – Adaptation and Livelihoods (CRiSTAL) is designed to help project planners and managers integrate climate change adaptation into community-level projects.
ITFMP Forest concession and forest industry models	FAO	Windows	Model	<a href="http://www.fao.org/forestry/1869/en/">http://www.fao.org/forestry/1869/en/</a>	Models analyze forest concessions as well as cash flows for incomes and expenditures. Data can be easily input for any country.

*>>> Assess externalities*

As forest adaptation options, especially management options, are related to with the maintenance and enhancement of ecosystem services, these usually provide considerable socio-economic and environmental co-benefits that further increase the resilience of the whole system.

We want to call the attention here to two main externalities;

- a) increment/decrease of the mitigation potential in the forest sector
- b) increment of adaptive capacity to other sectors

What is important to be bear in mind is that in the forestry sector any silvicultural activity (e.g., planting trees in a specific area) will have impacts on mitigation and at the same time on adaptation to climate change. We recommend therefore assessing the importance of the mitigation potential of any adaptation measure. In order to facilitate this assessment the tables following for the adaptation baseline and scenario establish the link between the adaptation options and the mitigation options in the forest sector as presented in this guidelines (see tables 6-14).

With regard to externalities to other sector what is important to assess is which forest environmental service increase the resilience of other sectors. For example, when forests reduce the risk of avalanches, resilience of the downstream systems – agricultural land or settlements – is higher depending of the health of the forest ecosystem.

The national team will have the opportunity to identify such links when fulfilling Table 7-3. According to the dependencies identified the national team will decide if externalities should be further assessed or not.

**Step #2: Compile Historical IF, and FF, and O&M Cost Data, Subsidy Cost Data (if included explicitly), and Other Input Data for Scenarios**

*>>> Compile historical annual IF & FF data, disaggregated by investment entity and source*

Historical I&FF data are needed to provide a historical basis from which to develop possible future scenarios. The historical data will give assessment teams an understanding of past investment patterns and a context for public and private plans for the sector, which can be used when developing the scenarios and estimating the associated cost estimates. The methodology recommends that countries compile 10 years of historical I&FF data, i.e., for the base year and the previous nine years. At a minimum, countries should collect at least three years of data (i.e., for the base year and two years during the previous decade). Data should be compiled for each investment type, and should be annual, be disaggregated by investment entity, and, if possible, by funding source, and also be divided into investment flows and financial flows (see Table 2-3 in Chapter II).

In the forest management sector, investment flows would include assets such as land and land preparation, vegetal material, equipment for reduced impact logging, equipments for research, education, assistance, and institutional adaptation (e.g., computers, hydro-meteorological gages, vehicles). Financial flows would include non-asset investments in research, education, assistance, and institutional adaptation (e.g., labour costs).

The I&FF data needed will likely reside in several domestic locations (e.g., national accounts, ministry records and plans, industry records, statistical agencies, extension agencies, research institutions). Note that sectoral and subsectoral definitions and disaggregations will vary among data sources, so assumptions may need to be made to reconcile datasets and extract needed data from aggregated and/or disaggregated categories.

The project team shall decide to use either historical trend or future scenarios or both according to the circumstances in your country. Historical trend refers to the extrapolation of the past trend to the future, while the development of future scenarios implies the modelling of different variables according to changes expected in the future. When using historical trends the project team will only have one future scenario, while through modelling different scenarios can be developed.

**Table 7-8: Compilation of historical data as a basis to develop the Baseline scenario in the forestry sector, example for the measures ‘sustainable forest management’ and ‘forest restoration’**

Category of Investment Entity	Cumulative Discounted IF, FF, & O&M Estimates For Mitigation/Adaptation Scenario (million 2005US\$)																							
	Investm. Type 1: Tenure			Investm. Type 2: Management system			Investm. Type 3: Law compliance & Monitoring			Investm. Type 4: Labour costs			Investm. Type 5: Training			Investm. Type 6: Infrastructure			Investm. Type 7: Machinery & equipment			Investm. Type 8: Miscellaneous		
	IF	FF	O&M Costs	IF	FF	O&M Costs	IF	FF	O&M Costs	IF	FF	O&M Costs	IF	FF	O&M Costs	IF	FF	O&M Costs	IF	FF	O&M Costs	IF	FF	O&M Costs
Households																								
Corporations																								
Government																								
Total																								

*Explanatory comments to Table 7-8:*

Establishment/clarification of *tenure* is an investment cost. The activity usually takes more than a year depending on the size of the area and possible conflicts/overlapping rights related to it. The costs to be covered include both the administrative process and demarcation of the designated area.

*Management Systems* refers to the particular sustainable forest management approach applied. Investments can be needed for restoring degraded national forests or launching afforestation programmes.

*Forest law compliance and monitoring:* The investment component is needed to design the system, to procure necessary equipment, and to arrange initial training, which the the government carries out itself. Cost for law compliance and annual monitoring costs for mitigation measures would be recurrent expenditure (annual financial flow). If the government decides to outsource monitoring, there will be no investment cost, and all the costs would be recurrent.

*Labour costs:* The costs of work input can be partly investment and partly recurrent. For example, the initial year plantation cost includes an element of labor input which is classified as investment cost. Annual labour costs in forest activities are related to e.g., forest guards, annual silvicultural operations, etc and will be financial costs/flows.

Training includes both investment and recurrent elements. Investment is related to basic training in the initial phase. Continuous refresher training can be considered recurrent costs if not specifically related to the project.

*Infrastructure:* Construction is an investment cost and maintenance is a recurrent cost.

*Machinery and equipment:* These costs are by definition investment costs. However, usually the services of construction of roads or buildings are procured from a contractor and therefore cost data is not necessarily broken down into components (labor, machinery and equipment, etc.). Depending on the scope of the contract, it can be either investment or recurrent cost.

*Miscellaneous:* These costs are mostly recurrent costs.

The columns in Table 7-8 are illustrative may be adjusted depending on the type of operation and national standards.

*>>> Compile historical O&M data, disaggregated by investment entity and source*

Historical O&M data are also needed to provide a historical basis from which to estimate future O&M costs for new physical assets, as well as to provide data for the first year of the scenarios. Annual O&M costs for assets purchased during the historical period, and for assets purchased prior to the historical period but that are still in operation, should be collected. The number of years for which historical O&M cost data are compiled should be the same as is done for historical I&FF data.

Similar as in the step above, we recommend establishing O&M per forest adaptation option, i.e. per ecosystem per year per category and after that disaggregate this information by investment entity and source.

The most significant O&M costs for the forest sector are likely to be establishment and, when planned, harvesting, including associated salaries. The O&M data that need to be collected may reside in one or more of the same locations as I&FF data (e.g., national accounts, ministry records and plans, industry records, statistical agencies, extension agencies, and research institutions). If such data are not available, countries should utilize one of the estimation approaches described in Chapter II. In-country experts may be particularly useful for supplying cost estimates.

*>>> Compile historical annual subsidy cost data, if subsidies are included in the assessment*

The explicit inclusion of subsidy costs in the I&FF assessment is optional because discriminating subsidy costs from other costs may not always be possible. However, if a country chooses to include subsidies explicitly, they should include them for both categories, investment and financial flows in the historical data set. Historical subsidy data will be helpful when estimating future subsidy costs, and will be needed for the first year of the scenarios.

In some countries national programs on subsidies for facilitating investments in the forest sector have been/are available. If that is the situation in your country the subsidies should be differentiated in the assessment.

*>>> Compile other input data for scenarios*

In addition to historical I&FF cost data, the characterization of the scenarios and estimation of annual costs for the scenarios will require the collection of other historical and present/current data relevant to the sector. What data are needed will depend on the analytical approach chosen and the sectoral scope, i.e. depending of the subsectors selected.

Ideally historical data should be on hand in the country. Such information is generally available through governmental agencies, e.g., ministries or departments specifically dealing with forests (e.g., Forest Departments), forest research centres, or Ministries of Territorial Planning, Agriculture, Environment, or national statistics office or special governmental agencies dealing

with development related statistics. Especially relevant here is the amount of ODA (multi- and bilateral) that has been invested in the sector.

However, country information about investments and financing flows in the forestry sector is often scattered and not centrally available. In such cases data from some generic database can eventually be used such as:

- FAO's Forest Economics and Policy Division maintains a series of publicly available databanks that provide information on forest finance including investment costs in forest management and trade of forest products (see <http://www.fao.org/statistics/> ).
- The databases can be founded under FAOSTAT: <http://faostat.fao.org/site/291/default.aspx>. The National Programme Facility includes country information on future plans in the forest sector (see <http://www.fao.org/forestry/nfp/en/>).

Information from research institutions can also be useful. CIFOR provides information on potential or real costs of different forestry options. As CIFOR has started a program on climate change and forest in 2007, former research activities were already focused on this subject, CIFOR provides good analytical data. See <http://www.cifor.cgiar.org/>. CATIE has built up a good knowledge basis ([http://www.catie.ac.cr/magazin\\_ENG.asp?CodIdioma=ENG](http://www.catie.ac.cr/magazin_ENG.asp?CodIdioma=ENG)), as well as the European Forestry Institute (<http://www.efi.int/portal/newsevents/pressreleases/?id=41>).

However, wherever available preference should be given to nationally accepted data.

### **Step #3: Define Baseline Scenario**

This step entails characterizing the forestry sector over the assessment period (e.g., 2005 – 2030), assuming business-as-usual conditions, i.e., it is a description of what is likely to occur in the sector in the absence of *new* policies to adapt to climate change, and given current sectoral plans. The baseline scenario should be consistent with trends reflected in the historical data collected in the previous step, unless sectoral or broader national plans dictate otherwise.



**Table 7-9: Possible subsectors for the Baseline scenario development**

Name of the forest ecosystems (subsectors)	Current management	Baseline scenario	
		Historical trend	Future scenario
Natural parks	Sustainable (production forest/protected area) management	Secured protected area or sustained yield management	To be determined according to the existing forest policy and other policies which regulate land use
Conservation areas	Unsustainable forest management in production and multi-use forests	Illegal use for logging, firewood gathering	
Other natural forest	Unsustainable forest management (continuously threatened by deforestation and/or under degradation)	Continuation of increase in degradation, tendency to land use	
Plantations	Extensively used	Production plantations	
Forest or non-forest	Forest plantations, grassing land, cropland, waste / abandoned land	Maintaining current use at the same productivity	

The Baseline scenario is linked to current national plans considering each sub-sector that have been developed in the absence of any climate change adaptation considerations and implies a “business-as-usual” approach to future I&FF. The major difficulty in quantifying the investments and financial flows for the baseline is the uncertainty of impacts due to future climate scenarios. When major changes are expected e.g., increments in extreme events, it is very difficult to calculate an accurate baseline for adaptation.

There is the possibility to identify possible major losses when/if extreme events happen over time. The closer the point in time in which such events would happen, the easier will be to calculate the financial loss. If such changes in climate variability are expected in your country the project team should at least flag the potential losses expected.

**Step #4: Estimate Annual IF, FF, and O&M Costs, and Subsidy Costs if included explicitly, for Baseline Scenario**

*>>> Estimate annual IF and FF for each investment type, disaggregated by investment entity and funding source*

In this step, annual IF and FF for the baseline scenario are estimated. Costs should be in real terms (i.e., inflation adjusted), ideally in constant 2005 US\$, should be reported in the year in which they are expected to be incurred, and should be discounted using both appropriate public and private discount rates. The annual IF and FF estimates for each investment type should be disaggregated by investment entity and funding source, and also be divided into investment flows and financial flows.

The output of this step will be a stream of annual investment flows and/or financial flows for each investment type for the entire assessment period, by investment entity and funding source. These data should be organized as outlined in chapter 2, Table 2-3, i.e., there would be a set of data for each year compiled in the format of Table 2-3.

For each chosen forest mitigation option, the analysis should identify the additional investment by source, e.g., along the following lines:

- **Domestic public financing**, including investments by national and local governments through transfer payments, soft loans, non-monetary incentives through e.g preferential resource policies, payments for forest-based services, such as fresh water conservation and direct investment;
- **International public funding** through bilateral ODA (grants by Overseas Development Assistance), multilateral ODA (including grants, investment lending, investment guarantees); multilateral targeted programs such as FCPF, UN-REDD, GEF, CDM and voluntary carbon market, etc; and
- **Private investment funding** (which include foreign direct investment by forest industries, FDI; investments by financial institutions and institutional investors, philanthropic funding and targeted funding through international conservation funds), etc. from 2005 up through 2030.

A country could choose to go into further details in respect to funding sources, but at a minimum, the three categories proposed above should be used.

When forestry plans do not provide enough information over the planning period, an analysis of forest product supply/demand relationships for the country can complete the information. This type of analysis is common in managed forest planning and involves comparing the projection of future demand for forest products with available annual timber yields, harvested sustainably. It is important to bear in mind that this information is useful only for some sub-sectors.

*>>> Estimate annual O&M cost for each IF, disaggregated by investment entity and funding source*

Annual estimates of O&M costs for the baseline scenario are also needed. These must include the O&M costs for assets purchased during the assessment period, and the O&M costs for assets purchased before the assessment period and that are expected to still be in operation. The annual O&M estimates for each investment type should be disaggregated by investment entity and funding source (as outlined in Table 2-4), and also be divided into O&M for assets purchased during the assessment period, and for assets purchased prior to the assessment period.

The output of this step will be a stream of annual O&M costs for each investment type that includes a new asset purchased during the assessment period, and streams of annual O&M

costs for assets purchased prior to the assessment period, disaggregated by investment entity and funding source.

As with I&FF data, O&M estimates may be from the output from a sectoral model, and/or might be obtained from a planning document or from several documents, and/or might be derived from the historical data. If a model is not used, information may be available from the investment entities, and/or relevant government ministries or statistical agencies, and/or research institutions.

*>>> Estimate annual subsidy costs for each investment type and for IF, FF, and O&M costs, if subsidies are included explicitly in the assessment*

If a country chooses to include subsidies explicitly in their assessment, annual subsidy costs for the baseline scenario need to be estimated. Subsidies should be estimated for each relevant investment type, and for all categories of cost (IF, FF), as in Table 2-5. Costs should be in real terms (i.e., inflation adjusted), ideally in constant 2005 US\$, should be reported in the year in which they are expected to be incurred, and should be discounted using appropriate public and private discount rates.

In some countries national programs on subsidies for facilitating investments in the forest sector have been/are available. If that is the situation in your country the subsidies should be differentiated in the assessment.

#### **Step #5: Define Forest Adaptation Scenario**

This step entails developing a description of what is likely to occur in the forest sector, over the assessment period, in the presence of new policies to adapt to climate change. The forest adaptation scenario should describe expected socioeconomic trends, technological change, relevant sectoral and national plans, the adaptation measures that will be implemented (including the nature, scale, and timing of each), and expected sectoral investments given implementation of the measures.

According to the forest adaptation options selected in your country a number of issues need to be addressed when quantifying an adaptation scenario. Table 7-10 illustrates a number of those specific issues that need particular attention in quantifying I&FF for forest adaptation options. Be aware of the fact that these I&FF can be very similar as for mitigation in the forest sector. If that is the case the project team shall avoid double accounting and flag mitigation and adaptation options are paid by one investment. Such synergy increases the cost-efficiency of the forestry activities for addressing climate change.

**Table 7-10: Activity needed to introduce a forest adaptation option**

Activity needed to introduce a forest adaptation option	Proposed scope of activities
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Finalization of international negotiations	<u>Preparing and analyzing national data</u> for different negotiation options, participation in the negotiation processes NAPAs and the Adaptation program of Work, providing inputs for the Adaptation Board
Development of enabling conditions	<u>Development of national plans</u> and agreements and specific projects within the forest sector and with other sectors affected by the implementation of forest adaptation options (e.g., agriculture) , analysis and development of data ; Consultation process (workshops and stakeholder facilitation.); Based on existing initiatives and relevant satellite monitoring and ground-truthing experiences being tested elsewhere.
Development and Establishment of a Monitoring and Verification System	
Markets and Financing, Negotiation and testing of Payment Distribution Mechanisms	<u>Development of equitable payment and distribution mechanisms</u> : Further exploration and negotiation financial mechanisms and links to financial mechanisms for the same activities on the side of mitigation. Pilot experiences
Spatial Forest Land Use Planning	A clear, integrated and secure spatial adaptation scenario is essential to model expected reduction in vulnerability
Clarifying rights, roles, liabilities and responsibilities for implementation of forest adaptation options and review forest law compliance mechanisms	Key issues for resolution include <u>clarification of land tenure and forest management rights</u> , governing revenue distribution and the respective roles of national and local government, civil society, the private sector and independent entities in payments for environmental services, regulation and fund management.
<i>Source</i> : Elaboration by the authors	

**Table 7-11: Issues to consider when quantifying I&FF for forest adaptation scenarios, with examples from the activities above**

Category of Investment Entity	Cumulative Discounted IF, FF, & O&M Estimates For Mitigation/Adaptation Scenario (million 2005US\$)														
	Investm. Type 1: Preparing and analyzing national data			Investm. Type 2: Development of national plans			Investm. Type 3: Development of equitable payment and distribution mechanisms			Investm. Type 4: clarification of land tenure and forest management rights			Investm. Type 5: ...		
	IF	FF	O&M Costs	IF	FF	O&M Costs	IF	FF	O&M Costs	IF	FF	O&M Costs	IF	FF	O&M Costs
Households															
Corporations															
Government															
Total															

If a model is being used in the analysis, it can be used to develop and define the climate change scenario. Otherwise, a sectoral plan, a projection of trends, or the current situation (assuming no change), or some combination, can be used as the basis of the projection. Prior work on climate change (e.g., National Communications, TNAs, NAPAs, GHG mitigation assessments, vulnerability assessments) should be utilized in this step.

Once these preliminary activities are done, the national team can proceed with defining the adaptation options in great detail.

**Table 7-12: Definition of the adaptation scenario**

Forest Management options		Name of the ecosystem	Adaptation scenario	
			Forestry option (some examples)	Categories to be considered for activities in the forest management plan for each forest adaptation option
<b>Management options for maintaining and providing forest ecosystem services</b>	Maintaining the Extent of forests			<ul style="list-style-type: none"> <li>• Clarification of land and carbon tenure</li> <li>• Defining the system</li> <li>• FLC and Monitoring</li> <li>• Labour</li> <li>• Training</li> <li>• Infrastructure</li> <li>• Machinery and equipment</li> <li>• Miscellaneous</li> </ul>
	Facilitating natural adaptation of biological diversity			
	Maintaining forest health			
<b>Management options for maintaining and providing provisioning services</b>	Maintaining the productivity of forest ecosystems			
	Maintaining the tangible socio-economic benefits			
<b>Management options for maintaining and providing regulating services</b>	Maintaining soil and water resources			
	Maintaining and enhancing forestry's contribution to global carbon cycles			
	Regulating human diseases and reducing disasters			
<b>Management options for maintaining and providing cultural services</b>	Maintaining cultural values and local knowledge			
	Maintaining aesthetic services (scenic beauty)			
	Maintaining spiritual services			
	Maintaining educational services			
	Maintaining recreational services			

<b>Forest Policy options</b>			
Including adaptation issues into international forest policy making and its related programs			
Including adaptation in forest into multilateral environmental funds (i.e. GEF, climate change funds)			
Including vulnerability and adaptation issues into national forestry plans			
Including vulnerability and adaptation issues into decentralization in the forest sector			
Promoting clarification of tenure, use and access right of forest ecosystem services related to vulnerability and adaptation			
Promoting inter-sectoral dialogue and dialogue among forest stakeholders			

\* Clarification of land and carbon tenure and access rights are relevant to all forestry options in the adaptation scenario and can imply major costs, depending of the specific circumstances in the country or in the region where a forestry option takes place

**Step #6: Estimate Annual IF, FF, O&M Costs, and Subsidy Costs if included**

In this step, annual IF and FF for the proposed forest adaptation scenario are estimated. The methodological steps are outlined in chapter 2, step 6. The more holistic inclusion of forest adaptation options will require a change in the way forest land and many forest stakeholders are managing the forest resources and compared to business-as-usual practice (baseline).

As an illustration, Table 7-13 presents, an analysis of issues and a preliminary estimation of the scale of investment which could effectively drive an initial five year phase of a long term (20 years) integrated forest adaptation program. Investment figures that are attributed in such an analysis represent scales of magnitude and need generally be based on professional experience and consensus.

Be aware of the fact that these I&FF can be very similar as for mitigation in the forest sector. If that is the case the project team shall avoid double accounting and flag mitigation and adaptation options are paid by one investment. Such synergy increases the cost-efficiency of the forestry activities for addressing climate change.



Illustrative example of potential components of an initial 5-Year Phase (e.g., 2010 – 2014) of a forest adaptation investment program and associated financial flows:

**Table 7-13: Activity needed to achieve standards**

Activity needed to achieve standards	Focus might include
<b>Implementation of strategies for more effective conservation and management of Forest Protected Areas</b>	<ul style="list-style-type: none"> <li>• <u>Review of national conservation plan</u></li> <li>• Completion of gazettal</li> <li>• Investment in training and professional capacity</li> <li>• Development of effective management of protected areas.</li> <li>• Development of collaborative management arrangements and ecosystem restoration</li> <li>• Implementation of demonstration projects (Plantations, conservation projects, etc)</li> </ul>
<b>Implementation of strategies for more effective management of Production Forests</b>	<ul style="list-style-type: none"> <li>• <u>FLEG related initiatives to contain illegal logging (FLEG: Forest Law Enforcement and Governance Programm)</u></li> <li>• Voluntary codes by private sector companies</li> <li>• Outcome based third-party certification</li> <li>• Investment in Reduced Impact Logging</li> </ul>
<b>Revised strategies for forest harvesting and management to supply the timber requirements of the country</b>	
<b>Strategies for forest restoration</b>	<ul style="list-style-type: none"> <li>• <u>Decentralization of forest management</u></li> <li>• Silviculture (natural regeneration, enrichment planting)</li> <li>• Ecological restoration</li> <li>• Investment in Reduced Impact Logging</li> </ul>
<b>Revised Strategies for increasing plantations systems with an adaptation potential (e.g., upstream watershed protection and combating soil degradation plantation with natural species)</b>	<ul style="list-style-type: none"> <li>• <u>Inventory of all useable land</u></li> <li>• Research climate resilient species</li> <li>• Planted forests (timber and NTFP)</li> <li>• Watershed/desertification greening</li> <li>• Improving investment conditions for specify plantation systems</li> </ul>
<b>Enhancement of the capacity of community groups, including adat communities to take control of forest management.</b>	<ul style="list-style-type: none"> <li>• The main objectives would be to improve quality of life of low income families, living in or adjacent to natural forests, to protect the rights of forest dependent indigenous peoples, reducing encroachment, forest degradation by subsistence activities and reducing forest fire.</li> </ul>
<b>Total for initial 5-years program</b>	

**Table 7-14: Issues to consider when quantifying I&FF for forest adaptation scenarios, with examples from activities above**

Category of Investment Entity	Cumulative Discounted IF, FF, & O&M Estimates For Mitigation/Adaptation Scenario (million 2005US\$)														
	Investm. Type 1: Review of national conservation plan			Investm. Type 2: FLEG related initiatives to contain illegal logging			Investm. Type 3: Decentralization of forest management			Investm. Type 4: Inventory of all useable land			Investm. Type 5: ...		
	IF	FF	O&M Costs	IF	FF	O&M Costs	IF	FF	O&M Costs	IF	FF	O&M Costs	IF	FF	O&M Costs
Households															
Corporations															
Government															
Total															

**Step #7: Calculate the Changes in IF, FF, and O&M Costs, and in Subsidy Costs needed to Implement Adaptation**

The changes in IF, FF, and O&M costs that are needed to implement the adaptation measures in the forest sector are calculated according to the general methodology as outlined in Step 7 in Chapter 2 of this Guidelines. The changes in investments and financial flows are obtained by simply subtracting baseline scenario costs from climate change scenario costs. There are two primary objectives of this step: 1) to determine how *cumulative* IF, FF, and O&M costs would change; and 2) to determine how *annual* IF, FF, and O&M costs would change. Five separate sets of calculations should be completed – two for estimating changes in cumulative IF, FF, and O&M, and three for estimating changes in annual IF, FF, and O&M. In addition, if subsidy costs are included explicitly in the assessment, the changes in subsidy costs may be calculated. The accompanying volume on reporting (*Reporting Guidelines for the Assessment of Investment and Financial Flows to Address Climate Change*) contains worksheets that can be used as models for developing country-specific worksheets for performing these calculations.

This step requires the subtraction of the Baseline Scenario from the Adaptation Scenario. Please refer to the General Methodology (chapter 2) for further information on the quantification of incremental I&FF associated with proceeding along an adaptation development path.

**Step #8: Evaluate Policy Implications**

The purpose of this step is to evaluate the policy implications of the results of changes in investments and financial flows which are due to the implementation of the adaptation measures in the forestry sector. It is recommended that at this stage, countries first re-evaluate their initial prioritization of the forest mitigation adaptation that was undertaken in steps 2 and 5, based upon the incremental cost estimates that have been derived in step 7. It is not recommended that cost be the most important criterion for prioritizing climate change measures, but instead that incremental costs be added to the set of evaluation criteria that a country is using to evaluate and prioritize climate change measures. The forestry sector is very particular in this respect, as all forest-based adaptation options have the potential of co-benefits, including mitigation of climate change. Thus, the entire benefit package will go beyond the estimated costs of mitigation in the forest sector.

The incremental I&FF results from step 7, in conjunction with the possible re-prioritization of forest-based climate change measures, should be used to determine which investment entities are responsible for the most significant changes in I&FF, and the predominant sources of their funds. Then, the policy measures that might be used to induce those entities to implement the proposed measures and change their investment patterns, and the additional sources of funds that might be utilized to meet new investment needs, need to be evaluated. It will be particularly important to distinguish between public and private sources of finance, as well as between domestic and foreign sources. Policy measures include a variety of instruments, including regulations, incentives, and education. New sources of funds include both domestic

options, e.g., taxes, and foreign options, e.g., ODA, carbon fund(s) or markets for environmental services.

Forestry sector policies are likely to be needed to induce the relevant entities identified in the assessment to implement the proposed measures and incur the related I&FF. It will be important to convene a discussion among all relevant stakeholders in the forestry sector, including e.g., government entities (forestry, agriculture, environment, water), private sector, environmental and social NGOs, and communities regarding the set of regulations or incentives necessary to influence investment decisions. When addressing the policy options, social, economic and environmental benefits should be assessed qualitatively.

When considering the entire package of forest adaptation options, a key feature that must underpin any investment of the magnitude proposed is partnership. Partnership has to happen at national level to introduce and implement the wider set of forest-based adaptation and mitigation options and among multilateral and bilateral donors to ensure that the sources of funding most appropriately fit the projects which they support and promoting existing synergies. Partnership and collaboration needs to be established particularly among national regulatory agencies. It will also need to engage representatives of local communities, conservation agencies, leading forest industrial and agro-business, as well as forest industrial associations.

The main risks of investment failure are political constraints to implementation of the essential forest land tenure and other policy reforms needed to engage local communities, difficulties of controlling the negative impacts of unregulated activities in the forest sector and difficulties in curtailing the influence of pressure to forests, due either by commercial interests for land conversion or pressure by the poorer segment of the countries population for food and shelter.