



# National Communications Support Programme Global Environment Facility

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*The NCSP is co-sponsored by the GEF, EU, Norway, Denmark, and Finland*

## **AN ADAPTATION POLICY FRAMEWORK: Capacity Building for Stage II Adaptation**

**A UNDP-GEF PROJECT**

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**FIRST ORDER DRAFT FOR REVIEW ONLY: NOT FOR CITATION OR QUOTATION**

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## **PREFACE**

This Adaptation Policy Framework (APF) is designed for non-Annex I Parties developing and implementing Stage II Adaptation under the United Nations Framework Convention on Climate Change (UNFCCC). Its development was initiated through the workshops of the National Communications Support Programme (NCSP) in response to a growing need for a more effective effort to advance strategies for adaptation to climate change. The APF is considered as work-in-progress in its application to policy development.

- It is intended as a flexible framework, to be modified and applied by countries carrying out their assessments. What is done, and how it is done, depend to a great extent on the socio-economic systems and traditions of particular countries. No one size fits all.
- It emphasises a ‘learning by doing’ approach, in which researchers, stakeholders, financial donors, national experts from government ministries and the private sector will work together towards the common goal of effective adaptation strategies. As such, the framework is closely aligned with the goal of sustainable development.

Several approaches will be used to prepare adaptation strategies. It is hoped that a series of research studies will be carried out using the APF as a basic guidance document, which will in turn provide feedback on its effectiveness. In parallel, complementary activities, such as workshops and training, and the further development of tools and methods are planned, subject to availability of funds. The UNDP-GEF is seeking co-operation with other agencies and donors for this project.

The framework is being circulated for review only, and it is expected that further consultations will improve the document prior to its publication in December 2001.

**Experts who are interested in developing this framework should provide comments to [Bo.Lim@undp.org](mailto:Bo.Lim@undp.org).**

## ACKNOWLEDGEMENTS

The initial discussions that led to the development of this APF were first held by the participants at the NCSP Thematic Workshop on Vulnerability and Adaptation Assessment for the Central American Region (Mexico City, Mexico, 8-10 September 1999). Subsequently, further ideas were generated at a series of regional NCSP workshops, including the following:

- *Vulnerability and Adaptation workshops:*
  - 26-28 January 2000, Chisinau, Moldova
  - 7-9 March 2000, Amman, Jordan
  - 10-12 May 2000, Jakarta, Indonesia
  - 13-24 March 2000, Port of Spain, Trinidad and Tobago
  - 30-31 May 2000, Yaounde, Cameroon
  - 6-7 July 2000, Nairobi, Kenya
  - 22-24 August 2000, Santiago, Chile
  
- *Regional exchange workshops:*
  - 25-26 April 2000, Saly Portudal, Senegal
  - 24-26 May 2000, Panama City, Panama
  - 26-27 July 2000, Apia, Samoa
  - 14 August 2000, Nairobi, Kenya
  - 26-29 September 2000, Kuala Lumpur, Malaysia
  - 10-12 October 2000, Yerevan, Armenia
  - 6-8 November, 2000, Cairo, Egypt
  - 12-14 December 2000, Asunción, Paraguay
  
- Preliminary versions of the framework have also been discussed at the following international meetings:
  - 28 September 2000, Seminar at the Potsdam Institute fur Klimafolgenforschung (PIK), Germany.
  - 5-7 October 2000, START Workshop, Washington DC, USA.
  - 26-28 October 2000, Workshop on National Assessments for Climate Change Impacts and Adaptation, Environment Canada, Mont-Gabriel, Sainte-Adèle, Quebec, Canada.
  
- A Zero Order Draft (dated 20 September 2000) was reviewed at some of these workshops, and by a number of independent international experts including:

Elaine Barrow, Tom Downing, Sam Fankhauser, Saleemul Huq, Roger Jones, Robert Kates, Richard Klein, Maria Lourdes, Richard Moss, Rosa Perez, Joel Smith, Barry Smit, Roger Street, and others.
  
- This First Order Draft (May 2001) is being distributed for global review, including review at the back-to-back UNFCCC Workshop on Methodologies on Climate Change Impact and Adaptation and the UNDP-GEF NCSP Workshop on an Adaptation Policy Framework (St Adele, Canada, 10-14 June 2001).

Brian Challenger, Martin Krause, Chris Mitchell, Rebecca Carman, and Henk Bosch have made comments on this draft. Their comments will be incorporated in the next revision. Additional contributions will be specified and acknowledged as appropriate.

## **I. THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE**

### **1. Introduction**

The goal of this framework is to help narrow a wide range of policy options and measures into site-specific policies and priorities for particular climate risks. Since the potential effects of climate change are pervasive, adaptation can include a wide range of responses and policies in all economic sectors and all regions.

This framework is intended to integrate short-, medium- and long-term threats into national economic development planning, as well as the relevant current policies and measures. What is being suggested is a more integrated approach, or a ‘win-win’ strategy, in which coping with present climate variability is seen as an effective way to reduce longer-term vulnerability to climate change. The weight given to short- versus longer-term responses will vary according to the situation.

### **2. A New Generation of Studies on Adaptation**

A new generation of international activities is planned on adaptation to climate change in the context of non-Annex I National Communications under the United Nations Framework Convention on Climate Change (UNFCCC). In order to facilitate these activities, a common framework is required. It identifies sources of research methods and tools, in collaboration with the UNFCCC Subsidiary Body of Science and Technology Advice (SBSTA) and the Science and Technological Advisory Panel (STAP) of the Global Environment Facility (GEF).

In its present form, this framework is a first-order draft for review and discussion. While discussions are under way, the identification and development of methods and research instruments will proceed simultaneously. Existing methods will be employed in some cases, while in other cases directions to sources will be provided. If new or improved methods are required, these will be developed as appropriate.

### **3. The Climate Convention Context**

#### **Box 1: Initial Guidance from the Conference of the Parties on Adaptation (Decision 11/CP.1)**

Stage I: “Planning, which includes studies of possible impacts of climate change to identify particularly vulnerable countries or regions, and policy options for adaptation and appropriate capacity building”.

Stage II: “Measures, including further capacity building which may be taken to prepare for adaptation as envisaged in Article 4.1(e)”.

Stage III: “Measures to facilitate adequate adaptation, including insurance and other adaptation measures as envisaged by Articles 4.1(b) and 4.4”.

Many countries have now carried out some studies under Stage I Adaptation (Box 1). However, it is recognised that more work is needed to progress to the next step and to prepare for Stage II Adaptation (Box 1), towards which this framework is specifically directed. Over the longer term, this framework is critical for preparing the ground for detailed analysis in Stage III Adaptation (Box 1) and for possible projects. Thorough preparation for Stage III Adaptation will be required if countries are to identify priority measures that will stand up to scrutiny for potential funding by the donor community.

It might be argued that the three stages of adaptation are not yet defined by the Convention. However, for the purposes of this framework, more detailed definitions are not needed. Unless more specific guidance is available, it may be more helpful for

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Parties to view adaptation as a process along which progress can be made in three stages. Another way of describing the process of moving from Stage I to II Adaptation is prioritisation of policy options.

Given this context, this framework is designed to meet the special needs of each country by serving three main purposes:

- to provide results for potential incorporation into Second National Communications
- to create adaptive capacity to prepare national plans for incorporating the risks of climate change into management and development activities, and
- to identify priority measures for adaptation to climate change.

## II. BUILDING ON PRIOR METHODOLOGY FOR IMPACTS AND ADAPTATION

### 1. The IPCC Technical Guidelines

This APF builds upon previous methodologies. These include the IPCC Technical Guidelines (IPCC, 1994, Parry and Carter, 1998), the US Country Study Program Guidelines (1996), and the UNEP Country Studies Handbook (UNEP, 1998). Research teams are advised to familiarise themselves with these guidelines and handbooks before designing their own studies on the basis of this framework. They contain descriptions of many useful tools and methods, and references to the literature, especially in the areas of climate change impacts studies. It is not the purpose of the APF to duplicate this work but to build upon it.

All the above publications share a common ‘scenario-driven’ approach, referred to here as the *standard approach* for assessing climate impacts (Box 2). This approach is derived from the IPCC Guidelines and has been extremely successful in providing guidance for research on climate change impacts. As practical requirements now demand a stronger focus on adaptation in a policy context, there is need to extend the standard approach into the adaptation policy arena.

### 2. The Standard Approach for Assessing Climate Impacts

The essential feature of the IPCC approach is the selection of climate change scenarios (Box 2, Step 4). The thinking behind the IPCC’s seven steps is logical; it proceeds from scenarios to impacts, and the autonomous responses that may take place as ecosystems and socio-economic systems experience the impacts. Publicly planned anticipatory adaptation is addressed in the final step of the assessment.

**Box 2: The Seven Steps of the IPCC Technical Guidelines for Assessing Climate Change Impacts and Adaptations**

1. Define problem (including the study area, its sectors etc.)
2. Select method of assessment most appropriate to the problems
3. Test method/conduct sensitivity analysis
4. Select and apply climate change scenarios
5. Assess biophysical and socio-economic impacts
6. Assess autonomous adjustments
7. Evaluate adaptation strategies

*IPCC, 1994*

Several issues have emerged from carrying out the first generation of country studies or ‘enabling activities’ for vulnerability and adaptation. A common experience is that much time and funding was given to climate scenarios and impact studies. Invariably, insufficient time was left to develop fully the adaptation component of the study. This has been widely reported in the NCSP workshops and is reflected in the impacts literature (Burton, 2000). This is only a partial explanation. It is not simply a matter of project time and financial resources. The reasons why the model and scenario-based approaches have not always yielded useful results for the purposes of adaptation are more fundamental.

First, by the time the analysis reaches Steps 6 and 7, researchers are faced with a battery of results that show the potential impacts of future climate conditions upon economy and society. Often climate change scenarios are imposed upon socio-economic systems as they presently exist. Sometimes consideration is given to the future state of society. However, there are wide confidence limits on the climate scenarios themselves, and it is recognised that the uncertainties about future socio-economic conditions are even greater. Since the scenarios are only plausible futures without any assigned probabilities and over very long timeframes (greater than 50 years), their use for policy formulation is limited to

considering measures for longer-term climate change. Such results are less likely to capture the interest of policymakers, since most developing countries are concerned with more pressing issues such as economic growth, productivity and sustainable development; poverty alleviation and equity; public health; energy supply, efficiency and security; and other urgent issues. Longer-term climate change does not present itself as an immediate threat.

Nevertheless long-term changes have to be taken into account, especially when major long-term investments are being made. The APF provides for the consideration of both short- and longer-term measures. What is required is an approach which leads to good short-term decisions that will also help in the reduction of longer-term vulnerability. The reconciliation of short- and longer-term objectives is a crucial issue to be addressed in project design.

Second, climate model projections have two important constraints. Adaptation measures are often site-specific, whereas the best climate scenarios provide information on a large spatial scale for the globe and large regions. Global circulation model (GCM) scenarios are not sufficiently precise at the spatial scale for local impacts assessment. Downscaling can be applied to projections, which can increase their precision in space but not necessarily their accuracy (Hulme *et al.*, 2000). While regional climate models are being improved all the time, they are still limited by the inherent constraints of the GCM from which they are derived. Furthermore, adaptation is driven more by variability and extremes of climate than by averages. Climate scenarios can only specify average conditions for a few variables. Generally, these are not the variables that are important for adaptation. Also small changes in average conditions can result in large changes in extreme events (Figure 6). Given these constraints, adaptation assessment would benefit from a new analytical framework as proposed here.

Third, impacts assessment alone are not designed to consider a wide range of adaptation measures. For example, crop yield studies can be useful for studying farm level adaptations, such as the effect of fertiliser on productivity but they do not help in considering other adaptations, such as changing land tenure systems, or price subsidies and other market interventions. Nor do they take into consideration possible future socio-economic changes such as changes in agricultural markets and patterns of trade. The APF sets up an approach in which projects can be designed from the outset to evaluate adaptations in a wider context.

However, the APF cannot remedy the above difficulties directly. Instead, the framework emphasises different areas of the assessment by making research for adaptation policy the main focus.

### **3. A New Direction for Assessing Adaptation**

This section summarises both the general principles and the specific initiatives of the APF.

This framework is underpinned by four *general principles*. It:

- pays greater attention to recent climate experience, impacts and adaptation as part of the development of a baseline for adaptation analysis
- ensures adaptation to climate variability and extreme events are explicitly included as a step towards reducing vulnerability to longer-term climate change
- adopts a stronger focus on vulnerability in the present as well as the future in order to ground future policy in present-day experience

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- includes specific consideration of current development policies and proposed future activities and investments, paying particular attention to those activities that may tend to increase vulnerability to climate change or which are maladaptive.

In effect, this requires:

- applying alternative ways of characterising future climates in order to capture climate and weather variables more relevant to adaptation decisions
- applying an analytical framework to socio-economic scenarios to help strengthen the ability to assess vulnerability and the capacity to adapt
- integrating adaptation strategies and measures with natural hazard reduction and disaster prevention programmes, and other relevant programmes
- taking other atmospheric, environment and natural resource issues into account.

A number of *specific initiatives* to be carried out for implementing the APF include:

- collecting and reporting data related to past adaptation and adaptation capacity
- determining the vulnerabilities of greatest and most pressing concern
- determining where adaptation has been and can be most effective
- strengthening economic analysis
- establishing priorities for adaptation
- developing national strategies for adaptation, and integrating them into national economic and sustainable development planning
- building capacity for adaptation
- supporting outreach, extension, and educational programmes on adaptation
- ensuring stakeholder and public participation
- addressing regional and transboundary issues in adaptation.

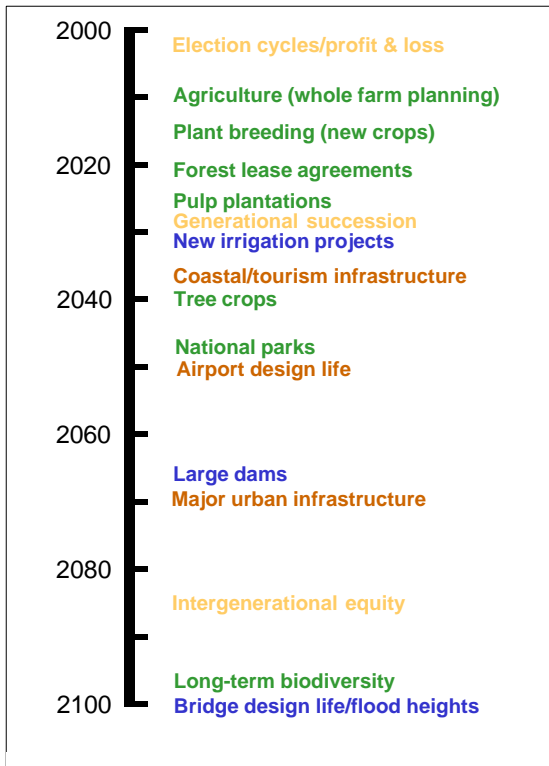
There are two essential innovations to this framework. First, it begins with the recent record in climate variability and extremes, and then assesses recent experience in vulnerability and adaptation. The assessment is therefore firmly grounded in the present situation and the context of current policy. It is development-driven rather than scenario-driven. Second, the framework allows the adoption of a ‘learning-by-doing’ approach. This means that adaptation is treated as an on-going process. A process approach is essential given that it is not known how best to adapt or what exactly to adapt to. What is sought is not once-and-for-all answers but some steps in the right direction that will improve current adaptation and will allow for corrections later.

The above description is a shorthand way of distinguishing between the APF and the IPCC Technical Guidelines, and other approaches. The standard approach is driven by climate model and scenario, with an orientation towards the longer-term impacts (2050-2100). By contrast, the APF is development-driven and looks primarily to near (five years) and medium-term adaptations (decades) as a means of integrating short- and longer-term perspectives: it is based on the present. The standard approach is primarily motivated to improve scientific understanding of future climate. The framework is above all an empirical approach, taking into account societal behaviour and stakeholder information; its motive is to provide inputs to adaptation policy. The standard approach is directed more towards studies on climate change impacts, although both approaches can lead to the same goal and depend highly upon the planning horizon of a particular adaptation (Figure 1). Where adaptations of structures with long physical and economic lifetimes (such as bridges, roads and dams) are being made, consideration of climate change is required during the design phase of the infrastructure. This is because the projects will be in place and functioning long into the future, when the climate will have had more time to

change. Other adaptations, such as agricultural practices, are inherently more flexible response measures as adjustments can be made on an on-going basis to changes in climate. The planning horizon of a measure is therefore an important consideration for adaptation.

### Figure 1: Planning Horizons for Adaptation Measures

[Comment: Does this diagram show that there are arguments for both short and longer-term needs?]



Source: Roger Jones

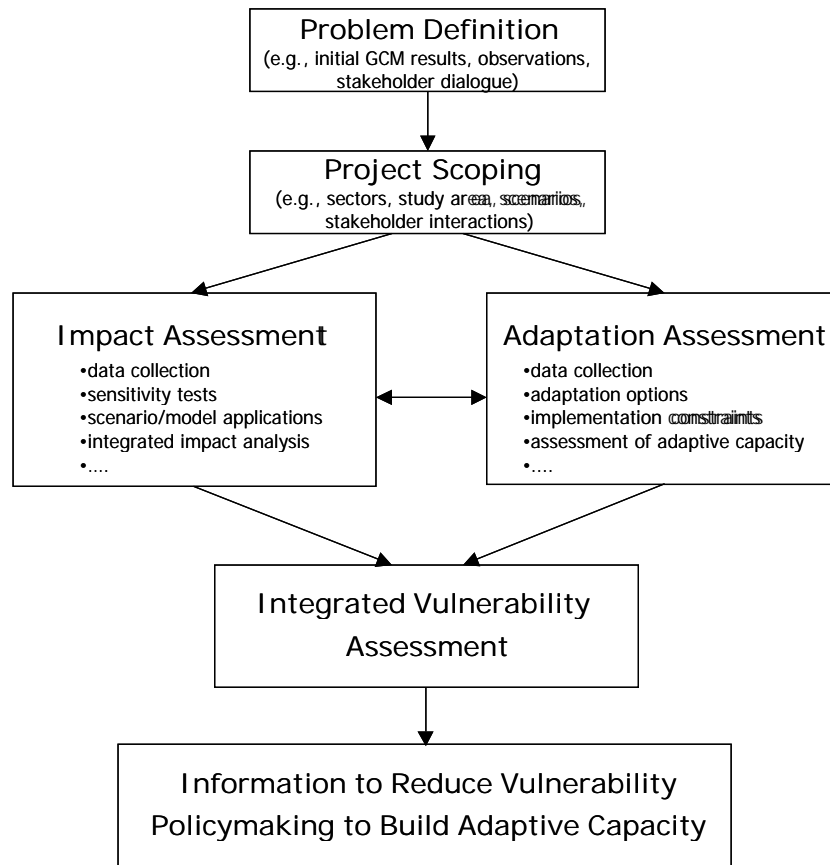
Figure 2 shows how the standard approach and the APF complement each other. Together they provide more methodological choices for countries to assess vulnerability and adaptation to climate change. The left-hand side shows the standard approach, while the right-hand side shows the APF approach. The application of the APF can help countries accelerate towards the goal of developing, evaluating and implementing effective adaptation policies and measures. In moving from Stage I to Stage II Adaptation, countries are recommended first to carry out an assessment of their current status (See Section VIII).

It can be argued that the present is not necessarily a good guide to future risks since some potential impacts may come as surprises and have no equivalent in recent experience. This is a valid concern, but one which can be addressed. First, by analysing adaptive capacity, it is possible to ask how countries have been able to adapt to surprises in the past. Coping with surprises is a capacity that can be learned and strengthened. To some extent this information may emerge from studies of recent experience with climate variability and extremes. Comparisons can also be made with other (non-climate) surprises. Second,

surprises are always likely to occur and it makes little sense to develop future adaptation responses without a good understanding of where adaptation is employed at present, and how effective it has been. Baseline adaptation knowledge is essential to future adaptation policy development.

The key point is not to struggle to reduce uncertainty but to recognise that it will remain, and to find effective ways of managing under uncertainty.

**Figure 2: Complementary Approaches for Impacts and Adaptation Assessment**



Source: GEF/UNEP proposal on Assessments of Impacts of and Adaptation to Climate Change in Multiple Regions and Sectors in Co-ordination with the IPCC

### **III. UNDERSTANDING ADAPTATION AS A DEVELOPMENT PROCESS**

#### **1. What is Adaptation Policy?**

An adaptation policy is a strategy for adapting to climate change in all sectors and regions of a country. Like an environment policy it stands on its own but incorporates adaptation into all relevant areas of government policy. At the national level an adaptation policy provides the context and guidance for specific adaptation measures. Usually a policy is not neutral with respect to the choice of measures but guides project analysts towards particular sorts or combinations of measures. Each country will wish to approach the creation of an adaptation policy or policies in accordance with its own practices and traditions. Countries may integrate adaptation into their various policies, as well as set up the institutional arrangements for co-ordinating these policies at the national level. However, no one size fits all.

The following suggestions illustrate some of the possibilities.

***Hazards Policies.*** Adaptation policy may be developed with respect to specific climate risks. It may include a flood management policy, a drought policy, a coastal zone management policy, and so on. In countries exposed to such hazards, a policy may already be in place. In these cases the policy may need to be re-evaluated and revised to take climate change into account. In some cases, there may be no plans or policies in place. Many countries, for example, have not found it necessary to have an explicit policy for coastal zone management. With the threat of rising sea levels, the need for such a policy may become more urgent.

***Sectoral Policies.*** Adaptation policies may be developed with respect to specific sectors such as agriculture, water resources, tourism, forests, biodiversity, health, and so forth. In most countries there will be policies in place for these sectors, especially where the sector is important to the national economy. In these cases, it may be sufficient to revise existing policies in order to take climate change risks into account.

***Regional Policies.*** Some countries have development policies for specific regions, such as an integrated rural development policy or an industrial and transport development policy. Where this is so the policies may need to be reassessed to ensure that climate change is taken properly into account.

***Economic and Social Policies.*** National governments have various policy levers that can be used to guide or regulate the pattern of the economy. These include taxation, incentives, and an array of rules and regulations. These can be deployed in order to promote adaptation.

***Physical Planning.*** In addition to the broader-scale social and economic policy instruments, governments can also set rules for the location, design and construction of infrastructure and buildings, including housing. Physical planning is often carried out at the local or municipal level within guidelines set by national governments and can be a potent instrument for the promotion of adaptation.

***Integrated National Adaptation Strategies.*** Regional and sectoral adaptation policies may be more effective if integrated at the national level. However, the feasibility of this approach will depend on the particular circumstances of the country. Many countries may find it better to leave most of the work on adaptation to the relevant sectoral or regional agencies of government which are hazards-based, not all necessarily at ministerial level, and to co-ordinate work through the creation of an interagency process or interagency body. Many countries carry out environmental impact assessments on all major projects. A comparable strategy would be to assess climate vulnerability for all relevant projects above a certain level of cost (Burton and Van Aalst, 1999). No single approach is recommended.

The institutional arrangements for such a climate vulnerability assessment would be part of or similar to those that exist for environment policy. Many countries have established ministries or departments of government which are responsible for the environment. Since there is an environmental dimension to most policy domains, these environment ministries or departments have to work closely with other ministries. Such co-operation is not always practicable. In some countries, therefore, ministries are charged with an environmental responsibility but an inter-ministerial or inter-agency committee manages the co-ordination. The approach adopted will vary from country to country. However, as non-Annex I Parties are committed to the preparation of national communications, it seems logical to create some national capacity that can be used to bring together adaptation activities in different policy areas. This role might fall under the responsibility of the climate change unit of the country, where this exists, which would:

- provide communication and co-ordination for climate change policy
- serve as a vehicle for the promotion of adaptation policies and measures
- help ensure that climate change and vulnerability to climate events is taken into consideration in major investments
- integrate climate change into public education and public awareness
- play a role as a country focal point in the international processes related to adaptation, including priority setting
- secure financial and technical assistance.

## **2. Adaptation to What?**

The UNFCCC recognises the need for adaptation to climate change, and specifies that assistance will be made available to “the developing country Parties that are particularly vulnerable to the adverse effects of climate change in meeting the costs of adaptation to these adverse effects” (Article 4.4 of the UNFCCC). This statement has led to much discussion. One difficulty in its application is that it is not possible on a scientific basis to separate the costs of adaptation to climate change from the costs of adaptation to climate variability.

Successive IPCC reports, as well as the debates in the ongoing negotiations, have served to broaden the concept of adaptation and to argue that adaptation to climate change cannot be separated from other social and economic development policies. The intent of the APF, therefore, is to help develop adaptation policies and measures that are effective both with and without climate change. ‘Win-win’ options yield benefits even if climate change is slow, and yield even greater benefits in the event of more rapid climate change.

The challenge of adaptation to climate change is to define it in an operational way, while ensuring that adaptation policies and measures adopted are consistent with the goals of sustainable development. The practicable answer to the question of “adaptation to what?” is to focus upon those policies and measures that can be used to reduce vulnerability to future climate.

## **3. What are the Objectives of Adaptation?**

The choice of the analytical framework depends upon the objectives of the study. It is important, therefore, to clarify the purposes of adaptation policies and measures in a national context. Each country may wish to specify these purposes in its own distinctive way, according to its own circumstances, priorities and values. It may be useful to consider the three ‘golden rules’ which are discussed below accordingly. The weight given to each rule varies from country to country. When all analysis is completed, it should be possible to apply the ‘golden rules’ to evaluate the adaptation policies and measures proposed.

**[Comment: These “rules” form part of the selection criteria for projects as well as giving guidance to overall adaptation policy. Questions. Is a technical annex required on selection criteria? If so what should it contain? How much detail is required? Should the Annex include information on indices such as human development and vulnerability indicators?**

***Rule 1. Adaptation must be economically efficient.*** Adaptation choice should be designed to contribute as much as possible to the objectives of national economic welfare. This is important because for many developing countries the increase of national wealth is a pressing need. A crucial test for adaptation actions is, therefore, the extent to which they will contribute to the growth of the national economy and protect it from further damage. A common method of analysis is cost-benefit analysis, which can be used, especially on a project-by-project basis, to help ensure that investments in adaptation projects or programmes give a good economic/social return. In cost-benefit analysis, those projects with a higher economic/social return are generally considered to be more desirable. The fundamental measure in this case is money (GDP) and commonly efforts are made to reduce as many of the development values as possible to monetary terms. However, since there are many values which are not easily represented in monetary terms, forcing them into an economic analysis may have a distorting effect. This applies especially to social and environmental values.

**[Question. Is guidance required on benefit-cost analysis and non-monetary assessments? Should such guidelines be based on or consistent with the methods used by Investment Banks? Is a technical report on adaptation costing required?**

***Rule 2: Adaptation must help to advance social goals.*** Adaptation choices should be designed in such a way as to promote the social objectives which have been agreed upon through the policy process. Dominant among these is often the issue of equity. Societies in which people have a voice through the democratic process, including a free press, radio and television, almost invariably adopt the idea that the national wealth should be allocated in a reasonably fair manner, without excessive accumulation of wealth in one group or class of people. Social values also extend to many issues. These include the protection of minorities or disadvantaged groups (such as women, children, the elderly, the handicapped, indigenous groups and other social minorities), poorer regions of the country, and so forth. Various methods of analysis can be used, frequently including the use of social indicators to measure relative degrees of disadvantage, inequity, and vulnerability.

***Rule 3: Adaptation must be environmentally sustainable.*** Adaptation choices should be designed in such a way as to be compatible with long-term environmental protection. Environmental impact analysis is the method commonly used to help ensure that improvements in one direction do not cause other kinds of environmental damage which may undermine the stated objectives of a project or programme.

Some international organisations have tried to promote development models that are not based purely on economic measures. For example, the UNDP regularly publishes a Human Development Index which has a range of indicators for development (UNDP, 1999). A UNDP Vulnerability Index is also in preparation. These may be useful tools if adapted for use at the national level, but no provision is made for such work in this APF.

#### **4. What are Adaptation Baselines?**

All societies are to some extent adapted to their current climate and its variability. The present level of adaptation is called the adaptation baseline. No specific year has been agreed as a baseline year for comparative international purposes so, for now at least, each country may select its own baseline year. The objective of an adaptation baseline is to improve adaptation over time and thus reduce vulnerability to climate change and variability. How adaptation may improve (or deteriorate) in the future can be described in an adaptation scenario. In principle, an adaptation scenario is a component of a socio-economic scenario. Where no specific

policy interventions are made, the level of adaptation will still change. This is a 'business as usual' scenario. The application of the APF should lead to adaptation policies, strategies and measures which will improve the level of adaptation. In theory, projections of adaptation levels from the baseline may be made but this has not yet been done and the methodology has yet to be developed. Countries wishing to help develop this methodology might wish to include it in their project plans.

Adaptation baselines are more readily developed on a sectoral basis or on a hazard basis. For example, an adaptation baseline for droughts would consist of an inventory of drought adaptation policies and measures now in use, and a measure of the extent of their use within a given population at risk. If farms in Area A have adopted supplemental irrigation as a drought standby measure then they would have a higher or better adaptation baseline than farmers in Area B where there is little or no supplemental irrigation in place, or where only a small minority of farmers use it. Similarly, the extent to which roads and bridges have been designed to take present climate variability into account represents a higher or lower adaptation baseline.

Measurement of the baseline is difficult in quantitative terms, but one surrogate measure is residual loss after adaptation. Where drought or flood or other climate risks result in high losses this may be taken as indicative of a low level of adaptation. In some instances increasing losses from climate and weather events have been recorded. This may suggest a decline in the adaptation level. Adaptation can both improve or deteriorate over time. The adaptation baseline for a particular sector is a snapshot of the level of adaptation at a particular moment in time.

Adaptation levels may be expected to change in the future in two ways. First, if no changes in policy or behaviour are made, the adaptation will continue on a 'business as usual' trajectory. However, if specific policy interventions are made, or if people change their behaviour on the basis of climate information, then there will be a difference between the 'business as usual' adaptation scenario and the policy-dependant scenario.

Adaptation baselines and scenarios are useful conceptual tools that can be a guide to thinking about adaptation policies and measures but they may be difficult to put into operation, especially in quantitative terms, and therefore the expenditure of time and effort may not be a worthwhile use of funds at the country level.

## IV. DEVELOPING A FRAMEWORK FOR ADAPTATION POLICY

### 1. Present and Future Vulnerability

A central feature of the APF is the division of adaptation studies into present and future vulnerability. This distinction is made because adaptation to reduce future vulnerability depends upon knowing where present vulnerabilities lie and the effectiveness of current adaptation policies and measures, especially in dealing with variability and extremes. In developing a work plan, project managers may find it convenient to divide the project into two phases corresponding to present and future vulnerability. This distinction is shown in Figure 3.

**The Concept of Vulnerability.** There are many dimensions to vulnerability, which is a complex concept. Simply stated, we may say that vulnerability to climate and climate change is a function of impacts minus adaptation. Thus:

$$V = I - A$$

where V = vulnerability  
I = impacts  
A = adaptation

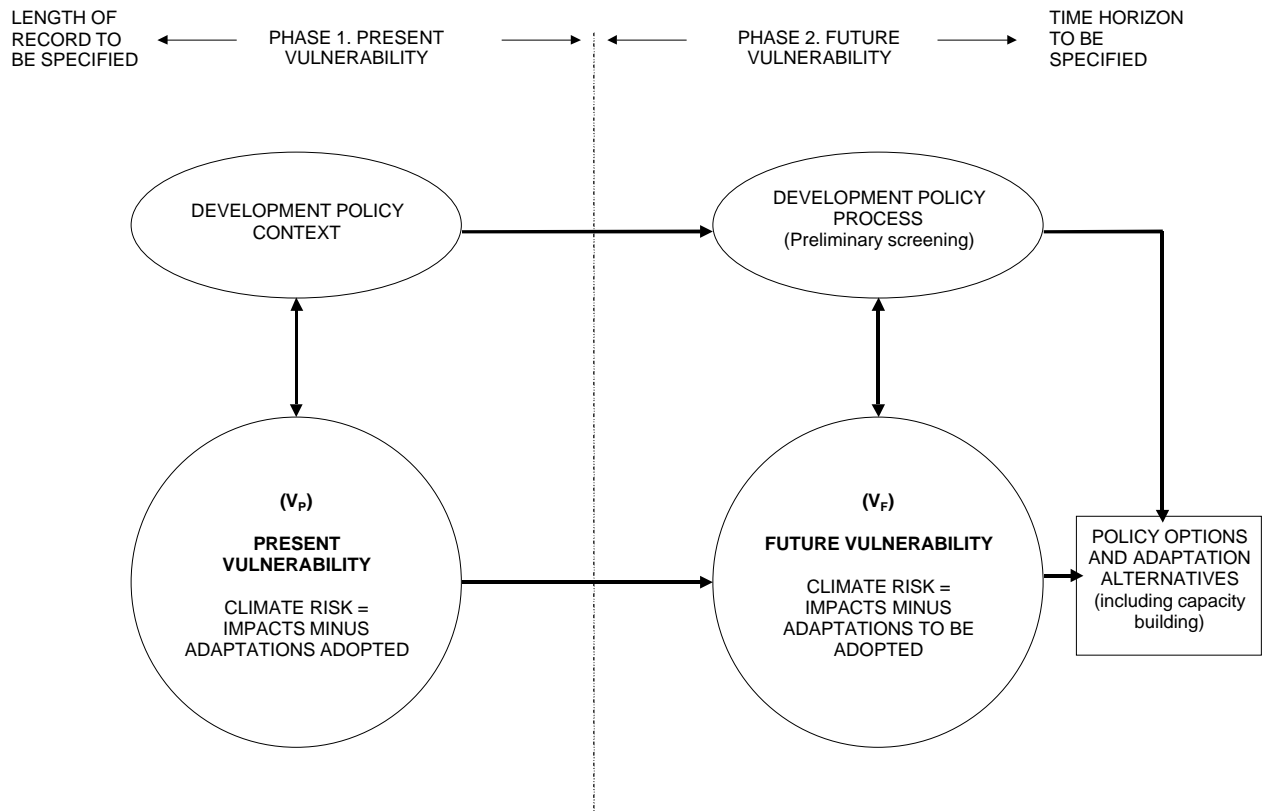
Impacts themselves are a function of both the climate system and the exposure of socio-economic and natural environmental systems to that system. Impacts may, therefore, be increased either by a change in the frequency of climate events or by an increase in exposure. As a result of population growth and economic development, there are likely to be more people and property exposed to adverse climate changes and, hence, greater losses.

The amount of exposure is largely a result of historical processes that increase exposure, and hence vulnerability. These include:

- growth of human settlements in flood plains or on steep and unstable slopes
- expansion of agriculture into areas of uncertain rainfall
- occupation and use of low lying coastal lands
- movement of farming down from higher mosquito-free zones to lower mosquito-infested zones.

**Adaptation is not static.** Adaptation is an ongoing process which takes place with or without policy interventions. Understanding this process requires the specification of the timeframes involved. Adaptation baseline needs to take account of the past record of climate variability and the adaptation to it. The length of record to be examined will depend upon the availability of data and information. Formal records of floods or extreme precipitation events may be quite limited in some cases and will have to be supplemented by other sources of information and analysis. Since adaptation choices are partly a function of the nature of the economy, the level of income, and available technology, it may not be too helpful to go back very far into the past; a decade or two will be enough in most cases.

**Figure 3: Changing Vulnerability**



**Adapting to future climate.** The choice of future adaptations is most relevant in the near term, that is five to ten years. The further away in time, the greater the uncertainty, and the less relevant to today’s decision-making. While both present baseline adaptation and future adaptation have longer-term implications, attention to the recent past (the last decade) and the near future (the next decade) is likely to be most policy relevant. While the science of climate change deals in timeframes of decades or centuries, the timescale for many adaptations is between months and years and decades. Some adaptation measures such as forecasting, warnings and emergency relief, rehabilitation and reconstruction can be very short term. Tropical cyclone and flood warnings typically range from a few days to a few hours. Where major engineering works are contemplated, such as coastal defences, flood control dams or irrigation schemes, analysis has to extend over the economic and physical life of the structures, typically several decades or longer.

Each study team will have to determine the time horizons to be considered. If the analysis is strictly limited to the near term, certain longer-term strategies may be overlooked. For example, when setting aside land for conservation of endangered species or ecosystems, or creating migration corridors, consideration should not only be given to where the species or ecosystems are located at present but also where they may be in the longer-term future as a result of climate change.

Nonetheless, it is not necessary to draw a sharp boundary between past, present and future. The key issue is to consider each policy option and compare this to the planning horizon or lifetime of the measure or project to be implemented (Figure 1). Many infrastructure choices made in the past, such as dams and harbours, have taken known climate factors into account at the time of their design. Such structures often have a long physical lifetime and can be expected to remain in place for decades or longer. They may not, however, be well adapted

to future climate changes, even if they have served well under past and current climate conditions. Adaptation policy is therefore not just a matter of making decisions about new adaptations but also involves effective adaptation for both the present and the future. Future vulnerability to climate change depends not only on present and future decisions, but also on the legacy of past decisions. A boundary is shown in Figure 3 between present and future vulnerability, but this should be treated with some flexibility.

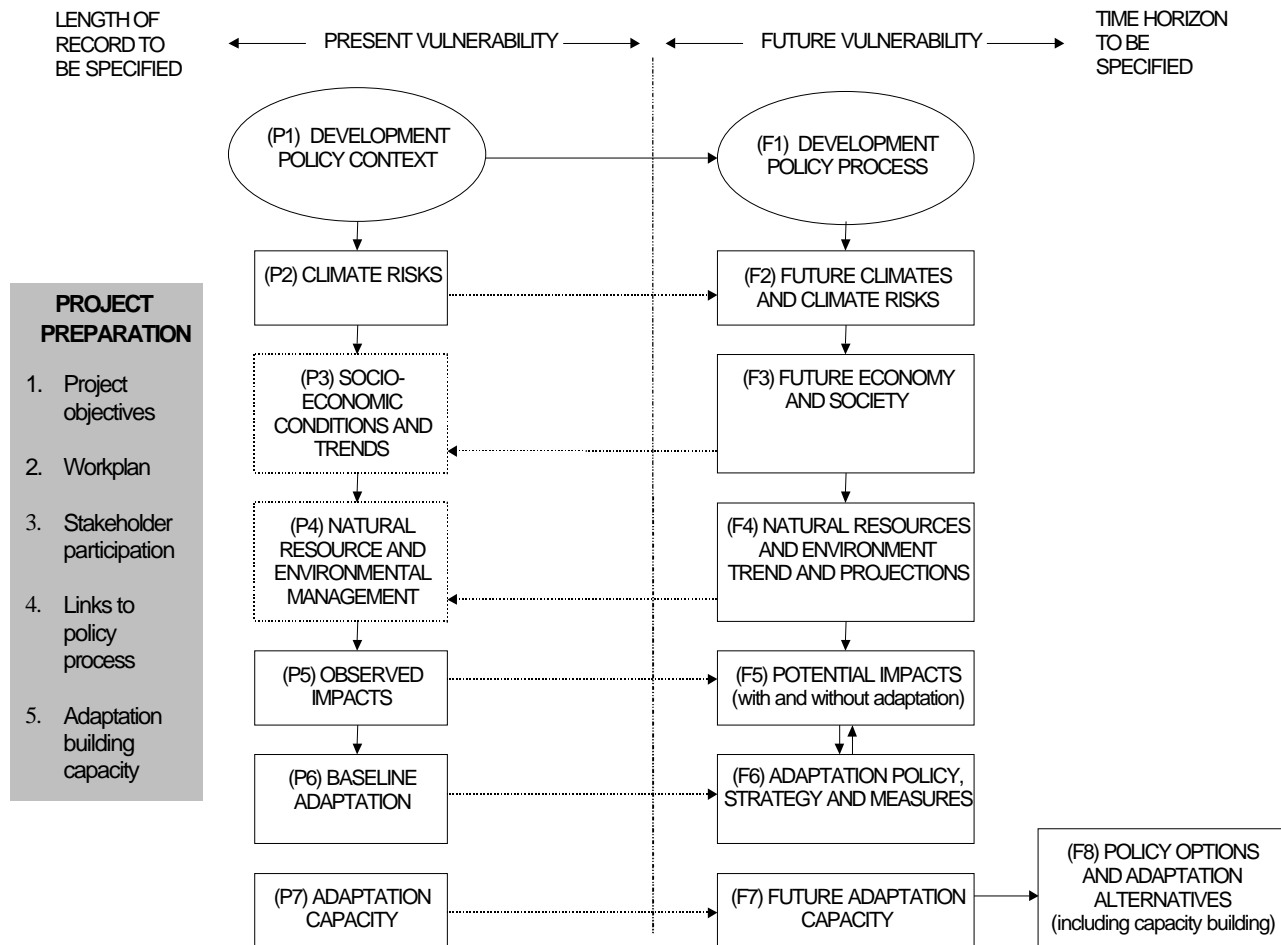
## **2. The Development Policy Context**

Figure 3 draws attention to the policy context of the vulnerability assessments. Present-day vulnerability can be partially explained by adaptation policy choices made in the past. For example, droughts can result in food shortages and migrations away from the drought-stricken land, and heavy damages can occur in coastal zones when storm surges occur. The fact that people occupy such areas and build human settlements in such locations is a result of past decisions, either planned or unplanned. Commonly, such decisions result from many different social and economic forces at the local, national and global levels. These forces include economic incentives, poor or unenforced regulations, market imperfections, and many others. It is therefore important for policymakers to carry out the studies with key persons from the community.

## **3. Adaptation Policy Framework**

The structure of the framework is shown in Figure 4. Each of the elements (P1-P7 and F1-F7) constitutes a study component in its own right. The purpose of each study is to characterise current vulnerability and to carry this characterisation forwards into the future. Each of the component studies under Present Vulnerability is therefore linked to a counterpart study under Future Vulnerability. This feed forward of present vulnerability information into future studies has implications for overall project design. Figure 4 is intended to show a sequential work plan and to ease project implementation. Present and future vulnerability are more accurately seen as continuing, circular, and iterative studies. They are discussed in Sections V and VI respectively, which emphasise the role of those involved at all stages.

**Figure 4: The Components of Vulnerability**



**Comment: Project preparation in this diagram is not consistent with the structure of Section VIII. This will be reconciled later.**

## V. ASSESSING PRESENT VULNERABILITY: PHASE I

### 1. Development Policy Context

The components of the APF are shown in Figures 4 and 5. Figure 4 may be more useful for project planning and management purposes. Figure 5 shows that the process is continuous and involves stakeholders at all stages.

**Component P1.** The development policy context is established at the start of the study, in particular as it relates to vulnerability of climate variability and extremes. This involves an examination of current policies and an inquiry into how climate risks have been taken into account (Burton and Van Aalst, 1999).

A key question is how different development paths can affect vulnerability to climate change (Box 3). Adaptation is not limited to measures such as building design or land-use planning. It can also include the resetting of development priorities through a consultative process, taking climate change into account. This parallels the development of National Environment Action Plans (NEAPs) and the Poverty Reduction and Growth Strategy consultations being undertaken by the International Monetary Fund and the World Bank. Country study teams might wish to consider what the national experience has been with these planning exercises and what lessons are relevant to a climate change adaptation strategy.

**[Comment: The UNDP, the Bank and others will be invited to review this section.]**

#### **Box 3: Development and Water Supply in Egypt**

Water shortage is a problem which is likely to result from climate change in a number of countries. Egypt is an example of a country which ‘ran out of water’ more than 25 years ago. All the Nile waters were already allocated and no new water was available for the growth of economically productive activities. Since then, Egypt’s development has included a considerable expansion of industrial production which was made possible by the reallocation of water from less water-intensive agricultural uses. Today Egypt imports a substantial amount of wheat, which is a way of importing water, water that is embedded in the production of wheat. Of course, Egypt could have made other choices. If self-sufficiency in food production was the priority goal, then wheat production could have been maintained, albeit at some cost to the economy. Where a country anticipates reduced water availability due to climate change, and where present development already presses on available supplies or is close to (or over) the limits of sustainability, one adaptation to climate change may be to move away from water-intensive types of production to other activities where the water requirements are lower per unit of production by value.

### 2. Climate Risks

**Component P2.** This component deals with present climate risk, especially in relation to recent climate experience. Climate experience includes the range of human experience in dealing with weather and its changes in a locality. Since communities are, almost by definition, adapted to their climates in their normal or benign states (otherwise they could hardly survive), here we focus on the ways in which climate is a source of damage. Hence, we are focusing on extreme climate events and variability.

However, adaptation is required for all weather conditions, including less-than-extreme variability. When the mean value of a climate variable changes, the variability and frequency of extremes also vary. This relationship is illustrated in Figure 6. Adaptation should, therefore, take into account changes in all significant levels of variability and not just the most extreme values.

Figure 5: Assessments of Present Vulnerability (V<sub>P</sub>)

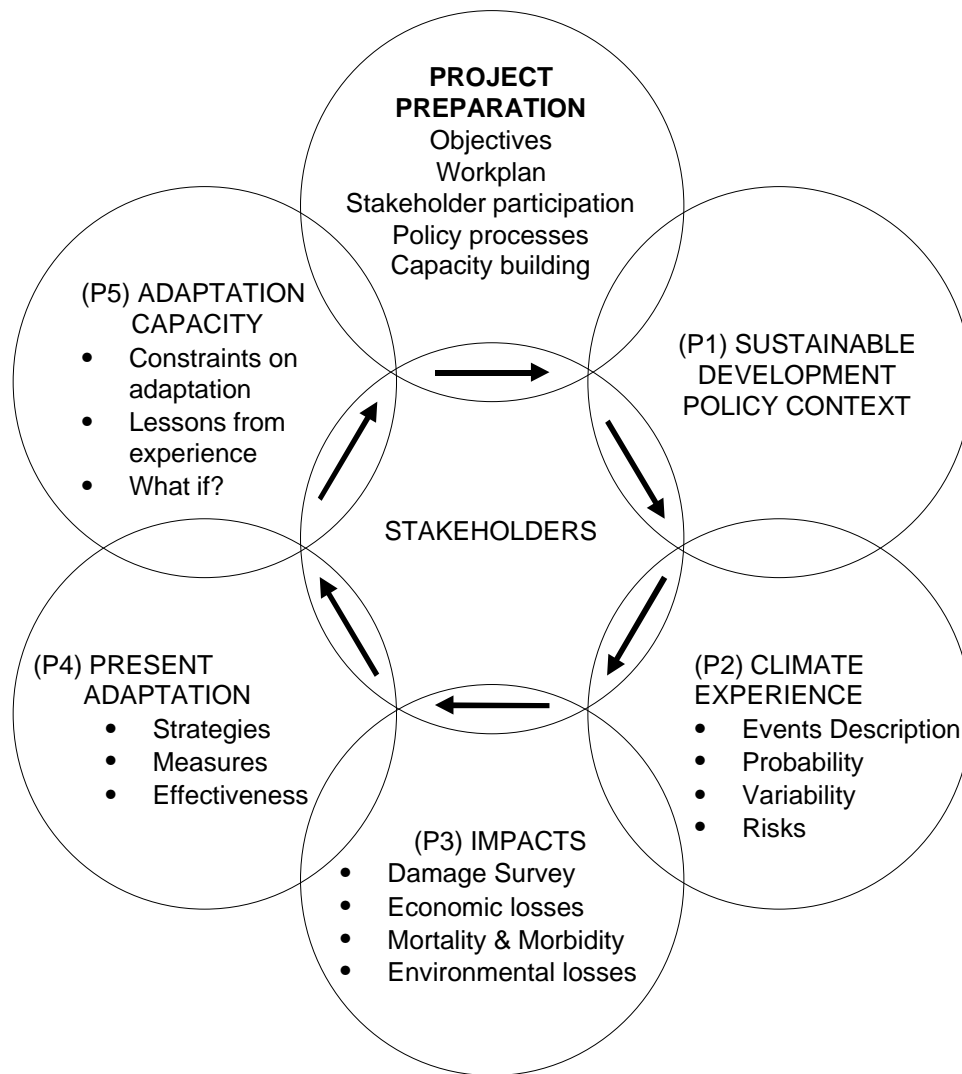
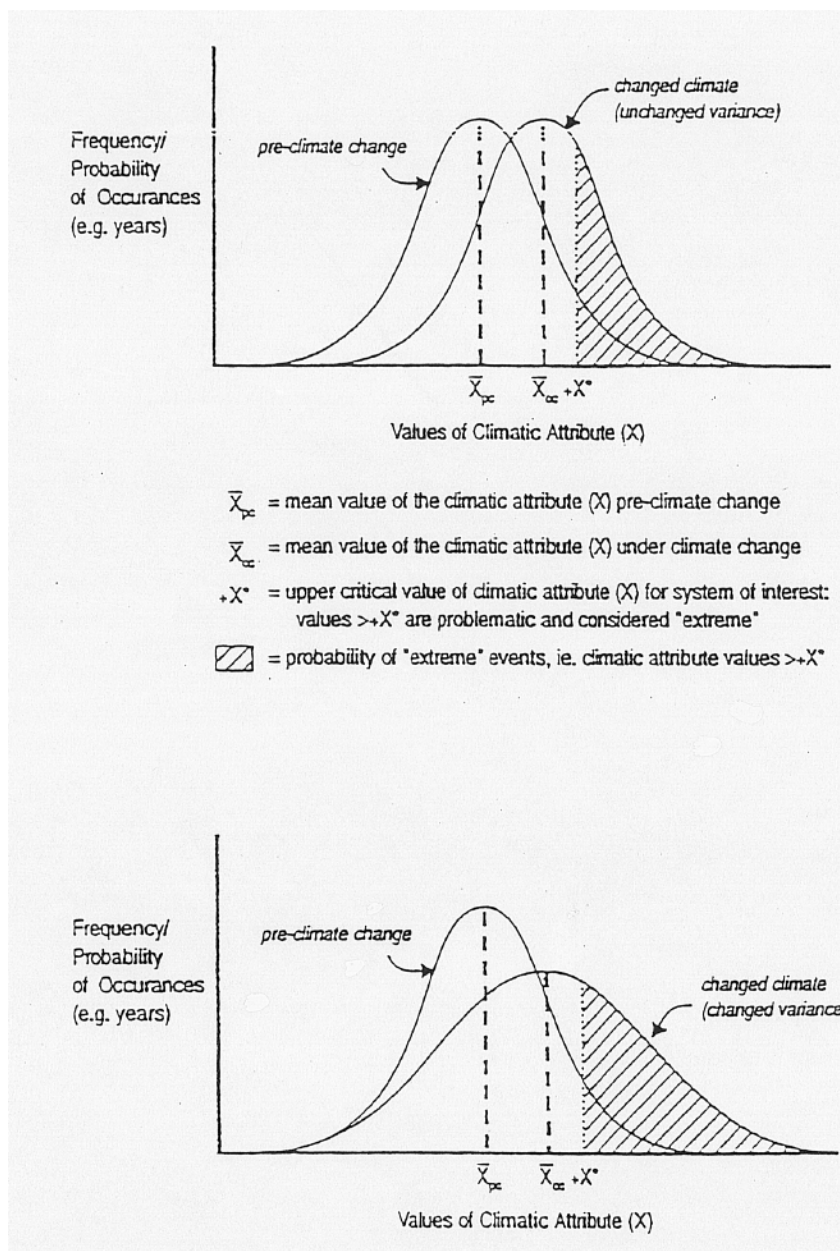


Figure 6: Climate Change, Variability and Extreme Events



**[Comment: The coping range, which is dynamic, needs to be thoroughly expanded so this becomes a core component of this framework i.e. to strengthen adaptive capacity, and to develop the concept of adaptation thresholds as a practical tool for identifying the potential for the adoption of adaptation.]**

Human societies are adapted to variable weather events within some coping range, as illustrated in Figure 7. This diagram introduces the concept of the “coping range”, which is defined by the upper and lower bounds of a fluctuating climate variable. The precise operational definition of the upper and lower bounds of the coping range depends upon the circumstances of each case and the amount of risk those exposed are willing or obliged to accept. The threshold may, for example, be defined as the point at which any damage begins. This would be a very strict (or risk-averse) definition of the limit. Alternatively, the bound may be set at the point at which damage exceeds some acceptable or tolerable level. Several criteria can be used to define this threshold level, such as the nature of the damage, how many and which people are at risk, and so forth.

With climate change, the fluctuations in the climate variable(s) may increase in magnitude and frequency so that the coping range is exceeded more often. The purpose of adaptation is to expand the coping range. Where adaptation policies and measures can expand the coping range, this is equivalent to reducing vulnerability. Conversely certain policies, or the lack of specific adaptation measures, can narrow the coping range and increase vulnerability.

The difficulty of measuring the impacts of the smaller events means that more attention is generally given to the major extreme events (Box 4) because adaptation is easier to measure in such cases. However, smaller and more frequent events can, in aggregate, inflict more losses than the rare extreme event. This is a phenomenon known as ‘death by a thousand cuts’. It can be argued that adaptations to the more visible extreme events will also serve to reduce vulnerability to the more frequent and less extreme risks of climate change.

**Box 4: Examples of Extreme Climatic Events**

*Primary climatic events*

- floods
- droughts
- tropical cyclones (hurricanes, typhoons)
- abnormally long or intense hot spells, or periods of low rainfall
- coastal storms and storm surges
- windstorms
- and others

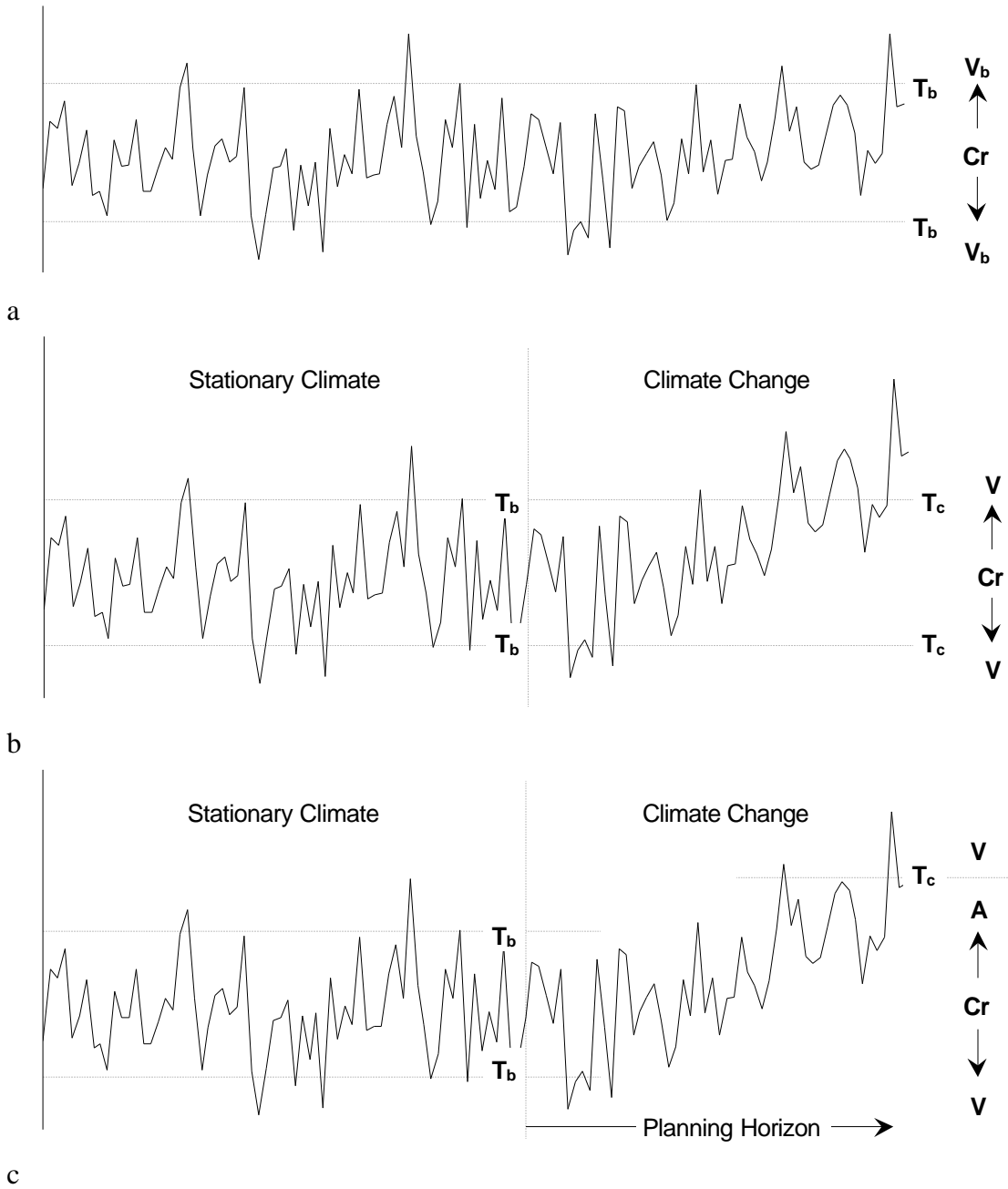
*Secondary events that may be climate-driven*

- disease outbreaks or epidemics
- chronic disease patterns and incidence
- water deficits, urban water shortages
- crop failures, lack of water for livestock
- landslides, mudflows
- and others

The record of variability and extremes can be examined for as long a time period as records and memory allow. Examples of specific variability and events might include:

- a drought or series of droughts which reduced crop yield and/or caused cattle to die or be slaughtered, with resulting shortages of food, and water shortages for domestic, commercial or industrial use, including power generation. Less severe events, such as small but frequent moisture deficits, can have a chronic effect on crop yields
- a tropical cyclone or series of cyclones which caused flooding associated with high winds that destroyed coastal property, eroded beaches, damaged coral reefs, and destroyed boats. Slowly increasing tide levels that are associated with an incremental rise in sea level can slowly erode coastlines even without severe storms

Figure 7: Climatic Variability and Coping Range



Schematic diagrams showing relationship between (a) the coping range ( $Cr$ ) and baseline thresholds ( $T_b$ ) and vulnerability ( $V_b$ ) under a stationary climate, (b) how climate change can lead to an increase in exceedance of a current threshold, and (c) how adaptation ( $A$ ) can establish new critical thresholds ( $T_c$ ), reducing vulnerability ( $V$ ) to climate change.

- a climate-related pest or disease vector outbreak or redistribution which resulted in crop losses, human health effects and, perhaps, increases in morbidity and mortality. Pest and disease losses are endemic in many places where crops are grown, stored and transported
- A river flood or series of floods which destroyed or damaged property and other infrastructure (such as houses, roads, bridges, schools, hospitals, and communications facilities), and forced evacuation of the population.

While such events are commonly described in terms of standard weather and climate parameters, they also need to be described in terms of damage and adaptation parameters. For each of these events, information is required on magnitude, physical extent, timing and duration, and estimated frequency. The specification of such parameters depends upon an understanding of impacts and the adaptation measures employed, and the coping range of the system or components of the system. Such parameters can include local phenomena and variables not captured in many climate scenarios, such as the:

- speed of the flood waters
- orientation of the coastline to the direction of the path of a cyclone
- probability or return period of the events of a given magnitude
- confidence limits around such estimates.

The objective of this component is to be in a position to characterise climate risks with as much precision as the data, information and analysis allow.

### **3. Socio-economic Conditions and Trends**

**Component P3.** In addition to the climate itself, vulnerability depends upon the social and economic characteristics of the places affected. To some considerable degree, these characteristics explain the adaptive capacity of a society. This capacity is known to depend heavily upon the availability of financial resources, skilled human resources and access to technology, and the development of appropriate institutions and organisational capacity. Where this capacity is present, the potential for adaptation is greater. These factors, however, do not entirely account for adaptive capacity. The relationship between wealth, human resources, technology, and vulnerability, is not a simple one. Some less developed countries have been able to adapt to changes more effectively than more developed ones.

In this component, the current socio-economic conditions are assessed in order to understand present adaptive capacity and its constraints. How the socio-economic system may change in the future is very important for future adaptation and adaptation capacity. One of the reasons for studying present socio-economic conditions and trends, therefore, is to be able to establish relationships between socio-economic conditions and adaptive capacity, both now and in the future.

### **4. Natural Resources and Environmental Management**

**Component P4.** A study component on natural resource and environmental management is also included in Phase I of the study because of the close links between climate adaptation policy, natural resources and environmental management. As the study proceeds, it is important that policy options for adaptation to climate change be consistent with other resource policies and that they be mutually reinforcing wherever possible. This study component is therefore linked to future natural resource and environment developments (Figure 4).

## 5. Observed Impacts

**Component P5.** This component deals with observed impacts. For each event, or series of events, a damage survey is needed. Damage surveys commonly include damage in the following categories:

- *Direct losses.* Economic losses may be divided into direct and indirect losses. Damage to houses, commercial and industrial buildings and their contents, public infrastructure (roads, bridges, harbours, coastal defences, irrigation systems, communications facilities, etc.) are examples of direct losses, which may be surveyed and/or estimated in monetary terms
- *Indirect losses.* These include disruption and loss of business
- *Life and health.* Mortality and morbidity, kinds and distribution of injuries and disease, psychological impacts such as post-traumatic shock syndrome
- *Intangible losses.* Environmental damage such as habitat loss, loss of wildlife, erosion, deforestation, desertification, and so on. In conventional economic analysis these are often described as intangible because of the difficulties in estimating their value in monetary terms.

## 6. Types of Adaptation

**Component P6.** This component describes the baseline adaptation, or adaptation policies and measures now in use. For each event, the adaptation measures that are/were in place should be identified and assessed in a preliminary way. For this purpose, a field survey and interviews with key people are required to establish what adaptation measures were or were not in place. The frequency of use of adaptation measures should also be noted.

Examples of such practices are the stocking of emergency reserves and the elevation or setback of buildings. For many adaptation measures (planting a different crop, delaying planting, adding supplemental irrigation, diversifying crops, using better tillage practices, adding more fertiliser, etc.), we can measure the frequency with which these practices are adopted. If we suppose that the effects of dry conditions (droughts) can be reduced by some combination of these methods, but that only 10% of the farmers adopt them, then we will know that adaptation can be improved by a higher rate of adoption. By interviewing the farmers, we can identify the obstacles to the adoption of adaptation measures. Once the obstacles are identified, then the task of adaptation capacity building can be tackled precisely.

For example, adaptation measures to droughts can include the storing of sufficient seed to replant a crop at a later date should the initial planting fail. A field survey (or interviews) could establish whether this practice is followed and by what proportion of the farmers. In the same field survey respondents can be asked about their ideas for adaptation, what measures they consider to be effective, and what obstacles prevent adoption.

**[Comment: Should we include an Annex on how to do this? It could be prepared, with a protocol of suggested questions, etc.]**

For the survey, based on IPCC Third Assessment Report (Chapter 18, IPCC, 2001), we recommend five classifications of adaptation measures be used:

<b>Classification</b>	<b>Examples</b>
Bear the costs	Accept the costs because it is the most effective choice or because there is no other choice
Share the losses	Use insurance or government relief, or community or family sharing
Prevent or modify the events or the impacts	Change the actual physical events themselves (e.g. flood control; irrigation projects) or change human use activities (e.g. regulate flood plain land use; use drought-tolerant crops)
Change the use of natural resources and relocate socio-economic systems	Use flood plains for recreation, parking areas or wildlife instead of agriculture or housing; avoid expanding agriculture into unsustainable moisture-deficit regions
Research and/or restore	Study adaptation alternatives, identify new alternatives, remedy past mistakes

For example, building a dam or protecting the watershed are actions that reduce the downstream flood peaks and in this sense they change the actual flood event as it is experienced by people and property in the flood plain. Some floods can be prevented. High frequency, low discharge flood can be completely prevented by dams. But dams do not prevent rare and large floods, they only modify them. Regardless of the prevention or modification of flood other actions can be taken to reduce losses by modifying impacts. Building a house on stilts, putting a dyke or a levee around the village, moving electronic equipment out of the basement into the bedroom are all types of measures which modify or prevent impacts but not the event. The reason for this distinction is that the actions are taken at different levels by different authorities. Usually government agencies are involved in modifying the events (because of higher costs and required collective action) and individuals, households and communities can prevent or modify the impacts.

*1. Bear the costs*

One type of adaptation is to do nothing, except bear the losses and accept the costs. For this adaptation, it is often helpful to have a baseline of losses so that changes can be measured for any given sector, region, or people most at risk. Criteria for baselines can be economic, social and environmental. However, complete inaction is rare because people are likely to take some actions to reduce their exposure to risk, even if this is only a last-minute emergency response.

*2. Share the losses*

Losses need not be accepted whenever and wherever they fall. At the simplest level, losses can be shared among family members but they can also be spread over a larger community and over time within extended families, by whole communities, and by states and national governments. Loss-sharing can take the form of relief and rehabilitation in cash or in kind. Assistance of this kind can come from anywhere, including the international community.

A more formal method of loss-sharing is through insurance. This can be available from the local to global level, according to need and capacity. Private insurance companies generally protect themselves from sudden large claims through reinsurance. Other ways in which losses are shared over time is by the use of loans and

accumulated surpluses. Families, communities, private sector organisations and governments can draw upon reserves or borrow against future income in order to cover immediate losses and reduce future vulnerability.

Loss-sharing arrangements can be reviewed to identify the potential for improvement. These arrangements may be in decline as traditional social structures, such as extended families and communities, themselves change. In some places, private weather insurance is no longer common, either because insurance companies have withdrawn the service or because premiums have increased beyond the financial reach of those most at risk. In these circumstances, policy innovations could help to rectify the situation.

### *3. Prevent or modify the events or their impacts.*

In the case of some climate hazards it may be possible to control or modify the natural processes themselves. The height of flood waters can be controlled by the construction of dams, or the extent of flood water can be contained by the construction of dykes (levees or polders). Floods can also be reduced by the protection and reforestation of upstream watersheds which slow the rate of runoff and reduce downstream flood crests. Similarly a drought can be modified by the provision of irrigation water. In some places cloud seeding has been used to induce rainfall which would not otherwise have occurred.

Many climate hazards are too powerful or too widespread to allow for any kind of human intervention. Experiments have been conducted on tropical cyclones or hurricanes with cloud seeding to try to control or deflect their paths away from populated regions, but without much success. In the case of hazards associated with climate change, another type of event control or modification is the long-term reduction of greenhouse gas emissions, otherwise known as mitigation.

Regardless of whether climate change is successfully mitigated, it should be possible to prevent or reduce damage by improved impact management. For example, steps can be taken to reduce the impact of drought on agriculture by using more drought-resistant varieties, by planting a different mix of cultivars, by changing or delaying the time of planting, or by adaptive measures such as supplemental irrigation. Where sustainable development is adversely affected, or where ecosystems have insufficient time to adapt naturally, human intervention can lessen the impacts. This is an important kind of adaptation.

The study can explore ways in which existing adaptation measures can be strengthened. Preventive adaptation can include modification of the impact of weather-related hazards through flood control, drought mitigation, and so forth. It can also be applied to the consequences of weather changes in such areas as disease control, water conservation and the like. Where existing measures are inadequate, new measures can be identified and developed.

In this component, a survey of the specific measures that are already in place can be carried out, according to the nature of the climate risk under consideration. For example:

- agricultural practices can be changed to reduce vulnerability by rescheduling planting and harvest dates, or through the use of more drought-resistant varieties
- building and infrastructure designs can be improved and standards raised to reduce damage by wind or water
- forecasting and warning systems can be improved to allow more time for rescheduling or emergency measures to be taken.

As comprehensive adaptation policies are developed, it is likely that prevention or modification of the effects of climate change will form a substantial part of the whole strategy. The effectiveness of these actions tends to depend upon the participation of the population, especially in those communities that are most at risk.

#### *4. Change the use of natural resources and relocate socio-economic systems.*

A more extreme kind of adaptation is a change in the use of natural resources and relocation of socio-economic systems. At a macro level, this adaptation means a shift from more climate-sensitive activities, such as agriculture and forestry, to commercial and industrial activities that are less directly dependent upon climate variables such as water and temperature. At a micro level, it can mean changing the use of land which is vulnerable to climate hazards from human settlements, to public open space or farmland. Such adaptation measures are often expensive and impracticable. Past development decisions which have resulted in the location of human populations in hazardous places or regions are difficult to reverse. There is a lack of policy innovations that minimise the growth of such types of vulnerability.

Adaptation measures which change the use of natural resources and relocate socio-economic systems are closely linked to national and regional planning. To reduce vulnerability, governments may wish to review their plans for human settlement, urban and agricultural development, and regional growth and investment. Choices that affect vulnerability can be made at different levels:

- local (e.g., avoiding narrow belts of flood prone-land)
- regional and national (e.g., avoiding the areas of highest drought risk).

Special attention should be given to evaluating the effectiveness of these adaptations and measures. Information can often be readily collected from the users themselves. Farmers generally know what has been an effective measure in the past, and what further steps might be needed in the face of increased risk. The same is true for other sectors of the community. An adaptation policy should be based upon those adaptation measures which can offer the greatest reduction in vulnerability for the least monetary and non-monetary cost.

#### *5. Research and/or restore*

The earlier four types of adaptation provide ways of thinking about how to adapt. It can be useful to group the wide list of potential adaptation measures into categories for policy analysis. Adaptation to climate is an age-old human experience; adaptation to rapid anthropogenic climate change is a new problem facing the international community, and new approaches and solutions are called for. Beginning at grass-roots level, people and communities can be assisted to develop and adopt their own adaptation measures. This may involve no more than the effective and frequent deployment of practices that are already well known. It is also possible to apply scientific research and technology development by the creation of new alternatives for adaptation. For example, new types of crop may be developed that are drought resistant or salt tolerant. New structural designs and new synthetic materials may help to build buildings and infrastructure that are more resistant to extreme climate events. While new technology development and technology transfer can help to reduce vulnerability to climate change, it is not a solution. Much also depends on local and national leadership and ingenuity. Organisational capacity and an ability to innovate are also required.

## **7. Adaptation Baselines**

The concept of an adaptation baseline is a recent one. Baselines can potentially be used to monitor and evaluate the success of adaptation measures and projects at different scales. Baselines can also be used to develop

adaptation scenarios in order to compare the effectiveness of different policy measures, either with or without climate change.

A singular baseline can be defined according to some specific climate risk for a specific locality or sector, for example the extent to which a village or an agricultural community is adapted to drought. This could be measured in terms of the number and types of adaptation measures in use, the frequency and extent of their use, and their efficacy. In addition, all adaptations in agriculture, including those at the policy level (price supports, subsidies, technical assistance, etc) may be combined into an adaptation policy to represent the aggregated adaptation baseline for a sector. The adaptation baselines for a number of sectors may then be aggregated into a national adaptation baseline.

**[Comment. The concepts of adaptation baselines and also adaptive capacity need more work if they are to be useful in research projects. Are technical annexes required? What should they cover?]**

While the concept of an adaptation baseline is feasible, it is clear that no single measure of adaptation has much validity. For any country or region, the present state of adaptation may be very different from sector to sector or region to region. It is quite possible, for example, for agriculture to be well adapted to drought while human settlements are extremely vulnerable to tropical cyclones or sea level rise. Adaptation measures may also be taken at individual or household (micro) levels.

It is of limited practical use to aggregate such diverse situations so how can such a diverse array of adaptation baselines be measured?

- First, it must be clarified for which system adaptation is being assessed. We may speak of the present adaptation baseline in agriculture, or water resources, or human settlements. We may also speak of adaptation across these systems to specific climate hazards, such as flood and droughts.
- Second, adaptation at the aggregate level can be more easily measured in its absence than in its presence. Thus the total costs of the impacts of adverse climate on agriculture, where measurable, could be regarded as a measure of the lack of adaptation.
- Third, a measure of the baseline might simply be the number of adaptation measures already in place.

However, since adaptation is an on-going process, the actual baseline would be transient not static. Therefore it may be not necessary to have an accurate measure of all adaptation measures in place at any given moment in time, for example 1990. It may be adequate to develop a methodology to assess a baseline that is consistent over time and which can be re-evaluated at a later date to demonstrate progress and success in project implementation.

## **8. Adaptation Assessment**

Just as adaptation can be carried out at all levels, from the individual to corporate and collective and from the local to the global, so too is the assessment of adaptation needed at all levels. The decision of a farmer to plant a different variety of grain, or to delay planting because the rains are forecast to arrive later than usual, is a micro-level and spontaneous (or autonomous) adaptation. Such decisions are made in the context of existing national agricultural and development policies, but are also partly driven by the demand of local, national and global markets for agricultural produce.

While the purpose of the APF is to provide inputs to adaptation policy at the national level, such policies can also include the numerous choices made by individuals. Communities and private sector organisations act, it

may be assumed, in their own interests. An important task for adaptation assessment and policy development is, therefore, to harmonise adaptation measures at different levels. The history of environmental management is full of examples of well-meant policies which turned out to have quite unintended and sometimes perverse consequences from those expected. A classic case is the construction of dams and levees for flood control. While these structures are justified in economic terms, they often have the perverse effect of stimulating more rapid expansion of human settlements onto the flood plain under a false sense of security. Entrepreneurs promoting the construction of housing and industrial development often encourage such expansion. Consequently, when flooding occurs, more damage results than would otherwise be the case. Similarly in agriculture, policies of price supports, crop insurance and so on may encourage farmers to take larger risks with the weather than they otherwise would. The selection of adaptation measures and their combination into successful management of climate risks is a complex matter which cannot be reduced to simple formulae of benefits and costs.

There are many methods and criteria by which adaptation measures may be assessed, and these have been combined into a number of suggested screening procedures that can be usefully applied in the assessment process.

**[Comment: Some methods for preliminary screening and assessment of adaptation measures have been developed and these will be described together with appropriate citations in the next version of this Framework.]**

## **9. Adaptation Capacity**

**Component P7.** Adaptation capacity is closely linked to (sustainable) development policy. In many instances, losses from climate impacts occur because adaptation measures are inadequate to cope with extremes and variability. Analysing the effectiveness of adaptation may help to understand adaptive capacity by identifying its constraints, which may include the following:

- lack of financial resources or access to credit
- lack of skills, training or access to technology
- lack of information
- lack of alternative choices
- social, and/or legal constraints upon choice
- incorrect or inaccurate estimates of risk
- short-term gains may be preferred to longer-term security
- others.

**[Comments: This is a key section and needs to be expanded considerably for the next version. The list of constraints could be discussed and developed by countries.]**

## **10. Conclusions**

Both adaptation and adaptation capacity change over time. It is important to have some idea, therefore, about the directions in which they are changing. Some insight may be gained by asking a ‘what if’ question. In this case it is: ‘What would the impacts be today if an event similar to one in the recent past were to recur?’

If development has taken place in areas that are exposed to climate risks without a corresponding improvement in adaptation, vulnerability may be increasing even without any change in climate. Such ‘what if’ questions help to link climate change adaptation to sustainable development policy. In some cases, improvements in adaptation

measures and adaptation capacity can be undertaken now with an immediate net benefit, even in the absence of climate change. Ensuring that appropriate steps are being taken to reduce present vulnerability may be the best insurance in the short term to deal with vulnerability to longer-term climate change.

Present climate vulnerability is a function of the climate itself, the impacts of climate, and the adaptations employed. The adaptations employed depend mainly upon adaptation capacity and the extent to which that capacity is applied in the context of sustainable development policy. The aim of the present baseline adaptation study is to improve understanding of the ways in which climate experience, risks, impacts, and adaptations are collectively integrated in order to explain current vulnerability. This provides a basis for assessing future vulnerability (Section VI).

## **VI. ASSESSING FUTURE VULNERABILITY: PHASE II**

Each component (P1 to P7) from Section V *Phase I: Present Vulnerability* corresponds to a component (F1 to F7) under *Phase II: Future Vulnerability* (Figure 8). However, the analysis of future vulnerability requires additional components to deal with the uncertainties, which are introduced in all future studies. In moving from Phase I to Phase II of the study, the research groups that have been responsible for Phase I can carry forward their research into the projection and scenario mode. At this point, it may be necessary to introduce additional expertise, for example to characterise future climate risks (F2) and to develop socio-economic scenarios (F3).

### **1. Development Policy Process**

**Component F1.** An important objective of the APF is to facilitate the incorporation of climate change into the development policy process. Logically this begins with an understanding of present vulnerability. Hence the assessment of future vulnerability and the identification and evaluation of possible adaptation measures begins by building upon the understanding of current vulnerability developed in studies of present climate risks and baseline adaptation.

The incorporation of climate change impacts and adaptation into the development policy process requires the establishment of a dialogue between the experts and the researchers and those involved in the policy process. This might be established by a joint workshop or a series of joint meetings at the outset of the project and continue periodically as the project develops. The purpose of the dialogue is initially to exchange information. The establishment of this relationship can then lead to adjustments in the research approach in order to better meet the needs of the policymakers, and at the same time to increase awareness among the policy community about climate change, its impacts and the policy alternatives.

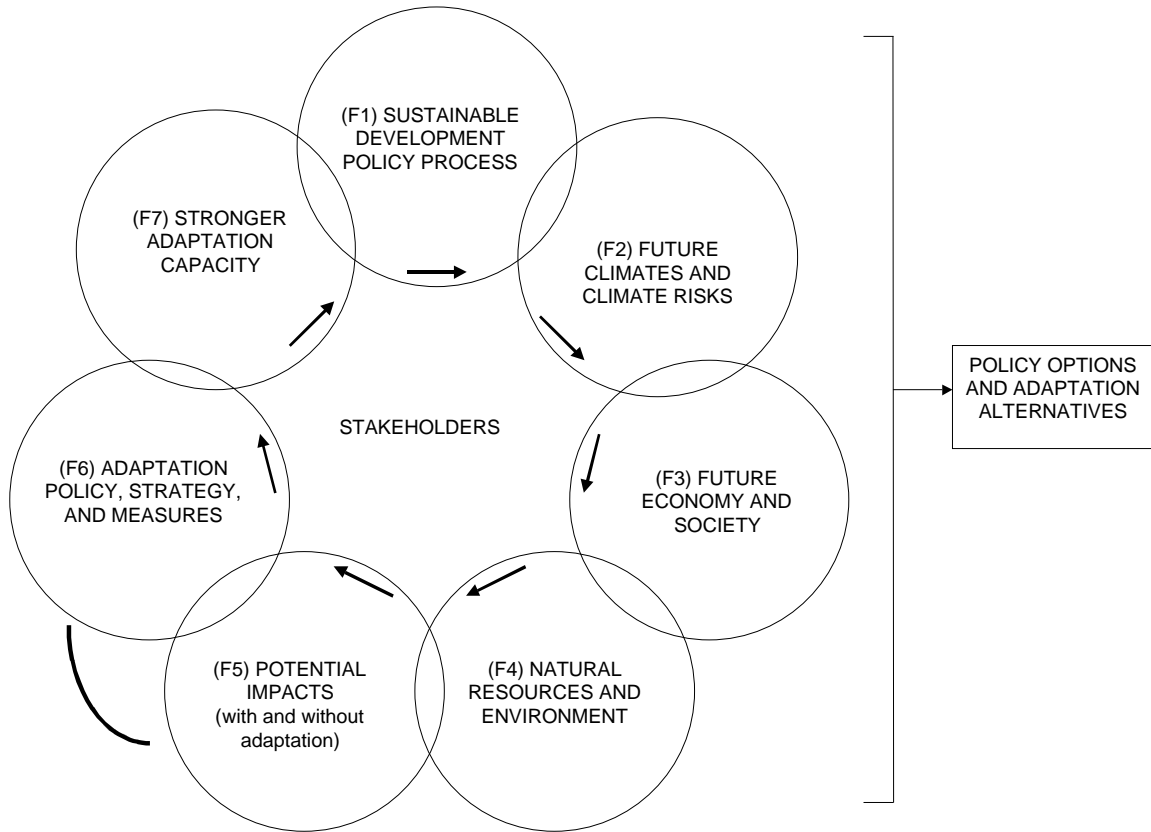
**[Comment: Perhaps add a technical annex on vulnerability. According to Figure 4 present vulnerability includes all the contents of boxes P2 to P7. So an annex that summarises present vulnerability is required.]**

### **2. Future Climates and Climate Risks**

**Component F2.** The purpose of this component is to characterise future climates and climate risks in ways that are relevant to adaptation measures and policies. As has been noted in Section II, progress in addressing adaptation has been hampered by the nature of the climate projections, both in terms of their spatial resolution and the variables presented. There is a growing body of research that is developing alternative ways in which future climates may be described. In addition, there is a growing awareness on the part of model-derived scenario builders of the need to be more responsive to adaptation research and the policy communities.

**[Comment: This section will be elaborated with contributions from climate scenario and risk experts. Opportunities to create more user-friendly and locally-relevant scenarios available together with training are being explored and are subject to the availability of funds.]**

**Figure 8: Assessments of Future Vulnerability (V<sub>F</sub>)**



### 3. Future Economy and Society

**Component F3.** A companion study, commissioned by the NCSP, is under way to develop an improved methodology for socio-economic scenarios relevant to adaptation, using the IPCC Special Report on Emission Scenarios for some general variables, as well as to develop some sector-specific variables. The purpose of this methodology is not to make forecasts, but rather as a sensitivity analysis to improve understanding of vulnerability and the implications of policy choices. In the field of climate impacts research, emphasis in socio-economic scenarios has been placed on emissions scenarios as the major drivers of climate change. The leading question has been, ‘How will various trajectories of future emissions change the global climate?’ The underlying determinants of emissions scenarios include such variables as population growth and levels of consumption, technology, and the rate of economic growth. For the purposes of adaptation, more detailed scenarios are required which are relevant to the sector or region under consideration. It is important to know, for example, how the agricultural sector or the amount and efficiency of water use in the economy of a particular country is likely to develop in the future. A socio-economic scenario methodology is required that addresses the needs of adaptation research and policy in a more specific way.

#### **4. Natural Resources and Environment**

**Component F4.** The impacts of future climate change will depend, to a large degree, on the amount and nature of the climate change itself and the character of future social and economic systems where and when they occur. Climate change is only one element of global environmental change and, therefore, it is important to take account of other environmental and natural resource changes that may be expected. This component of the study examines changes in environmental and natural resource conditions at all levels, from global to local. It is important that adaptation measures and policies designed for climate change are consistent with other environmental and resource policies, and that they reinforce each other and do not conflict.

[Possible addition of section on Adaptive Environmental Management with inputs from Roger Jones and others].

#### **5. Potential Impacts**

**Component F5.** The IPCC and other similar methodologies for climate impact assessment draw upon a rich array of research methods, models, and tools that are described elsewhere (see the guidelines and methods cited in Section II). The component studies of potential impacts in the APF can be expected to be similar in many respects.

As a result of the Phase I work, two important additional dimensions are added to these studies. Information about current and recent impacts provides a basis against which to assess potential impacts of the changing climate risks. In addition, the information about present baseline adaptation (P6) provides a basis on which to build the selection of expanded or strengthened adaptation to future risks. These are important from a policy perspective and will facilitate the development of adaptation policies and measures in a way that has hitherto been lacking.

In previous studies of the impacts of climate change, it has been the practice to study the gross impacts without adaptation, and then to estimate a reduction of impacts by making assumptions about the rate and degree of adaptation. In studies of climate change impacts on agriculture, for example, it has been argued that impacts can be significantly reduced according to the amount of adaptation practised. Often assumptions about ‘partial’ and ‘full’ adaptation are built into agro-climate impact models to show the benefits of adaptation. Such studies do not incorporate knowledge or experience of the process of adaptation as it actually occurs. In the APF, it is possible to draw upon such experience from the present baseline adaptation studies, and thus to develop more realistic and practical measures and policies.

#### **6. Adaptation Policy, Strategy and Measures**

**Component F6.** The task of this component is to develop a range of possible adaptation policies, strategies and measures, which can be presented to policymakers. This can be done on the basis of the knowledge gained in components F2 to F5 of the future vulnerability assessment and by combining this with the knowledge of present adaptation from Phase I studies.

The impacts of climate change depend not only upon changes in climate but also on the capacity of society to adapt, which is called the ‘coping range’. The theoretical relationship of climate variability to the coping range is illustrated in Figure 6. Note that in this diagram, a changing mean climate variable and a changing variance are imposed upon a static coping range. The effective use of adaptation measures can broaden the coping range such that society is able to accommodate a wider range of climate experience without a corresponding increase in

losses or vulnerability. A fundamental objective of the APF is to find ways of expanding the coping range by increasing adaptive capacity in relation to specific sets of climate variables.

There is an interactive relationship between components F5 and F6. It is important to be able to describe gross impacts before adaptation and reduced impacts after adaptation. At this stage, economic analysis is required to compare the benefits of different kinds and levels of adaptation with the costs that would be incurred with or without adaptation. The methodology for such economic analyses is well developed and has been the subject of much recent research and discussion in the IPCC on the costs and benefits of mitigation. However, further methodological work is needed on the costs and benefits of adaptation. (Note that the use of cost-benefit analysis can be valuable but this approach can have a distorting effect on the choice of options since it tends to favour ‘bricks and mortar’ projects over non-structural measures.)

## **7. Stronger Adaptation Capacity**

**Component F7.** As a result of the above analysis on future adaptation, it is possible to specify more precisely the requirements for stronger adaptation capacity. The ways in which adaptation capacity can be strengthened will depend to some extent upon the types of adaptation options selected in the policy process. If great emphasis is placed on the value of forecasting and warning, then expertise and training in these areas might be the most appropriate priority. If changing farming practices offers the prospect of successful adaptation, then increasing capacity and skills in agronomy and farmer training, and information services may be most important. Where building design and structural standards can be effective in reducing the impacts of climate events, the required skills and capacity will again be different.

It is expected that the vulnerability and adaptation studies carried out using the APF will at least help to clarify these choices and to assess their relative merits.

## **VII. DEVELOPING POLICY OPTIONS AND ADAPTATION CHOICES**

### **1. Synthesis Report and Final Workshop**

**Component F8.** The results from both the *Phase I: Present Vulnerability* and *Phase II: Future Vulnerability* studies can now be synthesised into a summary report to feed into the policy process. Provided that decisionmakers and stakeholders have been involved from the outset, it should be possible to organise a final project workshop in which informed discussion can take place on the steps needed to improve adaptation policy and measures in a particular sector or priority area, and to summarise the conclusions into a clear set of policy options for consideration. The output of such a workshop should include an agenda for the next steps of adaptation analysis, such as the more detailed evaluation of specific adaptation measures as part of Stage III Adaptation under the UNFCCC.

At this point in the development of policy options, the particular circumstances of each country and the specific nature of the climate risks being addressed make general prescriptions as to method and process chosen. What is done and how it is done depend to a great extent on the socio-economic and political systems, and traditions, of particular countries. It may therefore be more helpful to develop a hypothetical example that can serve as a generic model, without any implication that one size fits all. For this purpose, the example of elevated flood hazard is provided in Annex III.

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## **ANNEX I: DESIGNING A STAGE II ADAPTATION STUDY**

The purpose of this section is to provide guidance on how to design a study using the APF. It should be borne in mind that, as the study gets under way, details of specific research problems often come to dominate and it is possible to lose sight of the ultimate objective of the exercise. For this reason, we have modified the enabling activity (EA) project template to serve as a tool for developing the study. This approach should result in a well-defined study on Stage II Adaptation assessment, with results that can be readily adapted for future project proposals.

The template (Annex II) for designing a Stage II Adaptation study contains the following parts:

- |     |  |
|-----|--|
| (A) | Context/background                           |
| (B) | Study justification                          |
| (C) | Development objective                        |
| (D) | Immediate objectives, outputs and activities |
| (E) | Risks  |
| (F) | Prior obligations and prerequisites          |
| (G) | Logframe matrix and workplan                 |

A number of steps are required to complete this document (as shown in Figure 9). These are explained below, and we will refer to the related template throughout.

**[Comment: Indicative timeframe needed for carrying out the studies and preparation of the proposal]**

### **Figure 9: Steps in Designing a Study Using the Adaptation Policy Framework**

1. Prepare zero-order draft of the study outline
2. Consult with stakeholders
3. Carry out stakeholder survey
4. Prioritise vulnerable sectors
5. Prepare first-order draft of the study outline
6. Hold initial national workshop
7. Finalise study outline and workplan
8. Conduct Phase I study
9. Conduct Phase II study
10. Hold final national workshop

#### **Preparing the study outline**

*Step 1: Prepare zero-order draft of the study outline*

Begin by ensuring that all prior obligations and prerequisites concerning Stage I adaptation assessments (Part E) have been met. If not, more work may be required before the Stage II adaptation study can begin. Next, complete the context/background, study justification and development objective (Parts A, B and C) as best as possible. Use expert knowledge and the results of previous V&A studies for this purpose. Remember that there are two phases to the APF (for present and future vulnerabilities) which should be addressed during the study. The immediate objectives (Part D) are based upon the APF (Figure 2). You now have a background document to

*Draft, not for citation or quotation*

circulate to stakeholders in preparation for consultations. Remember that the study is a participatory and iterative process; objectives and strategies can change during the consultation process.

*Step 2: Consult with stakeholders*

Preparing a well-defined study that encompasses the viewpoints of all the stakeholders involved requires a great deal of planning if it is to be smoothly executed. The more cross-cutting the issue, the more co-ordination is required. It is important early in the design and definition stage to consider how the study will provide for the participation of policymakers, planners and practical adapters. This step is of crucial importance to the overall study design and its eventual success. Since the proposed framework is directed towards the policy process, it is essential to involve policymakers from the outset as a filter to assess which adaptations are likely to be acceptable as policy. Practical adapters provide on-the-ground information on current vulnerabilities and adaptations, allowing thresholds or adaptation criteria to be set. Stakeholder consultation should be seen as a continual, iterative process, particularly to ensure that linkages between present and future studies are established (Figure 2). For practical purposes, it is advised that a steering committee representing a range of stakeholders should formalise the review process throughout the entire study.

**[Comment: Add more detail on the type and range of stakeholders, e.g. how to select them]**

Feedback can be sought from stakeholders on the context/background and study justification (Parts A and B), in particular on the institutional framework (A.3), expected end-of-study situation (B.2), and study strategy and implementation arrangements (B.4). Encourage stakeholders to respond to the brief survey (Step 3) that is necessary in order to prioritise the sectors most vulnerable to climate change in a policy and development context. The development and immediate objectives (Parts C and D) are best addressed during the national workshop (Step 5), although stakeholder views can be canvassed.

*Step 3: Carry out stakeholder survey*

Since the impacts of climate change are potentially very broad, it is impractical to give full attention to all of them at once. A sequential approach is necessary so that the most pressing issues are addressed first. You can carry out a brief survey which defines a shortlist of the sectors and sites most at risk. The shortlist can be based upon a summary of the available knowledge, supported by expert judgement and stakeholder input, particularly that of policymakers. Experience with recent climate variability and extreme events could also be helpful.

**[Comment: Example of stakeholder survey required.]**

**[Comment: Survey of previous studies and Stage I adaptation.]**

*Step 4: Prioritise vulnerable sectors*

You may decide that all sectors are priorities. However, in order to make progress, some initial selection is necessary. For this reason, the APF is *intended to be applied to a narrower range of priority areas*. Remember that the choice of one sector does not exclude consideration of other vulnerabilities at a later date. Where regional projects and transboundary considerations are involved, some international co-ordination and agreement, especially at a regional level, is highly desirable.

*Step 5: Prepare first-order draft of the study outline*

Revise the zero-order draft based on the survey results, prioritisation exercise, and stakeholder consultations. This will be the key input to the initial workshop.

*Step 6: Hold initial national workshop*

A national workshop is the most efficient method to review the revised outline, while ensuring a transparent development approach. Encourage wide stakeholder involvement and have participants review the first-order draft in preparation. Allot sufficient time on the workshop agenda to finalise any outstanding issues relating to the shortlist of most vulnerable sectors, implementation arrangements and expected end-of-study outputs. However, the majority of time (up to three days) should be allocated for brainstorming on the development objective (Part C), immediate objectives (Part D), and risks (Part E).

The logical framework approach, which is used in all GEF projects, is recommended as the basis for the brainstorming as this approach provides a methodical structure for project planning. Participants first undertake a situation analysis by considering the problem, ways of overcoming the problem and selection of the best alternatives. A matrix is then completed in which the why (objectives), what (outputs), how (activities), and risks are considered. More information on the logframe approach can be downloaded from the UNDP-GEF website (<http://www.undp.org/gef/m&e/main.htm>). Consider the linkages between *Phase I: Present Vulnerability* and *Phase II: Future Vulnerability* as the ‘feed forward’ of present vulnerability information into future studies. This has implications for the overall study design. Figure 2 reflects a sequential work plan to facilitate implementation.

**[Comment: Guidance needed on setting the adaptation baseline.]**

**Carrying out Phase I and Phase II of the Study**

*Step 7: Finalise study outline and workplan*

Incorporate all issues raised by stakeholders into the final draft and develop a workplan based on the matrix of immediate objectives, outputs and activities (Part D).

*Step 8: Conduct Phase I study*

Phase I places current vulnerability in the development policy context (Section V). Remember that the conclusion of the Phase I study of the present baseline adaptation is to improve understanding of the ways in which climate experience, risks, impacts, and adaptations are integrated to explain current vulnerability. This provides a basis for moving into Phase II for assessing future vulnerability.

*Step 9: Conduct Phase II study*

As discussed in Section VI, in moving from Phase I to Phase II of the study it may be necessary to bring in additional expertise, for example to characterise future climate risks and to develop socio-economic scenarios. You may wish to hold a workshop to review the immediate objectives and outputs for Phase II once Phase I is completed. Synthesise the results of the *Phase I: Present Vulnerability* and *Phase II: Future Vulnerability* studies into a summary report for the final workshop.

**Finalising the Study**

*Step 10: Hold final national workshop*

*Draft, not for citation or quotation*

The objectives of the final workshop are for stakeholders and policymakers to identify the steps needed to improve adaptation policy and measures in a particular sector or priority area, and to summarise the conclusions into a clear set of policy options for consideration. Remember the three ‘golden rules’ of adaptation objectives discussed in Section III, part 3. Participants should also agree an agenda for the next steps of analysis in adaptation, such as the more detailed evaluation of specific adaptation measures as part of Stage III Adaptation under the UNFCCC.

**[Comments: Prepare a list of criteria/questions to rank the priorities.]**

## **ANNEX II: TEMPLATE FOR DESIGNING A STUDY USING THE APF**

This template is a modification of the climate change enabling activities project template. The instructions provided refer to the steps outlined in Section VIII for designing a study using the APF.

### **A. CONTEXT/BACKGROUND**

#### **1. Description of (sub)-sectors**

Describe the sector or sub-sector that has been selected for the study. Your decision will be based on the shortlist of most vulnerable sectors identified in the prioritisation exercise (Annex I, Steps 3 and 4). National circumstances and other relevant supporting information can also be included here.

#### **2. Host country strategy**

Briefly explain the development objective (C below) and place the study in the context of other work being carried out on climate change. If additional V&A work is planned under the Second National Communication (SNC), the relevance of this study as an input to SNCs should be highlighted.

#### **3. Institutional framework**

Include an explanation of the national institutional framework as it relates to adaptation. This section can be developed in consultation with stakeholders and finalised in the initial national workshop (Annex I, Step 6).

### **B. STUDY JUSTIFICATION**

#### **1. Problem to be addressed**

Define the problem in relation to two considerations:

- an initial choice of priority climate risks and vulnerabilities
- the objectives of the analysis itself.

Use expert judgement and the results of previous V&A studies. Your analysis will depend on the shortlist of most vulnerable sectors identified in the prioritisation exercise (Annex I, Steps 3 and 4).

#### **2. Expected end-of-study situation**

You will need to identify the endpoint of the study to assess your success in attaining it. You will be expecting to obtain a set of policy options for possible adoption as well as identifying next steps to improve adaptation policy and measures by the final national workshop (Annex I, Step 10).

In addition to the development and immediate objectives you agree during the initial national workshop (Annex I, Step 6), you might also expect the study to:

- build national capacity for assessing and prioritising Stage II Adaptation options and for increasingly taking them into account during planning and strategy formulation

- strengthen the dialogue, information exchange and co-operation among all the relevant stakeholders including governmental, non-governmental, academic and private sectors
- support the transition from this study to the actual implementation of the identified follow-up measures addressing the impact of climate change and variability on vulnerable sectors.

### **3. Target beneficiaries**

Identify the beneficiaries of the study and how they will benefit. For example, the study will enhance the capacity of the government and other participating institutions to analyse better the potential response measures to be undertaken for Stage II Adaptation and beyond. National capacity to contribute to ongoing international negotiations related to adaptation, and to analyse the opportunities and obligations that the new initiatives pose at the national level, will be strengthened. Practical adaptors may benefit from reduced vulnerability to the impacts of climate change on specific sectors or from enhanced response measures.

### **4. Study strategy and implementation arrangements**

Given the high level of stakeholder consultation proposed, you will need to plan carefully how to implement the study while minimising delays that might result from the review process. This section should be discussed with stakeholders and agreed during the initial national workshop (Annex I, Step 6).

Identify the most suitable national experts and/or institutions to implement the different activities of the study. Take stock and make full use of the resources and results of relevant prior or ongoing national or international activities. The NCSP will provide external support and encourage exchange of information between relevant national, regional and international expert institutions.

Describe all the institutional arrangements of the study and explain how you will strengthen the dialogue, information exchange and co-operation among relevant stakeholders during implementation.

The strategy of the study should briefly explain the link between Phase I and II, and how the expected outputs will achieve the immediate and development objectives within a given timeframe. To the extent feasible, identify permanent mechanisms that can be established to ensure the feedback processes will be incorporated into the national planning and policy formulation process.

An example of the strategy statement might be: “The study will be executed by (*national institution*) in consultation with a steering committee. A manager will be responsible for overseeing the study, summarising the results, and developing the resulting project together with government personnel and national experts. The results will be disseminated to and evaluated by all the relevant stakeholders. Other institutions that could participate in the implementation of the resulting project (including NGOs) will be identified during the development of the study.”

### **5. International and regional co-ordination arrangements**

You can present the results and lessons learnt from other ongoing or completed studies from international projects such as GEF enabling activities, NCSP workshops, UNEP Country Case Studies on Climate Change Impacts and Adaptation Assessment, CC:TRAIN and the US Country Study Program to avoid duplication of effort. If there is to be regional co-operation, identify modes of communication.

## **C. DEVELOPMENT OBJECTIVE**

While the study may have a number of different purposes, it is important at the outset to clarify an overall development objective. Identify an objective for stakeholder consultations that conforms to the descriptions of Stage I and Stage II Adaptation (Box 1), for example:

- reduction of vulnerability to climate change
- management of climate change risks
- incorporation of climate change adaptation into national policies.

Use the initial national workshop to reach a final decision on the development objective, with particular input and guidance from policymakers. You may define the objective more narrowly once the priority area(s) for the study is/are selected (Annex I, Steps 3, 4). For example, if the study is concerned with moisture deficits, uncertain rainfall and drought, the objective might be food security through reduction of vulnerability or prevention of loss in drought-affected areas.

## **D. IMMEDIATE OBJECTIVES, OUTPUTS AND ACTIVITIES**

The immediate objectives have been proposed in the modified logframe at the end of this Annex, based on Figure 2. Agree the objectives and identify the related outputs and activities during the brainstorming activity of the initial national workshop (Annex I, Step 6). Attention should be paid to ensure linkages between Phase I and Phase II.

## **E. RISKS**

Identify the risks associated with each immediate objective during the brainstorming activity of the initial national workshop (Annex I, Step 6). For example, one risk might be a change in government leading to changes in policy.

## **F. PRIOR OBLIGATIONS AND PREREQUISITES**

### **1. Prior Obligations**

The UN Framework Convention on Climate Change must have been ratified.

### **2. Prerequisites**

In the UNFCCC context, a vulnerability assessment is part of Stage I Adaptation Measures (Box 1). The V&A studies prepared for your initial National Communication should either be complete or in a final draft format. You should be able to identify priority areas for adaptation based on these studies. Where this is not the case, further work will be required before the APF study can commence.

## LOGFRAME MATRIX AND WORKPLAN

A logframe matrix is recommended during the brainstorming activity of the initial national workshop (Annex I, Step 6) to agree the development and immediate objectives, along with the outputs and activities that will form the basis of your workplan (Annex I, Step 7). The immediate objectives proposed below relate to the sequential components outlined in Figure 2.

**[Comment: To be revised in context of Figure 2 to provide basic format]**

Development Objective: For example: To reduce vulnerability in (selected sector) to the impacts of climate variability and change.			
Immediate Objectives:	Outputs:	Activities:	Risks:
1. To identify adaptation options and evaluate capacity for their implementation in the sustainable development policy context.	List of alternative adaptation options to address climate risks, including no-regret options. Prioritisation of adaptation options, based on implementability and sustainable development context.	Stakeholder interviews. Literature assessment. Development of criteria for evaluation (e.g., cost-effectiveness, technical feasibility, social acceptability, environmental sustainability). Application of evaluation tools (e.g., cost-benefit analysis, multi-criteria analysis).	
2. To assess current climate experience and future needs	Awareness of adaptation requirements among public and policymakers. Integrated planning skills. Climate risks considered in development plans. Stronger links between policymakers and experts.	Development of simple and accessible education and training materials for all population categories. Science-policy dialogue on adaptation findings and opportunities. Training on integrated policy planning. Cross-sectoral policy meetings.	
3. To assess potential impacts to extreme events and longer-term changes in climate variables.	Climate hazard map and other products to describe climate risks.	Construction of climate and socio-economic scenarios. Application of climate impact models. Identification of non-climate risks. Literature assessment. Expert judgement.	
4. To analyse adaptation and adaptation needs to current climate variability.	Awareness of the sensitivity of today's society to climate. Improved understanding of the process of adaptation to current climate conditions. Opportunities for adaptation to current climate and socio-economic situation.	Stakeholder interviews. Development of natural and socio-economic indicators for assessment. Analysis of past events, including damage survey. "What-if" assessment. Identification of activities that increase vulnerability to climate variability and change.	
5. To strengthen capacity for adaptation implementation.	Increase in number of qualified national experts. Data and skills to develop and apply framework and methods for adaptation assessment Stronger links between experts and policymakers.	Training to apply adaptation assessment tools and methods (e.g., conceptual framework, GIS, economic analysis, evaluation tools). Exchange of relevant information between research and policy institutes. Improvement of access to internet.	

Source: NCSP Regional Exchange Workshop on Climate Change for Europe and Commonwealth of Independent States, Yerevan, Armenia, October 2000.

### **ANNEX III: THE FLOOD RISK EXAMPLE**

#### **Purpose**

This is a hypothetical example of an elevated flood hazard problem designed to show how the APF might be applied, and to help identify the data, surveys, and analysis to be carried out. It is not a detailed instruction on 'how to do it' but an example that can be used as a template or guide in the design and execution of adaptation policy studies. Although this example deals only with elevated flood risk, it is hoped that it will assist in adaptation policy development in relation to other climate change risks.

#### **The Situation**

Let us assume a country with an important region subject to recurrent flood hazard. The region contains a growing population, with an agricultural sector which is partly commercialised but which also includes semi-subsistence smallholdings. There are also expanding cities and towns, and a developing industrial and commercial sector. Development is being assisted by public investment in transport, communications, water resources, and agroforestry. Hydrometeorological records and anecdotal evidence, including stories recounted by older people, show that floods of varying magnitude have occurred in the past but it now appears that losses from recent floods are more serious. Crop losses occur more frequently. More houses, roads, bridges, commercial and industrial premises, and communications facilities are being destroyed or damaged, and the evacuation of people from flood zones is frequently necessary. A major flood disaster occurred in the fairly recent past and was a considerable setback to the national economy. As a consequence, it was necessary for the national government to negotiate an additional loan from the World Bank to replace destroyed infrastructure, especially roads and bridges. The effects of the social disruption are still being felt since many of the most vulnerable families lost their livelihood entirely. Also, some areas where floods have never occurred in living memory have recently been inundated. One positive element about the situation is that, despite heavier losses and more frequent disruptions to economic life, fewer lives are being lost. This is probably due to improvements in the flood forecasting and warning system, and to the greater capacity for speedy evacuation. In addition some (but not all) construction has been to a higher design standard.

The country has ratified the UNFCCC as a non-Annex I country and has recently completed (or may still be completing) its First National Communication under the Convention with the assistance of the UNDP National Communications Support Programme. National delegations and experts participating in the Conference of the Parties to the Framework Convention and its subsidiary bodies, as well as the IPCC, are familiar with the advancing science of climate change and are anxious to develop national policies and programmes for mitigation and adaptation. In both these areas there is some prospect of international technical and financial assistance. Flood risk is one of the candidate areas for adaptation assistance since it seems quite possible that flood risk will become more severe under projected conditions of climate change. It has been agreed that a study team should be established to carry out an investigation using the APF in co-operation with UNDP and GEF.

The national meteorological service is asking for increased funding to improve its weather and climate monitoring in order to provide better estimates of the frequency of extreme events and improve forecasts. Other government departments, including agriculture, have warned about the potentially serious consequences of climate change on water resources: droughts could occur more frequently and a rise in sea level could affect coastal ground water resources. Water supply, sanitation and public health services are in urgent need of improvement in both urban and rural areas, and here too there is concern about the potential adverse effects of climate change. A foreign consortium is proposing the construction of a major flood control and irrigation dam on a major river, subject to international financing. There is therefore a lot of interest in the study and many groups are hoping for results that will further their interests.

## **Project Design**

The main objective is to design the project and define its boundaries. Let us assume that a political decision has been made to give priority to the problem of recurrent and increasing flood damage. Other studies may be under way on water resources and their development but, from the perspective of climate change, it has been determined that floods are the most pressing issue and other water issues can be addressed later. It is important, nevertheless, not to ignore them since actions taken with respect to floods should not restrict other options and adaptation strategies concerning land use management or other water-related areas.

Given this context it is important to specify the objectives of the study clearly and precisely. Possible objectives might include the reduction of flood damages and the prevention of mortality and morbidity due to floods. Because flat valley land has great potential value for agriculture, communications and industrial development, another objective may be to make the best use of lands subject to flood without exposing many more people to flood risk. As a consequence some flood losses may be acceptable, provided that the added benefits of using the land in productive ways more than compensate for the risks. It is important that the project objectives be carefully thought through and agreed among the stakeholders.

Since the problem of floods is already well recognised it is highly likely that some relevant policy already exists. It is important therefore that policymakers such as structural and design engineers, project evaluation economists, environmental experts, and land use planners are involved in discussions on the design of the project from at the outset. The aim of the study is not to replace existing policy and expertise but to build upon it, strengthen it where necessary, and incorporate the additional risks arising from climate change. In this way the adaptive capacity of the country will be increased.

The objectives of the project (stakeholder participation, links to current national policy, and capacity building) should all be reflected in the project workplan. The workplan should also show how and when each component of the APF is to be carried out and who will be responsible in each case.

## **Development Policy Context**

Given the objectives of the study have been defined, the next question might be how these objectives are to be achieved and what the policy alternatives are. In this case it is assumed that the study will provide some policy options and choices on alternative ways to achieve the agreed objectives. The approach adopted here is to begin by identifying specific measures that are theoretically available to achieve the policy objectives. The task of policy is then to facilitate the adoption of an appropriate mix of measures in a timely fashion.

## **Adaptation Measures for Flood Risk Management**

One aspect of natural resource use is coping with flood problems as they now are and as they may become under conditions of climate change. In this case the resource to be managed includes both the flow of water in the rivers and the land resource which is subject to flood hazard. An initial question, therefore, is to know all the possible management options that are theoretically available. Such a list may be called “the theoretical range of choice” (White, 1961). In any natural resource management situation there is a wide range of possible choices and it is helpful to compile a list of such choices, including those that have been used in the past, those that are used elsewhere, and others that might be developed to suit the changing circumstances.

To help identify such choices it may be helpful to classify all adaptation options into one of the following types (Burton, Kates and White, 1993). This list can be elaborated into many more specific choices which will, of

course, vary according to the climate change risk under consideration. For floods a description of theoretical choices follows:

1. Bear the losses
2. Share the losses
3. Prevent or modify the events or conditions
4. Prevent or modify the effects (impacts)
5. Change use
6. Change location
7. Research and/or restore.

*1. Bear the losses*

A base measure against which all other alternatives can be evaluated is simply to ask what the consequences would be of doing nothing except bear the losses and accept the costs whenever and wherever they may fall. For the purpose of later analysis it is helpful to have an estimate of the likely amount of future losses in economic, social, and environmental terms. It is also important to know what facilities and which people are most at risk. This alternative is never likely to be strictly applied because in any circumstances people are likely to take some actions to reduce their exposure to the risk. 'Doing nothing' to reduce losses therefore means 'doing nothing more' than the adaptation measures already in place. The estimation of future losses should, however, take into account actions that those at risk may spontaneously take to protect themselves and their property. The study shows that, in the absence of other measures, the costs of flood damage will probably increase from \$XX to \$XXX on an annual basis over the next two decades.

*2. Share the losses*

Losses need not be accepted whenever or wherever they fall: they can be spread over a larger community and over time. At the simplest level of organisation, losses can be shared among family members, within extended families, by whole communities, and by state and national governments. Loss-sharing can take the form of relief and rehabilitation in cash or in kind, and can come from anywhere, extending in the case of major disasters to the international community.

A more formal method of loss-sharing is through insurance, at either local or global level according to need. Private insurance companies generally protect themselves through reinsurance and in this way the worldwide insurance industry can be involved. In this instance a number of major industrial and commercial properties were found not to be covered by flood insurance. In some cases they have been able to resume business, but a number of smaller companies have been unable to get loans to rebuild and replenish their inventories and will go out of business unless government assistance is provided.

Another way in which losses are shared over time is by the use of accumulated surpluses. Families, communities and governments can draw on reserves, or borrow against future income in order to cover the immediate losses from floods. In this case it is found that that the traditional pattern of loss-sharing within and between families is breaking down. Many people made homeless in a recent flood were not taken in by close relatives or neighbours lucky enough to have avoided the floods. The number of homeless and street dwellers increased, and some temporary emergency shelters constructed by relief agencies seem likely to become permanent.

*3. Prevent or modify the events or conditions*

Events or conditions which cause the flood problem include rainstorms, run-off, and rivers overflowing their

banks. It is possible to modify this process in several ways. Watershed treatment, including preserving or replanting forests, can slow down the rate of run-off and hence reduce the peak flow downstream. Flood control reservoirs can be built to store water at times of peak flow for later controlled release. Dams include small upstream structures which are often earth-filled and large downstream concrete structures. Along the lower courses of large rivers, dykes can be built to contain the high flows and prevent flooding onto adjoining land.

In this particular case substantial land clearance in the upper watersheds has accelerated runoff and erosion is adding to the silt load downstream, so increasing flood risk.

#### *4. Prevent or modify the effects (impacts)*

To prevent or modify effects implies changing areas which are at risk from flooding rather than trying to prevent the floods themselves. Property on flood-prone land can be built in such a way that it is immune or less vulnerable to flood waters. Strong structures are less likely to be washed away in swift currents. Buildings can be flood-proofed so that the water does not get inside them. Buildings can also be built on stilts or otherwise raised above all but the most extreme flood heights. Activities can be timed so that there is less valuable property on the flood plain during the known flood season. For example, farmers can adjust their planting or harvesting dates and factories can reduce on-site inventories.

Flood forecasts and warnings can be issued so that property likely to be damaged can be removed or elevated as a precautionary measure, and people also can be evacuated.

In this case many of the houses in a low-income area of the main city were of poor construction and were washed away in the flood waters. A few people had elevated their houses by building them on earth platforms and others had raised their houses on stilts. Some of these measures worked satisfactorily and enabled the occupants and their possessions to remain above the flood waters. Although flood forecasts were issued by the meteorological service, the warnings failed to reach many of the residents in time. Some people who did hear the warnings chose to stay with their houses and possessions for security reasons.

#### *5. Change use*

The use of land subject to flood can be changed through land use planning so that less damage will be caused. Farmers can plant less valuable crops on the flood plain, or the land can be reserved for grazing livestock. Flood plain land may be reserved for parks or recreational land, or for other uses which expose fewer people and properties to risk.

In this case land use planning has been ineffective and many migrants from rural areas have moved into the cities and have established informal and unauthorised settlements close to the river. These areas were among the hardest hit and suffered most loss of life.

#### *6. Change location*

Changing the location of property or specific land uses is an extension of land use planning. Property which is particularly valuable or vulnerable can be kept off the flood plain, or relocated if it is already there. This includes hospitals, schools, communications equipment, emergency and other community services likely to be needed at times of natural disaster. Toxic and other dangerous substances present a special problem since they can be spread widely by flood waters and therefore should not be kept on flood plains unless their security can be guaranteed.

In this case several schools and one hospital were flooded, and the patients had to be evacuated to a temporary field hospital in tents. Some tanks containing toxic chemicals were moved from their foundations but, fortunately, no significant leaks are known to have occurred. Rumours of water supplies contaminated with toxic chemicals were unfounded.

#### *7. Research and/or restore*

The list of possible adaptations to climate-related flood risk applies to all flood problems, whether or not caused by climate change. It consists of all adaptation measures and policies that have been previously used, plus any new ones that may become available through research and development. Given the possibility of increased flood risk from climate change, all possible adaptations must be considered or developed. Where losses have occurred in the past to vegetation, ecosystems, or valuable archaeological, religious, or cultural sites, these can be restored, perhaps with higher levels of protection. In most cases the best adaptation strategy will consist of a carefully chosen mix of the alternatives. It is the task of the policy process to evaluate adaptation measures and to develop ways of implementing or combining measures appropriate to the circumstances.

#### **Present vulnerability**

The first phase of the APF consists of an assessment of current vulnerability. As shown in Figure 2, vulnerability is a function of the flood risk and the present level of adaptation.

#### **Flood risk from experience**

The flood problem in the hypothetical example being considered here requires analysis of the nature of the flood threat without climate change. For specific sites or reaches of river the most important considerations are the expected height of floods and their frequency. A standard discharge/frequency curve may be plotted by hydrometeorological analysis. From the point of view of adaptations other flood variables may also be important, such as the speed in the rise of the flood waters (including the amount of warning time), the seasonality of occurrence, the duration of the flood, and the speed of flow.

Some data required for this analysis are likely to be available from meteorological records. Where these are not available, or where the data set is weak, additional information can be used, such as transferring records from adjacent regions (with necessary adjustments) and the use of traditional knowledge.

#### **Observed impacts**

Flood damage surveys can be carried out in greater or lesser detail, according to resources and requirements. In this instance reliance has to be placed upon previously recorded data since cost estimates made more than a few days or weeks after the event are subject to wide margins of error. There are two purposes of a damage survey: one is to know how damage actually occurred so that preventive adaptations can be chosen appropriately; the second is to be able to compare the costs of past (and estimated future) damages with the costs of alternative adaptation measures.

#### **Adaptation baseline**

The main objective of the APF is to identify and assess adaptation policies and measures that can be used to reduce vulnerability to future climate change. In order to be able to propose improvements, a good understanding of present adaptation is required. It is therefore proposed that a flood adaptation survey and analysis be conducted in order to ascertain which adaptation options are now in use and to what extent they are

deployed. It is also important to know what adaptation alternatives are not being employed and the nature of the obstacles to their use.

Local involvement can be very helpful at this stage to identify key information and to help to understand the social, economic and political pressures in the community that prevent effective adaptation or which affect the distribution of adaptation measures among people or from place to place. The reasons why adaptation choices are and are not made should be canvassed at all levels of decision-making, including that of households, commercial and industrial enterprises, farms, public agencies, and government from the local community up to the national level.

Taken together, the analysis of the flood risk (observed climate experience), the impacts observed (damages and other losses), and the present level of adaptation (distribution and frequency of adaptation measures employed), give an overall measure of current vulnerability. This constitutes the 'adaptation baseline' for the flood risk problem. When measured in monetary terms it may be expressed as the costs of present adaptation plus the remaining or residual damage. In cases where little adaptation has taken place the damages may be expected to be relatively high; when many adaptation measures have been taken it is to be expected that damages will be lower.

The concept of the adaptation baseline can be applied at different levels. As far as the individual household is concerned, it refers to its own internal household costs, plus its share of the social, community, and national costs. For the nation as a whole, adaptation baseline refers to the aggregate adaptation costs wherever they are incurred plus residual damages.

If the objective of social policy is measured simply in terms of economic efficiency then the best policy may be described as that which minimises the total costs of adaptation measures and residual damages. As has been noted already, there are other social objectives which should be taken into account, including social and environmental values. And to complicate the analysis, flood losses should not be isolated from other water resource and land use issues.

### **Adaptation capacity**

The analysis so far will have provided many ideas about the ways in which adaptation to present flood risk (and increased climate change risk) can be improved. Such improvements typically require a combination of public and private actions. Householders, farmers, and the owners and managers of industrial and commercial enterprises can be made aware of additional steps they can take to reduce their own vulnerability. Similarly, public agencies may be challenged to improve design standards for public works, improve extreme weather forecasts and warnings, legislate new requirements for land use planning and building codes, improve watershed management, and build flood control dams and dykes.

Three questions arise. What is the appropriate mix of adaptation measures, and how should responsibility be distributed between public agencies and the private sector? How are individual or private choices affected by public policy and vice versa? Who should pay for the costs of adaptation and how should be costs of residual damages be borne?

The response to these questions depends in part upon the policy process. Governments and peoples have different ideas about the appropriate roles of public and private expenditure. The response also depends to a considerable extent on the capacity of peoples and governments to take effective adaptive action.

The survey of current adaptation measures will have identified many factors that help to explain the present level

of adaptation or baseline, and the nature of the obstacles to improved adaptation. This information can be brought together and synthesised to suggest effective ways to strengthen adaptive capacity.

In general terms, adaptation capacity has been considered to be a function of access to financial resources (wealth), availability of skilled human resources and technology, the existence and effectiveness of relevant institutions, and organisational capacity. When applied to individual cases it is possible to be much more specific about adaptation capacity. Adaptation capacity also depends upon, and may account for, the distribution of current adaptation measures and the nature of the adaptation baseline. For example, there may be a greater capacity in the engineering field (dams, dykes, structural measures), and a lesser capacity in the use and enforcement of laws and regulations and in emergency forecasting and warning. Circumstances will vary from country to country.

For the purposes of the APF it is sufficient to describe the various possibilities for strengthening adaptation capacity, together with the arguments for and against each. How much adaptation capacity should be increased, and in which ways, is likely to be a political choice and will depend in part upon the choice of adaptation measures both in respect to flood risk and other climate-related changes.

### **Future vulnerability**

Flood risk management policy should be based upon an assessment of future vulnerability as well as an understanding of present vulnerability. The components of the analysis of future vulnerability are very similar to those required in the analysis of present vulnerability except that they have to be based on models or assumptions about the future and not on experience.

The workplan for the APF should establish links between the various component studies in the present vulnerability phase and the future vulnerability phase. As the future vulnerability phase gets under way, both groups should be involved. For example, those who have been engaged in studies of current flood risks should also be involved in the study of future flood risks. Additional expertise may be needed at this stage such as knowledge of climate models and scenarios, and how flood risk is likely to be affected.

### **Sustainable development policy process**

As part of the future vulnerability phase the APF should consider the sustainable development process and ask how this policy may be implemented in the future, especially with respect to flood risk. The team that was involved in setting the sustainable development context for Phase I of the study should be consulted in order to ensure that adaptation policies are developed which are consistent with overall sustainable development policy.

### **Future climate and climate risks**

The crucial question here is how and to what extent flood risks will change with a changing climate. This requires co-operation between national experts on current flood risks and trends, and experts on climate change. Considerable difficulty has been encountered in previous studies because climate models and scenarios do not provide precise information about future probabilities of flood events. The study team has to make some expert judgements at this point on how to blend climate scenario information with the knowledge of present flood risk and observed trends. Sensitivity analysis offers a useful method. Instead of relying on a single future flood risk projection, several plausible scenarios might be developed ranging from little or no change to moderate and substantial increase in flood risk. Studies of each level of risk can reveal how sensitive flood losses are to increases in flood risk caused by climate change.

## **Future economy and society**

In order to estimate probable future flood losses, the projected flood hazard scenarios have to be imposed on a future socio-economic situation. Those developing the socio-economic scenarios should be prepared to say what increase of population, property, and economic activities of various kinds might take place on land subject to flood risk. Since the APF is designed to develop policy choices that will directly guide such future development choices, estimates of future losses will vary with the assumptions made about the pattern of future economic growth and the expansion of human settlements.

When preparing socio-economic scenarios, the focus should be on those future developments which are likely to increase or decrease vulnerability to the specific climate hazard under consideration. Here again sensitivity analysis is a useful approach when addressing the question as to what extent future developments as captured in socio-economic scenarios might serve to increase or reduce vulnerability to floods. Vulnerability may be expected to increase or decrease according to the amount and pattern of development.

## **Natural resources and environment**

The flood policy study should not be conducted in isolation from other natural resource and environmental issues. It is important to ensure compatibility of flood risk policies with other resource and environmental management policies. In the case of flood risk this includes watershed management, river basin development, and other water resource development projects such as irrigation, hydroelectric power, water supply for municipal, industrial, commercial and household use, and perhaps also river navigation and water quality. Developments and future plans in these areas should be taken into account in the development of policy options for climate change and flood risk management.

## **Potential Impacts**

Studies of observed impacts of floods completed in Phase 1 (Present Vulnerability) can be projected into the future, taking into account changes in the frequency and magnitude of floods (Component F2) and expected socio-economic developments, including those in related natural resource (water) and environmental areas. An important question here is the relative importance of different factors in vulnerability. To what extent is future vulnerability likely to increase due to increased flood risk as a consequence of climate change, and to what extent may the rate of population and economic growth and patterns of development also contribute to an increase in vulnerability? To put the question in a more positive way, to what extent can modifications to the development process and decisions taken contribute to a reduction in vulnerability? This is essentially the role of adaptation.

## **Adaptation policy, strategy, and measures**

The purpose of the assessment of future vulnerability (Phase 2) is to permit the development of policy choices in such a way that comparisons can be made between different options. How much adaptation to flood risk can be justified and what should be the mix of component measures? Three broad policy choices illustrate the sort of outcome that may be envisaged. These are described below as hypothetical examples. The actual formulation of the policy choices will depend upon local and national circumstances, and the development policy choices made at a political level.

### **Policy 1: Enhanced business as usual or the 'win-win' strategy**

The management of flood risks will continue on the present basis with some incremental strengthening where

this can be justified in the absence of climate change. The benefits of this policy will exceed the costs, even in the absence of a significant increase in flood risk. The policy includes the following:

- a new national programme of flood risk assessment
- improvements in flood forecasting, warning and evacuation plans
- stronger efforts to control the expansion of human settlements into high flood risk areas
- higher design standards and building codes, especially for the most vulnerable areas and uses. All new construction to conform to the new standards
- reforestation of upstream watersheds
- technical advice to farmers on practices to reduce vulnerability
- study of the potential for flood insurance in combination with other methods of adaptation and involving the private insurance industry.

### **Policy 2: Additional precautionary measures**

In addition to the Policy 1 initiatives, additional precautionary measures will be taken in areas of high flood risk (probability) and where especially vulnerable property is located. These may include:

- increasing the height of flood control dykes
- a planned, phased removal and relocation of particularly vulnerable or dangerous land uses
- higher design standards and building codes, and more aggressive control of flood plain development
- the introduction of some public/private insurance where the necessary conditions can be met.

In the absence of significant increase in flood risk the full benefits of this policy option will not be realised, but the measures are considered justified to reduce risks and increase confidence in the development process in the region.

### **Policy 3: Comprehensive flood damage reduction in association with other river and water resource policies**

In addition to Policy 2, a comprehensive programme of flood damage reduction and flood plain land use planning will be developed in association with an integrated water resources and river development plan. This may include additional reservoir storage for flood control, irrigation, and other multiple use and multi-objective plans. For this purpose the impact of climate change on other water resources will be taken into account.

*Draft, not for citation or quotation*

**ANNEX IV: GUIDELINES FOR SOCIO-ECONOMIC SCENARIOS**

To come in a separate document.