Guidelines for Climate Change Proofing in UNDP Projects and Programmes in Armenia

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List of Acronyms and Abbreviations

APF	Adaptation Policy Frameworks
CCA	Common Country Assessment
CDM	Clean Development Mechanism
CPAP	Country Programme Action Plan
CPD	Country Programme Document
DNA	Designated National Authority
GEF's	Global Environmental Facility
GHG	Greenhouse gases
HRBA	Human rights-based approach
IPCC	Intergovernmental Panel on Climate Change
MDG	Millennium Development Goals
ODA	Official Development Assistance
RBM	Results-based management
UNCT	United Nationals Country Team
UNDAF	Development Assistance Framework
UNDP	United Nation Development Programme
UNFCCC	United Nations Framework Convention on Climate Change

Introduction

Climate change is one of the greatest challenges facing the world's environment, society and economy today. Its expected repercussions, which include worsening droughts and crop failures, rising sea waters, more frequent and intense storms, and extinction of species, will impact every nation on earth. Climate change impacts can already be seen across the globe and Armenia will not be immune.

Recognizing that the impacts of climate variability and climate change must be addressed in all development activities, UNDP has included climate proofing in the Corporate Climate Change Strategy (2008) under its 4th pillar 'Integrate climate change into UN and UNDP development assistance at the global, regional and national levels'. The development of the present guidelines[1] was motivated by the need to climate proof UNDP projects and programmes in Armenia against adverse impacts of climate change though the introduction of sustainable and economical viable adaptation opportunities.

The **objective** of these guidelines is to assist development practitioners in the process of incorporating climate change concerns into development programmes, projects, policies and strategies. It is recommended that the climate proofing is commenced at the project/policy formulation stage, however, it could be also initiated during project implementation. Because each project's needs and resources are different, the guidelines aim to strike a balance between encouraging flexibility in the climate proofing process and providing concrete recommendations.

The guidelines are based on the 'Climate Impact Assessment of the Lusadzor Community Development Project'[2], which is a pilot initiative in the Europe and the CIS region and one of the first in UNDP globally. The guidelines are also developed on the basis of existing manuals, draft UNDP Quality Standards for the Integration of Adaptation to Climate Change into Development Programming, and UNDP's Adaptation Policy Framework (APF). Although the guidelines are tailor made for Armenia, they can also be used by other country offices.

The guidelines are divided into three parts, Part I introduces key concepts and provides some background information. Part II is a tool for simplified assessment of a project or a programme, which helps to decide whether an in-depth climate risk assessment is needed. Part III will guide the user through the climate proofing process step by step.

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[2] Lusadzor Community Development Project is a part of the Community Development Programme in Armenia.

Part I - Background and key concepts

This part of the guidelines explains why climate proofing is important, reviews key concepts related to climate proofing and adaptation and provides some background information on climate change issues in Armenia.

1. What is climate proofing and why is it important?

What is climate proofing?

Climate proofing is a process that makes projects, strategies, policies and measures resilient to climate change, including climate variability, by (1) systematically examining programming documents and projects to identify ways to minimize climate change risks and optimize adaptation, i.e. climate risk screening, and (2) integrating these ways into programming and project, i.e. mainstreaming.

Based on ADB 2005

Climate mainstreaming (integrating climate change adaptation) is incorporation of priority climate change responses into development projects, strategies, policies and measures (either at the national level or within development agency programming) to reduce potential risks.

Based on Klein et al. 2007 and OECD 2008

An example of mainstreaming would be the creation of communal safety nets and common resource pools (seeds, communal irrigation) in a region prone to droughts. Integration of climate change adaptation is the second step in climate-proofing.

Why Climate Proof UNDP Projects & Programmes?

There is now clear scientific evidence that global warming and climate change is real. The challenge is to learn how to cope with its effects. In its Fourth Assessment Report, the Intergovernmental Panel on Climate Change (IPCC) concluded that average global surface temperatures increased by 0.74 ± 0.2°C between 1906 and 2005. This trend is expected to persist, with a 1.8 to 4°C warming predicted for the current century.[3] Warming will vary by region and be accompanied by significant changes in local precipitation, sea level rise and changes in the frequency and intensity of some extreme events.

Climate change has the potential to stall and even reverse human development, via its impacts on key development sectors and activities, including agriculture and food production, water resources, disaster risk management, natural resources and health[4]. Yet these impacts will not be distributed or felt uniformly, as those 'with the least resources have the least capacity to adapt and are the most vulnerable.'[5] Climate change is likely to compound existing vulnerabilities of poor natural resource-dependent communities, which may face substantial consequences due to their vulnerability. As the availability and quality of natural resources decline, so does the security of their livelihoods. Limited resources and capacities for responding to stresses such as floods and droughts constrain their ability to meet basic needs and move out of poverty.

Climate change risks threaten to derail UNDP's mission of securing the Millennium Development Goals (See Annex II, Potential impacts of climate change on the MDGs). UNDP's corporate re-

[3] IPCC. Climate Change 2007: The Physical Science Basis. Summary for Policymakers.
[4] Human Development Report 2007.
[5] IPCC. 2001. Climate Change 2001: Impacts, Adaptation and Vulnerability. Technical Summary. Geneva: IPCC.

sponse to this challenge is to 'climate proof' UNDP activities as well as to take advantage of development investments to reduce the vulnerability of the poor to climate change.

Climate proofing ensures that project results will not be hampered by potential climate change

In many instances, development projects and programmes may need to be restructured so that they are 'climate resilient'. Climate change may pose a **direct risk to development projects/programmes and deliverables**, e.g. as a result of extreme weather events or other changes not properly factored into the programme design. An example could be undersized culverts in a road project that lead to road erosion and damage during excessive rains. There may be also a risk of **underperformance of development projects/programmes and the deliverables**, e.g. the expected outcomes of investment are reduced (loss of effectiveness) due to external impacts like changes in rainfall patterns and health impacts, i.e. by altering the enabling conditions for economic growth and poverty reduction. For example, a facility designed to process certain crops may no longer be economical if the crop mix in its service area changes as a response to climate change. Finally, there may be **direct and indirect impacts on the target population due to their vulnerability to climate change**, e.g. a rural population targeted in a social sector projects/programme may have changed needs and priorities if their crops are at risk or their access to water deteriorates.

Climate proofing helps to identify and enhance inherent adaptation value of a project

Although a development project or programme may not be at particular risk due to climate change, there may be options in project design and implementation that may contribute to a reduction of vulnerabilities to climate change.

Example 1. Project activities with inherent adaptation value

One of the activities under the Integrated Development Plan for Lusadzor Community project in Armenia involved planting of persimmon orchards and distribution of seedlings to rural households. This activity has an inherent adaptation value because persimmon orchards will reduce the current vulnerability of fruit yield to spring frosts. However, a complete replacement of other traditional varieties may lead to other types of risks. The validity of this option may require additional expert judgment and inputs.

Adaptation is an adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.

IPCC 2007; OECD 2008

Vulnerability to climate change is the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes.

IPCC, 2001

Climate proofing ensures that a programme or project results will not lead to maladaptation

As well as actively promoting adaptation where it is appropriate, programmes and projects also need to avoid maladaptation. Maladaptation may occur where there is no obvious need for adaptation under current circumstances, but where existing development policies and practices yield short-term benefits while increasing longer-term risks (e.g. agricultural expansion into areas that are currently humid but which are projected to become too dry to support agriculture in the longer term).

Maladaptation is a business-as-usual development, which by overlooking climate change impacts, inadvertently increases exposure and/or vulnerability to climate change.

OECD, 2008

Which projects/programmes to climate proof?

The decision to **exempt** some projects **from climate proofing** could be made even before preliminary screening. It is recommended that projects with the budget below US$ 200,000 are not considered for climate proofing, because transaction costs would be rather high compared to the project budget.

In general, climate proofing is relevant for all types of projects/programmes. **Climate proofing** will be almost certainly **required** for projects in the areas of natural resource management, disaster risk reduction, forestry, water, energy, food security and in general, geographic area-specific initiatives, such as area-based development that target rural communities, farmers and socially vulnerable groups.

Projects and programmes which **may not require climate proofing** include governance and capacity development projects. However, it may still be relevant to climate proof these types of projects/programmes as they often support national and local planning capacities, which are important for climate change mainstreaming into the national plans, programmes and policies.

Who should do climate proofing?

In order to successfully address climate concerns in UNDP's projects and programmes, climate proofing and mainstreaming must be an integral part of the functions of UNDP. This would include making available sufficient technical capacity and human resources to ensure a successful integration of climate concerns.

Country programme officers/project managers should be responsible for ensuring that climate change concerns are taken into account in their projects and programmes. As many project managers do not have prior knowledge or experience with climate issues, it is essential that they receive at least basic training on climate proofing and can draw on the expertise of the Environmental Focal Point (EFP) and / or of the Regional Technical Advisor(s) (RTA) for guidance and assistance whenever needed.

These guidelines suggest that the climate proofing be done in two stages: 1) Rapid climate risk screening; and 2) In-depth climate risk screening. The Rapid screening can be done by project managers to identify potential high risks to the project associated with climate change and decide whether in-depth climate risk assessment is needed. For high-risk projects and programmes it may be necessary to involve EFPs/RTA and/or hire a consultant who should use the second part of these guidelines for an in-depth climate risk screening.

2. Important concepts and considerations

Climate Risk

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

Risk = Hazard (climate) x Vulnerability (exposure)

Adaptation Policy Framework for Climate Change, UNDP 2005

For example, a landslide in an uninhabited area may not cause a problem, but in a densely populated area it is likely to result in the destruction of infrastructure, agriculture lands, entailing major economic losses.

Climate hazard – is a physically defined climate event with the potential to cause harm; such as heavy rainfall, drought, flood, storm, and long-term change in mean climatic variables such as temperature.

Adaptation Policy Framework for Climate Change, UNDP 2005

Climate change sensitivity, adaptive capacity and vulnerability

Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity. Vulnerability increases as the magnitude of climate change or sensitivity increase and decreases as adaptive capacity increases. Reducing vulnerability can happen through any combination of reduced magnitude of climate change, reduced exposure, or increased adaptive capacity.

Example 2. Vulnerability in Armenia

In Armenia the socio-economic development and improved livelihoods of the poor depend to a large degree on the state of, and access to, environmental and natural resources. The scarcity of water resources, for example, is a critical constraint for economic growth and poverty reduction. In the absence of sustainable management of natural resources and planning capacity, the vulnerability to the impacts of climate change events may be exacerbated from a combined effect of deforestation, governance failures, absence of health services and climate change, for example, on water resources. Climate change may amplify the already existing constraints on economic growth and poverty reduction from 'natural' climate variability, depletion of natural resources, governance and not least a growing population.

Vulnerability is a broader concept than just a reflection of the impacts of climate change. The definition used in these guidelines incorporates three main variables: exposure to climatic variations, sensitivity and adaptive capacity of a system to various stressors.[6] Because climate impacts occur in the context of a constantly changing socio-economic situation, a vulnerability assessment makes use of socio-economic scenarios, in addition to climate scenarios (see the climate change scenarios section below), to better capture the non-climatic stressors that influence the adaptive capacity of systems.

Sensitivity is the degree to which a system can be affected, negatively or positively, by climate-related stimuli.

IPCC, 2001

Such stimuli encompass all elements of climate change, including change in mean climate characteristics, climate variability and the frequency and magnitude of extremes. The effect may be direct (for example, a change in crop yield in response to a change in the mean, range or variability of temperature) or indirect (such as damage caused by increased frequency of coastal flooding due to a rise in sea-level). Sensitivity includes exposure which considers the nature and magnitude of climate change and whether systems would be affected by such change.

Exposure is the nature and degree to which a system is exposed to significant climatic variations. It is the probability of a climate hazard combined with a system's current vulnerability.

Adaptation Policy Framework for Climate Change, UNDP 2005

[6] Füssel and Klein, 2006.

For example, the low-lying coastal areas of Bangladesh are exposed to sea level rises, whereas the Rift Valley in Africa, because of its elevation, is not exposed. Sensitivity also considers the extent to which an exposed system can be affected by climate change. Some crops such as maize are quite sensitive to climate change. Systems such as manufacturing are much less sensitive to climate change, although they can be affected by extreme events, severe reductions in water supplies, power disruptions, etc.

Adaptive capacity is a system's ability to adjust to climate change (including climate variability and extremes), to moderate potential damage, to take advantage of opportunities or to cope with consequences.

IPCC, 2001

A system's capacity to adapt is a function of the relative level of a society's economic resources, access to technology, access to information on climate variability and change and skills to make use of the information, institutions (i.e., degree to which institutions can help adaptations be adopted), and equitable distribution of resources (societies with a relatively more equitable distribution of resources will be better able to adapt than societies with less equitable distributions). The level of adaptive capacity tends to be positively correlated with the level of development; more developed societies tend to have more adaptive capacity. However, possessing adaptive capacity is not a guarantee that it will be used effectively.

Climate change models and scenarios

Expected climate changes can be monitored and compared with historical data to identify changes and trends, e.g. in rainfall and temperature. However, the use of historical data for rainfall (floods and droughts) and extreme weather events is insufficient for future planning, e.g. of infrastructure projects and food security. Planning needs additional information to factor in possible climate change and cannot rely only on information from past events.

Climate models are mathematical representations of the climate system which quantitatively describes, simulates and analyses the interactions between the atmosphere and the underlying surface (e.g., ocean, land, ice) and thus predicts future changes in temperature, rainfall and other climatic variables over time and areas. Climate models are applied as a tool to study and predict monthly, seasonal and inter-annual climate variations and changes and are used in the construction of climate change scenarios.

Often there is a need to downscale national or regional climate models to predict climate changes at local level. This frequently poses problems as the climate models only provide a bigger picture at the moment and downscaling requires more accurate information on the local impacts of climate change.

A climate change scenario is a simplified description of a possible future state of the climate based on estimates of changes in temperature, rainfall and other climatic variables averaged over large areas and representing specific periods in the future (e.g. 2030, 2070, 2100). with the level of development; more developed societies tend to have more adaptive capacity. However, possessing adaptive capacity is not a guarantee that it will be used effectively.

IPCC, 2001

Climate variability is especially difficult to predict and this is important to bear in mind as it is more often climate variability rather than a change in the average climate that increases vulnerability. 'Natural' climate variability with events such as droughts and floods as natural recurring elements has always existed. Anthropogenic, or man-induced, climate change is what is usually referred to as 'climate change', the idea that the climate is changing beyond its natural range. Since climate change is counterfactual it may be difficult to estimate what can be ascribed to anthropogenic climate

change or to natural climate variability. However, to the farmer on the ground the impacts are felt all the same.

Adaptation responses to climate change

The greatest climate change risks exist where both vulnerability and climate hazards are highest and adaptation is an important means to secure achievements of the MDGs in the face of climate change impacts. The UNDP adaptation activities are built upon the following overarching principles:

- The goal of pro-poor and pro-growth adaptation that encourages sustainable economic development and livelihoods in the face of climate change;
- The objective of climate-resilient development, including systemic changes to development processes.
- A key outcome is that climate change risks are integrated into national planning and poverty reduction efforts.
- Success will be measured using indicators and targets that reveal systemic and sector-wide policy changes.

It is crucial to ensure that the mainstreaming exercise and the proposed adaptation measures are in line with these principles.

The direction and magnitude of climate change will always be uncertain because of the complexities of the weather systems, and this constitutes part of the problem of preparing an adequate response. However, there is a broad range of adaptation measures that can be considered 'no regrets adaptations', which are justified under the current (or historical) climate and are even more justified when climate change is taken into account. No-regrets adaptations include removing or limiting maladaptations, investments in development, particularly those that enhance the capacity of a society to adapt to climate change, reducing pressure on ecosystems, enhanced public health systems, etc. Indeed, promoting development makes sense anyway and will reduce future societies' vulnerabilities to climate change. However, some development paths can reduce vulnerability more than others. Exact projections of climate change may not be necessary to justify no-regrets adaptations. General knowledge that the climate is changing may be sufficient.

'Climate justified' adaptations are those that are specifically introduced to anticipate climate change. Often these are changes made to long-lived investments. For example, a sea wall being built or rehabilitated might be built somewhat higher to account for a rise in the sea level. Such adaptations also include changing land use (e.g., limiting development in areas that would be vulnerable to climate change), enhancing emergency response procedures, enabling standards to be updated based on changed conditions, and so on. Here, information on how the climate may change may be needed to change infrastructure design, land-use decisions, or other long-term decisions.[7]

The IPCC distinguishes among different types of adaptation divided between natural and socio-economic systems (see Table 1 below).

Table 1 – Adaptation responses to climate change

	Reactive adaptation	**Proactive adaptation**
Social and economic systems	**Adjusted (natural) adaptation** - after the impacts of climate change have occurred **Spontaneous adaptation** - not a conscious response; triggered by responses of	**Anticipatory adaptation** – before the impacts of climate change are observed **Planned adaptation** – adaptation as a

[7] Source: Draft OECD Guidance on Integrating Climate Change Adaptation into Development Co-Operation, 2008.

	ecological, social and economic systems	result of a deliberate policy decision.
Natural systems	**Adjusted adaptation** after the impacts of climate change have occurred	(Probably none)

Source: adapted from IPPC, 2006 and Linddal, 2008

IPCC also offers generic adaptation options typology, which is presented in the Example 3 below.

Example 3. Generic Adaptation Options

- Bear losses. All adaptation measures may be compared with the baseline response of 'doing nothing' except bearing or accepting the losses. In theory, bearing a loss occurs when those affected have no capacity to respond in any other ways (for example, in extremely poor communities) or where the costs of adaptation measures are considered to be high in relation to the risk or the expected damages.

- Share losses. This type of adaptation response involves sharing the losses among a wider community. Such actions take place in traditional societies and in the most complex, high-tech societies. In traditional societies, many mechanisms exist to share losses among a wider community, such as extended families and village-level or similar small-scale communities. At the other end of the spectrum, large-scale societies share losses through public relief, rehabilitation, and reconstruction paid for from public funds. Sharing losses can also be achieved through private insurance.

- Modify the threat. For some risks, it is possible to exercise a degree of control over the environmental threat itself. When this is a 'natural' event such as a flood or a drought, possible measures include flood control works (dams, dikes, levees). For climate change, the major modification possibility is to slow the rate of climate change by reducing greenhouse gas emissions and eventually stabilizing greenhouse concentrations in the atmosphere. In the language of the UNFCCC, such measures are referred to as mitigation of climate change and are considered to be in a different category of response from adaptation measures. Such modifications as enhanced flood control also come under this category.

- Prevent effects. A frequently used set of adaptation measures involves steps to prevent the effects of climate change and variability. An example would be for agriculture: changes in crop management practices such as increased irrigation water, additional fertilizer, and pest and disease control.

- Change use. Where the threat of climate change makes the continuation of an economic activity impossible or extremely risky, consideration can be given to changing land use. For example, a farmer may choose to substitute a more drought-tolerant crop or switch to varieties with lower moisture. Similarly, crop land may be returned to pasture or forest, or other uses may be found such as recreation, wildlife refuges, or national parks.

- Change location. A more extreme response is to change the location of economic activities. There is considerable speculation, for example, about relocating major crops and farming regions away from areas of increased aridity and heat to areas that are currently cooler and which may become more attractive for some crops in the future.

- Research. The process of adaptation can also be advanced by research into new technologies and new methods of adaptation.

- Encourage behavioural change through education, information and regulation. Another type of adaptation is the dissemination of knowledge through education and public information campaigns, leading to behavioural change. Such activities have been little recognized and have received low priority in the past, but are likely to assume increased importance as the need to involve more communities, sectors, and regions in adaptation becomes apparent. Furthermore, behavioural change can be fostered through appropriate regulatory instruments, as well as pricing and (removal of) subsidies.

OECD, 2008

There are different possible outcomes of the climate risk screening and response to climate change risks and how adaptation is addressed (see Figure 1):

- The 'worst-case scenario' is the '**climate ignorant**' scenario (*future 3*) where no adaptation is made to climate changes. This is for example, when a prescriptive approach is followed year by year to crop selection, flood dike construction and building standards that just keep on failing with changes to climate.
- In the '**climate adjusted**' scenario (*future 2*) there is a passive adjustment based on the failures ('learning by failure') that are experienced. This is for example, a change in crops after successive failures, abandoning of increasingly marginal crop lands, or changes in health care responding to problems as they emerge. The responses are to impacts rather than causes, and the response does not consider the causes.
- In the '**climate proofed**' scenario (*future 1*) potential climate change risks are addressed prior to the emergence of the impacts. This can be based on improved knowledge, early warning systems and planning taking the potential impacts of climate change into account. The response also concerns the causes in addition to the impacts.

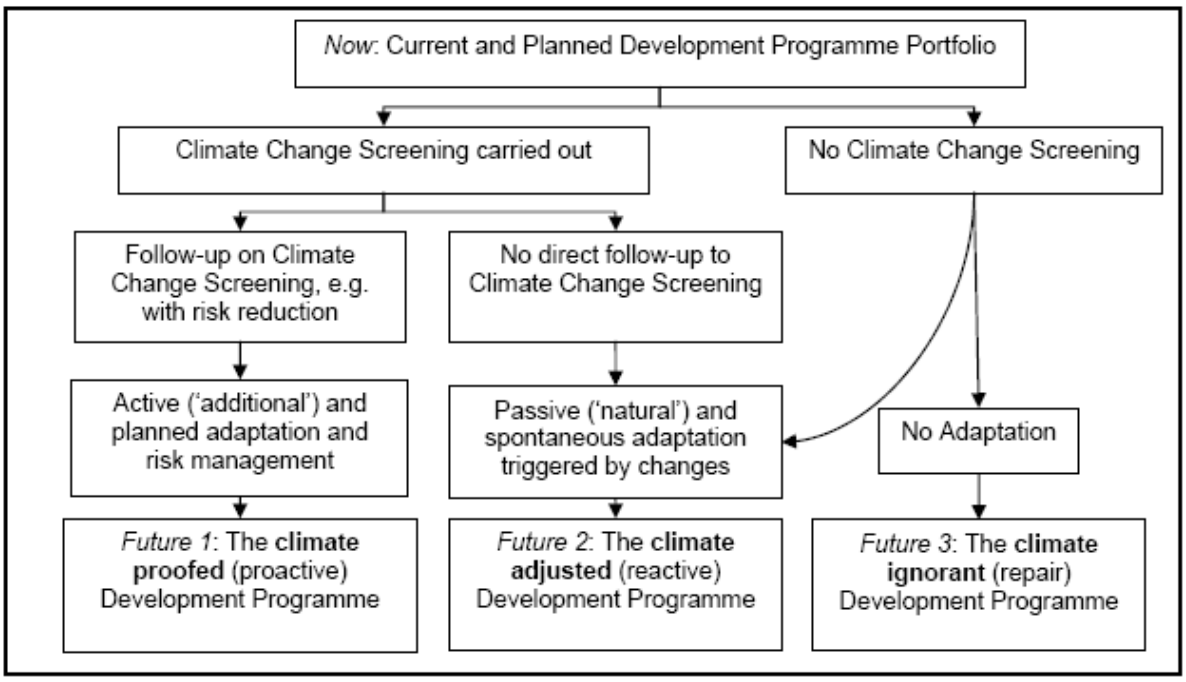


Figure 1 – Climate change screening and adaptation scenarios

Costs of climate proofing and adaptation

The costs of climate proofing and adaptation are often seen as the main obstacle to the implementation of adaptation measures. However, it is important to bear in mind that without preventive actions to climate change, human lives and the global environment may suffer greatly. On the project level, it is important to recognize that there may be also a cost to ignoring the impacts of climate change; a project may not perform as expected, reducing the return on investment and the benefit to the target community. By acting now, the costs are considered marginal compared to the costs of inaction and the benefits of strong, early action will considerably outweigh the initial costs of climate proofing. As the Stern Report argues, tackling climate change will cost 20 times less than doing nothing.

The actual cost of climate proofing a project depends on a number of factors including the geographical scale of the project; how detailed the information on climate variability or change needs to be; and the availability of data and analyses. An elaborated vulnerability assessment and climate proofing exercise can be quite costly, but for smaller projects the process can be simplified. If the

projected climate change and the proposed activities are known it is possible to quickly get an overview of the sensitivity of the proposed activities and subsequently identify adaptation measures.

Adaptation measures often are 'investments' and make good sense. However, if funds are not available they are easily ignored and not prioritised. Although many proposals for supporting adaptation measures entail 'doing development better'[8], significant additional funds will be required to upgrade infrastructure, to ensure agricultural productivity gains, to introduce better early warning systems, to protect vulnerable communities and so on.

Climate change adaptation and disaster risk reduction

The link between climate changes and the risk of disasters is apparent. Climate changes are already causing an increase in extreme climatic events, which increases the risk of natural disasters. Both man-made and climatic factors contribute to this increase. Factors such as population expansion and displacement and environmental degradation are expected to continue to increase the levels of vulnerability with a huge impact on both the local and global economy. As climate changes increases the pressure on nature, weather-related hazards (wind storms, surges, floods etc. but also diseases) will increase in intensity, frequency and distribution. This has socio-economic consequences and will result in increased vulnerabilities.

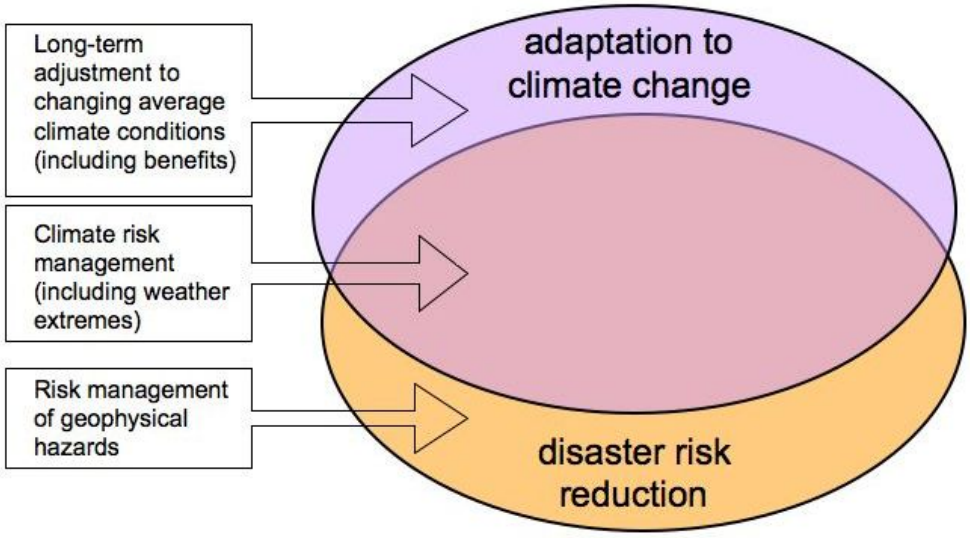


Figure 2 – Linkages between DRR and Adaptation

A misconception that disaster risk reduction is the same as adaptation is not uncommon. However, although there is some overlap, there is also a clear difference in the policy response to climate change adaptation and disaster risk reduction. Whereas disaster risk reduction is more concerned with the present and is focused on near-term trends (disaster relief and prevention), climate change adaptation is a long-term development effort aimed at attenuating the negative effects of climate change, including natural disasters. Climate Change adaptation focuses not only on extreme events but also on gradual changes in average climatic conditions and climate variability. Climate change adaptation encompasses disaster risk reduction in a longer timeframe by addressing the root causes of vulnerabilities at the broader societal scale rather than focusing on singular extreme phenomena for immediate or short-term preparedness and response.

[8] In the sense implied by the 2006 Stern report on the economics of climate change: that adaptation will be an extension of 'good development practice'.

Identification of project/programme beneficiaries and stakeholders

Engaging stakeholders in the adaptation process is crucial to the successful implementation of adaptation. It is especially important to ensure the participation of stakeholders from the most vulnerable sectors of the economy and groups particularly vulnerable to climate change.

Stakeholders can contribute significantly to understanding current vulnerability and adaptation and to identifying the necessary adaptation measures. At the same time, their involvement in a project can educate stakeholders about the risks associated with climate change, and encourage them to support the adaptation process. Done well, this process of engagement can assist the implementation of adaptation policies and the formation of an adaptation community. More important, it can provide the momentum to carry the adaptation process forward.[9]

The main challenge is how to determine the types of stakeholders who should become involved in the analysis, review and decision-making process. For example, for a food security project, stakeholders might include local farmers, other participants in the value chain, government ministries and extension services. For a water project, stakeholders might include municipal government officials and water users. The local stakeholders chosen should have a keen interest in the project under consideration and how it will affect their livelihoods.

Additional materials

For users who want more detail on analytical issues, this information can be found in a number of manuals, handbook and sourcebooks elaborated by international organizations and donor agencies, such as[10]:

- UNDP/GEF's Adaptation Policy Frameworks for Climate Change (http://www.undp.org/climatechange/adapt/apf.html#intro)
- UNFCCC's Handbook on Vulnerability and Adaptation Assessment (http://unfccc.int/resource/cd_roms/na1/v_and_a/index.htm)
- UNEP sourcebook (http://www.unep.org/themes/climatechange/docs/UNEPAdaptationSourcebook.doc).

[9] ADF, Section 1, page 25.
[10] Also see List of Literature in Annex I.

3. Climate Change Issues in Armenia

Current climatic trends in Armenia[11]

Armenia is located in a complex mountainous region and possesses a diversity of natural conditions. Six climatic zones have been identified, ranging from dry subtropical to high mountainous and from everlasting snow caps and glaciers to warm humid subtropical forests and humid semi-desert steppes.

Although Armenia's general climate is defined as arid, precipitation is irregularly distributed across the country varying from 200-250 mm in the lowlands to 1000-1300 mm annually in the mountains and highlands. There are also important seasonal variations. The wettest periods (April-May and October-November) receive approximately 40 percent of the annual precipitation, whereas the warmest moths (July to August) are the driest months where only 10 percent of annual rainfall on average is reported. The fact that the warmest months receive the least rainfall is an important limiting factor for agricultural production. The spatial distribution of precipitation is quite irregular, thus the north-eastern and central regions (Ararat Valley) of the country have been drying, but in the southern, northwestern parts and the Lake Sevan basin, precipitation has slightly increased over the last 70 years.

The mean annual temperature likewise covers important regional and seasonal variations. In June-August the average air temperature varies from $+10^0$C in high mountainous regions to $+25^0$C in the lowlands. In January the average air temperature depending on the altitude and peculiarity of the relief fluctuates from $+13^0$C to -1^0C. The absolute maximum and minimum temperatures in Armenia are reported as $+43^0$C and -42^0C accordingly.

Studies based on meteorological observations show that Armenia has been warming during the last decades, and according to available data, 11 of the last 12 years have been the warmest since 1850. Renewed linear trend of the century (1906-2005) presents an increase in temperature of 0.74^0C. The trend of the last 50 years (0.13^0C in a decade) is almost twice that of the century[12].

Climatic hazards, such as mud flows, hail, flooding and drought have always been recurring phenomena in Armenia, however these hazards are being reported more and more frequently. These various climatic hazards affect livelihoods and the economy. Especially the most climate-sensitive economic sectors in Armenia, which include water resources, agriculture, settlements and infrastructures, energy, and natural ecosystems, will be affected.

Future climate changes and risks in Armenia

Climate changes in Armenia are mainly predetermined by the global climate change of the Earth, and also on the internal microclimatic changes of anthropogenic origin. The Caucasus is subject to many forms of severe weather and because of its complicated topography and location in a meteorological transition region, the Caucasus has several unique risks, such as the variability in precipitation incorporating flood and drought microclimates.[13]

The IPCC has developed various global climate change scenarios based on the result of 40 different global climate change models. Each model is based on a number of assumptions as to future emis-

[11] Climate change issues by sector and potential adaptations are found in Annex V and the institutional framework for climate changes in Armenia in Annex VI.
[12] National Communication of the Republic of Armenia, 1998.
[13] Weather and Climate Services in Europe and Central Asia: A Regional Review, IBRD/WB, 2008.

sion of greenhouse gases, pollution, land-use, future technological and economic developments, and other driving forces. All scenarios are deemed 'equally likely'.[14]
In Armenia, the most likely scenario is an increase in air temperature by 1.1^0C in 2030, 2.7^0C in 2070 and 4.4^0C in 2100 and a decrease in precipitations by 3.1 percent in 2030, by 5.9 percent in 2070 and 8.7 percent in 2100[15]. These projected climate changes are likely to result in:

Water stress. Armenia is located in a region which experiences a chronic humidity deficit, where the natural flows of the rivers and their contraction volumes depend on the climate conditions and are impacted by anthropogenic factors. Scenarios for changes in water resources have been developed for the years 2030, 2070 and 2100. Compared to the period 1961-1990, water resources are likely to decrease by 0.6 billion m3 by 2030, corresponding to 8.5 percent of the total water volume. In 2070 and 2100 the decrease will constitute 1.2 m3 (18.9 percent of the total) and 1.8 billion m3 (25.4 percent of the total) respectively.

The climate change scenarios foresee an increase in the annual snow precipitations in the northeast and southeast parts of the country by 7-15 percent in 2030 and 20-40 percent 2100, whereas it is likely to decrease in the rest of the Armenia by 7-11 percent and 20-30 percent by 2030 and 2100 respectively.

The cumulative flow in rivers is likely to decrease by 7 percent, 14.5 percent and 24.5 percent by the years 2030, 2070 and 2100 respectively. This trend hides considerable regional variations and although the river flows will show a decreasing trend in most of Armenia[16], the river flows are expected to increase in the southern part of the country. The water reserves in snow on the whole territory have already decreased by 5-10 percent during the baseline period (1961-1990). This will have severe consequences for water use and management, e.g. irrigation systems and wetland areas.

Climate aridification and changes in natural habitat. Armenia has experienced a decrease in precipitation by 5,8 percent during the period 1961-1990. If this trend continues, precipitation will decrease by about 9 percent in 2100. Other expected climate changes include an increase in the average air temperature in Armenia by 4.4^0C by 2100.

As a result of the reduction in precipitation and the increase in temperatures, most climate models foresee a shift of the landscape-zone borders up the mountain by 100-150m over the next 100 years. It is expected that the desert/semi-desert zones will expand by 33 percent and a new desert zone will form (see map 1).

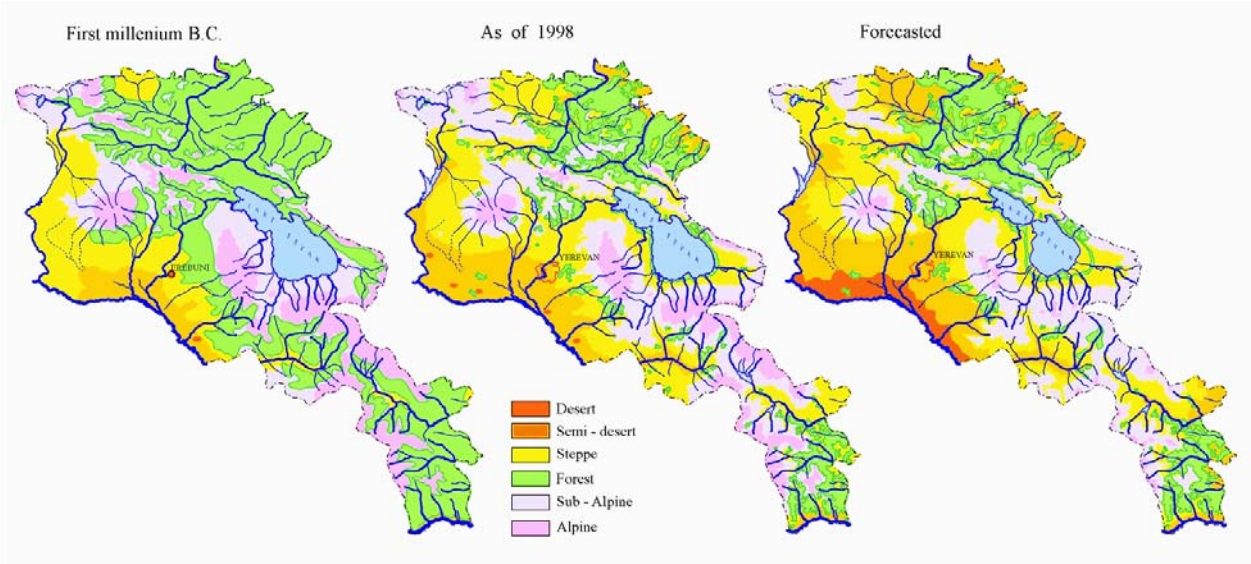
The expansion of the desert/semi-desert zone and possible reduction of lakes and wetlands will have a significant impact on the most vulnerable species of fauna in Armenia and a number of vegetation communities as well as endemic and rare species are expected to disappear.

Land productivity. As a result of the decline in rainfall and the increase in temperature, a reduction of soil humidity by 10-30 percent is expected and the efficiency of plant-cultivation in Armenia may be reduced by 8-14 percent unless more heat-resistant crops are introduced. Pasture areas will equally decline followed by a reduction of livestock. An increase in temperatures will result in the expansion of plant-growing zones at 200-300 metres in elevation which, combined with the forecasted water deficit, will require changes in farming systems.

[14] Theses projections are based on the First National Communication of the Republic of Armenia, 1998. The Second National Communication is presently under elaboration, and may reveal a slightly different scenario.

[15] Vulnerability Assessment of the Water Resources of the Republic of Armenia in the Climate Change Context - Brief Summary Report. UNDP/GEF/Ministry of Nature Protection, 2008.

[16] The most vulnerable rivers are found in the Sevan basin and include the Dzknaget, the Martooni, the Argichi, the Arpa, the Vedi, the Akhuryan, the Sevjoor rivers and the lower sections of the north-eastern rivers.



Map 1 - Forecasted changes in vegetation zones in Armenia, showing the expansion of the desert/semi-desert zones (Source: First National Communication, 1998)

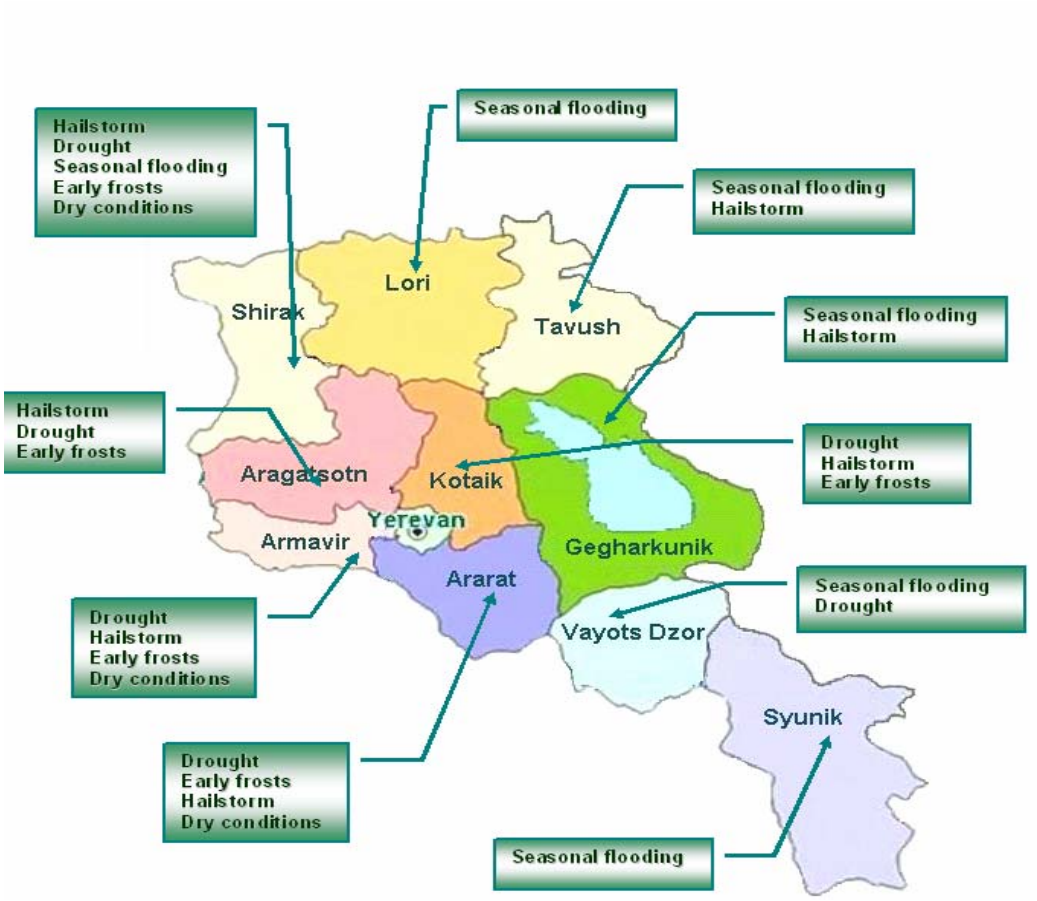
More frequent and extreme weather events and disasters. Every year a part of agricultural production is destroyed as a result of an extreme weather event, such as hail, frost, mudflow, droughts and floods. The analysis shows that intensity and frequency of extreme weather and climate has increased during last several decades. The recorded number of hailstorms during 2001-2006 reached 46 cases (hailstone diameter 22-35mm, on average); heavy floods during the past decade even resulted in human losses. In 2000, losses of the agriculture sector from droughts amounted in $66.7 million, constituting 10.1 percent of agricultural gross product. This includes 35 percent share of potato yield, 20 percent of cereals, and 16 percent of vegetables. Again in 2005 a major portion of crops was lost as a result of a combination of hail, floods and frost.

The prevalence of extreme weather events varies from region to region. The key types of extreme weather and regional variations are presented in Table 2 and Map 2. This tendency is likely to continue and result in more and more disasters.

Table 2. Vulnerability of different regions of Armenia to hydro-meteorological hazards

Marz	Dry conditions /0 – low, 5 – high/	Drought /0 – low 5 – high/	Seasonal flooding /0 – low 5 – high/	Hailstorm /0 – low 5 – high/	Early frosts /0 – low 5 – high/
Shirak	3	4	3	5	3
Lori	1	0	4	2	0
Tavush	1	0	4	3	0
Kotayk	2	4	1	3	3
Aragatsotn	2	3	2	5	4
Armavir	4	5	0	5	5
Ararat	4	5	2	4	5
Gegharquniq	1	3	4	2	2
Vauots dzor	2	3	4	2	3
Syuniq	1	2	4	2	2

Source: Ministry of Emergency Situations, Hydromet Second National Communication to UNFCCC



Map 2 - Key type of extreme weather events in Armenia by region (Source: Ministry of Emergency Situations, Hydromet Second National Communication to UNFCCC)

Health issues. The increase in temperatures may lead to higher incidence of cardiovascular diseases, especially among the most vulnerable part of population, such as the elderly. An increase in the number of malaria deaths has been detected and there is the chance of an outbreak of the plague as a result of an increase in plague microbe carriers in certain areas. An expansion of areas with plague carriers and an increase in the risk of malaria epidemics are expected. According to forecasts there is also heightened risk of cholera epidemics.

Part II - Rapid climate risk screening of UNDP/UNCT programming

This part of the guidelines is intended to be used by Programme Officers and Project Managers who do not necessarily have an environmental background. This part will help Programme Officers to review their project/programme portfolio and decide which projects/programmes require an in-depth climate risk screening and climate proofing. It is estimated that, provided necessary information is at hand, Rapid screening could take 1-3 hours, depending on the complexity of the project examined.

Information Needed

1. Basic information about each project/programme in the country portfolio, such as budget, main activities, target groups.

2. Basic climate change information, including current climate variability and projected climate change will be useful for considering relevant climate change risks.[17]
   This could include:
   • Local projections of climatic variables (precipitation, wind, flooding, snow melt);
   • Local consequences of the impacts (changes in local river hydrology, changes in ground water availability, impacts on slope stability, occurrence of pest and diseases etc.);
   • Best practices for adapting to climate change that have been applied in similar conditions.

Rapid climate risk screening

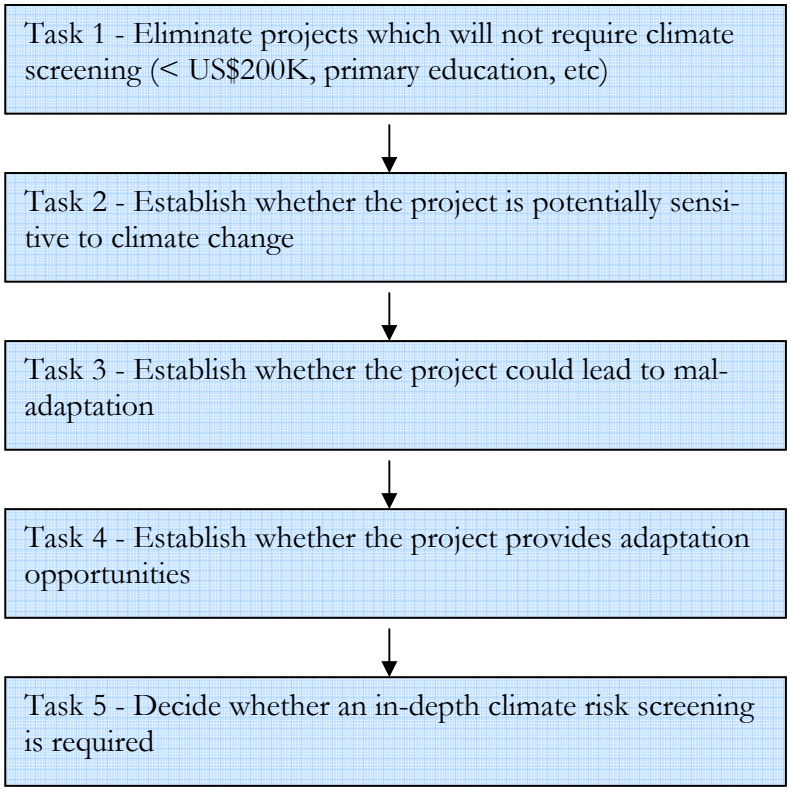


Figure 3 – Tasks in Rapid climate risk screening

[17] See UNDP's Country Adaptation Profiles at http://adaptationlearning.net/profiles/.

TASK 1. Eliminate projects which definitely will not require climate proofing

Projects **not requiring** climate proofing include projects with a budget below US $200,000 and projects related for example to primary and secondary education, elections, anti-corruption projects, some projects in the area of democratic governance, gender mainstreaming and HIV/AIDs prevention. Projects focusing on vocational training might be subject to a climate screening if they include training of people in areas related to the use and transformation of natural resources, such as training of extension services workers or training of SME entrepreneurs.

TASK 2. For the rest of the country portfolio establish whether each project or programme is potentially sensitive to climate change

If the project is located in an area prone to flooding, on steep lands or at high elevation, there is an increased risk that activities will be compromised by extreme events, such as mudflows, landslides and flooding. An area experiencing a rapid land use change may equally pose an increased risk if the rapid land use change is a sign of land degradation, soil erosion or unsustainable land-use. The arid and semi-arid areas subject to impacts from re-occurring droughts that may worsen due to increased intensity and frequency of droughts and heat waves, as a result of climate change may pose significant threats to those development projects focusing on agricultural productivity and rural development at large.

Example 4. High risk projects in Armenia

Armenia has considerable potential to produce hydropower, especially near Lake Sevan. However, a hydropower project relies on certain level of water flow for the generation of electricity. This may be seriously compromised by receding water levels as it has been predicted in certain regions of Armenia as a consequence of climate change. Armenia has already lost 5-10 percent of water run-off in certain regions and is seeing a decline in rainfall, which will likely lead to a further decrease in run-off.

Other high risk projects in Armenia include infrastructural developments, such as roads and bridges, which need to be designed to support more pronounced seasonal variations in rainfall and more extreme events, such as floods, droughts etc.

Likewise, the project is to be considered at high risk if it involves activities related to use of and access to natural resources (such as land, forests water, energy). This would involve most livelihood projects, primary production and land-use projects, irrigation schemes, infrastructure projects as well as development planning projects.

In order to identify projects at high risk, a number of guiding questions have been formulated (see Box 1).

Box 1 - Guiding questions for Task 2 [18]

If the answer to any of the following questions is yes, then the programme or project has the potential to be sensitive to climate change:

a) Is the project/programme located:
- In a flood plain?
- On steep lands?
- At high elevation?
- In an area prone to flooding?
- In an arid or semi-arid environment?
- In an area prone to extreme weather conditions, such as droughts, floods, strong winds, hail, tem-

[18] Based on consultancy report (2007) Jon Padgham 'Method for doing a portfolio review of climate risk to UNDP projects'.

perature extremes?
- In an area experiencing a rapid land use change?
- Close to a coastal shoreline?
- In an area affected by epidemics of climate-sensitive diseases (e.g. malaria, encephalitis)?
- Etc.

b) Does the project/programme involve?
- Agriculture and food security?
- Forestry?
- Water resources management?
- Energy?
- Disaster risk management?
- Natural resource management?
- Resettlement?
- Livelihoods?
- Tourism?
- Coastal zone management?
- Land-use and zoning?
- Development planning for water, agriculture, health, livelihoods, settlement?
- Regional development planning?
- Etc.

c) Does the project/programme target areas that may be indirectly sensitive to climate change?
- Governance in areas where climate change may exacerbate existing conflicts over access to and availability of resources?
- Economic development that depends on revenues from climate-sensitive sectors (agriculture, forestry, hydropower, tourism)?
- Capacity building of women or other vulnerable groups who tend to be more reliant on climate-sensitive sectors (nature resources) for livelihood support?
- Capacity building of groups that will be directly involved with the use or planning of natural resources (extension officers, SMEs that would be involved in transformation of natural resources (processing)?

TASK 3. Establish whether project/programme may lead to maladaptation

Socio-economic development in itself is not 'climate-risk' neutral, and may either increase or diminish vulnerability to climate change impacts. It is thus important to ensure that policies, actions, and other initiatives are designed to limit the potential adverse impacts arising from climate variability and change (including extreme events), and exploit any positive consequences.

All programme and project components should be screened to assess whether they are likely to increase environmental or societal vulnerability to climate change in the longer term. Increases in vulnerability may occur as unintended and unforeseen consequences of project activities where these do not consider changing climatic contexts. It is important to also screen for long-term impacts, the project may promote something that could have negative consequences in 5-20 years.

Box 2 - Guiding questions for Task 3[19]

If the answer to any of the following questions is yes, then the programme or project will probably lead to maladaptation:

a) Are elements of the programme or project likely to amplify the adverse impacts of climate change on key resources?

[19] UNDP's Quality Standards for the Integration of Adaptation to Climate Change into Development Programming, 2009.

b) Are elements of the programme or project likely to increase vulnerability of local communities or ecosystems to future climate change hazards?

For example, development interventions that increase groundwater use may accelerate a fall in groundwater levels where rainfall is declining and/or evaporative losses are increasing due to higher temperatures. Agricultural expansion or intensification in areas at risk of future desiccation may produce dependency on food production systems susceptible to future collapse.

TASK 4. Establish whether project/programme provides opportunities to promote adaptation

It is important to see whether project activities have inherent adaptation value, which can be further increased. Also, there could be opportunities to facilitate adaptation via synergies with existing or planned initiatives and/or exploit potentially beneficial changes in climatic or environmental conditions to deliver developmental benefits.

Example 5. Opportunities to promote adaptation in Zaravshan Valley Initiative (Tajikistan)

Zaravshan community development programme (CDP) includes pro-poor micro-finance institution that provide loans to households. Out of a total portfolio of micro-credits, 40 percent of them are farming initiatives; 30 percent husbandry and dairy produce; 15-20 percent shuttle trade; and 10 percent public services (hairdressers, tailors and other entrepreneurs). Since farming systems are particularly sensitive to climate change impacts, one of the recommendations that came out of the climate proofing exercise was that livelihood diversification should become a prominent part of the CDPs adaptation strategy. Otherwise, the project is sending a wrong signal to local communities and ties them up to agriculture, which becomes increasingly unreliable in the face of steady desiccation and more frequent weather extremes. Agriculture will remain an important practice for the Zaravshan communities for many years to come. However, income diversification of some degree will help accumulate assets and improve adaptive capacity. The project can deliberately promote off-farm livelihoods by offering longer-term credit pay-back preferential conditions for non-agricultural businesses through its successful micro-credit schemes.

TASK 5. Based on the outcomes of Tasks 2 through 4, decide whether an in-depth climate risk screening is required

To facilitate the assessment it is suggested to use the following table:

Practice Area	Project title	Activities at risk to climate change	Maladaptation risks	Stakeholders/systems at risk	Climate risk rating (1-5)	Opportunities for supporting adaptation	Budget	Comments

If the rapid screening demonstrates that the project is potentially sensitive to climate risks, has potential to lead to maladaptation or presents adaptation opportunities, generally it is recommended to undertake an in-depth climate risk screening. However, sometimes it will be possible to identify response measures or take advantage of adaptation opportunities already based on results of the rapid screening (see Example 6).

Example 6. Adaptation measures suggested based on initial screening of the Lusadzor project

Initial scoping exercise identified the project area as one of the disaster-prone regions of Armenia. In particular, occurrences of floods, hail, frost and mudflows constitute main climatic threats. High climatic variability and future changes in mean parameters may exacerbate the current development challenges and even undermine efforts to address these challenges. Therefore, the integration of climate risk management into the community development efforts was important and highly relevant.

The two main areas of activities within the project are the improvement of infrastructure and the development of agricultural practices. Based on the general information about the extreme weather events and climate-related disasters, the following adaptations measures were suggested per project component:

For Improvement of rural infrastructure component, which included: Construction of 20 private houses; Construction of the Getahovit-Lusadzor irrigation system operating through gravity flow and renovation of the internal irrigation network of the village; Reconstruction of a part of the internal irrigation network in the community; Construction of an internal network of potable water and renovation of two water reservoirs; Construction of a bridge over the Lusadzor River and renovation of field roads, the following was suggested:

Hazard mapping for housing:

In addition to conducting a bottom-up Vulnerability and Adaptation Assessment, it can also be suggested that the project supports a rigorous hazard mapping of the target area. This will help identify the areas of high exposure to floods and mudflows where house construction should be avoided. Clearly, there will be other criteria feeding into the decisions on where to construct houses (e.g. proximity to arable lands, schools, accessibility to water etc.) however, disaster prone 'hot-spots' should also be identified and considered in the construction scheme.

Runoff cycle and availability for water infrastructure:

In the construction of an irrigation system that will operate through gravity flow it is important to consider the flood-drought cycle of the area (based on historical data from the hydrological service or SNC, community information) to identify the current and anticipated high cyclical variability that needs to be considered in the design of water infrastructure. Additionally, the necessity for runoff capture and storage of flood water (as one of the means of local communal irrigation and flood management practice) needs to be identified and considered.

Bridge on the river Lusadzor:

The Hydrological regime of the Lusadzor River needs to be considered in the bridge construction scheme. The maximum water flow volumes and flood plain expansions in the last 10-20 years should be taken into account. The availability of projections for the next 30-50 years will contribute to more adequate parameters for the bridge. During past decade, it is almost a common picture in many countries of the region that bridges in rural settlements are destroyed or damaged during floods. This should be avoided by considering current and future vulnerabilities.

For the Development of agriculture component, which included: The return of non-cultivated arable land that had turned into natural pastures back into the sowing cycle; Planting of persimmon orchards and the distribution of seedlings to rural households, the following was suggested:

Farm-based adaptation:

Expansion to the non-cultivated arable land offers the opportunity to consider current climate variability and future risks. Based on more detailed V&A assessment, noted above, the project can provide valuable advice and guidance to farmers on tillage and cropping practices, on the right selection of stress resistant varieties. The project can also help by creating social safety nets and a pool of resources that will help to withstand major climatic stresses (droughts, floods, hail and frost). This approach will strengthen the community's coping capacity and enhance social ties within the community (identified by the project as one of the weaknesses).

Persimmon orchards (see Box 1)

Additionally, the following adaptation measures were suggested:

Adaptive capacity development:

As one of the community development activities, the project should introduce a set of actions for adaptive capacity development. Stemming from the peculiarities of the household economy in the target area, adaptive capacity development may focus on improving knowledge and understanding of climatic stressors to agricultural production in immediate, short- and longer-term perspectives. This can be done by providing climate information and warning system to the communities, so that they have sufficient time and information to adequately respond and adapt.

Policy impact:

1. Incorporation of adaptation measures into the three year integrated development plans for communities;
2. Addressing adaptation costs in local budgets to develop local adaptive capacity (introduction of local stress resistant varieties, local water and flood management, etc).

In case the decision is to proceed with an in-depth climate risk screening, it is recommended to contact the UNDP CO Environmental Focal Point and request support of the UNDP/GEF Regional Technical Advisor, based in the Bratislava Regional Centre. Once the relevance of climate change has been established for the project, it is advisable that programme the officer includes the specific task and associated budget in the project feasibility study (or situational analysis).

An example of country project portfolio screening is presented in Annex III.

Part III - In-depth risk screening of high-risk projects/programmes

This part of the guidelines is primarily designed for UNDP/UNCT Environmental Focal Points and climate proofing experts. It will guide the user though the climate proofing process step by step and will assist in incorporating climate change concerns into the development programme/project design and implementation.

1. In-depth risk screening of high-risk projects/programmes

Steps in the climate proofing exercise

Climate screening and proofing exercises will inevitably vary according to what is being proofed, e.g. is it a project or a community/region, is it the local level or national level. A number of guidelines on climate proofing have been developed[20], suggesting different approaches to the process. However, the basic steps in a climate-proofing exercise remain the same: a) description of the project areas and the project activities; b) estimation of expected climate changes (climate change scenarios), c) assessment of the sensitivity of proposed activities to the expected climate changes, d) assessment of the implicated population vulnerability to - and their possibility to cope with - these changes, e) identification of adaptation measures; f) monitoring & evaluation of the implementation of adaptation measures. The order and the 'wording' of the different steps may vary according to individual preferences and the type of proofing exercise.

These guidelines suggest dividing the climate proofing exercise into seven main steps presented in Figure 4 below. The first step (Rapid climate risk screening) is explained in Part II of these guidelines, the remaining six steps are described in detail in this section.

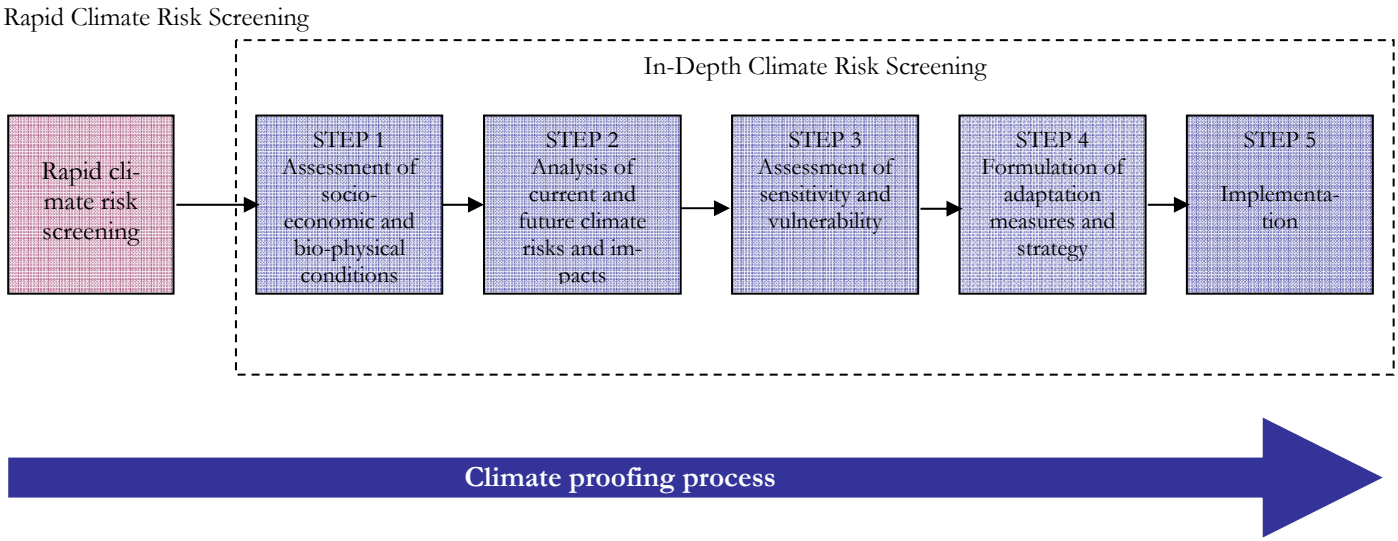


Figure 4 – Steps in the climate proofing exercise

[20] For example:
- UNEP Sourcebook , 2008;
- 'Climate Proofing: A Risk-based Approach to Adaptation', ADB 2005;
- 'Adapting to Climate Variability and Change: A Guidance Manual for Development Planning', USAID 2007;
- 'OECD Guidance on Integrating Climate Change Adaptation Into Development Cooperation', OECD 2008.

STEP 1. Assessment of socio-economic and bio-physical conditions

The aim of this step is to describe the socio-economic and bio-physical conditions of the project area(s). This will give an overview of information and will allow the user to assess what are the major development issues in the project area that could be exacerbated by climate risks.

Characteristics of the project zone, such as information on the geographical location, topography, soil types, the population, socio-economic conditions, livelihoods strategies, production systems, land-use, infrastructure, energy sources and consumption, and any other factor which might be relevant to the project, are important in the understanding of potential climate risks, coping strategies and the assessment of how vulnerable the community is to climate change and variability, including extreme events and disasters.

For easy reference, the description is divided into two Tasks: a description of bio-physical conditions and a description of socio-economic conditions (see Figure 5).

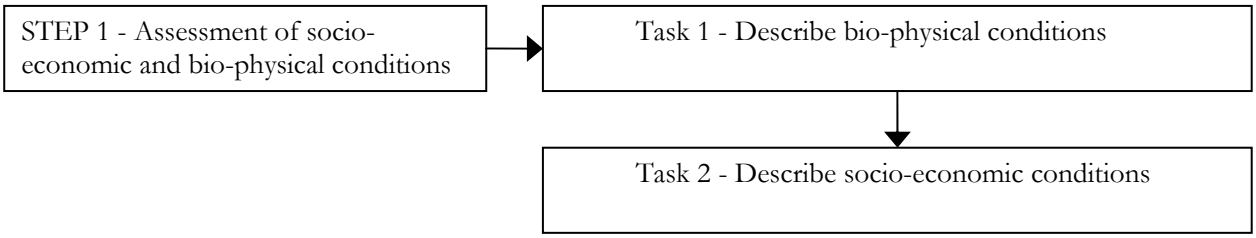


Figure 5 – Tasks related to Step 1

This is a flexible process and if deemed relevant, this step can be divided into more tasks. It would be important to include a thorough description of all the factors relevant to the project and its interaction with the environment.

Example 7. Analysis of background information in the Lusadsor case study

An analysis of background information identified that agricultural activities are the main source of employment and income for the population. However, the community's access to agricultural markets is rather limited. Inhabitants sell the products at prices lower than the market prices to resellers, who make purchases in the community rather irregularly, or transport the goods to the closest market in Ijevan at their own expense. This, in part, explains why agriculture in Lusadzor is largely directed toward internal consumption.

Such information is important for a climate risk assessment. Since agriculture is particularly vulnerable to climate change risks, climate change has the potential to undermine both food security and income generation in the Lusadzor community, and thus could jeopardize the achievement of the objectives of the UNDP community development project.

TASK 1: Describe bio-physical conditions

The purpose of the first task is to analyse baseline bio-physical data allowing the user to describe the natural resource management conditions. For example, the growing need for natural resources (water, land, timber, etc.) raises important issues regarding access to and use of these resources and what effect this has on people's livelihoods and vulnerability. There are many examples of serious environmental degradation caused by the exploitation of fossil fuels, mineral, and other resources. Since climate impacts are likely to be exacerbated as environmental degradation increases, an assessment of natural resource management trends can provide an essential input to assessments of the risks associated with future climate change. Such an assessment links the communities who may be vulnerable to climate change impacts with the potential sources of their vulnerability.

Environmental scenarios may need to be developed in which important feedbacks exacerbate climate risks, where environmental conditions influence adaptive capacity, or where environmental management options can be used to assess adaptation.
The description of the bio-physical conditions should include a description of (but not be limited to):

- **The topographical conditions**: Is the project located on a steppe, in a hilly area, at high elevation, in an area prone to extreme weather events (flood, drought, hail, storms, mudflows)?

- **Ecosystems and natural habitats**: What are the main types of ecosystems, types of vegetation? Is it an arid or semi-arid zone? Are there endangered species? How are forest resources exploited? What are the trends in terms of exploitation of natural habitats?

- **Water resources**: What are the main water resources in the area? Where do communities get their water supply? Are there water issues in the communities? Do communities experience water shortages? Floods?

TASK 2: Describe the socio-economic conditions

The purpose of this task is to describe socio-economic conditions in the project area and include the description of (but not be limited to):

- **Land-use**. What are the different land-uses in the areas (agriculture, forest, habitation, etc.)? Is the area experiencing rapid changes in land-use change? Agricultural lands should be divided into irrigation areas, grazing areas, crop areas etc. Even if agriculture occupies the vast majority of the surface, it is useful to specify other uses, especially forest areas, as both timber and non-timber forest products are important as a supplement to other incomes, and thus help to reduce the dependence on agriculture.

- **Livelihoods and economic activities**. What are the main sources of income in the project area? Agriculture (crop production, livestock), small-scale industries, etc.? Do farmers commercialize all their production and are there food security issues? What are the coping practices in case of disasters?

- **Poverty issues.** Are people considered poor in the project area relative to neighbouring areas or a national average? Are there vulnerable groups, (female-headed households, the poor, people with no access to land)? Are the communities experiencing rapid changes in their socio-economic conditions?

- **Infrastructure**. Description of primary infrastructure, such as roads, bridges, irrigation dams and channels and gas lines. Although the construction or rehabilitation of infrastructure is not a project activity in itself, the lack of, or inadequate, infrastructure may jeopardize project activities. This information will help give an overview of the accessibility and remoteness of the community and are important in the assessment of how vulnerable the community is to disasters and changing climatic conditions (e.g. aridification).

- **Energy sources and consumption**. What are the main energy sources, and what part of the population depends on firewood for cooking and heating? Gas lines have been put in place in many places in Armenia, but does everyone in the community have access to gas? Gasification at the community level is likely to reduce the consumption and dependence on fire wood, which will decrease CO2 emissions and have a positive impact on forest resources, which again may reduce the risk of erosion and hence mudflows.

- **Health issues**. What are the sanitary conditions like? What types of water or airborne diseases are prevalent? Are there increases in the number of deaths related to infectious epidemic diseases?

STEP 2. Analysis of current and future climate trends, risks and impacts

The objective of this step is to assess climate changes and likely scenarios for climate changes. This step will allow the user to assess what are the major risks in terms of climate change for the project area; understand the perception of the local population with regard to these risks and provide a description of existing adaptation and coping strategies.

The assessment of current and future climate trends, risks and impacts includes four major tasks as shown in Figure 6.

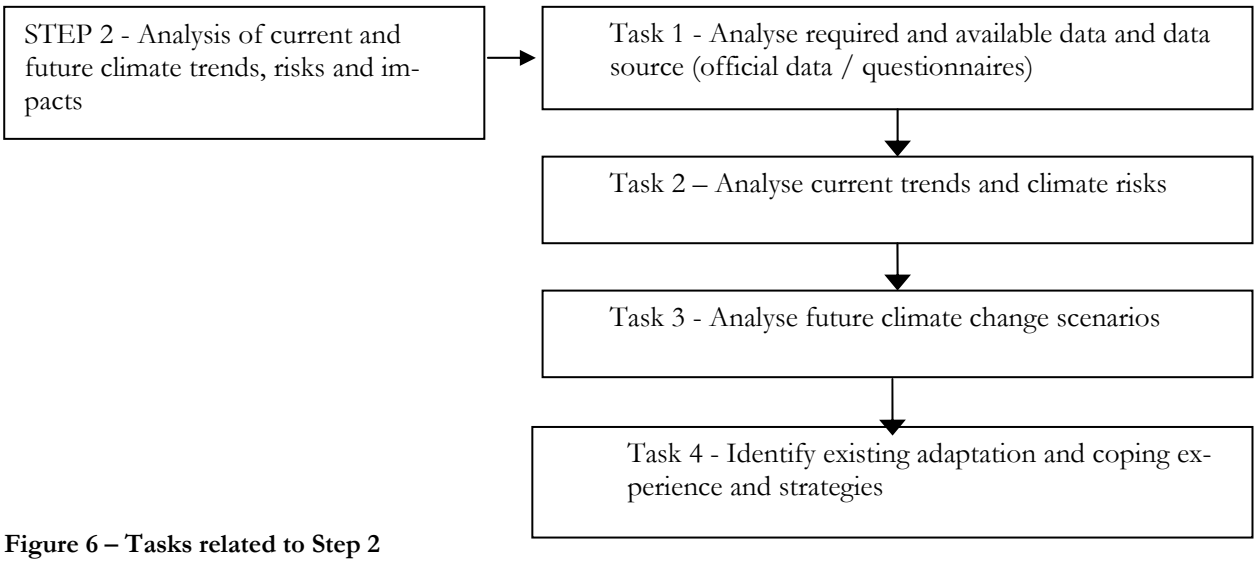


Figure 6 – Tasks related to Step 2

TASK 1: Analyse required and available data and data sources

This task is based on official national, regional or local data on changes, trends and seasonal variations in air temperature, precipitation, winds, extreme weather events, etc. in the project area.

Users can refer to various background materials to understand available information. Examples include: national communications on climate change, studies, surveys, modelling, national development plans, Poverty Reduction Strategy Papers, environmental sustainability plans and natural hazards assessments. These and other existing sources should be identified and explored, and information can be extracted for use in developing the baseline[21]. The focus of this effort should be on both key climate and environmental concerns - e.g., the history of drought and crop failure in a region – and the relationship between risk and coping measures - e.g., the impact of drought on smallholders.

Existing sources of information may include a) National Communications to the UNFCCC; b) studies/projects that have focused on climate change related impacts (e.g., previous vulnerability and impact studies, www.nature-ic.am); c) studies/projects that have been carried out that may not have an explicit focus on climate change (e.g., national action plans under the Desertification Convention), but are nonetheless highly relevant; and d) existing policy context for coping with current climate risks and variability. This information will provide the necessary basis for constructing the current climatic trends in Task 2.[22] This list is not exhaustive and other relevant sources of information may be found for a specific area.

[21] A baseline is in a climate change context understood as a reference period (typically a 30-years period) which is used to represent the climate of that period, and which is used to compare fluctuations of climate between one period and another.

[22] Climatic data of Armenia is available in a number of reports, such as:

- First National Communication of the Republic Of Armenia (1998);

Often local-level data does not exist, and it is necessary to base the analysis on data from other sources. This includes, e.g. data from a neighbouring area with similar conditions or downscaling of national climatic models (this data can only be used as an indication and with precaution), or data from interviews, questionnaire surveys, etc. (see Example 8).

Statistical data as well as questionnaires can be used to describe current climate (e.g., mean, standard deviations, frequency of extreme events, etc.). For all secondary data, it is important to assess the reliability of the source of the data, the objective of survey/study and the data collection process.

Example 8. Data analysis in the Lusadzor Climate Change Impact Assessment

As baseline data did not exist in the Lusadzor community at the time of the climate change impact assessment, two approaches were used to identify past and current climate trends, namely: a) interviews with the local community and agricultural officers and b) analysis of meteorological data from two meteorological posts near Lusadzor.

Interviews with the local community

A questionnaire was developed containing three sets of questions: 1) general information, such as landholding size, agricultural practices, and main sources of income; 2) occurrence of climatic hazards in the community in recent years, such as floods, mudflows, landslides, droughts, hail, wind and etc., and 3) coping strategies with climate extremes, in particularly, accessibility and use of climate information, types of adjustments made to cope with climate risks. In order to estimate economic losses due to climatic hazards, meetings were held with the representatives of the regional Department of Agriculture.

Analysis of meteorological data

Given the similar climatic conditions between Lusadzor and two nearby communities, Ijevan and Berd (respectively 8.2 km south and 27 km east of Lusadzor), meteorological data from these posts were used as a basis for the analysis of climate trends in Lusadzor.

TASK 2: Analyse current trends and climate risks

The compilation and analysis of climate data carried out under Task 1 is a precondition for the description of climate trends. Based on the data collected it is possible to describe current climate trends and risks. Example 9 presents an example of current changes in the Lusadzor community.

Example 9. Description of current changes in Lusadzor community

Interview studies with local residents from Lusadzor community and with representatives of the Department of Agriculture in the Tavush revealed the following climate changes:

- An increase in the frequency and intensity of climatic hazards

A large majority of the interviewed residents mentioned that the frequency and intensity of climatic hazards had increased in the period of 2001-2007. This particularly relates to flooding, mudflows, hail, strong winds and frost. Likewise, according to both residents and local authorities there is less water available nowadays;

- Tangible economic losses due to climatic hazards

None of the climatic hazards were reported to have caused human losses. However, significant damage was caused to infrastructure (destruction of roofs due to storms, washing out of land area due to flooding, etc.) and crops.

- Model Simulations of Climate Change over Armenia Region. 'Enabling Activities for Preparation of Armenia's Second National Communication to the UN Framework Convention on Climate Change (UNFCCC)' UNDP/GEF/00035196 (2008);
- Weather and Climate Services in Europe and Central Asia: A Regional Review. IBRD, 2007;
- UNDP's Country Adaptation Profiles at http://adaptationlearning.net/profiles/.

All involved stakeholders need to understand elements of risk early in the project development process. Box 3 presents a number of guiding questions to help the user describe current trends and risks.

Box 3 - Guiding questions to the analysis of current trends, risks and impacts[23]

- What characterizes climate variability, extremes, and hazards in the project area?
- What are the current major climate-related hazards?
- What are the current major impacts/outcomes of these climate-related hazards?
- What currently determines the type and severity of the impacts/outcomes (vulnerability)?
- What measures and policies currently relate to relevant climate risks, impacts and selected development outcomes? How effective are they?
- Do development policies increase these risks?
- Do other activities increase the risks?
- Are socio-economic conditions affecting current vulnerability and risk?

TASK 3: Analyse future climate change scenarios

While adaptation to current climate risks is important, it may not be sufficient to deal with all of the possible future risks of climate change. To understand these risks, users need to take into account future scenarios of climate change, vulnerability to climate impacts, and socio-economic dynamics. Example 10 illustrates the analysis of future climate scenarios in Lusadzor.

Example 10. Future climate trends in Lusadzor

The North-Eastern region, where Lusadzor community is located, is likely to experience:

- An increase in the annual temperature of approx. 1^0C in 2030, 2^0C in 2070 and between 2.5 to 4.5^0C in 2100. This average covers distinct seasonal variations, e.g. the summer temperature is likely to increase by 4 to 5^0C in 2100.
- A general increase in precipitation, but a decrease during the growing season. The precipitation is likely to increase during autumn and wither, but decrease during summer. As crops and pastures depend on rain during the agricultural period, a decrease in rainfall during this period may have dire consequences for natural vegetation and crops.
- Increasing climate variability across the seasons and more extreme weather events. An intensification of extreme weather events will pose continued damage to infrastructure and economic activities of the local population. With an increased frequency and intensity of floods and hails agriculture and farming practices are particularly vulnerable

The assessment of future climate risks involves examining intersections between trends (e.g., climate, natural resources, socio-economic conditions) and factors that influence the development of adaptive responses (i.e. barriers and opportunities). This can be done though stakeholder meetings.

In the analysis of future climate changes and intersections between trends, the user should:

- **Identify relevant climate variables and assess trends** (observed and projected/ modelled trends). E.g. are there changes in temperature, precipitation, stream flow, growing season, min/max temperatures, seasonal changes; more frequent or more extreme hazards, etc.;
- **Assess socio-economic trends** (relevant to the policy, plan or project). E.g. are there large infrastructural, forestry or/and agricultural developments projects planned? Have incomes

[23] Based on UNDP's Quality Standards for the Integration of Adaptation to Climate Change into Development Programming, 2009.

been decreasing or increasing? Is it an area of rural exodus? What is the occurrence of certain water or airborne diseases – or signs of food insecurity?

- **Assess trends in natural resources and environment,** including changes in anthropogenic drivers of environmental stresses; e.g. changes in biodiversity, regeneration of natural vegetation, etc.;
- **Assess barriers to adaptation to climate risks and opportunities for adaptation**. Are there elements in national, regional or local plans and strategies which pose barriers or present opportunities for integrating climate change risks? E.g. planned activities and developments, institutional arrangement, etc.

Box 4 includes a number of guiding questions to the analysis of future climate scenarios.

Box 4 - Guiding questions to the analysis of future climate change scenarios

- How sensitive is the project area to climate change?
- What is the planning horizon for e.g. agricultural and infrastructure developments? (10, 20, 50 years?)
- What are the trends (observed) and projected (future) major climate-related hazards?
- What is the range of severity of these hazards (accounting for uncertainty)?
- What future socio-economic or other factors will determine the type and severity of the impacts/outcomes?
- What are the projected impacts/outcomes of these hazards?
- What are the barriers and opportunities for adaptation?
- What aspects of national planning pose barriers or present opportunities for integrating climate change risks?

TASK 4: Identify existing adaptation and coping experience and strategies

TASK 4 is very closely related to TASK 2 and TASK 3 of this STEP. For example, some of the information to be analysed under this TASK, may have been already collected (and analysed) under TASK 2. TASK 4 aims to identify existing strategies to cope with weather extremes and disasters and should include a description of:

Local community's perception of the frequency and intensity of extreme weather events and climate hazards (floods, mudslides, droughts, hail etc); Do communities experience changes/shifts in seasons (early/late spring rains, early snow melts, frequent floods/droughts etc)? Have there been more unusual weather phenomena during the past decade (unusually strong hail, stronger floods, longer droughts, etc)? How do communities traditionally cope with extreme events? Are the coping strategies still useful/sufficient today?

Type and magnitude of losses due to these hazards (human losses, damage to infrastructure, economic losses such as crop failures etc). If there are changes and unusual weather patterns, how do these affect families (household economy)?

Assessment of the current coping mechanisms and capacities; what are usual responses to such events (availability of compensation in case of damage and loss)? How much does a household spend on recovery)? What are the priority needs to address the additional vulnerability induced by climatic risks and actions for risk reduction? What are the needs to minimize / avoid damage and loss?

STEP 3 - Assessment of sensitivity and vulnerability

The aim of this step is to assess how sensitive the proposed activities are to the expected climate changes and how vulnerable the project target group is.

An assessment of sensitivity and vulnerability involves the identification, quantification and prioritisation of an area's or a project's vulnerabilities to climate changes. This requires an analysis of the interaction of biophysical and the socio-economic elements and commonly covers: exposure to specific social/environmental stresses, associated sensitivities, and related adaptive capabilities.

The key guiding questions for this step are: 'Are the projects/programmes as they stand today vulnerable to climate risks?'; 'Are climate variability and changes likely to undermine project/programme goals, results or activities?'; 'What factors determine current vulnerability?'; and 'What are the options to minimize or avoid such risks, secure the results and capture adaptation benefits through these projects/programmes?'.

The sensitivity and vulnerability assessment involves two tasks as shown in Figure 7.

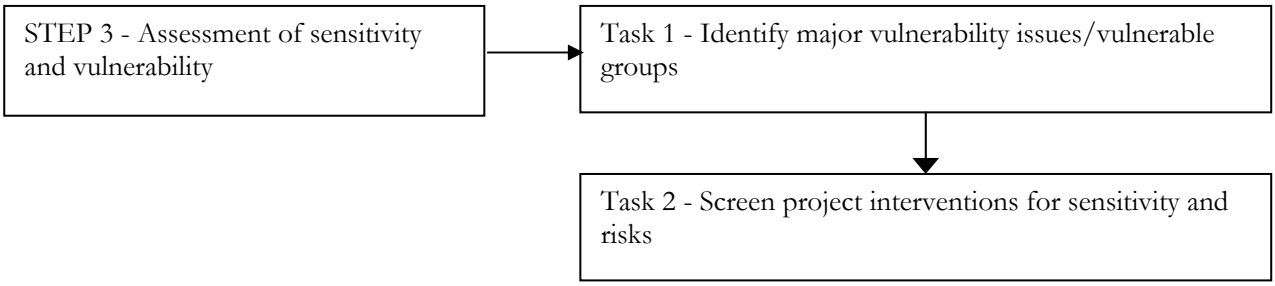


Figure 7 – Tasks related to Step 3

TASK 1 - Identify major vulnerability issues and main vulnerable groups

In its most complete form, assessing vulnerability can clarify definitions and analysis questions; define key vulnerable groups; define exposure to climate risk (using results of the socio-economic analysis); and assess current vulnerability (the conjunction of climate hazards and socio-economic conditions).

A vulnerability assessment would identify the risks of climate change, including the components of natural ecosystems that may be negatively affected by rapid climate change, economic activities and geographic areas most at risk, consider the effects of climate change - both positive and negative - on populations, economic sectors and ecosystems. The vulnerability assessment can be qualitative as well as quantitative in nature. It is usually based on local experience with past weather events (e.g., severe rain storms, droughts, hot spells, cold snaps, floods, and wind storms) that resemble climate change.

It is important to understand the factors that enhance or threaten the adaptability of vulnerable populations and natural systems. Based on the risk and sensitivity assessment, vulnerable production systems and key vulnerable groups can be identified as groups whose livelihood is climate sensitive and at risk to climate changes and who have little or no means to cope or adapt. Vulnerable production systems may include agricultural systems with inappropriate farming methods; land degradation; inappropriate water management resulting in water losses, etc. Box 5 presents guiding questions to help identify vulnerable groups.

Box 5 - Guiding questions to the identification of vulnerable groups

- Which activities are sensitive to climate changes?
- Which groups of beneficiaries are involved in the activities? Women, poor, young?
- Which beneficiaries are involved in climate sensitive activities?
- Where does the community stand today with respect to vulnerability to climate risks?
- What factors determine current vulnerability?
- How successful are its efforts to adapt to current climate risks?
- Are these beneficiaries able to cope with climate risks and impacts?
- Do project activities enhance adaptation or is it counterproductive?
- Which are the vulnerable groups?

TASK 2: Screen project interventions for sensitivity and risks

The sensitivity screening is based on an assessment of the sensitivity of each activity to the current and future climate changes. This could be done in the form of a table indicating a) the proposed activity, b) the estimated sensitivity and c) the adaptation value, i.e. is it considered as contributing to adaptation or making it worse. Below is an example of such a table, based on the Lusadzor case study (Example 11).

Example 11. Sensitivity assessment from the Lusadzor case study

Activity a. Reconstruction of a part of an internal irrigation network in the community
Sensitivity: The activity is not sensitive to the forecasted climate change for that area
Adaptation Value[24]: Positive - given the forecasted decline of water resources, the renovated internal irrigation network will help reduce water loss and save water.

Activity b. Construction of an internal network of potable water (6 km) and renovation of two water reservoirs (150 m^3)
Sensitivity: The activity is limited in scope and doesn't change the former design parameters. Water use volume in the source will not increase as the construction of 6 km pipeline is intended only for improvement of the distribution system
Adaptation Value: Positive - community residents will receive safe water. The forecasted negative impact of an average temperature increase on outbreaks of intestinal infectious diseases will be mitigated.

The description of the project activities is important to identify those that may have inherent adaptation value (such as improving water efficiency, economic diversification, etc.) and activities that might raise the risks for human populations (maladaptation), e.g. by introducing development in vulnerable areas, such as floodplains.

Box 6 identifies a number of key questions to ask in order to assess the sensitivity and vulnerability of the project.

[24] The adaptation value can be defined as the value of an activity as an adaptation measure.

Box 6 – Guiding questions to sensitivity and vulnerability assessment[25]

1. **What activities does the project involve:**
   - Agriculture, livestock production, crop production, irrigation, commercialization, pest management, etc.?
   - Forestry?
   - Natural resource management?
   - Wildlife?
   - Water resources management?
   - Disaster risk management?
   - Health?
   - Resettlement? Livelihoods?
   - Land zoning?
   - Development planning for water, agriculture, health, livelihoods, settlement?
   - Regional development planning…?
2. **Sensitivity**
   - Which activities are sensitive to climate changes?
   - Are climate variability and changes likely to undermine project/programme goals, results or activities?
   - Does climate change impact biodiversity and major ecosystem services?
   - Does climate change impact fresh water storage by increased water evaporation and / or glacier retreat?
   - Are there any disruptions in municipal services on water supply (both drinking and irrigation) due to climatic events?
   - Do dry seasons and droughts become longer contributing to land degradation and disruptions to ecosystem services?
   - Is there a detectable increase in incidents of climate-related disasters (floods, storms, droughts etc)?
3. **Vulnerability**
   - Which groups of beneficiaries are involved in the activities? Women, poor, young?
   - Which beneficiaries are involved in climate sensitive activities?
   - Which are the vulnerable groups?
   - Are these beneficiaries able to cope with climate risks and impacts?
   - Do project activities enhance adaptation or hinder it?
   - Does climate change impact the resource base of the poor (agricultural and natural resources)?
   - Do climate related disasters lead to damage to the poor's livelihood assets and infrastructure?
   - Do changes in water, temperature and vegetation contribute to increased prevalence of disease?
   - Which risks could have direct or indirect impact on the achievement of the project outcome?
4. **Coping strategies**
   - Does the government offer farmer compensation schemes for loss of agricultural produce due to climate change (droughts, floods, forest fires, etc)?
   - Have efforts in this area supported improved capacity of national and sub-national agencies in improving climate risk management services?
   - Have efforts in this area supported the capacity of civil society and local communities to better adapt to climate change?

[25] Based on consultancy report (2007), Jon Padgham, 'Method for doing a portfolio review of climate risk to UNDP projects'.

STEP 4 - Formulating adaptation measures and strategy

In response to current and future vulnerability and risks, policy options and measures should be identified and selected, and from the options, a cohesive, integrated policy, plan or project adaptation plan developed.

This step includes a synthesis of previous steps, in terms of climate risk, sensitivity, and vulnerability, identification of barriers and options for adaptation, and formulation of adaptation measures and their costs and implementation (see Figure 8).

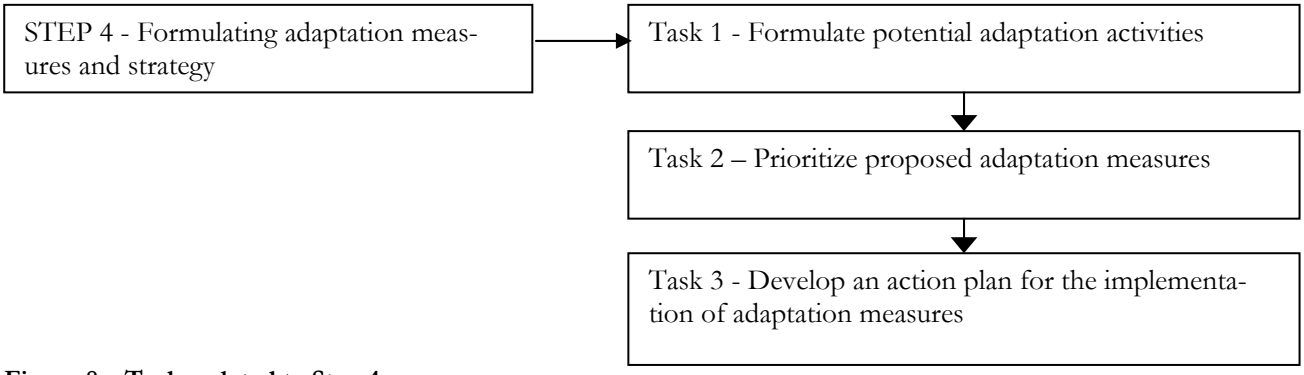


Figure 8 – Tasks related to Step 4

Climate considerations can be integrated in new projects either by formulating 1) activities that are adaptation measures in themselves (e.g., enhanced soil fertility, new farming techniques, new design criteria for infrastructure, infrastructure investment with a longer life-span in mind, options for water storage, dimension of culverts and bridges in road building, etc.) or 2) activities which are climate-neutral, i.e. do not affect local vulnerability and/or adaptive capacity.

TASK 1: Formulate potential adaptation activities

The goal of this task is the development of a preliminary, non-prioritized list of potential adaptation options (see Box 7 for guidance). This shall be done after taking stock of what has emerged so far in the process, including assessments of current and future climate risks and existing adaptation efforts (if any) and barriers.

Box 7 - Guiding questions to formulation of potential adaptation activities

- What are the existing methods for managing climate risks and adaptation? Are these viable in the future, can these be built upon?
- What other interventions can be utilized to reduce impacts and improve development outcomes?
- Can these adaptation interventions be undertaken? What are the barriers?
- What are success criteria?
- What are the costs, impacts and barriers of each option (based on agreed criteria)?
- How do the options compare through ranking?
- What suite of policies and measures constitutes a cohesive approach to development and adaptation?

Some of the adaptation measures identified in the Lusadsor case study are presented in Example 12 below. Detailed list of issues and possible adaptation measures for the agricultural and water management sectors in Armenia are presented in Annex IV.

Example 12. Selected adaptation measures from the Lusadzor case study

- Introducing farm piloting/demonstration of adaptation measures (e.g. intercropping, tillage practice, efficient irrigation scheme, new stress-resistant varieties (preferably local endemic varieties), testing seasonal protection infrastructure against hail and frost, etc).

- Consideration of climatic hazards in infrastructure development works as part of community development plans. This can be done through ensuring that during the planning and design of the main infrastructures it is necessary to take into consideration the climatic hazards through the use and analysis of hydro-meteorological information. This adaptation measure has to be communicated to higher level authorities, since it has significant budget implications and given the fact that most of the rural infrastructure works projects are financed from the central government budget.

- Creation of communal social nets and common pools of resources (e.g. common pool of seeds and seedlings, communal irrigation management, etc) to help cope with major stressors in the community. This adaptation measure is proposed given the increasing incidents of evidenced and anticipated climatic hazards, such as hail, strong winds, floods and droughts.

TASK 2: Prioritise proposed adaptation measures

The main goal of this task is to characterize adaptation options in terms of their impacts and potential barriers, and to develop criteria for prioritizing options.

This task involves selecting and applying prioritization methods. In view of the diversity of climate change adaptation options, probably more than one method may be needed to review all choices. To decide which should be used in the prioritization process, users should carefully consider the available methods (e.g., cost benefit analysis, cost effectiveness analysis, multi-criteria analysis, and expert judgment). Some methods require higher levels of data and resource inputs (in terms of time and skills of stakeholders).

The development of criteria for prioritizing adaptation options should be a stakeholder-driven process. To ensure that criteria reflect the needs of the target groups, stakeholder input is critical. The criteria developed will be used to prioritize measures and policies. They can also act as indicators of the project's longer-term success in achieving the adaptation objectives. An example of a set of criteria for prioritization of the initial list of adaptation measures is presented below (Example 13).

The issue of additional funds for climate change adaptation is important as this is often a barrier for the implementation. In this respect it is important to weight the cost again the costs of NOT adapting. Adaptation measures are often good development and could be seen as 'an investment'. However, often significant additional funds are required if infrastructure is to be upgraded, and new systems are to be introduced, such as early warning systems.

Community contributions are, as in all development activities, important to ensure ownership of the adaptation measures.

Based on the list of potential adaptation measures and the criteria it is possible to identify priorities from the array of possible adaptation measures. The output will be a ranked list of adaptation options.

Example 13. A set of criteria for prioritization of adaptation measures[26]:

Effectiveness - effectiveness of adaptation options as a solution to problems arising from climate variability and climate change (benefits, damages mitigated, costs avoided, and lives saved as different specifications of "effectiveness");

Cost – Additional cost to implement the adaptation options and/or cost of not modifying the project;

Feasibility - Capacity and means to implement the measure. Barriers to implementation and the need to adjust other policies to accommodate the adaptation;

Social/Cultural Feasibility - All adaptations identified as feasible may not be equally attractive to all stakeholders for political, economic, social, cultural reasons. The proposed measure must not disrupt social and cultural values and traditions, but rather builds on them;

Institutional capacity – how much additional capacity building and knowledge transfer is required for the adaptation option to be implemented;

Adequacy for current climate – Benefits under the current climatic conditions and future scenarios. Are there negative consequences of the adaptation option in the current climate? Some adaptations may be targeted at the future climate, but may have costs and consequences under the current climate.

Size of beneficiaries group – Adaptations that provide small benefits to large numbers of people will often be favoured over those that provide larger benefits, but to fewer people;

Consistency with project / programme goals – Are the adaptation measures in line with the project purpose, scope and a timeframe; supports and reinforces the core objectives of the project and does not diverts its focus to other aims.

TASK 3: Develop action plan for the implementation of adaptation measures

The output of this task will be an action plan that outlines the proposed adaptation measures, the responsible persons, implementation plans (who, where, with what resources), time frames (when) and operational issues (what types of institutional support).

This task will generally involve the following activities:

- Drafting the adaptation action plan (a set of suggested adaptation measures);
- Reviewing the coherence of the action plan with project implementation plan;
- Scoping issues related to the implementation, such as barriers and barrier removal plans; and
- Finalising the action plan.

Stakeholder support may be the single most important factor in determining whether the adaptation plan is successfully implemented. For this reason, broad stakeholder input to the strategy development process is critical.

STEP 5 – Implementation

This step involves ensuring that adaptation measures implemented in an efficient manner and is thus related to monitoring and evaluating of the action plan realization. Two tasks have been identified, namely the development of indicators and the development of an M&E plan (see Figure 9).

[26] USAID: Adapting to climate variability and change – A guidance manual for development planning, 2007.

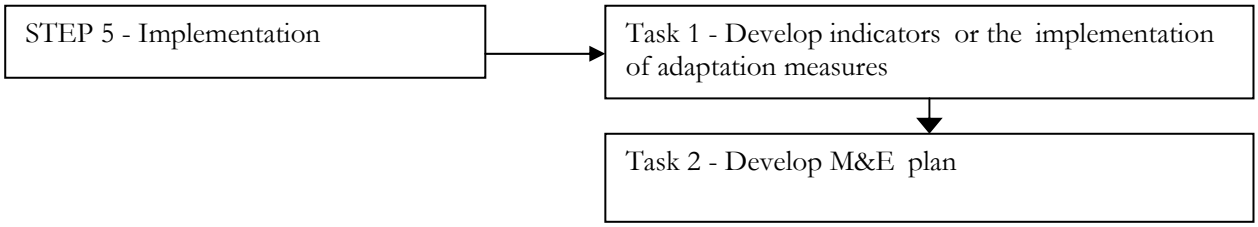


Figure 9 - Tasks related to Step 5

TASK 1: Develop indicators or the implementation of adaptation measures

To ensure that adaptation measures are effective and efficient it is recommended to develop indicators to be included in the project's Resource and Results Framework to monitor the implementation of the measures.

These types of indicators can be difficult to monitor or assess as they are often long term indicators. Example of such indicators could be a reduction of a community's area that is flooded on an annual basis, or crop production that is lost.

TASK 2: Develop M&E plan

In conjunction with the action plan, a progress monitoring & evaluation plan should be elaborated, specifying the time scale and how to track progress. Box 8 presents a set of questions to guide the user in the formulation of the M&E plan[27].

Box 8 - Guiding questions to the implementation

- What are the channels for integrating the policy, plan or project into development plans and policies? What barriers exist, including capacity?
- What are the necessary management, oversight, implementation and support structures?
- What are the indicators of progress and over what time scale and how should they be tracked?
- What is the strategy for reviewing, monitoring and evaluating impacts?

[27] See also Proposed Framework for Monitoring Adaptation to Climate Change, UNDP 2008.

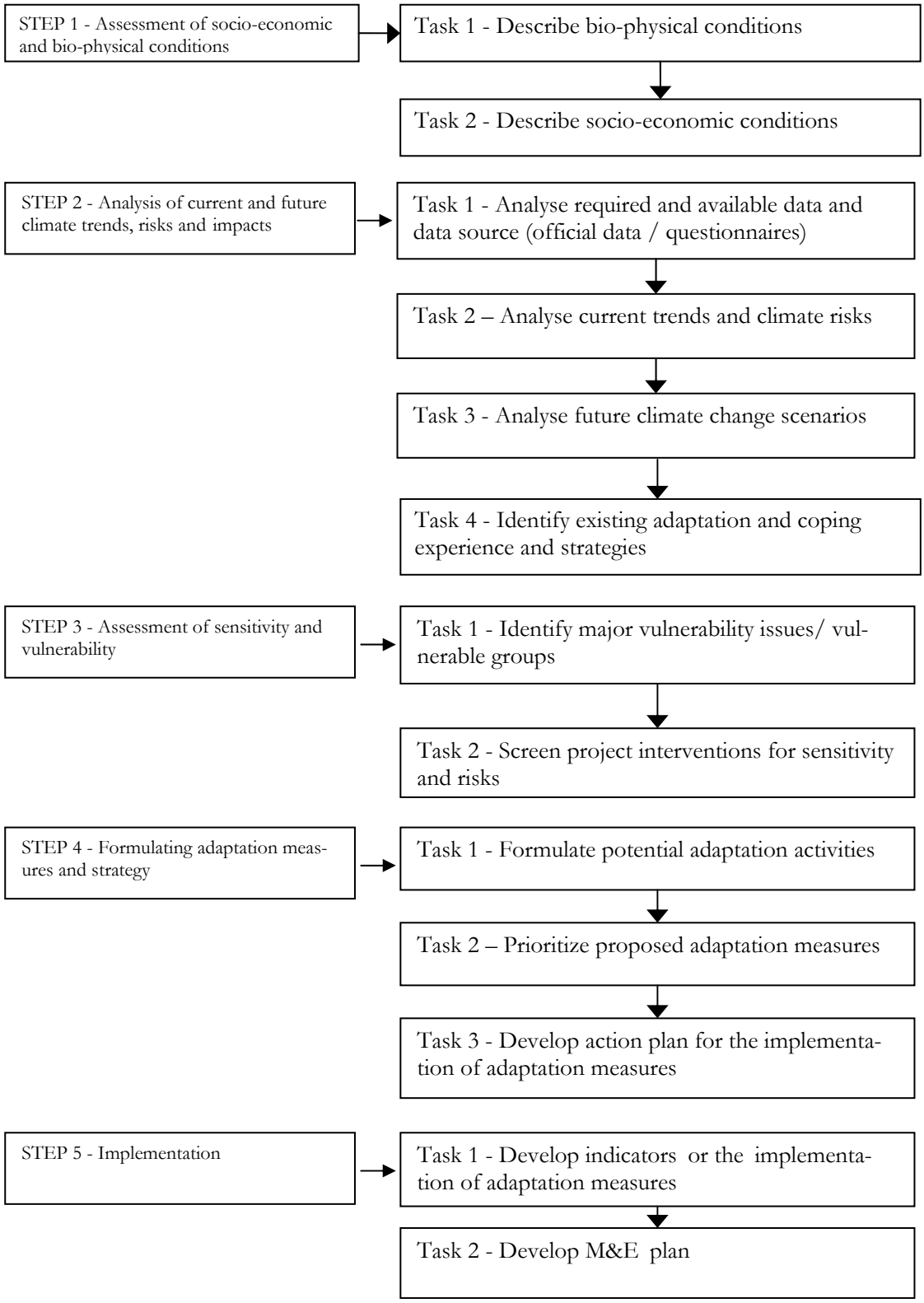


Figure 10 - Climate proofing steps and tasks

2. Mainstreaming climate risk management in UNDAF and CPAP

The Common Country Assessment (CCA) and the UN Development Assistance Framework (UNDAF) constitute the overall framework for project and programme activities in UNDP. Based on these documents, a UNDP Country Programme Document (CPD) and a Country Programme Action Plan (CPAP) are developed and all UNDP projects are formulated in line with the plans (See Figure 11). Climate change should be mainstreamed into all these stages of programme design.[28]

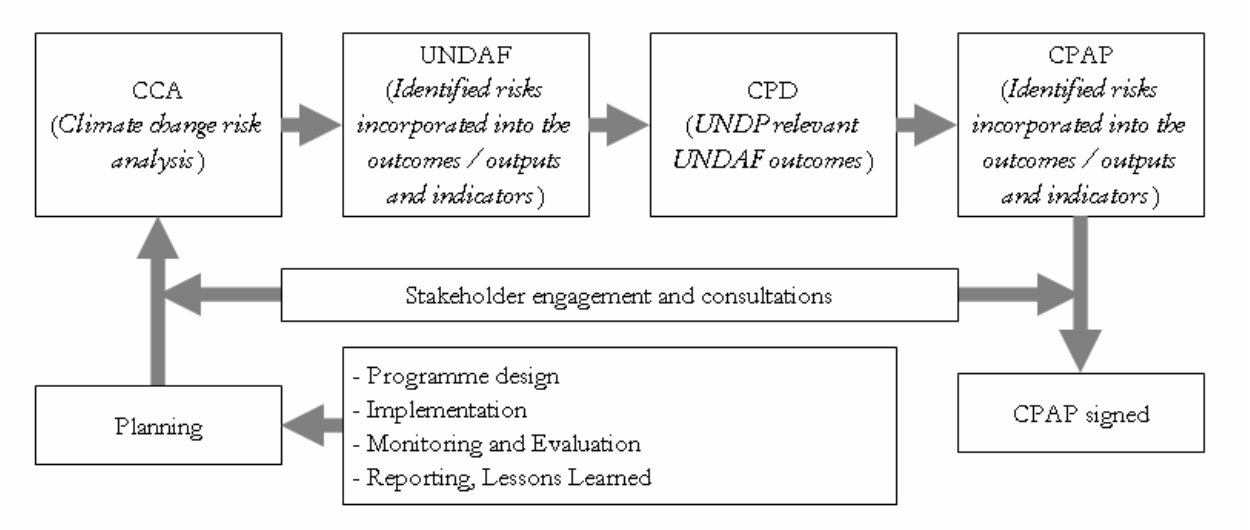


Figure 11 - The UN programme cycle (source: UNDP, 2008)

The CCA is a strategic tool to analyse the causes of poverty and identify development challenges in the country, especially in relation marginalized groups such as women, minorities, indigenous peoples, migrants and displaced persons. It is very important to include an assessment of these groups' vulnerability to climate changes. As the CCA contributes substantively to the preparation of the national development framework, it is crucial to ensure that national priorities and national obligations towards internationally agreed treaties and the fulfilment of the MDGs do not accentuate certain group's vulnerability.

The UNDAF is the overall planning tool in UNDP and it is in line with UNCT's priorities. It is also a support to national planning in order to ensure that MDGs and multilateral agreements are reflected. The UNDAF is thus an ideal opportunity for mainstreaming adaptation to climate change into the national development framework. As the system already requires that UNDAF is screened for environmental impact and sustainability, it is recommended to extend this system to include screening for climate change impacts. The Table 4 below proposes a structure for the analysis of climate risks related to each output. The climate change risks/opportunities can be defined as low, medium or high. Examples of high risk outputs are outputs related to water management, agricultural production, infrastructure, landfills, energy, etc.

[28] Experience shows that these documents are often essentially the same, so it would be sufficient to screen one document (most used by the CO or last updated) and to suggest overall adaptation measures.

Table 4 – Proposed UNDAF structure to include climate change concerns

UNDG agency programme component	Expected Outcomes	Expected Outputs	Climate Change Risks* / Opportunities	Adaptation measures
			High Medium Low	

* Including maladaptation

Example 14. Mainstreaming adaptation in UNDAF in Armenia (1)

UNDAF-2 in Armenia has defined two major national priorities, which are divided into a number of Agency Outcomes and sub-outputs. Agency Outcome 2.4 'Improved national capacities to promote crisis management' target climate change mitigation and adaptation interventions.

Climate changes are considered as a primarily environmental issue in the UNDAF-2. This may pose limitations for the implementation of adaptation and mitigations measures, if other equally relevant sectors (especially energy, agriculture and water management) do not see themselves as responsible for the funding and implementation of these measures. Climate change adaptation should be approached as a crosscutting issue in the planning, implementation and coordination of development programmes and strategies at all levels.

Climate change is addressed in the UNDAF-2 narrative: "*another challenge for the country concerns the protection and management of water resources. The improvement of water management is becoming a critical strategic need, in particular connected with forecasted climate change and increased demand for water resources due to growing economic activities*".

As climate change impacts have implications for all sectors, not just water, it will have an effect on the national as well as local economies. A paragraph about the links between economic development, poverty reduction and climate change should be included in the chapter on social issues under the country situation.

Example 15. Mainstreaming adaptation in UNDAF in Armenia (2)

Output/activity	Sensitivity to CC High/middle/ low	Adaptation potential	Comments
UNDAF Agency output 1.1.1 - *Innovative and competitive agricultural schemes, training tools and programmes developed in poor rural areas.*	High	Development of tools to identify and develop climate change adaptation measures, such as improvement of the irrigation system; preservation of soil humidity and moisture reserves; soil mulching; adapted crop varieties and planting cycles	This is an activity which is highly dependant on natural resources and the weather, and it is important to ensure that there is no maladaptation and that vulnerability to climate change is reduced in poor areas.
Governance improvement efforts which include disaster preparedness and/or public infrastructure	High	- Increase of share of governmental expenditure for climate related disaster rehabilitation for infrastructure - Vulnerability mapping and zoning to identify areas particularly vulnerable to extreme events	

Key question for mainstreaming climate risk management in UNDAF and CPAP can be found in Box 9 below.

Box 9 – Guiding questions for mainstreaming climate risk management in UNDAF and CPAP

Formulation of the Country Programme Document (based on UNDAF framework)

Poverty Outcomes:

a. Does the poverty reduction outcome consider climate change risks? (Yes/No)
b. Are climate change risks relevant to poverty reduction efforts in a country? (sub-questions)
   - Are changes in mean climate, variability, extreme events and sea level rise significant in a country?
   - Does the climate change impact the resource base of the poor (agricultural and natural resources)?
   - Is there detectable increase in incidents of climate related disasters (floods, storms, droughts etc)?
   - Do the climate related disasters lead to damage to the poor's livelihood assets and infrastructure?
   - Do changes in water, temperature and vegetation contribute to increased prevalence of diseases?
c. Which of the above risks could have direct [or indirect] impact on the achievement of the poverty outcome?
d. Sub-step 1.2. – consider the risk / identify opportunities to address climate change risks in poverty reduction efforts

Governance Outcomes:

a. Does the governance outcome consider climate change risks? (Yes/No)
b. Are climate change risks relevant to governance improvement efforts in a country? (sub-questions)
   - What is the share of governmental expenditure for climate related disaster rehabilitation for infrastructure (annually / or during the past 5-10 years)?
   - Does the government execute farmer compensation schemes for the loss of agricultural produce due to climate change (droughts, floods, forest fires, etc)?
   - Are there any disruptions in municipal services on water supply (both drinking and irrigation) due to climatic events?
c. Which of the above risks could have direct [or indirect] impact on the achievement of the governance outcome?
d. Sub step 1.3. – consider the risk / identify opportunities to address climate change risks in governance reduction efforts.

Energy and Environment:

a. Does the energy and environment (sustainable development) outcome consider climate change risks? (Yes/No)
b. Are climate change risks relevant to sustainable development efforts in a country? (sub-questions)
   - Does the climate change impact country's biodiversity and major ecosystem services?
   - Does the climate change impact fresh water storage by increased water evaporation and / or glacier retreat?
   - Do dry seasons and droughts are extended contributing to land degradation and disruptions to ecosystem services?

Formulation of CPAP

c. Address identified climate risks into the relevant outcomes;
d. Address identified climate risks into the relevant outputs;
e. Develop indicator framework based on UNDP M&E framework;
f. Consider adaptation measures at the output level;

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Annex II. Potential impacts of climate change on the Millennium Development Goals

Millennium Development Goal	Examples of links with climate change
Eradicate extreme poverty and hunger (**Goal 1**)	• Climate change is projected to reduce the assets and livelihoods of many poor people, for example, health, access to water, homes, and infrastructure. • Climate change is expected to alter the path and rate of economic growth due to changes in natural systems and resources, infrastructure, and labour productivity. A reduction in economic growth directly affects poverty through reduced income opportunities. • Climate change is projected to alter regional food security. In particular in Africa, food security is expected to worsen. Adverse impacts on food security could be seen in Latin America as well as in South and Southeast Asia.
Health related goals: • Combat major diseases • Reduce infant mortality • Improve maternal health (**Goals 4, 5 & 6**)	• Direct effects of climate change include increases in heat-related mortality and illness associated with heat waves (although fewer winter cold related deaths may happen in some regions). • Climate change may increase the prevalence of some vector-borne diseases (for example malaria and dengue fever), and vulnerability to water, food, or person-to-person borne diseases (for example cholera and dysentery). • Children and pregnant women are particularly susceptible to vector and waterborne diseases. Anaemia – resulting from malaria – is responsible for a quarter of maternal mortality. • Climate change will likely result in declining quantity and quality of drinking water in many locations, which is a prerequisite for good health, and exacerbate malnutrition – an important source of ill health among children – by reducing natural resource productivity and threatening food security, particularly in Sub-Saharan Africa, but also in many other low latitude areas.
Ensure environmental sustainability (**Goal 7**)	• Climate change is likely to alter the quality and productivity of natural resources and ecosystems, some of which may be irreversibly damaged, and these changes may also decrease biological diversity and compound existing environmental degradation.
Global partnerships (**Goal 8**)	• Global climate change is a global issue and response requires global cooperation, especially to help developing countries to adapt to the adverse impacts of climate change.

Source: Draft OECD Guidance on Integrating Climate Change Adaptation into Development Co-Operation, 2008.

Annex III. Case studies

Ethiopia

The rapid climate risk screening for Ethiopia revealed that potential climate change risks to UNDP projects and stakeholders include:

1. Water resource management including:
   - well drilling in areas where water availability and ground water may change
   - irrigation systems in areas where water availability may change (EEG).
2. Protected areas planning where climate change may alter species distributions and ecosystems (EEG).
3. Crisis/disaster recovery efforts, including resettlement of populations in areas potentially negatively impacted by climate change (CPR).
4. Livelihoods support (particularly in resettled areas) where climate change may impact natural resources (CPR).
5. Agriculture and food security planning where climate conditions may affect crops, soil, water and fluctuations in seasonal and/or annual productivity (water, EEG; agriculture, Poverty).

Potential opportunities to reduce climate change vulnerability of stakeholders through UNDP projects include:

- Improving water conservation and demand management to prepare for projected water stress (Water resource development, EEG).
- Developing food security plans that incentivize climate-resilient crops, support food storage, etc. (Agriculture development, Poverty).
- Utilizing farm technology and information management investments to provide tools to better manage climate change impacts (e.g. drip irrigation, resilient crops, soil conservation, forecasts, early warning, etc.) (Agriculture development programme, Poverty).
- Building institutional capacity to integrate climate change information into agriculture/food security and water resource planning (Agriculture development, Poverty; Water resource development, EEG).
- Developing protected areas plans based on climate change projections (EEG).
- Settling populations in areas at lower risk of negative climate change impacts (Resettlement programmes, CPR).
- Diversifying livelihoods to include climate-resilient activities (CPR).
- Building capacity of crisis prevention and recovery planning to reduce exposure/risks to future climate change (Resettlement programmes, CPR).
- Incorporating information about future disease ranges into public health planning and integrating climate monitoring systems with health monitoring systems through health sector development (Health sector development, Poverty).

What are the messages of this assessment?

1. Risks are highest to Environment and Energy, Crisis Prevention and Recovery projects, and Poverty Reduction projects. There are few direct risks to Democratic Governance projects.
2. Opportunities to support adaptation are also highest in EEG, CPR, and Poverty Reduction projects. The opportunities in Democratic Governance projects are primarily secondary effects, such as better government accountability, improved institutional capacity, etc.
3. A number of projects in EEG, CPR and Poverty Reduction reduce climate change risks and stakeholder vulnerability as they are currently designed.

Practice area	Project title	Activities at risk to climate change	Stakeholders/ systems at risk	Climate risk rating	Opportunities for supporting adaptation	Budget	Comments -- explanation of risk, or -- project factors that reduce risk
Energy & Environment							
Energy & Environment	Water Resources Development and Utilization Programme	Rehabilitation of rural water supply and small-scale irrigation schemes	Rural communities in water scarce areas	High	* Improve water conservation methods * Analysis of climate change on future water supply	$5 m	Project includes empowerment of women in water resources management.
Energy & Environment	Environment and Sustainable Dry Land Management	Natural resources accounting and environmental impact for valuation of natural resources Community capacity building in natural resource management and utilization	Rural communities who depend on natural resources	High	* Prioritize conservation commitment to those NR most at risk from climate change * Encourage diversification away from NR use	$4.5 m	Climate change could negatively impact future availability/valuation of natural resources.
Energy & Environment	Biodiversity Strategy and Action Plan	Biodiversity Strategy and Action Plan to sustainably manage biological resources	Natural systems and communities who rely on them	High	Prioritize conservation commitment to those NR most at risk from climate change	?	The project examines threats to biodiversity (may include climate change?), and aims to meet requirements of the UN Convention on Biological Diversity.
Energy & Environment	Protected Areas System	Prepare a master plan of protected areas for future investment Improve conservation and management of Ethiopia's protected areas system	Natural systems and communities who rely on them	High	Prioritize conservat. commitment to those NR most at risk from climate change	?	Protected areas could be vulnerable to temperature rise and changes in precipitation patterns. The plan focuses on threats, which may include climate change.
Energy & Environment	UNDP/DDC Mille Integrated Dry land Management Pilot Project	Livelihood improvement of people in dry land areas especially pastoral communities	Rural communities	High	Supporting climate-resilient livelihoods in high risk environ-ments	?	Possible future drought impacts on viability of pasture areas.
Energy & Environment	Zayed Bin Sultan Foundation Water Well Drilling in the Somali Region	Water well drilling activities of approx. 20 water wells in the Somali Region.	Water users	Medium	Improve water availability over the long term	?	Groundwater less sensitive to climate change than surface water but potential risk if inadequate groundwater recharge

Crisis Prevention & Recovery							
Crisis Prevention & Recovery	Early recovery and reintegration following the aftermath of natural crisis	What measures are in place to mitigate climate risk during recovery and reintegration, and thereafter?	Internally displaced communities		Support recovery in lower-risk areas	?	Possible resettlement in climate hazard-prone areas
Crisis Prevention & Recovery	Enhance the livelihoods of populations voluntarily resettled seeking productive lands	Does livelihood enhancement increase reliance on climate-sensitive natural resources?	Internally displaced communities		Reduce reliance on climate sensitive sectors/ Crops	?	Possible resettlement in climate hazard-prone areas Climate change could reduce land productivity in resettlement area
Crisis Prevention & Recovery	Systematic return and reintegration of displaced persons affected by natural disasters to their original home communities	What measures are in place to mitigate climate risk during return and reintegration, and thereafter?	Internally displaced communities		Assess degree of climate hazards in home communities	?	Possible resettlement in climate hazard-prone areas
Poverty reduction							
Poverty reduction	Agricultural Development Programme • Improved farm technologies • Agricultural info management, national ag info system • Small-scale irrigation • Micro finance institutions for rural communities	Viability of agriculture investments in future climate conditions Viability of irrigation systems in future	Agriculturalists, rural households		Strengthen capacity for improving food security and poverty reduction	?	
Poverty reduction	Food security strategy: Diversification and land use for drought prone areas, Moving populations to more fertile areas	Diversification to vulnerable crops or livelihoods Relocation to vulnerable areas	Agriculturalists, rural households dependent on climate-sensitive livelihoods		Considering fertility and crop suitability under future climate change scenarios	?	Is there information about future climate projections of these fertile areas? Is rainfall projected to increase or decrease? Are the fertile areas impacted by El Niño events?
Poverty reduction	Health Sector Development Programme Support	None			Incorporate information about future disease ranges into planning	?	
Poverty reduction	Education Sector Development Programme Support	None			Strengthen environmental	?	

					education		
Poverty reduction	ESRDF: Ethiopia Social Rehabilitation and Development Fund: Rural poor and women beneficiaries in education, primary health, water supply and sanitation, small-scale irrigation and capacity building	Irrigation viability over longer term	Agriculturalists at risk to future changes in water availability or crop viability Women at risk to changes in water availability		Improved health system preparedness Improved water availability Improved irrigation capacity	?	
Poverty reduction	* MDGs reporting and monitoring process * Support to MDGs-based development planning and policy advice * Making aid management and coordination more effective * MDGs campaigning and advocacy	None			Awareness raising? Coordinating donors to support climate change risk reduction?	?	
Democratic governance							
Democratic governance	Support to the National Election Board of Ethiopia (NEBE)	None			Low, improved accountability	?	
Democratic governance	Justice Sector Reform Programme	None			Low, improved accountability	?	
Democratic governance	Support to Parliament	None			None	?	
Democratic governance	Public Sector Reform (Decentralization, Public Sector Capacity Building Programme: -gaps in national capacity as part of Sustainable Development and Poverty Reduction Programme (SDPRP) District Level Decentralization	None			Building local governance capacity for managing climate change risks	?	

Cape Verde

As part of the Spain-funded Integration of Climate Change Risks and Opportunities into National Development Processes and UN Country Programming, Cape Verde produced a screening paper exploring the potential implications of climate change for development and UN development assistance. Specifically, potential climate change risks to development, and to development aspirations, were assessed through the review of the 'One UN Programme' document.

Cape Verde prioritized its recommended adaptation measures in terms of "High Priority Intervention Packages" and 'Medium Priority Intervention Packages', with the former representing more systemic adaptation interventions whose impact will be felt across Cape Verde. The following order of priority was suggested but may change; for example, health-related adaptation interventions have been listed under 'medium priority' due to the low incidence of climate-sensitive transmissible diseases such as malaria in Cape Verde, but these might be elevated to high priority if evidence suggests that such diseases are becoming more prevalent in the future.

High Priority Intervention Packages

- Ensure regulatory frameworks include measures to prevent "maladaptive" practices by private business and public bodies – i.e. practices that increase exposure and vulnerability to climate-related hazards.
- Ensure that considerations of climate change risks and adaptation options are fully integrated into decentralisation activities, through the provision of training to key personnel in decentralized authorities. Promote participatory, local level risk assessment and adaptation (Sub-programme 3).
- Screen plans under this theme to identify which elements of each plan are exposed to climate change risks (including risks of maladaptation) and identify and implement measures to reduce these risks. Extend screening to micro-credit schemes.
- Inclusion of climate change and adaptation issues in school curricula, higher education and vocational training in order to raise awareness of climate change risks and promote adaptation and good practice.
- Capacity development through training of those involved in environmental management activities in climate change risks and adaptation measures/methodologies.
- Screen activities aimed at delivering clean water and sanitation and improving hygiene to identify potential climate change impacts. Identify and implement adaptation measures where necessary.
- Assessment of vulnerability to climate change in Cape Verde – identify where climate change impacts are most likely to (i) exacerbate existing poverty or drive people into poverty, (ii) exacerbate or result in food insecurity (identify groups at greatest risk), (iii) increase risks to the well-being of children associated with food insecurity and poor health & sanitation and identify and implement measures to reduce vulnerability. Identify groups at greatest risk of climate-related food insecurity and identify and implement measures to reduce their vulnerability.

Medium Priority Intervention Packages

- Perform study on links between climate-related stresses and gender inequality, and identify any factors that make women disproportionately vulnerable to climate change and variability. Identify and implement measures to reduce women's vulnerability.
- Promote risk reduction measures through integration of adaptation measures into activities of a volunteer corps.
- Develop and implement surveillance schemes for climate-sensitive diseases and identify trends in incidences of these diseases.
- Promote measures to prevent the spread of climate-sensitive transmissible diseases.
- Perform "mini Stern Review" to assess exposure to and potential damage costs of climate change at the national/macroeconomic level, and compare these with potential adaptation costs.

Annex IV. Climate Change Issues and Potential Adaptations in Armenia[29]

Water resources

For the mitigation of climate change impact on the water resources of Armenia and adaptation of economy to the new natural conditions, the following measures should be carried out.

- Increase in accumulation of winter-spring flow in rivers by the construction of new reservoirs with a total volume of 2.0 billion cubic metres.
- Revision of territorial distribution of water resources and transfer of part of the flow from the basins with sufficient water supply to those with poor supply.
- Reconstruction of irrigation system in order to reduce losses of water, application of advanced water-saving methods of irrigation.
- Expansion of the water reserves of Lake Sevan (of great long-term benefit).
- Saving and rational use of water in all branches of the economy.
- Improvement of water resource monitoring.
- Consider the climate change impacts on water resources in the Law on the National Programme (2006), considering the long-term demand of the national economy and possible climate change.
- Shift from relatively high water demand crops to more drought-resistant crops,
- Application of state-of-the-art agri-technical measures and irrigation technologies (e.g. drip-subsoil, squirt-basin, micro-sprinkling, subsurface: porous tubes or mole's).

Agriculture

Climate warming and aridization will result in the expansion of plant-growing zones at 200-300 metres in elevation which, considering the forecast water deficit, raises the need to change the structure of sowing areas. The sowing areas of potato, cabbage and spring barley may be moved to 2600 metres, and crops of early maturing varieties will probably be displaced from the plan to the zone of 1400-1500 metres and higher. Early maturing varieties of fruit—pear, apple, plum, etc.—that can be cultivated at elevations of 1400-2200 metres will also be moved from plain to foothills. Thus in the Ararat plain, plantations of grapes, peaches, and apricots, and the areas sown in heat-loving vegetable crops (tomatoes, peppers, eggplants, etc.) can be extended. In Armenia's internal arid regions up to elevations of 1600 metres, and in the northeast up to 1200 metres, the borders of the cultivation can also be extended. The upper border of winter-wheat cultivation will reach 2000 metres in the northeast, and in the internal regions, 2300 metres. In both regions, subtropical crops (pomegranates, figs, Japanese persimmons, nuts) can be successfully cultivated in the 400-900-metre zone; areas of valuable technical cultures such as geranium can also be extended. Tobacco, various fruits and vegetable crops can be cultivated in medium and high zones.

- The reduction of water resources, connected to climate change, will have an adverse impact on the irrigated agriculture. Therefore, measures on the improvement of the irrigation system and the reduction of losses of irrigation waters and the preservation of moisture reserves of the soil are especially important. The estimations have shown, that

[29] First National Communication.

through the introduction of technically intact irrigation system, it is possible to save 20-25 percent of irrigation water only in Ararat valley. The application of the drop method of irrigation of vineyards and fruit gardens will enable the reduction of the water irrigation outlay in 4-6 times - if compared to the used method.

- The preservation of soil humidity will be contributed by the application of evening and night watering, which increases the humidity by 8-10 percent, by the carrying out of cereal and vegetable crops watering with high frequency and by small portions, by mulching the soil with volcanic rocks (Dacit tuffs, perlits, slags), which will enable the reduction of evaporation from soil in 3-4 times, and also by use of manure.

- The implementation of the appropriate agrotechnical measures is necessary for the expansion of adaptability of plant growing. In case of rise of temperature by 2^0 Celsius the plan vegetation period will increase for 20-25 days on average, therefore, the planting of winter crops in autumn has to be done 10-12 days later, and planting of spring crops in spring and the transplantation of plant seedlings - 10-12 days earlier.

- The lowering of vulnerability of crops at large depends also on optimal terms of implementation of measures, like soil cultivation, fertilizer application, combating pests and diseases, harvest and shelter of grapes, etc.

- For organizing vineyards and horticultures on less-frost-inclined terrain it is necessary to create terraces with special irrigation system on the slopes, and also, to regulate the photo- and micro-climate using the method of improvement of the over-ground part of the vineyards and fruit gardens. This method contributes to the increase of the soil shading and receipt of light by the foliage surface, and lowering of soil temperature and evaporation from its surface.

- The creation and the introduction of new high-yielding frost- and drought-tolerant agricultural crops is important during the change of climatic conditions.

- For the mitigation of the adverse impact of climate change on grazing industry the following adaptation measures are required: giving the pastures a long-term rest and, whenever possible, irrigation of certain sites 1-2 times a year; maintenance of the optimal ratio of the livestock and pasture areas; introduction of new inventory for pastures, estimation of norms and terms of pasture and load distribution in view of the contemporary unfavourable situation, ecological factors and forecast of climate change; increase of biodiversity of pastures and mountain grassland through introduction of more valuable species of grass; restoration of large cattle-breeding complexes, improvement of the breed structure of herd, observance of norms and terms of feeding, etc..

Natural Ecosystems

The forecasted climate change will cause significant negative consequences for the nature of Armenia. Thus, the application of measures and approaches, directed to the maximum reduction of these consequences and to the cessation of environmental degradation processes should become the important component of the strategy in responding to climate change.

Basic adaptation measures for the **natural ecosystems** of Armenia are the following:

- creation of optimal landscape-zone structure for the republic as a whole (increase of the forest share given the preservation of landscape diversity);
- reforestation of damaged forest areas and increase of forest cover area through annual forest planting. To plant 5000ha during the coming 11 years (2009-2020) (450-460 ha an-

nually). The suggested volumes are substantiated by the actual forestation volumes in the country over the recent years and by the midterm expenditure framework for 2009-2011 approved by the RoA Ministry of Agriculture. Application of integrated system of forest protection from pests, illnesses, weeds, fires, illegal logging , , etc. (appendix, Fig. A5);

- It is recommended to establish forest shelter belts of a total area of 600 ha on agricultural land (in 2009-2020) (55 ha annually)
- allocation of reserves and specially protected natural territories for the mitigation of general anthropogenic pressure on vulnerable ecosystems, including cenoses of desert and semi-desert zones, and also the Alpine communities for the realization of their own adaptability at forecasted climate change;
- preservation of genetic fund of the most vulnerable and valuable species by their maintenance and cultivation *ex situ*, preservation of genetic material in seed banks, etc.
- realization of measures, directed to the mitigation of the climate change impact on the vulnerable components *in situ* or creation of conditions for the existence of separate species in case of displacement of their areals;
- monitoring of endangered ecosystems, mapping of areas of Alpine species for revealing the 'island' populations and species, which have 'nowhere to go';
- adaptation of the legislative base in the field of environment protection to climate change.

To stop the **desertification process** the following measures are necessary.

- Expansion of the forest covered areas (*see* measures on forest adaptation); Creation of a protective woodland belt in all regions, where the desertification processes proceed most actively;
- Creation of protective plantations and engineering structures for combating mud-torrents;
- Active retention of snow on fields;
- Strict standardization of loads on pastures;
- If necessary, the desalination of salinated soils;
- Organization of monitoring of the desertification processes.

Health

The increase in temperatures may lead to higher incidence of cardiovascular diseases, especially among the most vulnerable part of population, such as the elderly. An increase in the number of malaria deaths has been detected and there is the chance of an outbreak of the plague as a result of an increase in plague microbe carriers in certain areas. An expansion of areas with plague carriers and an increase in the risk of malaria epidemics are expected. According to forecasts there is also heightened risk of cholera epidemics.

Proposed adaptation measures include:

- Increase of social-economic living standards of the population;
- Increase of the sanitary-hygienic awareness level and household culture of the population of the republic;
- Use of house construction technologies, which enhance the creation of optimal temperature mode;
- Creation of zones with a sparing microclimate (parks, green zones, fountains, etc.) in the populated areas;
- Monitoring the risk group population vulnerable to thermal load;
- The preliminary notification of the population and organization of preventive measures to facilitate emergency responses to extreme heat;
- The strict quarantine surveillance on borders, at the airports for prevention of infectious agents transmission;

- Monitoring of exposed territories for especially dangerous infections in order to take timely measures for revealing and treatment of the sick and parasite-vectors for the prevention of further spreading of the infection;
- Combating of infections agents and vectors;
- Monitoring and control of sanitary-hygienic condition of water-collecting and water supply network, maintenance of water-pipes by modern installations and means for water purification and disinfection;
- Vaccination and chemical prevention measures for the population (in case of epidemic complications);
- Use of individual protection means.

Annex V. Institutional framework for climate changes in Armenia

Armenia signed the United Nations Framework Convention on Climate Change (UNFCCC) in 1992 and ratified it in 1993. The Kyoto Protocol was signed in 2004. The overall coordination of the UNFCCC, as of all other environmental conventions, is located in the Ministry of Nature Protection. The Environmental Protection Department within the ministry is nominated as UNFCCC National Focal Point and the Designated National Authority (DNA) for Clean Development Mechanism (CDM) projects in Armenia.

The First National Communication was elaborated in 1998 with UNDP/GEF assistance through the project 'Armenia - Country Study on Climate Change'. The ultimate objective of this project was building capacity in Armenia to fulfil the country's commitments to the UNFCCC.

The First National Communication incorporates: the inventory of greenhouse gases (GHG) for 1990, projection of GHG emissions till 2010, climate change forecast scenarios for Armenia, and possible impacts of these changes on the country's economy, water resources, ecosystems and health of the population. The Communication also incorporates materials on information provision, systematic observations in Armenia as well as a number of studies pertaining to the latter. The Second National Communication is presently under elaboration and is expected in spring 2009.

In 1997, a Climate Change Informational Centre was established with the aim of providing information on ongoing and envisaged environmental projects targeted to climate change mitigation, as well as development and dissemination of publications and awareness rising materials.

Armenia has signed and ratified a large number of international environmental conventions besides the UNFCCC. These include:
- Convention on world cultural and natural heritage (1973);
- UN Convention on biological diversity (1993);
- UN Framework Convention on climate change (1993);
- Convention on long-range transboundary air pollution(1997);
- Convention on environmental impact assessment in a transboundary context (1997);
- Convention on the transboundary effects of industrial accident (1997);
- UN Convention to combat desertification (1997);
- Convention on the control of transboundary movements of hazardous wastes and their disposal (1999);
- Convention for the protection of the ozone layer;
- Montreal protocol on substances that deplete the ozone layer (1999);
- Kyoto Protocol (2002)

Other national strategies and plans include:
- Sustainable Development Programme of the Republic of Armenia, October 2008
- Agricultural Sustainable Development Strategy. *Non-official translation* Republic of Armenia. Ministry of Agriculture, (2006)
- Energy Sector Development Strategies in the Context of Economic Development in Armenia. (2005)
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