

Dialogue on Climate Change Adaptation for Land and Water Management

Draft Concept Paper

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SUMMARY

The objective of the Policy Dialogue Process is to improve resilience to climate change in Developing Countries. Current development trends, including rapidly growing populations, growing mega-cities, and increased demand for food and energy, lead to increased pressure on land and water resources, which are further exacerbated by the impact of climate changes.

Recognising the fundamental importance of land and water linkages for livelihoods, food security and water-related ecosystem services, the focus of the dialogue process is on increasing the resilience to climate change of private and public land and water management systems, with particular emphasis on agriculture and water resources management. It is envisaged that a major output of the policy dialogue process will be the identification of guiding principles for climate change adaptation in land and water resources management.

Numerous approaches exist for land and water management that include cross-sectoral, environmentally-focused, and participatory considerations. However, while many of these approaches are meant to coordinate and integrate various interests, the reality is that truly coordinated and integrated land and water management is difficult to achieve. The main reasons for this are that interventions are planned for and implemented in different institutional environments, and because sector interests often are very strong and overrule "good intentions".

The dialogue process is based on a series of regional and global conferences and workshops, involving developing countries and relevant international organisations and experts engaged in climatic change adaptation research, as well as land and water management issues.

This Concept Paper aims at providing inspirational background for the Policy Dialogue Process and at capturing the main themes, issues and recommendations emerging in the process. The paper is considered to be dynamic and subject to changes in the course of the process accumulating and consolidating the outcomes of the planned series of conferences and regional workshops.

The background part outlines the policy dialogue process and briefly highlights the likely impacts, adaptation context and potential responses in land and water management. Recent experiences and views on adaptation that have emerged in activities under the IPCC and UNFCCC are compiled and summarised.

The expected result of this dialogue process is to exchange knowledge and best practice experiences as input to the "Nairobi work programme on impacts, vulnerability and adaptation", and thereby contribute to the climate negotiations as part of the COP15 meeting in Copenhagen, 2009, and to the development of guiding principles for land and water management measures in development programmes.

BACKGROUND

1 The strategic policy dialogue process and adaptation initiatives

There is now clear scientific evidence that global warming and climate change is real and that there is a global challenge of learning to cope with its impacts. The international community is increasingly concerned about the consequences of climate change for the world population, especially those who are particularly vulnerable in Developing Countries including small island developing states (SIDSs).

The Bali Action Plan, adopted at the 13th UN Framework Convention on Climate Change (UNFCCC) Conference of Parties (COP) in Indonesia in December 2007, calls for enhanced action on adaptation. Although much has been accomplished and our understanding of climate change adaptation is constantly improving, a lot remains to be done. The most notable programmes under the UNFCCC, which have resulted in an improved understanding of adaptation to climate change include:

- **The Nairobi Work Programme** on impacts vulnerability and adaptation to climate change (2005-2010) aims to improve Parties understanding and assessment of impacts, vulnerability and adaptation to climate change, and make informed decisions on practical adaptation actions and measures to respond to climate change on a sound scientific, technical and socio-economic basis, taking into account current and future climate change and variability.
- **The Buenos Aires programme of work on adaptation and response measures**, adopted by the COP10 in 2004, Parties elaborate on ways of implementing climate change adaptation measures with particular emphasis on meeting the needs and concerns of developing countries.
- **National Adaptation Programmes of Action** whereby DEVELOPING COUNTRIES identify and prioritise urgent adaptation needs.

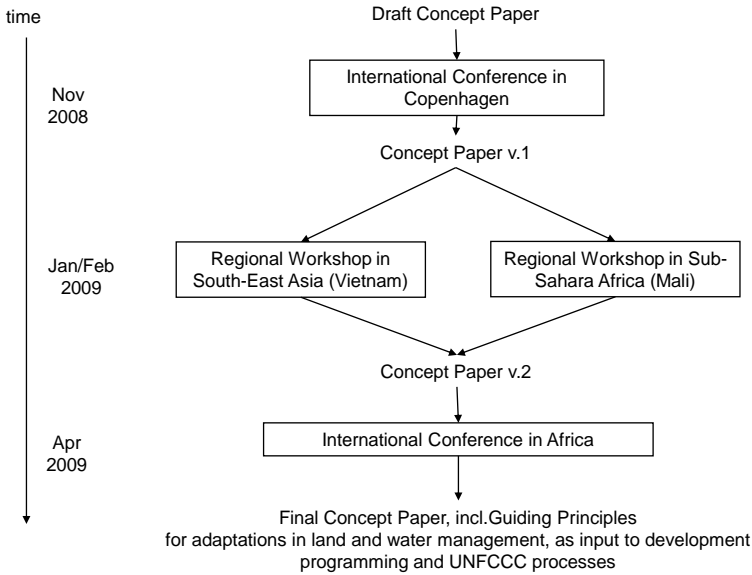
As a result of these and other related initiatives, significant progress has been made. The most vulnerable countries and regions have been identified, information and experience on possible adaptation options is accumulating and capacity to prepare for adaptation to climate change is being built. There is, however, a disconnect between awareness and adaptation to climate change being fully coordinated and integrated into planning programmes at all levels and across all sectors.

In this light, the Danish Ministry of Foreign Affairs is facilitating a strategic Policy Dialogue Process with developing countries, relevant international organisations and experts involved in land and water management, as well as climate change issues. The objective of the Policy Dialogue Process is to improve resilience to climate change in developing countries. Recognising the fundamental importance of land and water linkages for livelihoods, food security and water-related ecosystem services, the focus is on increasing the resilience to climate change of private and public land and water

management systems, with particular emphasis on agriculture and water resources management.

The Dublin Statement served as an input to the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro in June 1992, and recommendations were translated into a programme for water and sustainable development. In a similar fashion it is anticipated that the findings and recommendations emerging from the present dialogue process may serve as input to the climate change negotiations to be concluded at the COP15 in Copenhagen. The strategic policy dialogue process (as illustrated below) will be based on a series of regional and global meetings and workshops, where the need for adaptation will be discussed and the best measures to address the challenges of climate change adaptation will be identified. The starting point will be an international conference in Copenhagen, followed by two regional workshops in Sub-Sahara Africa (Mali) and in South-East Asia (Vietnam). The initiative will conclude with a final conference in Africa.

Fig. 2 The strategic policy dialogue process.

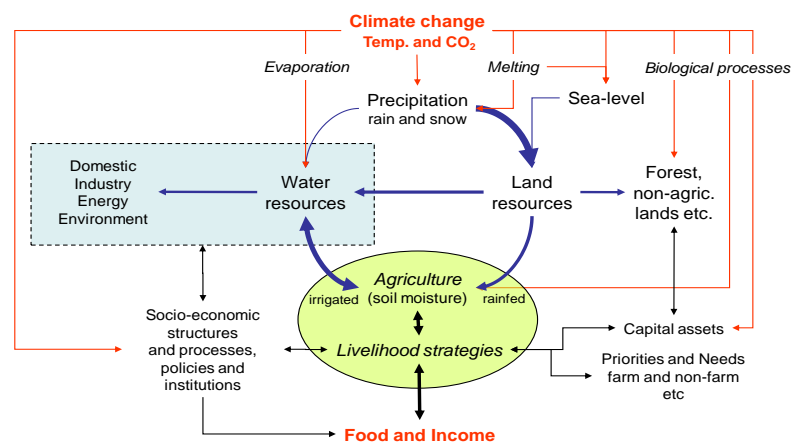


- Potential Issues for guiding principles regarding the strategic policy dialogue process and adaptation initiatives:*
- What other relevant complementary initiatives may this process both inspire and be inspired by?
 - How to aligning the Policy Dialogue Process with UNFCCC (COP15) and other initiatives?
 - What are the critical considerations for optimising the outcome of the regional workshops and of the overall process?

2 Climate change impacts on land and water resources and management

Current development trends include rapidly growing populations, growing mega-cities, land and water degradation and increased demand and competition for land, water, food and energy. As land and water resources are already under severe pressure in most developing countries, climate change will aggravate the pressure, further hampering and possibly reversing efforts to reach the Millennium Development Goals. Robustness and resilience is needed – in particular within agriculture and water resources management – in order to achieve the necessary economic development.

Fig. 1 The land and water systems and the climate change impacts.



The climate change impacts on land and water management are shown in the figure above, with particular emphasis on agriculture and water resources management and linkages through the hydrological cycle (blue lines). Agriculture is by far the main water user, livelihood support system and economic sector in most developing countries. Households engaged in agriculture will therefore be the primary group to be influenced by climate change and to implement adaptation measures. The direct climate change impacts (red lines) of rising temperature and CO₂ concentrations are on biological processes (e.g. photosynthesis, respiration, physiological development and transpiration) and on hydrological processes (evaporation, melting and sea-level changes). There are also important interactions between impacts on hydrological and biological processes, e.g. by determining changes in water requirements, water consumption and water stress in agriculture.

There are many indirect impacts of climate change not shown in the figure, some of which may have winners and losers. Mitigation efforts aimed at e.g. reducing deforestation and increasing the tree cover will improve the flow and quality of water resources but may also reduce peoples' access to land negatively and hereby affecting their livelihood.

Climate change impacts on rural livelihoods and land use patterns depend on the reference situation, development trends and the nature of climate change. There may be major shifts between areas of high potential and those with less potential, e.g., changing from multi-cropping areas to single-cropping areas. Crop calendars will change according to shorter or longer growth periods. Pests and disease patterns are likely to change, according to changes in climate and in species composition. In a low potential area, people are likely to shift to raising livestock if it becomes drier or to growing crops if it becomes wetter, and to shift to smaller livestock as it becomes warmer. In marginal areas, desiccation of grazing lands will force pastoral people to change their livelihood strategies. Irrigation and water harvesting potentials may increase in some areas, which would benefit parts of Africa with underdeveloped irrigation systems. Conversely, some irrigation systems could also become obsolete, either because of reduced water availability or because of increased rainfall, making rain-fed cropping comparatively more attractive. Peri-urban agriculture may come under increased pressure from intensified competition for scarce water, and coastal areas may become inhabitable or have reduced agricultural potential resulting from rising sea-levels, floods and salinity.

Adaptation approaches must be well-informed and formulated with flexibility to account for the uncertainties in future climate changes and impacts. Firstly, while precipitation is the major input factor of land and water management systems, precipitation is not reliably simulated in present climate models, whereas projections of future temperature increases and increased variability of precipitation are considered more reliable (IPCC), although uncertainty about the scale and extent of regional and local impacts persists. Secondly, the combined impact of temperature, CO₂ and water availability on biological systems at field level is poorly understood. Thirdly, impact projections are necessarily based on highly complex and uncertain development scenarios. Finally, downscaling to regional and local levels, especially in developing countries, is very complex and yet to be developed. Thus, changes and impacts, especially at local levels, could be less or more than currently projected.

Adaptations in land and water management systems therefore need to be guided by flexible approaches that take account of uncertainty and diversity as basic conditions. Adaptation needs and potentials will obviously be very diverse and location specific and there will never be a standard package of adaptation measures that can be applied everywhere.

Climate change impacts and adaptation raise distributional concerns as climate change may exacerbate inequality. There is likely to be both winners and losers (e.g., in terms of access to water and land) and the poorest people in developing countries are generally considered more vulnerable also to the hazards of climate change. Securing pro-poor growth in the face of climate change and other development trends is therefore an important consideration in climate change adaptation in land and water management systems. The gender dimension is crucial in relation to the challenges and treats facing natural resource dependent communities as men and women have distinct roles and

responsibilities. Thus adaptation measures need to reflect these differences and be gender specific.

3 Adaptation in land and water management

3.1 Adaptation in a development context

Adaptation has been defined by the IPCC (2007) as 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.” The UNDP defines adaptation in a relatively short-term development context as “*changing existing policies and practices and adopting new policies and practices so as to secure Millennium Development Goals in the face of climate change and its associated impacts*”. The IPCC, in the 4th Assessment Report, states that “*a high priority should be given to increasing the capacity of countries, regions, communities and social groups to adapt to climate change in ways that are synergistic with wider societal goals of sustainable development*”. The adaptation context and terminology are summarised in Annex 1.

The implication of adaptation as an integral part of development is critical for developing countries as it adds an additional challenge for sustainable development and has associated costs. The resources available in the developing countries are notoriously weak and must therefore be prioritised and internationally supported to satisfy both immediate development needs and to adapt to short- and long-term impacts of climate change. The difficulty is “to address the serious problems of to-day while considering the changes of tomorrow”.

Adaptation to climate change and variability requires a holistic approach that recognises peoples’ vulnerabilities and their livelihood strategies as fundamental issues which need to be integrated with wider societal objectives and adaptation concerns in a comprehensive framework. Particular attention needs to be paid to the gender dimension as climate change will impact greatly on poor women. Women are the ones taking care of household duties and need reliable sources of clean water for these purposes. Also, rural women are commonly the main responsible in the family for farming activities. Vulnerability assessments, the integration of climate change adaptation into national policy frameworks, and implementation of adaptation measures requires highly complex analysis and is resource demanding.

Adaptation to the impacts of current climatic changes is in its early stages. One such approach is the National Adaptation Programmes of Action (NAPAs) in the Developing Countries. Although many countries are in the final stages of preparation, today 33 out of 48 have completed NAPAs identifying most urgent and immediate adaptation needs, containing over 300 project ideas. However, these have resulted in only 11 project proposals being submitted to the Global Environment Facility and even fewer have received funding for implementation. Difficulties are faced in terms of follow-up actions, implementation of priority projects, integration with national policy and planning frameworks, and effective stakeholder involvement.

Experiences and lessons learnt related to land and water resources management in developing countries under the IPCC and UNFCCC are summarised in Annex 2 and 3 for reference. The challenge is to have adaptation integrated in the overall planning, and to define guiding principles for this integration

Potential Issues for guiding principles regarding adaptation in a development context:

- How can improved land and water management systems contribute to increase developing countries' resilience to climate changes?
- How to develop resilience to long term climate changes, which also improve poor peoples' short term coping capacity to current climate variations.
- How can pro-poor growth be secured in the face of climate change?
- What kind of gender specific strategies needs to be applied to cater for the specific needs of women to land and water related climate change adaptation?

3.2 Integrated approaches for effective adaptation in land and water resources management

The climate resilience of a sub-system of wider land and water management systems can not be analysed and improved in isolation from other sub-systems because of land and water linkages. These interdependencies have bio-physical, social, economic and political dimensions influencing hazards and vulnerabilities. Furthermore, adaptation to climate variability and change needs to be integrated across private and public land and water management systems in the context of sustainable development and poverty reduction frameworks.

The challenge is to integrate complementary approaches for establishing guiding principles for the operationalisation of effective adaptation strategies in land and water management systems; noting of course, that a fully integrated approach may not always be the optimal solution for action, and flexibility is needed to allow the scale of integration to match the specific purpose.

There are two main integrated approaches widely used in land and water management: i) the ecosystem based and ii) the livelihood oriented.

The ecosystem approach is widely accepted as a foundation for the current integrated approaches and area development programmes in land and water management. These are broadly referred to as catchment or watershed approaches, i.e., *the establishment of an enabling environment for the integrated use, regulation and treatment of water and land resources of a watershed-based ecosystem to accomplish stated objectives*. These objectives may differ according to spatial and socio-political scale of focus, but reflect a desire to harmonise various and often conflicting objectives and demands on natural resources.

A number of conceptual frameworks for land/water management have evolved from these approaches based either on the ecosystem approach, the livelihood approach or a

mixture of the two approaches: Integrated Water Resources Management (IWRM), the Sustainable Livelihood Approach (SLA), Integrated Watershed Development and Management (IWDM); Sustainable Land Management (SLM) and Coastal Zone Management (ICZM) (see also Annex 4).

Integrated Water Resources Management (IWRM) is an overall multi-stakeholder and multi-level approach to sustainable water resources development and management, basically advocating cross-sectoral coordination and a sound governance framework at all levels (including the river basin) which contribute to mainstreaming water (and land) in the national economy and societal processes. IWRM reform processes are spearheaded by many governments and national IWRM planning processes are ongoing in many countries.

Sustainable Livelihood Approach (SLA) is a strong analytical framework at the micro-level (households). The framework focuses on how households in their livelihood strategies use their capital assets to produce desired outcomes (wellbeing and environment) in a context of their vulnerability and of policies, institutions and external processes. SLA is implemented through e.g. Sustainable Rural Livelihood Programmes focusing on peoples' development needs.

Integrated Watershed Development and Management (IWDM) is conceptually closely related to both IWRM and SLA in focusing on land and water management at the community/landscape level. IWDM has been widely applied in community-oriented rural development programmes aimed at agricultural development and protection of water catchments and forest areas (e.g., buffer zone management). The main strategic concerns are: improved productivity of land, water and biomass at household and community/watershed levels, cost sharing, and improved policy, institutional, organisational and governance frameworks for sustainable natural resources management.

Integrated Coastal Zone Management (ICZM) has many similarities with the catchment oriented programmes but has evolved for addressing coastal zone issues which cannot simply be conceptualised within a watershed framework. On the other hand many impacts in the coastal zone stem from upstream activities and organisations such as the United Nations Environment Programme (UNEP) and The Global Environment Facility (GEF), are promoting the linking of freshwater and coastal zone management under the concept of Integrated River Basin and Coastal Area Management (ICARM).

The integrated approaches and management frameworks mentioned above have many proven and potential advantages for adaptation to climate change. Technologies and measures of potential relevance for adaptation are summarised in Annex 5.

Potential Issues for guiding principles regarding integrated approaches for effective adaptation in land and water resources management:

- How to establish integrated approaches and guiding principles for adaptation strategies and actions linking livelihood and wider resource management concerns and objectives?

- How to make adaptation an integral part of national and development assistance policy frameworks and planning exercises.

3.3 Mainstreaming

There are a number of ways in which resources may be mobilised and channelled for supporting and enhancing climate change adaptation capacities for the poor, e.g., through national policy mainstreaming, social transfers, donor funded adaptation projects, civil society actions and private sector provision of products and services.

While the international donor community has responded to the climate change challenge in taking some steps to integrate climate change adaptation and disaster risk reduction into the context of development cooperation, much is still needed in integrating climate change adaptation into the countries' own policies, planning, programming and implementation systems.

At the central national level in developing countries, the Poverty Reduction Strategy (PRS) processes have become key processes for development policy-making and planning, particularly in the Developing Countries. In these countries the PRS processes are therefore essential for climate change adaptation. Mainstreaming thus implies that climate change measures must be incorporated in the PRS framework of development policies, plans, programmes, reviews and implementation systems.

Mainstreaming can raise concerns over a possible diversion of attention and resources, from the development and poverty reduction measures towards the “new” measures, prompted by the general acknowledgement of climate changes as inevitable.

Institutionalisation of the “integrated approaches” mentioned above, is a major challenge. The integrated approaches require coordinated decision-making and planning across sectors as well as across administrative boundaries and different types of geographical areas (e.g. upstream and downstream). However, national ministries, government agencies and other parts of the administrative systems, at the central level as well as at decentralised levels, are often organised along sector lines. Land and water management issues are thus parts of resort areas under different sector ministries (agriculture, forestry, fisheries, water, environment, etc.) and corresponding agencies.

The ability to realise win-win situations (e.g. upstream-downstream), where winners compensate losers, could be a decisive factor as to whether or not the required physical measures can be implemented and/or sustained. Possible measures are several (taxes and subsidies is one model) but they may require local government to be involved or for other local institutional arrangements to be made. This implies that planning, decision-making and implementation arrangements can take place or be coordinated across administrative boundaries.

Changes in policy focus are needed to address these issues. The PRS processes are very “macro”-oriented, and planning and policy-making have to be broken down into smaller policy areas, not only to broad sector levels (like e.g. agriculture) but also to sub-sector levels or to still smaller, but coherent policy areas, i.e. towards “meso” and “micro” levels of the decision-making processes. Likewise, policy-making, planning and implementation involves geographical (regional) aspects and many different stakeholder groups, which a centralised planning process is often unable to accommodate. This “breaking up” of the PRSP processes into smaller coherent policy areas does not seem to be in place in most cases.

Such changes in policy focus is, however, particularly important in the climate change adaptation context as climate changes and their impacts are space-specific and as the poor are the groups most vulnerable to consequences of climate changes. Mechanisms for involving local stakeholder groups (smallholder farmers, small private businesses, CBOs and local NGOs) and particularly vulnerable groups in policy-making and planning are thus needed for targeting climate change adaptation measures effectively. If these needs could be achieved, mainstreaming climate change adaptation could in addition mean increased focus on (rather than diversion from) poverty reduction. Policy changes may also be needed to make it possible for people to leave areas or sectors highly vulnerable to climate change.

At the international, regional and trans-boundary levels, there is a need for the Developing Countries to “strengthen their case” and for improved regional coordination of policies and planning related to impacts of climate changes which cut across national boundaries.

Potential Issues for guiding principles regarding mainstreaming:

- What are the potential synergies between poverty reduction strategies and programmes and adaptation to climate change, and how to realise such synergies in practice?
- How to set up the institutional mechanisms needed for implementing the integrated approaches to adaptation in land and water management in the existing institutional systems and processes for policy-making, planning and implementation of development?

3.4 Capacity building

Capacity building for development and poverty reduction oriented policy-making, planning and implementation has been a key concept in development thinking for quite some time. Changes and additional actions are needed in this context for the inclusion of climate adaptation measures. Emphasis is particularly to be given to improve information to the policy- and decision-making processes and to ensure implementation on the ground.

Institutional development is required at the national level as well as at the decentralised levels. Decentralisation and improved governance has also for some time been part of the capacity building agenda for development efforts and poverty reduction. As indicated

above, such efforts are equally important for mainstreaming climate change adaptation measures into the development process.

In this context institutional mechanisms for implementing the above mentioned integrated approaches to land and water management are particularly needed to achieve the appropriate climate change adaptation at the different appropriate levels. Building capacity for efficient integrated natural resources management (IWRM; IWDM, SLA etc.) will in itself provide resilience to climate change effect.

Potential Issues for guiding principles regarding capacity building:

- What are the critical capacity building needs for improving the capacity of countries, regions, communities and social groups to adapt to climate change in a development context?
- How to facilitate innovation of climate proofing technologies, identification of best practices, dissemination and scaling up?
- How to build human and social capital for enhancing adaptation to climate change?

4. Towards guiding principles

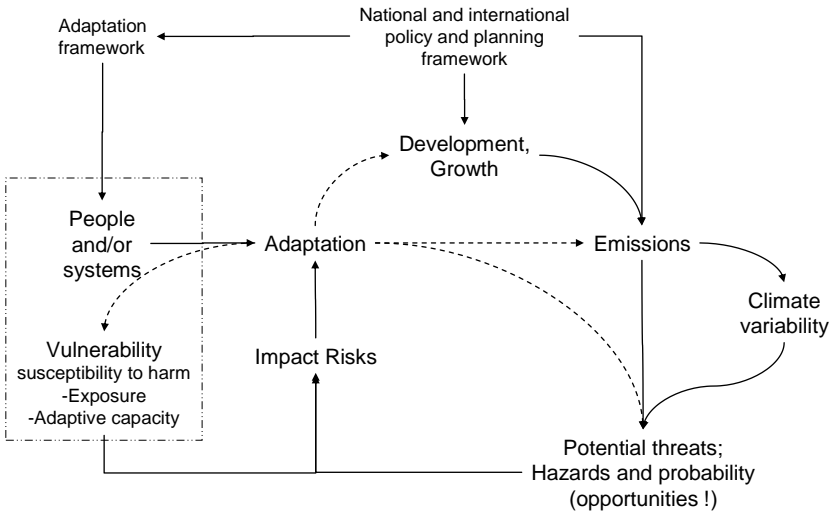
Based on the existing knowledge on climate change impacts, developing experiences on adaptation, ongoing processes for integrated land and water resources management as well as the needs for mainstreaming and capacity building, it is envisaged that the Dialogue Process will result in guiding principles for adaptation in land and water resources management. The regional workshops will ensure that the largest spectrum of issues will be included and that the outcome reflects the specific needs of developing countries. The results of the discussions will be documented in the Concept Paper, which is expected to develop as follows:

At the International Conference in Copenhagen from the 30. November to 11. December 2009, the background section of the concept paper presented above will be reviewed, and a consolidated version will be produced. Moreover, the Conference will make initial suggestions to themes and issues for the development guiding principles, which will serve as a starting point for the further dialogue process. These will be summarised in a second “Dialogue” section of the Concept paper, which will be progressively developed with inputs from the two regional workshops in Vietnam and Mali early 2009. The findings and suggested guiding principles will be finally consolidated at a concluding conference April 2009 and will both serve as i) guidance for planning of land and water development and ii) as input to the climate change negotiations leading to the COP15 in Copenhagen in November 2009.

5. Background documents

- FAO (2007): Adaptation to climate change in agriculture, forestry and fisheries. Interdepartmental working group on climate change. FAO, Rome.
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ANNEX 1: ADAPTATION CONTEXT AND TERMINOLOGY



The figure highlights adaptation to climate change and variability as a continuous response (broken lines) of people and systems to impact risks (or actual impacts; positive or negative), that in turn are determined by a combination of the probability of hazards and vulnerability. Vulnerability is shaped by multiple causes and dimensions, of which access to land and water is an important determinant of a household’s vulnerability.

Climate change will affect livelihoods and economic growth depending on the mix between mitigation, proactive adaptation (reducing anticipated future damages), reactive adaptation (coping as the damages/opportunities occur), residual damages (remaining with or without adaptation) and the timing of adaptation relative to changes in climate and probability of hazards.

Term	Meaning
Hazard	adverse effect of climate change and variability on natural and human systems.
Vulnerability	susceptibility to adverse climate impacts of people and systems, composed of: - Exposure: sensitivity of social units/systems to climate-related hazards. - Adaptive capacity: the ability to adjust to climate change (including climate variability and extremes), to moderate potential damages, to take advantage of opportunities, or to cope with the consequences.
Risk	product of probability of hazard and vulnerability.
Resilience	the ability to absorb climate disturbances while retaining the same basic structure and functioning including the capacity for self-organisation and for adapting to climate stress and change; often used as the opposite of vulnerability.
Mainstreaming	integration of policies and measures addressing climate change into development policies, planning, budgeting and sectoral decision-making.

ANNEX 2: IPCC VIEWS ON ADAPTATION RELATED TO LAND AND WATER MANAGEMENT

The IPCC 4th Assessment Report, in assessing the knowledge and practice on adaptation, summarises with very high confidence that:

- Adaptation to climate change is already taking place, though on a limited basis and often as part of existing programmes such as livelihood enhancement, water resources management (eg., the National Water Management Plan of Bangladesh) and drought relief. Societies and people have a long record of adaptation in land and water related activities (crop diversification, livestock/crop mix, water harvesting and storage, irrigation, flood control, etc). Current infrastructure-related adaptations relate primarily to the implications of sea-level rises.
- Comprehensive estimates of costs and benefits of adaptation are currently lacking, eg., in the agricultural sector. Adaptation to sea-level rise has been more analysed.
- Adaptive capacity is dynamic, shaped by multiple processes of change, and unevenly distributed across and within societies and households (gender dimension). Human and social capitals are key determinants of adaptive capacity at all scales and as important as economic and technological factors. Adaptive capacity should be analysed across scales. The uneven distribution of adaptive capacity within and across societies is a major constraint to the effectiveness of adaptation strategies.
- There are substantial limits and barriers to adaptation, eg., cognitive and behavioural, technological, financial, and social and cultural. Major barriers are: uncertainty, awareness and coordination.

ANNEX 3: UNFCCC WORK ON SPECIFIC ADAPTATION NEEDS AND CONCERNS

The UNFCCC has through a series of workshops and expert meetings (2006-2007) on adaptation planning and practices identified specific adaptation needs and concerns:

- It is widely pointed out that adaptation should be considered as a development issue, requiring coordinated and comprehensive approaches addressing multiple environmental stresses and factors for effectively supporting adaptation in the context of sustainable development.
- Capacity building is needed in the area of vulnerability and adaptation assessment processes (including economic assessments and access to appropriate models, tools and methodologies), and for linking of these processes with the planning and implementation of concrete action.
- Public awareness on climate change risks and the need for adaptation should be raised, and a communication strategy should be elaborated.
- Improving the coordination of different efforts is critical for enhancing effectiveness and delivery at the national level. The need for effective South-South collaboration is emphasised.
- Climate data are often with temporal and spatial gaps. Historical data needs to be rescued, current observation networks need to be enhanced (density, technology and maintenance) and the collaboration between data providers and users improved. Socio-economic data are also lacking for assessing vulnerability.
- Vulnerability and adaptation assessments are vital, and participatory approaches are important for effective assessments.
- The current adaptation process fails to establish continuity in capacity for impact and vulnerability assessment and to facilitate follow-up and implementation of identified adaptation projects.
- Traditional adaptation knowledge is important and should be more integrated in the adaptation process and disseminated among different users.

Land and water sectors specific needs for adaptation are summarised as.

Agriculture and food security:

- Need to distinguish short- and long-term planning, where short term planning addresses disaster risk reduction and preparedness while long-term planning aims at poverty reduction and providing alternative livelihoods.
- Successful adaptation strategies are likely to include: enhancing heat, drought and pest resistance of crop cultivars, changing crops and cultivation practices and farming systems, rainwater harvesting and irrigation, and introducing crop insurance schemes.
- Improved dissemination and capacity of farmers and support services (eg., extension and research).

Water resources:

- Adaptation planning and practices need to be comprehensive, cross-sectoral and consistent across sectors with regard to the sharing and conservation of water resources.
- Important adaptation practices are: protection of water supply infrastructure and traditional water supply sources, water harvesting, improved watershed management and slowing down salinization caused by sea-level rises.
- Integrated management should include supply and demand management and the maintenance of water quality.
- Adaptation for transboundary water resources must be planned at the water basin level involving transboundary communities.
- There is a need for capacity-building, for socio-economic and observational data tailored to water sector planners, adequate monitoring of all aspects of the hydrological cycle, and for better understanding adaptation options and their influence on the hydrological cycle at various scales.

Coastal zone:

- Good practices include the integration of disaster risk reduction and adaptation into planning processes using Environmental Impact Assessment (EIA) and Integrated Coastal Zone Management (ICZM), construction of dikes and seawalls and community practices such as rehabilitation of coastal zones with mangroves.
- Adaptive capacity is determined by the relationship between coastal settlements and ecosystems, natural adaptive capacity and social networks.
- Many gaps remain in the provision of data and information and the understanding of adaptive capacity in coastal zones.
- Adaptation induced threats to communities and livelihoods through eg., relocation and economic conflicts must be taken into account, and responses need to address the preferences of local people.

Barriers to adaptation:

Institutional and budgetary constraints; short-term planning horizons; a lack of knowledge about risks, adaptation options and integration with national development plans; and lack of regional and international coordination and leadership and awareness.

Recommendations of stakeholders from the UNFCCC work for actions include:

- Develop a conceptual framework for adaptation.
- Enhance the integration of adaptation into national frameworks.
- Actively diversify farming systems.
- Strengthened agricultural extension services and dissemination of results from pilot adaptation activities.
- Climate-proofing of rural development plans.
- Rehabilitate deteriorating hydro-meteorological observational networks.

- Provide incentives for IWRM, eg., through appropriate water pricing.
- Capacity building for improved understanding of competition for water and for adaptive water budgeting based on water carrying capacity.
- Identify policies enhancing adaptive capacity of the coastal zone sector.
- Capacity building for wider application of ICZM
- Establishing legal frameworks for applying ICZM as part of sustainable development strategies and for empowering coastal communities.

ANNEX 4: INTEGRATED APPROACHES IN LAND AND WATER MANAGEMENT

Integrated Water Resource Management (IWRM): a process which promotes the coordinated development and management of water, land and related resources in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems. IWRM aims at balancing “water for livelihoods” and “water as a resource”. The principles and practices of IWRM are largely based on the four principles of the Dublin declaration: freshwater is finite and vulnerable; management at the lowest appropriate level, women play a central role; and water as an economic good. IWRM involves a mix of “hard” infrastructural and “soft” institutional measures and has been widely accepted and applied in several national water action plans and in transboundary basin management schemes. Though still in its infancy, the framework has obvious advantages in an adaptation context in also recognising flexibility and adaptability as basic elements. IWRM was recently proposed by the Global Water Partnership to be the appropriate response framework for climate change adaptations assuming that the way we use and manage our water must become the focus of adaptation. In IWRM the river basin/catchment is seen as the natural unit for water resources management and notions such Integrated River Basin Management (IRBM) is often used for water management at the basin level.

Integrated Watershed Development and Management (IWDM): a process which seeks to facilitate sustainable and equitable economic growth through a participatory capacity building and development process, balancing resource conservation and biomass production objectives while recognising peoples’ participation in planning, financing and implementation as a core principle. IWDM has been widely applied in community-oriented rural development programmes aimed at agricultural development and protection of water catchments and forest areas (eg., buffer zone management). The main strategic concerns are: improved productivity of land, water and biomass at household and community/watershed levels, cost sharing, and improved policy, institutional, organisational and governance frameworks for sustainable natural resources management. The IWDM approach has evolved over a period of say 40 years, from early interventions of top-down conservation oriented activities towards a more recent focus on local communities’ priorities and concerns for overall livelihood improvement (Watershed Plus). The approach has been widely applied in national, bilateral and multilateral ODA financed rural development programmes, and has eg., for decades been the cornerstone and vehicle of rural development programmes in India. Coping with climate conditions and variability is a basic consideration in many of these programmes. The Watershed Plus strategy has (implicitly) recently been supported as an appropriate climate response framework by some international organisations, when they advocated the following guiding principle for integrating land and water related adaptation concerns in development frameworks: *“To reduce climate-related vulnerability through ecosystem management and restoration activities that sustain and diversify local livelihoods”* (IUCN, IISD, SEI, EF 2003), pointing out that this approach is also a window of opportunity to more fundamentally address the objective of sustainable development.

Integrated coastal zone management (ICZM), targeting coastal settlements and the coastal ecosystem, has many basic principles in common with IWDM but is more cross-sectoral and with a focus on fishery based livelihoods and the protection of near-coastal habitats and species. Because of the nature of land and water linkages, ICZM programmes to be effective often rely on the implementation of upper catchment measures through eg., IWDM programmes.

Sustainable livelihood approach (SLA): a framework facilitating a holistic and interdisciplinary analysis and understanding of the complexity of livelihood strategies and the contexts within which poor people makes their living. The framework focuses on how households in their livelihood strategies uses their capital assets to produce desired outcomes (wellbeing and environment) in a context of their vulnerability and of policies, institutions and external processes. SLA integrates farm, off-farm and non-farm activities with exogenous and endogenous factors. The complementary role of Farming System Analysis may be noted. SLA is implemented through eg., Sustainable Rural Livelihood Programmes focusing on peoples development needs, eg. the Watershed Plus activities mentioned above.

ANNEX 5: POTENTIAL TECHNOLOGIES AND MEASURES IN AGRICULTURE AND WATER RESOURCE MANAGEMENT

Technologies and practices for adaptation should ideally contribute to reducing the overall vulnerability of populations and systems, decrease the probability of hazards and to reducing net-emissions of green house gasses, without compromising the general objective of sustainable and equitable economic growth. There are both soft and hard technological measures to address the adverse effects of climate change and will consist of specific technologies to address single hazards, and more complex technologies to address multiple hazards and interacting factors.

In **agriculture**, the adaptation – whether autonomous or planned – is likely to involve a combination of improved genetic capacity of plants and animals and improved agronomic practices and agro-ecosystem management, or simply a shift in crop variety. Agriculture also has a great potential to reduce emissions through changes in land use. Several well-known practices are potential win-win technologies, realising both mitigation and adaptation benefits while improving the overall resilience to climate change and sustainability (eg., enhanced soil C-sequestration and soil fertility). The potential adaptation technologies in agriculture are obviously many and include farmers' traditional coping practices. Furthermore, the much needed agricultural intensification may in itself be regarded as an adaptation with potential win-win outcomes. These practices need to be adapted under location-specific conditions. Successful examples of practical applications of sustainable land management technologies and approaches have been systematically described in great detail and made available in a database to a broader audience by WOCAT (World Overview of Conservation Approaches and Technologies). Many of these practices have a potential as win-win climate adaptation measures. Furthermore, a brief description of best practices of adaptation in agriculture are being compiled and made available to the public by the UNDP.

In **water resources management**, adaptation strategies and measures are highly influenced by the uncertainty of precipitation change and the long-term perspective of many water supply and control systems. Win-Win solutions, simultaneously addressing mitigation and adaptation, are less obvious than for agriculture and other land uses and mostly related to the nexus between water and energy.

Agriculture:

- Climate resilient crops and animals; more heat, drought and salinity tolerant varieties of major staples (wheat, maize and rice), horticultural crops and grain legumes, and drought tolerant grasses for livestock feed.
- Soil and water conservation technologies (at field and landscape levels) for increasing infiltration, controlling soil erosion, improving rainfall productivity and fertilizer use efficiency and groundwater recharge; combines with integrated soil fertility management.

- Conservation agriculture (reduced tillage and mulching etc): potential for conserving moisture, reducing soil erosion and improving soil fertility, habitat conditions, drought resilience and soil C sequestration.
- Agroforestry: crop-tree (and livestock) based systems, with a potential for improved land husbandry and C sequestration in vegetation and soil, substitution of fossil fuel, and reduced deforestation and net-emission of green house gasses from agriculture.
- Mixed agriculture with crops and livestock, shifting species composition and improved livestock feeding practices reducing emission of green house gasses; feedstocks as a source of bio-energy substituting fossil fuels.
- Irrigation, realising irrigation and water harvesting potentials, reassessing irrigation requirements, infrastructure and management, adjusting to marginal water quality and improving water use efficiency and productivity using water saving irrigation practices. In rice, new water saving practices may also alter the emission of green house gasses and potentially reduce the net-emission from rice fields.
- Restoration of grasslands and good grazing lands management, improving livelihood resilience of pastoral and agro-pastoral people while possibly reducing the net-emission by increasing soil and vegetation C-storages.
- Improved extension and farmer-extension-research linkages to develop and disseminate adaptation options.
- Research, for identifying farmers' traditional adaptation practices, developing potential technologies and for removing barriers to adoption.
- Subsidy programmes, promoting improved practices and access to inputs (eg., fertilizer in Africa).

Water resources management:

- Improved design procedures for water-related infrastructure to incorporate non-stationary climatic conditions.
- Reassessment of the design and operation of water resources systems accordingly.
- Improved flood protection in areas sensitive to climate change, often as part of a more comprehensive package enhancing society's ability to live with floods.
- Expansion of rainwater storage and increasing water storage with dams and reservoirs.
- Application of the IWRM principles widely, increasing recycling of water and demand management by expanded use of economic incentives and water pricing for encouraging water conservation and allocation for optimal and equitable benefits.
- Improved hydro-meteorological networks and seasonal forecasting, also as a basis for allocation of scarce water among competing uses.
- Research on adaptation in water resources management under climate uncertainty.