



Global Climate Change Alliance Support Facility

Training workshops on mainstreaming climate change in national development planning and budgeting

HANDOUT FOR PARTICIPANTS

MODULE 1

Understanding climate change–development linkages



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MODULE 1 – Understanding climate change–development linkages

TOPICS COVERED BY THE MODULE:

- Adaptation, mitigation and vulnerability.
 - Climate change, environment and development.
 - Moving to climate-resilient, low-emission development.
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KEY TOOL:

- Conceptual framework of interactions between ecosystem services, human well-being and poverty reduction, and drivers of change (Millennium Ecosystem Assessment 2005).
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KEY CONCEPTS AND MESSAGES:

Adaptation, mitigation and vulnerability

1. Human activities and the environment (in the wider sense, including climate and natural resources) are in constant interaction. On the one hand, the environment is a source of opportunities, risks and constraints for human activities; *adaptation* addresses these opportunities, risks and constraints. On the other hand, human activities exercise pressure and generate impacts on the natural environment; *mitigation* addresses these pressures and impacts, in particular for minimising negative impacts.
 2. *Adaptation to climate change* involves adopting measures to protect natural and human systems against the actual and expected harmful effects of climate change, to exploit any opportunities it may generate, and to ensure the sustainability of investment and development interventions in more difficult climatic conditions; it aims to reduce *sensitivity* and vulnerability to the effects of climate change (Klein et al 2005, IPCC 2007a, EC 2009b, World Bank 2010a).
 3. *Climate change mitigation* involves reducing greenhouse gas (GHG) emissions and/or enhancing the capacity of ‘sinks’ for GHGs (i.e. processes and mechanisms that remove greenhouse gases or their precursors from the atmosphere), for the ultimate purpose of stabilising their concentration in the atmosphere; it aims to reduce global *exposure* to the effects of climate change (IPCC 2007d, EC 2009b).
 4. *Vulnerability* to climate change is the extent to which a system, individual or group of people is susceptible to, and unable to cope with, the adverse effects of climate change. Vulnerability to climate change depends on:
 - *exposure* to climate hazards (i.e. the extent to which a system, individual or group is exposed to the physical manifestations of climate change, considering that their character, magnitude and likelihood and the rate of variation of climate differ across regions of the world);
 - *sensitivity* to its effects (i.e. the degree to which a system, individual or group is affected, either positively or negatively, directly or indirectly);
 - and adaptive capacity (Brooks 2003, IPCC 2007c, EC 2009b, OECD 2009a).
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5. *Adaptive capacity* is the extent to which a system, individual or group has the capabilities, and/or has access to the information, resources and institutions, required to cope with existing or anticipated external stresses – and in this specific context, to adapt to climate change, notably through the adoption of risk prevention and management measures (Brooks 2003, IPCC 2007c, EC 2009b, OECD 2009a). It has also been defined as ‘the property of a system to adjust its characteristics or behaviour, in order to expand its coping range under existing climate variability, or future climate conditions’ (Brooks & Adger 2004: 168). Note that adaptive capacity can be ‘generic’ (i.e. supportive of a positive reaction to stresses of various types), or specific to climate change-related stresses (Burton & van Aalst 2004). Increased adaptive capacity leads to improved *resilience*, i.e. the ability of a system, individual or group to absorb disturbances, and adapt to stress and change (IPCC 2007c); it determines the ability to access and successfully implement adaptation options (Klein et al 2005).

6. Adaptive capacity (and therefore also vulnerability) is strongly influenced by *factors* such as:
 - wealth, age, gender, social group;
 - education and skills;
 - access to information and technology;
 - ‘built’ and ‘green’ infrastructure¹;
 - institutions and social organisation;
 - cultural norms;
 - equity and (in)equality;
 - the ‘development level’ in general (Brooks & Adger 2004, IPCC 2007c, EC 2009a, OECD 2009a).

7. *Maladaptation* is an inadequate response to climate change, by which ‘business-as-usual’ development interventions that overlook the implications of climate change inadvertently result in increased vulnerability (e.g. building new infrastructure and settlements in flood-prone areas). The term also designates an inadequate adaptation response, which fails to reduce vulnerability to climate change and instead ends up increasing it, displacing it or reducing the future potential for adaptation. For example, maladaptation may result from developing oversized irrigation systems in areas likely to suffer from increasing water scarcity; or building infrastructure such as sea walls that accelerate coastal erosion elsewhere along the coast and, by providing a false sense of security, end up encouraging development in high-risk areas (Burton & van Aalst 2004, EEA 2007, EC 2009b, OECD 2009a, Olhoff & Schaer 2010, World Bank 2010a). Besides disregard for the potential impacts of climate change, one of the factors that may give rise to maladaptation is uncertainty; and ‘adaptation which can be successful at a specific temporal or spatial scale can become maladaptation at a different spatial and temporal scope’ (EEA 2007: 21).

8. The *biophysical impacts* of climate change, which may vary significantly with location, include:
 - changes in average and/or extreme temperature and rainfall patterns, shifts in seasons;
 - increased frequency and/or severity of extreme weather events;
 - raised sea levels, increased coastal and river bank erosion;
 - acceleration in desertification and soil erosion processes;
 - decrease in the availability and quality of water, changes in the levels of groundwater, surface water drainage patterns and permafrost;
 - loss of habitats and changes in ecosystems, biodiversity loss;

¹ ‘Green infrastructure’ refers to the life-supporting and regulation services provided by the natural environment and ecosystems (EC 2009a); it has been defined as ‘the network of open space, woodlands, wildlife habitat, parks and other natural areas that sustains clean air, water and natural resources and enriches our quality of life’ (Benedict & McMahon 2001:3).

- increased frequency and/or severity of disease and pest outbreaks;
- changes in atmospheric pollution patterns (EC 2009a).

9. These biophysical effects may in turn lead to *socio-economic impacts*, such as:

- damage to or destruction of infrastructure;
- reduction in the availability of energy (hydropower);
- economic disruption, loss of livelihoods and social disruption;
- reduced food security, increased malnutrition;
- increased mortality and morbidity;
- increased probability and intensity of conflicts;
- population displacement and human migrations (EC 2009a).

10. **Table 1.1** provides illustrations of some of these linkages between biophysical and socio-economic impacts.

Table 1.1 – Examples of climate change impacts

PHENOMENON AND DIRECTION OF TREND	LIKELIHOOD OF FUTURE TRENDS BASED ON SRES SCENARIOS	EXAMPLES OF MAJOR PROJECTED IMPACTS BY SECTOR			
		AGRICULTURE, FORESTRY AND ECOSYSTEMS	WATER RESOURCES	HUMAN HEALTH	INDUSTRY, SETTLEMENT AND SOCIETY
Over most land areas, fewer cold days and nights, warmer and more frequent hot days and nights	Virtually certain	Increased yields in colder environments; decreased yields in warmer environments; increased insect outbreaks	Effects on water resources relying on snow melt; effects on some water supply	Reduced human mortality from decreased cold exposure; increased mortality and illness due to malaria	Reduced energy demand for heating; increased demand for cooling; declining air quality in cities; reduced disruption to transport due to snow, ice; effects on winter tourism
Warm spells/heat waves. Frequency increases over most areas	Very likely	Reduced yields in warmer regions due to heat stress; wild fire danger increase	Increased water demands; water quality problems, e.g. algal blooms	Increased risk of heat-related mortality, especially for the elderly, chronically sick, very young and socially-isolated	Reduction in quality of life for people in warm areas without appropriate housing; impacts on elderly, very young and poor
Heavy precipitation events. Frequency increases over most areas	Very likely	Damage to crops; soil erosion, inability to cultivate land due to water logging of soils	Adverse effects on quality of surface and groundwater; contamination of water supply; water scarcity may be relieved	Increased risk of deaths, injuries, infectious, respiratory and skin disease	Disruption of settlements, commerce, transport and societies due to flooding; pressures on urban and rural infrastructures; loss of property

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		AGRICULTURE, FORESTRY AND ECOSYSTEMS	WATER RESOURCES	HUMAN HEALTH	INDUSTRY, SETTLEMENT AND SOCIETY
Area affected by drought increases	Likely	Land degradation; lower yields, crop damage and failure; increased livestock deaths; increased risk of wild fire	More widespread stress on water supply or availability	Increased risk of food and water shortage; increased risk of malnutrition; increased risk of water- and food-borne diseases	Water shortages for settlements, industry, and societies; reduced hydropower generation potentials; potential for population migration
Increased incidence of extreme high sea level (excludes tsunamis)	Likely	Salinization of irrigation water, estuaries and freshwater systems	Decreased freshwater availability due to saltwater intrusion	Increased risk of deaths and injuries by drowning in floods; migration-related health effects	Costs of coastal protection versus costs of land-use relocation; potential for movements of people and infrastructure

Information for this exhibit was taken from "Climate Change Impacts, Adaptation and Vulnerability - Summary for Policy Makers of the Working Group II (World)," IPCC, <http://www.ipcc-wg2.org/>.

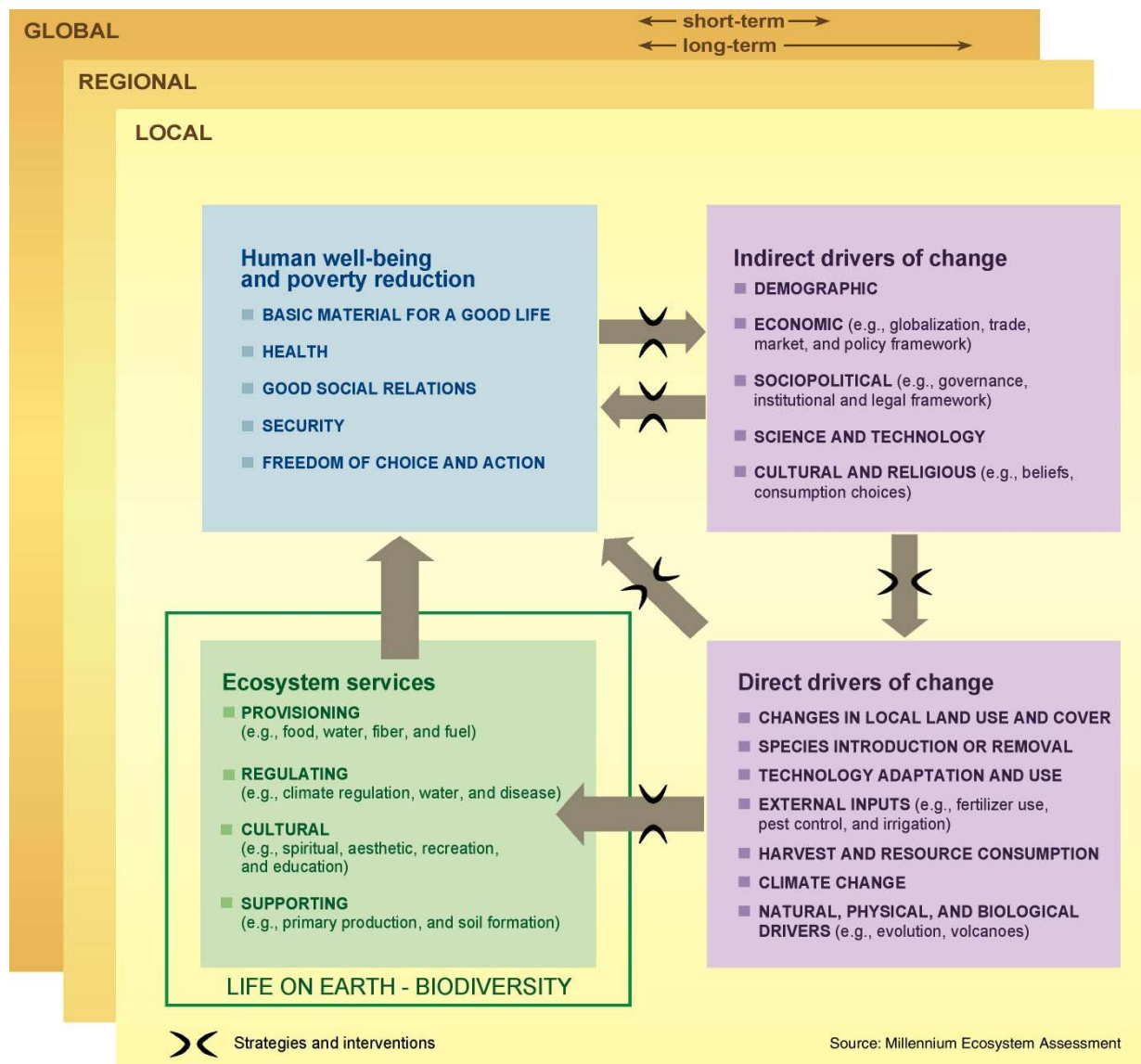
Source: USAID (2007) *Adapting to Climate Variability and Change: A guidance manual for development planning*. United States Agency for International Development, Washington, DC. Exhibit 3, p. 4 – based on IPCC report as quoted.

11. *Vulnerability factors* influence the way in which the biophysical effects and impacts of climate change generate socio-economic impacts. Poor countries, and the poor and socially vulnerable within each country, are disproportionately vulnerable to the effects of climate change as they cumulate vulnerability factors, including: dependence on natural resources for livelihoods; lack of financial resources; poor health and education levels; poor or no access to infrastructure, essential services and social safety nets; gender-based inequalities; and exposure to degraded ecosystems, social inequities, poor governance practices and weak institutions (World Bank 2010a, World Bank 2010g).

Links between climate change, environment and development

12. **Figure 1.1**, from the Millennium Ecosystem Assessment (2005), provides a good illustration of the linkages between economic activities, climate change, environmental change, human well-being and poverty reduction. **Annex 1.1** lists a number of guiding questions for assessing climate–development–poverty linkages.
13. Economic activities, one of the indirect drivers of ecosystem changes, are a key cause of climate change which is in turn a direct driver of changes in ecosystem services. Climate change affects human well-being and the outcome of poverty reduction efforts, directly and through its effects on ecosystem services. *Climate change is both a development issue and an environmental issue.*

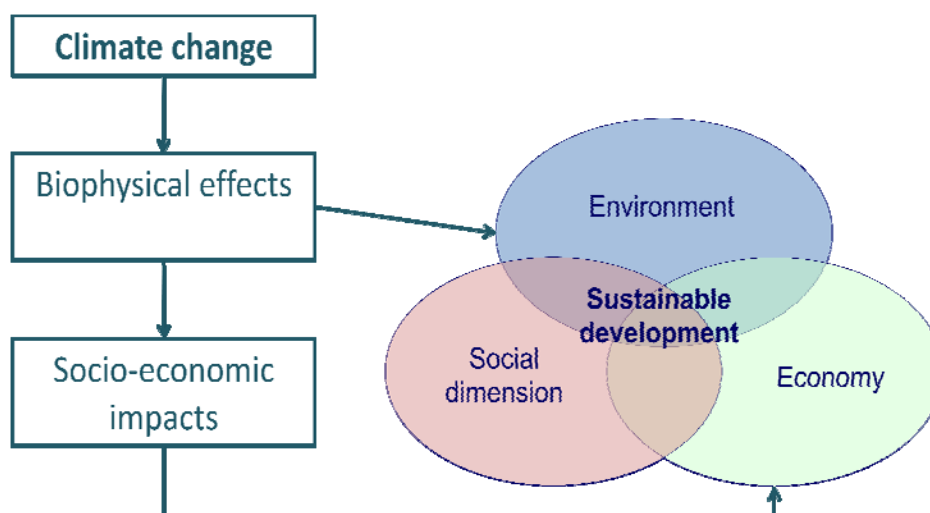
Figure 1.1 – Conceptual framework of interactions between ecosystem services, human well-being and poverty reduction, and drivers of change



Source: Millennium Ecosystem Assessment (2005) *Ecosystems and Human Well-being: Synthesis*. Figure B, p. 7.

14. The wide range of biophysical effects and socio-economic impacts of climate change, if not addressed, threaten all three pillars (economic, social and environmental) of *sustainable development* (EC 2009b), as illustrated by **Figure 1.2**. Both adaptation to climate change and climate change mitigation can support more sustainable development – while the pursuit of sustainable development can enhance society’s response capacity in terms of both adaptation and mitigation (IPCC 2007c).
15. Climate is a critical aspect of the environment. *Climate change should be addressed with other environmental issues*, for two main reasons:
 - It exacerbates a wide range of existing environmental trends and problems (e.g. desertification, freshwater scarcity, loss of biodiversity, air pollution).
 - The way we manage environment-related issues (e.g. waste management, soil management, land use planning and management) has an impact on climate change.

Figure 1.2 – Climate change impacts on the three pillars of sustainable development



Source: GCCA Support Facility.

16. Through its multiple potential biophysical and socio-economic impacts, climate change may also threaten the achievement of the *Millennium Development Goals (MDGs)* (OECD 2009a). **Table 1.2** provides illustrations of the potential impacts of climate change on the MDGs. Again, both adaptation and mitigation efforts can support the achievement of the MDGs.

Table 1.2 – 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)	<p>Climate change is projected to reduce the assets and livelihoods of many poor people, for example health, access to water, homes, and infrastructure.</p> <p>Climate change is expected to alter the path and rate of economic growth because of changes in natural systems and resources, infrastructure, and labour productivity. A reduction in economic growth directly affects poverty through reduced income opportunities.</p> <p>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 South-East Asia.</p>
Promote gender equality and empower women (Goal 3)	<p>In the developing world in particular, women are disproportionately involved in natural resource-dependent activities, such as agriculture, which are particularly vulnerable to climate change.</p> <p>Women’s traditional roles as primary users and managers of natural resources, primary caregivers and labourers engaged in unpaid labour (<i>i.e.</i> subsistence farming) mean they are involved in and dependent on livelihood and resources that are put most at risk by climate change.</p>

MILLENNIUM DEVELOPMENT GOAL	EXAMPLES OF LINKS WITH CLIMATE CHANGE
Health-related goals: Combat major diseases (Goal 6) Reduce child mortality (Goal 4) Improve maternal health (Goal 5)	<p>Direct effects of climate change include increases in heat-related mortality and illnesses associated with heat waves (although fewer winter cold-related deaths may occur in some regions).</p> <p>Climate change may increase the prevalence of some vector-borne diseases (for example malaria and dengue fever), and vulnerability to water, food, or contagious diseases (for example cholera and dysentery).</p> <p>Children and pregnant women are particularly susceptible to vector and waterborne diseases. Anaemia – resulting from malaria – is responsible for a quarter of maternal mortality.</p> <p>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.</p>
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)	Climate change is a global issue and response requires global co-operation, especially to help developing countries adapt to the adverse impacts of climate change.
<p>Multi-Agency Report (2003), "Poverty and Climate Change: Reducing the Vulnerability of the Poor through Adaptation", report by the African Development Bank, Asian Development Bank, UK Department for International Development, Federal Ministry for Economic Co-operation and Development (Germany), Ministry of Foreign Affairs Development Co-operation (Netherlands), OECD, United Nations Development Programme, United Nations Environment Programme and World Bank; Sperling, F. (ed.), Washington.</p> <p>IPCC (2007), "Climate Change 2007: Impacts, Adaptation and Vulnerability", Working Group II Contribution to the <i>Fourth Assessment Report of the Intergovernmental Panel on Climate Change</i>, "Chapter 17: Assessment of Adaptation Practices, Options, Constraints and Capacity", Cambridge University Press, Cambridge, pp. 717-743.</p> <p>WEDO (Women's Environment and Development Organization) (2008), <i>Gender, Climate Change and Human Security</i>, policy report developed for the Greece Government Chairmanship of the Human Security Network, New York/Athens.</p>	

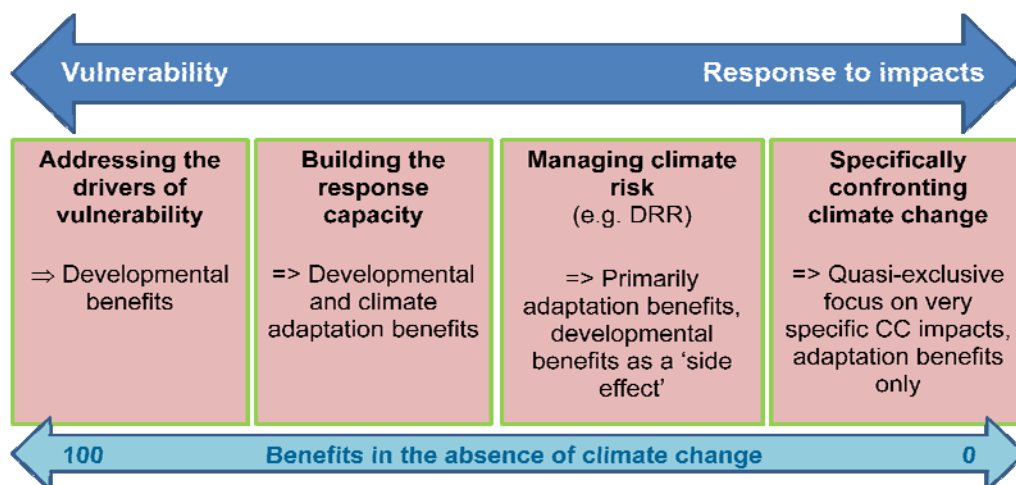
Source: OECD (2009a) *Integrating Climate Change Adaptation into Development Co-operation: Policy guidance*. Table 1.1, p. 29.

17. Because of the many linkages between climate change and development, in practice many *adaptation measures overlap with development measures* – and climate policy overlaps with development policy, even if their time horizons differ (Burton & van Aalst 2004, Klein et al 2005, OECD 2009a). Development, notably through achieving the MDGs, is critical to reducing vulnerability to climate change (Fankhauser & Schmidt-Traub 2010, World Bank 2010c, World Bank 2010g) – and the factors that constrain or facilitate adaptation are often the same factors that constrain or facilitate development. Most development processes can bridge the 'adaptation deficit', i.e. the failures in managing and adapting to current climate variability and risks², thereby preparing the ground for adaptation to climate change. However, 'development-as-usual' is not always conducive to adaptation: the need for flexibility (i.e. possibility of adjustments to evolving conditions) and for avoiding anything that might increase future vulnerability must be kept in mind (Burton & van Aalst 2004, Sperling et al 2008).

² Burton and van Aalst (2004: 15) note that 'many projects and development plans are well in tune with the climate normals (average conditions), but tend to pay less attention to the risks associated with climate variability and extreme events'.

18. There is a *continuum between development and adaptation measures* (see **Figure 1.3**), from measures focused on vulnerability to those focused on addressing specific climate impacts:
- Some measures address the drivers of vulnerability, and deliver primarily developmental benefits (e.g. any measures aimed at reducing poverty and enhancing human development).
 - Some measures help build the response capacity, producing benefits in terms of both climate change adaptation and overall development (e.g. awareness raising on climate–development linkages, institutional building, development of weather and climate monitoring systems, improvements in natural resource management and land use planning practices).
 - Some measures, focused on managing climate risks, involve developmental benefits as a positive ‘side effect’ (e.g. climate risk screening and assessment and climate proofing of projects and infrastructure resulting in improved resilience to current climate conditions);
 - Some measures, focused quasi exclusively on confronting very specific climate change impacts, deliver adaptation benefits only (e.g. relocation in view of expected sea level rise, building of dikes) (McGray et al 2007, OECD 2009a, Olhoff & Schaer 2010).

Figure 1.3 – The development–adaptation continuum



Adapted from: McGray et al (2007), OECD (2009a), Olhoff & Schaer (2010).

19. Other *typologies of adaptation measures* exist. The UNFCCC, for instance, distinguishes measures that foster behavioural change, technological and engineering solutions, risk management and vulnerability reduction strategies, research, and capacity building. **Table 1.3.** gives examples of adaptation options based on this classification. Note that these are examples only, not blueprints or pre-defined measures to be integrated in policies and strategies: relevant adaptation measures are very much context-specific and must result from the process of mainstreaming climate change into policies and development plans.

Table 1.3 – Examples of adaptation measures for sectors most likely to be affected by climate change

	Fostering behavioural change	Technological and engineering solutions	Risk management and vulnerability reduction strategies	Research	Capacity building
Fisheries	Diversifying sources of income	Downscaling fleet size and fishing effort	Improving mapping and monitoring of fish stocks; adopt ecosystem based approach to fisheries management	Stepping up research on sustainable aquaculture	Increase knowledge of climate change impacts at local level, information dissemination, awareness raising, sharing of best practices, and integration of climate change in planning and decision-making
Coastal zones and marine ecosystems	Promoting settlements and economic activities in less exposed areas	Building dykes, sea defences and barriers	Early warning systems; coastal afforestation, restoration of mangroves	Establishing baselines of mangroves status and trends, using standardized methods, in order to better understand of sea rising effect on mangroves and reefs	
Disaster risk reduction, disaster management	Awareness raising on how to respond to warning signals, evacuation,...	Construction of shelters	Early warning systems	Improved monitoring and weather forecasts	
Health	Prevention against malaria in newly exposed population	Improving the protection of health infrastructure against extreme weather events	Information systems on climate change related disasters; promotion of healthy environment to reduce breeding grounds for vectors	Strengthening and developing long-range epidemic forecasting systems	
Infrastructure	Raising the awareness of infrastructure managers, both public and private, about climate-related risks and adaptation options	Enhancing resilience in urban, rural and coastal infrastructure (flood protection dykes, dams, small-scale hydraulic infrastructure)	Adopting appropriate engineering standards and building norms, making new infrastructure more resilient to adverse weather conditions and natural disasters	Monitoring trends in migrations and population resettlements, so as to anticipate future needs at the time of planning investments in infrastructure	
Water supply and sanitation	Rainwater harvesting, promoting of water saving techniques	Adopting new technology for safe water in coastal communities to combat salinity due to sea level rise	Protection of groundwater recharge areas (e.g. by not multiplying them and by promoting the kind of vegetation that can maximise water retention and infiltration)	Improving storage capacity by constructing reservoirs at community level	

	Fostering behavioural change	Technological and engineering solutions	Risk management and vulnerability reduction strategies	Research	Capacity building
Agriculture³	Promoting water conservation or soil conservation practices	New irrigation technologies	Improving the use of weather forecasts for farmers; insurance to cope with climate risks; creating or strengthening national centres for the conservation and use of diversity of in food plant species	Research on drought, flood and salinity-tolerant varieties of crops	
Energy production and use	Promoting the use of improved stoves, energy conservation and renewable energies	Promoting the use of improved stoves, renewable energies. Introducing new technologies for the use of firewood and for making charcoal	Promoting better use of weather information and forecasts, as well as climate change related disasters; sustainable forest management and biomass production / use	Supporting R&D for low-carbon, sustainable energy technologies	

Source: EC (2009b) *Guidelines on the Integration of Environment and Climate Change in Development Cooperation*. European Commission, Brussels, p. 124.

³ Both agriculture and energy supply and use offer significant opportunities for promoting low-carbon development paths while increasing adaptive capacity.

Moving to climate-resilient, low-emission development

20. *Climate-resilient development* requires addressing climate vulnerability, risks and impacts in development planning and budgeting and in the implementation and monitoring of developments strategies, programmes and projects. It rests on the implementation of development activities aimed at addressing vulnerability factors, and of climate risk management and specific adaptation measures focused on the biophysical and socio-economic impacts of climate change. Capacity building underpins all types of measures. Climate-resilient development ‘implies that adaptation to climate change should not be seen as a separate process, but a continuous and integrated one that addresses present and future climate risks’ (Sperling et al 2008: 6) and that adaptation and development should be implemented in a fully integrated manner (Fankhauser & Schmidt-Traub 2010). The ultimate goal is to ensure that the chosen development path adequately addresses both current and future vulnerability, risks and impacts.

21. Recommendations for achieving climate-resilient development include:

- improving governance mechanisms, including stakeholder participation;
- providing better access to information and planning processes, across all levels of governance;
- building on past strategies to cope with climate variability, as long as they do not result in maladaptation;
- investing in enabling policies (e.g. land use planning and management, natural resources management, support for technology transfer and adoption) that enhance sector-specific interventions;
- promoting multi-sector investments to build resilience in targeted geographical regions;
- implementing pro-poor social policy interventions and adaptation options that generate sustainable development co-benefits;
- and combining ‘soft’ (social, environmental) adaptation options⁴ with ‘hard’ (infrastructure-based) adaptation options, keeping in mind the needs of the poorest and most vulnerable (World Bank 2010g).

22. *Low-emission development* requires addressing sources of GHG emissions, and developing or enhancing carbon sinks, to support the objective of stabilising atmospheric GHG concentrations ‘at a level that would prevent dangerous anthropogenic interference with the climate system’ (UNFCCC, Art. 2). At the global level, the three ‘sectors’ that are the biggest contributors to GHG emissions (namely energy generated from fossil fuel burning, agriculture, and land use change – especially deforestation) are also the main choices for emission reductions (Herzog 2005). Globally, the largest potential for curbing GHG emissions lies in:

- improving energy efficiency (across all uses/sectors);
- relying more on low-carbon technologies to generate heat and power;
- opting for more sustainable modes of transport;
- curbing deforestation (and stopping desertification);
- and modifying agricultural practices (e.g. more efficient use of nitrogen-based fertilisers, improved management of manure) (IPCC 2007d, Stern 2007, EC 2009a, McKinsey & Company 2009).

⁴ ‘Soft’ adaptation options are sometimes neglected, even though they may have a better cost-benefit ratio than infrastructure-based options.

23. At the national level, country-specific patterns of emissions and circumstances (including development objectives and priorities) should be considered when determining national priorities for mitigation. Developing countries should also consider the existence of opportunities linked to international carbon finance flows. The ultimate goal is to ensure that the chosen development path addresses sources of emissions.
24. Many developing countries have now submitted their national adaptation programmes of action (NAPAs) and nationally appropriate mitigation actions (NAMAs) to the UNFCCC Secretariat:
- NAPAs were promoted to help least developed countries (LDCs) raise awareness, build national capacities and identify priority adaptation projects with developmental benefits. Non-LDCs have not prepared NAPAs, but many have national climate action plans or equivalent documents – and the majority of UNFCCC signatory countries have now submitted their first (and increasingly their second) National Communications under the Convention.
 - NAMAs are voluntary mitigation measures consistent with a country's development strategy, that are meant to put it on a more sustainable development path.
- Both are good starting points for addressing the climate challenge without compromising development objectives – and can contribute to the mainstreaming effort if they manage to federate and to some extent replace standalone plans and measures (see Module 2).
25. *Climate adaptation and mitigation should not be seen only as a constraint but also as a source of opportunity*. In many instances, the adoption of adaptation and mitigation measures actually makes a positive contribution to development objectives, and creates opportunities such as green growth, green jobs and development co-benefits (EC 2009a).
26. *Green growth* can be defined as 'a way to pursue economic growth and development, while preventing environmental degradation, biodiversity loss and unsustainable natural resource use' (OECD 2010b). It provides a way of rethinking the traditional tradeoffs between economic development/improved living standards and environmental sustainability, with the perspective of promoting and accelerating sustainable growth. Green growth is relevant to developed and developing countries alike and should be part of the mainstreaming process. It entails:
- the use of a mix of policy instruments to create adequate incentives and disincentives (e.g. regulations and standards, market-based incentives such as tradable permits or payment for environmental services, taxes and subsidies, information-based instruments);
 - long-term, stable support for research and development (R&D) and innovation;
 - support for the diffusion of clean technologies and related knowledge – and the removal of barriers to clean technology adoption (e.g. trade barriers, regulatory barriers, skills barriers, market failure barriers, environmentally harmful subsidies, policy inconsistencies);
 - support for technology transfers (e.g. financing mechanisms for global public goods, joint R&D initiatives);
 - the management of the negative employment and distribution effects of the transition to a greener economy, which may require significant re-allocations of capital and labour;
 - and the development of new performance assessment frameworks (PAFs), with indicators related to the environmental efficiency of production and consumption, stocks of natural assets, environmental quality and quality of life, and the effectiveness of green growth policy responses and instruments (Dervis et al 2009, OECD 2010b).
27. One of the ways for 'climate-compatible' development to be conducive to pro-poor economic growth is to encourage the creation of '*green jobs*', i.e. jobs associated with the deployment of

clean technologies and the adoption of improved environmental practices. Green jobs may be associated with both adaptation and mitigation. Possible sectors for the creation of such jobs include (renewable) energy supply, public transport, manufacturing (e.g. clean technology equipment), construction (e.g. climate proofing of buildings and other infrastructure, retrofitting of buildings for improved thermal insulation), materials management (e.g. resource efficiency and recycling), retail (e.g. promotion of locally produced goods), agriculture (e.g. soil conservation, water efficiency) and forestry (e.g. afforestation, reforestation, sustainable forestry, agroforestry). Active training and capacity building policies are required to support the development of green jobs (UNEP 2008, EC 2009a).

28. The *development co-benefits* (also known as ‘ancillary benefits’) of climate change adaptation and mitigation should be specifically considered from a multidimensional perspective, including economic growth, poverty reduction, gender equality and environmental sustainability (Perch 2010). For instance:

- The development of renewable energy sources may reduce pollution from fossil fuel burning, with significant environmental and health benefits – while making the national economy less exposed to external shocks and increases in the price of imported fuels.
- Projects, programmes and strategies developed in the context of REDD+ (the global initiative for Reducing emissions from deforestation and forest degradation) may deliver benefits in terms of forest- and forestry-related livelihoods and the preservation or restoration of important ecosystem services – provided they are conceived with the participation of forest-dependent people and local communities.
- Adaptation measures for agriculture, and measures for reducing emissions from agricultural soils, may improve the livelihoods of farmers, including the many women involved in subsistence agriculture, by improving yields, reducing soil erosion and degradation, or improving water quality and availability.
- Adaptation to future climate change may entail immediate benefits in terms of reduced vulnerability to current climate risks (EEA 2007, Agrawala & Fankhauser 2008).

29. *Adaptation and mitigation* are both essential; they are like two sides of a coin, the complementary elements of the response to climate change (IPCC 2007c). Recent economic analysis shows that ‘the total costs of climate change are the lowest when both mitigation and adaptation are undertaken in conjunction’ (Agrawala et al 2010: 4).

30. There are both *potential synergies and potential conflicts or trade-offs* between adaptation and mitigation responses:

- Although adaptation and mitigation are quite different in nature (Klein et al 2005), sometimes adaptation and mitigation measures are congruent, so that mitigation produces a double stream of benefits. For instance, reduced tillage agriculture enhances carbon sequestration in soils while supporting soil moisture retention, thus increasing resilience to dry spells; and sustainable reforestation may simultaneously enhance carbon stocks and, by offering new livelihood opportunities, enhance the adaptive capacity of local communities.
- Mitigation measures should be compatible with adaptation policies and requirements, avoid increasing vulnerability to climate change, and rely on environmentally sustainable practices. Biofuels or agrofuels, for example, are often presented as a good mitigation option, but in practice, depending on local circumstances, may be a threat to food security, water availability and ecosystems.
- Similarly, adaptation measures should be designed and selected taking emissions into account. For example, when opting for agricultural intensification in support of improved food security,

emissions associated with the use of fertilisers should be considered; similarly, when deploying cooling systems for adapting to heat waves, users should consider emissions from fossil energy.

31. *Climate change mainstreaming is at the heart of the process of moving to climate-resilient, low-emission development* (IPCC 2007c): climate-resilient development results from adaptation mainstreaming, while low-emission development results from a process of mainstreaming climate change mitigation in all policy-making and planning activities. (For explanations on the concept of mainstreaming, see Module 2.) In both cases, focusing on co-benefits can create powerful incentives for initiating and sustaining the mainstreaming process.

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USEFUL WEBSITES:

UNDP – Adaptation Policy Frameworks for Climate Change: <http://www.undp.org/climatechange/adapt/apf.html>

UN Framework Convention on Climate – including links to available National Communications and NAPAs: <http://unfccc.int>

United Nations Development Programme (UNDP) – Human Development Report: <http://hdr.undp.org/en/>

Annex 1.1 – Guiding questions for assessing climate–development–poverty linkages

Climate and environment

- What is the climate situation (average climate parameters, climate variability, seasons, frequency of extreme weather events,...)?
- What is the state of the environment?
- How does the current climate interact with other drivers of environmental change to impact on ecosystems and their services?
- Could climate change exacerbate existing environmental problems or aggravate negative environmental trends?

Vulnerability and adaptation

- What population groups, sectors and regions are most vulnerable to the impacts of current climate variability? And to those of future climate change?
- Why are they at greatest risk (e.g. poverty, degraded natural resources, lack of infrastructure)? What are the key factors contributing to vulnerability?
- How could climate change impacts exacerbate existing vulnerabilities?
- What is the current situation with respect to climate change adaptation? Is there an adaptation deficit?

Development and poverty reduction

- What are the links between current and future climate and national development priorities/key sectors?
- To what extent could climate change jeopardize the achievement of certain development objectives (e.g. the MDGs)?
- Do existing policies, strategies and programmes increase the risk of maladaptation, and/or contribute to enhancing adaptive capacity and reducing vulnerability?
- Do current development policies and strategies contribute to increased or reduced greenhouse gas emissions? Is there a potential for reducing emissions and/or enhancing carbon sequestration?
- If so, what are the implications of realising this potential on livelihoods, economic growth, poverty reduction, employment, human health, and other components of human wellbeing?

Adapted from: UNDP-UNEP (2011) *Mainstreaming Adaptation to Climate Change into Development Planning: A Guide for Practitioners*. Box 4.1, p. 20.