Module 4: Adaptation Options

Introduction

As seen in the previous modules, climate change and vulnerability affect both the landscapes and livelihoods in Afghanistan. Module 4 provides an overview of possible adaptation options in the sectors of agriculture, including livestock, and forestry while Module 5 will focus on the mitigation options.

Adaptation to climate change in Afghanistan

Throughout history, people have had to adjust to climate variability and cope with climatic extremes. As we saw in Module 2 and 3, the risks have however increased and the nature of risks has changed in Afghanistan so that adapting to the changing climate becomes vital (cf. Module 2 and Module 3).

Water resources, agriculture, rangelands and forestry are the sectors most vulnerable to climate change in Afghanistan. Crop failure, reduced yields and stress on livestock due to climate and weather events will affect the most vulnerable people in the country, especially rural communities. Mainstreaming climate change in rural development is thus key. The NAPA scored a set of 11 priority activities for Afghanistan, mainly related to floods and droughts (see Table 1), of which many confer with the approaches of sustainable land, agriculture and livestock management (c.f. Module 2).

Table 1: Eleven adaptation project concepts for Afghanistan, identified by the NAPA (NAPA, 2009: Afghanistan. National capacity needs self-assessment for global environmental management (NCSA) and national adaptation programme of action for climate change (NAPA). Final joint report)

Improved water management and use efficiency through the introduction of drip and sprinkler irrigation, improved physical structures and increased public awareness.	Improved Water Management and Use Efficiency
Research into drought resistant seeds, different varieties of plants and livestock and plant protection; including establishment of agricultural farms.	Agricultural Research
Improved livestock production through the creation of livestock unions, cooperatives and associations; introduction of improved species and veterinary services.	Improved Livestock Production
Development of horticulture through use of improved varieties, establishment of nurseries and plant protection.	Development of Horticulture
Improving food security measures through diversification; promotion of household level industries, including chicken farms, beekeeping and silk farms; and development of market potential for agricultural products.	Improved Food Security
Rangeland management, including development and implementation of systems of rotational grazing and production of improved fodder along grazing routes (mixed grasses, legume).	Rangeland Management
Create more off-farm or cash earning job opportunities for farmers who are affected by crop loss due to climate change effects.	Creation of Off-farm Employment
Installation of agro-meteorological stations, early warning system, hazard mapping; survey, assessment and projection of the impact of deep wells on the water table and future water supplies. Build capacity and expertise for assessment of climate change adaptations, including technical capacity to monitor and analyze climatic trends, plan and implement adaptation activities, improve forecasts and inform policy makers.	Climate-Related Research and Early Warning Systems
Disaster management strategy – planning for food security and emergency supplies to vulnerable communities.	Development of Disaster Management Strategy
Land and water management at the watershed level. Community based forest management and afforestation projects in ways that conserve land, water resources and wood production; realize afforestation of catchment areas and stabilization of unstable slopes; soil conservation techniques.	Land and Water Management at the Watershed Level
Terracing, agroforestry and agro-silvo pastoral systems that reduce soil erosion and run-off on steep slopes; conserve land, water resources and wood production; soil conservation techniques.	Improved Terracing, Agroforestry and Agro-silvo Pastoral Systems

Given high poverty rates, existing harsh climate and variability, a first step for adapting to future climate change is reducing the vulnerability and exposure to present climate variability through measures that offer development benefits now, and reduce vulnerability to climate variability in the longer term, irrespective of the exact long-term climate impacts (‘low’ or ‘no regret’ measures).

Box 1: Some definition in the field of adaptation to climate change

No and low regret measures: The costs of the adaptation are relatively low vis-à-vis the benefits of acting and yield development benefits even in absence of climate change.

Win-win options: Measures that have the desired result in terms of minimising climate risks or exploiting potential opportunities but also have other social, environmental or economic benefits.

Maladaptation: Actions that may lead to increased risk of adverse climate-related outcomes or increased vulnerability to climate change, now or in the future.

Source: IPCC, 2014: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Fifth Assessment Report and Climate-Adapt

This implies that actions are prioritised such that they yield both development and adaptation benefits. Planned interventions should also be reviewed from a longer term climate change perspective to avoid promoting actions that are no longer feasible in a changed climate. Such actions are called 'mal-adaptation', examples would be a focus on irrigated crops in a drying trend or investments in infrastructure that is no longer usable after some years due to a changed climate.

Box 2: Some recommendations when planning adaptation measures

- Traditional practices for dealing with variability are often an important starting point, but need to be complemented and improved with external technical know-how.
- When planning adaptation measures, the temporal dimension of when the impacts are felt and a good balance of short to long-term measures are crucial.
- As farmers take agricultural decisions for short time horizons, local, autonomous measures are the basis for long-term adaptation.
- Given the long-term nature of adaptation and mitigation, the involvement of stakeholder is key to ensure ownership, continuity and upscaling.

Source: HELVETAS Swiss Intercooperation, Topic Sheet Climate Change and Agriculture

The most effective adaptation strategies offer development benefits in the relatively near term and reduce vulnerability over the longer term. Adaptation to climate change measures are often not new technologies but are based on local knowledge and practices. An example is the traditional practice of *hing* cultivation which is now promoted as a soil and water conservation measure that also provides incomes in the project on Improving Livelihoods of Rural Communities in Afghanistan.

The full participation of local communities, especially women and men farmers, can help in identification of locally appropriate practices and the assessment of their continued utility in a changing climate.

Box 3: Hing-cultivation – a traditional practice that can help in adaptation to climate change

Flash floods and droughts are the most common hazards in Afghanistan. With the changing climate, the intensity and frequency of these hazards will tend to increase even further. Planting grasses and trees in the uplands can help to attenuate the effects of flash floods as vegetation increases water infiltration and decreases soil erosion. In the livelihoods project in Afghanistan, financed by the Swiss Agency for Development and Cooperation (SDC) and implemented by HELVETAS Swiss Intercooperation, the regreening of the upland with dryland cash crops, medicinal plants and fodder turned out to be more successful compared to the plantations of fruit/non-fruit trees. In particular hing cultivation (*Ferula asafoetida*), a medical plant, seems to be a successful adaptation measure to more frequent and intense flash floods. Besides the direct benefits such as improved soil structure, reduced erosion, increased water availability and biodiversity, reduced temporary migration and increased capital in local economies are important co-benefits of this measure.

Adaptation options for Afghanistan

Table 2 presents a set of **adaptation options,** these are place specific. Some options may work in one location and not another. The table also reflects their mitigation and disaster risk reduction benefits.

Several of these measures are already being implemented in Afghanistan, including in projects implemented by HELVETAS Swiss Intercooperation.

These practices are short to mid-term measures that contribute to strengthening current resilience. Depending on climate trends some livelihood activities may no longer be valid and would need a complete change, often called 'transformational adaptation'.

Table 2: Summary table of practices contributing to climate change adaptation						
Practice	**Main objective**	**Technical requirement**	**Disadvantages of adoption**	**Adaptation benefits**	**Mitigation benefits**	**Disaster risk management benefits**
Manure, compost, and mulching	To increase organic matter content in soils	Available biomass (e.g. twigs, leaves)		Improved water-holding capacity, reduced evaporation losses in a warming climate	Enhance carbon sink in soil	Attenuate flash floods due to improved water retention Attenuate droughts due to improved water infiltration
Conservation agriculture	To achieve sustainable and profitable agriculture	Minimum soil disturbance (zero/minimum tillage) Permanent soil cover (crop residue or live mulch) Crop rotation or intercropping	Requires careful management practices to be successful	Decreased soil erosion, increased water infiltration Conserves, improves and makes more efficient use of soil, water and biological resources		
Use of crops and varieties adapted to current climatic conditions	To minimize effects of drought and other extreme climatic events To minimize the negative impacts on seasonal variability			Continued viability of agriculture, Increase in yields, reduced losses		
Establishment of seed banks, seed production groups, and small seed enterprises	To assure that seeds are (geographically and monetarily) available and accessible to farmers			Access to alternate seeds for sowing in the event of crop losses due to late onset of rains, interruptions in rainfall, pest attacks or too much rain		Use of seedbank as emergency item / emergency fund in disaster situation
Development of adapted seeds (to future climatic conditions)	To minimize effects of drought and other extreme climatic events (in the future) To minimize the negative impacts on seasonal variability (in the future).	Research to develop new varieties	Investment Process of around 10-year time	Increase in yields and reduced losses		Reduce loss in case of drought, heat wave or other disaster event

Practice	Main objective	Technical requirement	Disadvantages of adoption	Adaptation benefits	Mitigation benefits	Disaster risk management benefits
Integrated Pest Management	To control pests in a sustainable way	Good knowledge of crop system		Reduce negative impacts of expected changes in pest range and intensity and reduces loss in yields		Reduced risk of pest outbreak
Livestock Water Productivity	To increase water-efficient livestock production			Reduce negative impacts of expected reductions in water and food for livestock production		Reduce vulnerability to drought events
Good grazing management practices	To maintain pasture's long-term productivity	Assess pasture (area, vegetation, users)	Appropriation of the rangeland of nomadic communities if their representatives are not includes in the development of the management plan	Increased rangeland's biodiversity No bush encroachment Better organization among rangeland users Reduces soil erosion	Enhance carbon sink in soil	Reduce flash flood risk caused by land degradation/overgrazing
Planting palatable species, weeding, planting trees	To increase vegetation cover in grazing land /range land	Permanent control of grazing and browsing (time and intensity)		Diversification of income sources. Protecting biodiversity which can support future adaptation needs	Enhance carbon sink in soil	Reduce flash flood and erosion
Agroforestry/agro-silvo-pastoralism	To increase productivity and income	Choose tree species that do not compete against crops and are adapted to site conditions Land-use management system combining trees/shrubs, crops and/or livestock	Possible competition between trees and food crops for space, sunlight, moisture and nutrients, potentially reducing crop yields.	Favourable micro-climate and permanent cover Decreased soil erosion Improved soil structure Increased infiltration Enhanced fertility and biological activity of soils	Enhance carbon sink in soil	Reduce flash flood and erosion

Practice	Main objective	Technical requirement	Disadvantages of adoption	Adaptation benefits	Mitigation benefits	Disaster risk management benefits
Underground water tanks and channels	To collect rain, snow melt and underground water	Good knowledge of site's geology and topography	High construction costs & higher sedimentation (due to excavation of rocks)	Greener watersheds Increased conservation knowledge		Reduce flash floods due to increased underground flow
Sustainable irrigation systems	Reduce soil erosion	Materials and costs to install systems	Installation costs and potential risk of salinization	Adapting practices to lower availability of water, improve water use efficiency	Conservation of soil carbon	Reduce flash flood risk when irrigation system includes water storage for buffering of flow peaks
Water User Associations	To supply irrigation water in equitable and efficient manner	Technical knowledge Good governance		Build local adaptive capacity		Support to disaster preparedness committees in emergency situations
Construction of trenches and bunds	To reduce runoff, soil erosion and flash flood risks	Resources and construction materials	Soil disturbance, sedimentation and loss of productive land (due to excavation)	Increased fodder production Cash earnings for families Improved water retention	Reduce loss of carbon soil	Reduce flash floods due to improved water retention Attenuate droughts due to improved water infiltration
Planting grasses, shrubs and trees	To maintain a high vegetative cover To reduce runoff, soil erosion and flash flood risks Improvement of grazing land/rangeland vegetation	Fast-growing, deep-rooted, nitrogen-fixing, wind-resistant plant species that are suited to local climate Rotational grazing, managed high-intensity grazing, mob grazing or bunch grazing		Increased fodder production Cash earnings for families Diversification of livelihood options	Enhance carbon sink in soil	Attenuate flash floods due to improved water retention

Agricultural practices

Climate change poses several challenges to agriculture and food security in Afghanistan (c.f Modules 2 and 3).

Climate-smart agriculture (CSA) is an approach to achieve sustainable agricultural development for food security under climate change (FAO 2013). A main pillar of CSA is adapting and building resilience to climate change through cropping adaptation strategies that aim to:

- maintain healthy soils to enhance soil-related ecosystems services and crop nutrition;
- cultivate a wider range of species and varieties;
- diversify cropping patterns;
- use quality seeds and planting materials of well adapted, high-yielding varieties;
- adopt the integrated management of pests, diseases and weeds.

To enhance agricultural production, it is necessary to maintain **healthy soils** by adding organic material to them. Soil organic matter increases the ability of soils to retain water and nutrients, and prevents soils from becoming too acidic. A sustainable practice is then to continuously "feed" the soils with plant residues and animal manure. This practice is very relevant for Afghanistan because soils are characterized by their high pH, low organic matter content and water-holding capacity. Some available options are application of green and farmyard manure, compost, and mulching. Available biomass (e.g. leaves, twigs, straw) is critical for **manuring, composting and mulching**. In semi-arid climates biomass is scarce, but its availability can be increased by collecting more existing biomass (e.g. pruning trees, collecting weeds); by planting winter crops; inter cops and fodder trees; by cultivating waste land. It is important to consider that building soil organic matter content is a long-term process, and its results only become visible after a few years (cf. Sustainable Soil Management.

Conservation agriculture is an agronomic soil and water conservation measure that combines agricultural production with environmental measures and sustainability. It covers a wide range of agricultural practices based on no-till or reduced tillage (minimum soil disturbance), permanent soil cover and crop rotation or inter-cropping. Soils under conservation agriculture are characterized by their high surfaces roughness, lower runoff, and higher water infiltration. This improves the water balance and reduces the flash flood risk (cf. Vegetative and Agronomic SWC Measures). Furthermore, crop rotation and intercropping improve the soil nutrient cycles and enhance plant growth (cf. Nutrient management).

In addition to flash floods, farmers in Afghanistan face an increase in drought frequency and intensity. Thus, whether in rain-fed or irrigated agriculture, it is crucial to choose **crops** and varieties that are well **adapted to the local conditions and adverse climatic conditions**. Generally, each crop has at least a few varieties with different requirements for cultivation (e.g. drought-tolerant, resistant to pest) and choosing the right one can increase yields and incomes. For example, farmers participating in the Green Saighan Project have significantly increased their wheat and potato yield by using improved seeds. It is necessary, however, to assure that those seeds are (geographically and monetarily) available and accessible to farmers by establishing **seed banks** (with borrowing schemes), cooperatives and seed production groups (horticulture and vegetable nurseries), and small seed enterprises (private enterprise that produce and sell quality seeds; cf. Sustainable Seed Supply). In addition, these activities should be complemented by the development of drought-tolerant seeds, which should be available and affordable to farmers. The introduction of **adapted seeds** are long-term measures, in the remit of national entities and research institutes in the country.

Figure 1: Integrated Pest Management (IPM) in wheat fields in Afghanistan (IPM-AF)

Crops such as wheat and potato are vulnerable to pest attacks (e.g. Moroccan locust, white flies). In Afghanistan pests, diseases and weeds significantly reduce yields and climate change is expected to enhance this problem. A key adaptation strategy is then to develop effective **Integrated Pest Management** (IPM) options. IPM involves environmentally-friendly crop production methods that reduce the use of chemical pesticides (insecticides, fungicides, herbicides) and improve the growth and productivity of crops in a sustainable manner. To apply IPM successfully, farmers must have a broad understanding of the entire production system (cf. Integrated Pest Management). The application of IPM in wheat fields leads to an increase of yield by 43%, a reduction in production costs (less chemical fertilizers and pesticides), and an increase of net return by up to 100% (IPM in Afghanistan).

Livestock practices

Water and food are essential elements for livestock production. Both resources are limited in Afghanistan and are expected to become scarcer in the future due to climate change. Thus, both sedentary livestock keepers and transhumant, nomadic pastoralists (e.g. *kuchis*, *karakuk* sheep production systems) need to take measures to adapt to the new scenario.

An important strategy is the **Livestock Water Productivity** framework that reflects the ratio of net beneficial livestock products and services to the amount of water depleted in producing these products and services. Livestock production can be more water efficient by improving feed sourcing, water conservation and production enhancing strategies. Feed sourcing strategies involve the use of crop residues or by-products of food production, which reduces water costs. Water conservation refers to measures that reduce water run-off and increase water infiltration. Production enhancing strategies covers the provision of continuous quality water, the selection and breeding of livestock for increased feed conversion efficiency, the provision animal health to reduce animal mortality and morbidity, among others (cf. Livestock Welfare, Care and Water).

Figure 2: Slope with grazing land/rangeland vegetation

Another key strategy is to develop **good grazing management practices** to maintain pasture's long-term productivity. The first step is to assess the pastures (e.g. area, state of vegetation, users) and based on this, define the frequency and length of grazing periods (e.g. livestock mobility, resting time). By keeping a healthy vegetation cover, rangelands can act as water buffer by increasing water infiltration, soil organic matter and nutrient cycling, and by reducing soil erosion. This allows rangelands to absorb water and slowly release it through the year. In addition, rangeland's biodiversity will recover and increase, bush encroachment will be minimized, and a better organization among rangeland users will be promoted (cf. Grazing Management). Here it is worth mentioning that indigenous breeds (e.g. kandahari, karakul, asmari, kulangi) are well adapted to local conditions and production systems, and produce in conditions that crossbreeds or exotic breeds would not even survive. Conserving indigenous breeds and developing them further through selective breeding is therefore crucially important (cf. Sustainable Livestock Breeding).

Similarly, vegetation cover on grazing land and rangeland can be increased by planting **palatable, medicinal plants or fodder species** (e.g. sanfoin, agropyron, alfalfa), removing unwanted vegetation and planting trees (agroforestry/agro-silvo-pastoralism land use system). The success of these measures, however, will depend on the permanent control of grazing and browsing, both in their time and intensity, and on the cost of irrigation (cf. Vegetative and Agronomic SWC Measures).

Agroforestry/Agro-silvo-pastoralism and forestry

Agroforestry is a collective name for land-use systems and practices in which trees are integrated into cropping and livestock systems to achieve multi-functionality, increase productivity and income. The integration either can be in a spatial mixture (e.g. crops with trees) or in a temporal sequence (e.g. improved fallows, rotation). By providing a favourable micro climate and a permanent cover, **agroforestry systems protect soils from erosion, improve soil structure and increase infiltration**. As a result, agroforestry helps to reduce flash flood risks. A limitation of agroforestry is the possible competition between trees and food crops for space, sunlight, moisture and nutrients, potentially reducing crop yields (c.f. Vegetative and Agronomic SWC Measures). Similarly, trees have specific requirements in terms of light, water, soil and climate, and their plantation should be decided based on the site's characteristic. Some fodder trees that fix nitrogen and improve soil fertility are black locust *Robinia pseudoacacia* and Russian olive *Elaeagnus latifolia*. The Sustainable Land Management Project has shown that almond trees are the best option in the uplands, because of their high survival and economic benefits. Other trees such as mulberry, Russian willow, arghwan and walnut did not grow well in the upland.

Water management

Most of the impacts of climate change on agriculture will occur through changes in the water cycle. Since water supply is predicted to become more scarce and unpredictable, adaptation practices aim at improving water harvest and its use efficiency.

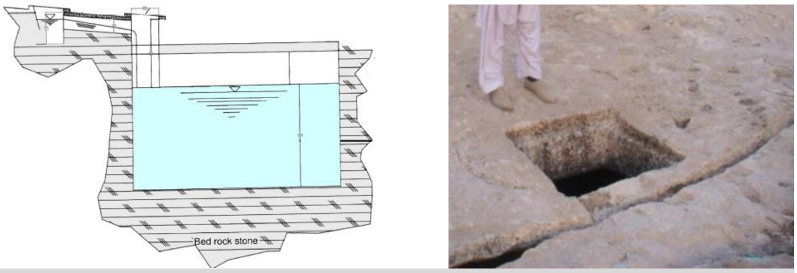

Figure 3: Technical drawing of a kanda (left) and runoff collection hole (right)

Building underground channels (*karaz*) and **water tanks (*kanda*)** allow collecting groundwater, rainwater and snowmelt, which later can be used for plant irrigation and livestock. The construction of these structures can be costly and requires a good knowledge of the site's geology and topography. However, by using the collected water to "green" the watershed, surface runoff and flash flood risk are reduced (cf. Structural SWC Measures).

Sustainable irrigation systems, e.g. hand, sprinklers and drip irrigation, are not only more efficient than surface irrigation techniques (e.g. furrow or basin irrigation) to provide the right amount of water at the right time, but they avoid soil erosion through irrigation and reduce the flash flood risk (cf. Sustainable Irrigation Practices).

Good governance in Water User Associations (WUA) is needed to supply irrigation water in equitable and efficient manner. Particularly in situations where water is scarce, the delivery of in-time irrigation is not only a technical issue but a social question. WUA should be well organized to delegate the responsibility for the management and distribution of water rights to a "head water master" (*mirab bashi*) or "water master" (*mirab*), and to assure that all users contribute to the construction and maintenance of the irrigation systems (cf. Sustainable Irrigation Practices).

Soil management

To control soil erosion and prevent flash floods in the uplands/rangelands of watersheds, it is necessary to decrease water runoff (quantity and velocity) and increase water infiltration. This can be achieved through both structural and vegetative soil and water conservation measures.


Figure 4: Contour trenches with a staggered design (HELVETAS Swiss Intercooperation Afghanistan, 2015)

In the first case, the **construction of contour tied trenches**, **stone lines, soil bunds, eyebrow pits,** among others, lead to a change of slope profile. Moreover, these structures help vegetation to grow, which also decreases water runoff, increases infiltration and reduces the flash flood risks. The increased vegetation establishment leads to an increased fodder production and more cash earnings for families (cf. Structural SWC Measures).

In the second case, the **planting of grasses, shrubs and trees** (e.g. grass strips, hedgerows, live fences, hedges aims to increase vegetation cover. As a consequences, surface roughness increases (leaves and stems) and soil structure is enhanced (roots). This way, water runoff decreases and the entire watershed is better protected against flash floods. To assure the success of this measure is important to use fast-growing, deep-rooted, nitrogen-fixing, wind-resistant plant species that are suited to the local climate. An additional advantage is the production of subsistence or income-generating crops (cash crops; cf. Vegetative and Agronomic SWC Measures).

Risk insurance

Adaptation measures in agriculture and livestock farming help farmers to improve their livelihoods by reducing their vulnerability to climate variability. However, farming is always linked to uncertainty and risk, even when good management practices are implemented. Climatic hazards and pests can cause crop failures, livestock mortality and loss of incomes. As climate change is expected to increase the frequency and intensity of climatic hazards, disaster risk management strategies progressively complement prevention and adaptation with insurance programmes.

In recent years, micro-insurance programmes have been developed and introduced in several regions around the world. In exchange for an insurance premium small-holder farmers can insure their harvests against catastrophic losses. Micro-insurance acts as a safety-net that allows farmers to recover faster from such catastrophic losses. However they require engagement of an appropriate local insurance service providers, a diversified portfolio of risks and support from a re-insurance service provider. These are at a nascent stage in Afghanistan.

Concluding remark

It is important to highlight that adaptation is place and context-specific and no single adaptation strategy will meet the needs of all communities in a particular region. Sound knowledge of the local context is therefore key. In all cases, specific support to partners (public and private) on issues related to climate change is crucial. A sound understanding of the causes and effects of climate change is required for innovative and efficient solutions. Considering this, HELVETAS Swiss Intercooperation has defined 7 elements of a climate change project that include assessment of climate projections, weather monitoring and collaboration with multiple stakeholders (c.f. Topic Sheet Climate Change and Agriculture).

Box 4: Seven elments to build up a climate change project

1. The project's design is based on a clear analysis of climate projections and trends and a risk assessment.
2. Weather data is monitored/accessed from designated institutions, and project interventions are analysed with reference to this information.
3. Relationships and partnerships are established with meteorological departments, agro-meteorological centres and research institutions for adaptation, as well as with the private sector for mitigation actions.
4. Establishment of relationships with national environment ministries/climate change units for up-scaling and accessing upcoming climate funds.
5. Systematic monitoring and participatory assessment of project outcomes in relation to observed weather patterns for creation of new knowledge and experiences among community members.
6. Focus on long-term institutional sustainability, as adaptation (and mitigation) actions need to continue for the long term unlike classical time-bound project interventions.
7. Look for co-benefits between DRR, adaptation, mitigation and development, and avoid 'silo thinking'

Source: HELVETAS Swiss Intercooperation, 2015 (c.f. Topic Sheet Climate Change and Agriculture)

Last, it should be noted that climate change poses a threat to sustainable development as climate and social-ecological systems are complexly connected. For example, climate change impacts livelihoods (Module 3) and economic growth. Managing the risks of climate change has implications for future generations, economies and environments. Thus, it is vital to choose **climate resilient pathways**, development trajectories that combine adaptation and mitigation (Module 5) measures to achieve sustainable development while reducing climate change and its impacts.

Box 5: Climate resilient development pathways

Climate-resilient pathways include strategies, choices and actions that reduce climate change and its impacts. They also include actions to assure that effective risk management and adaptation can be implemented and sustained

Source: IPCC, 2014: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Fifth Assessment Report

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Further readings

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