C5 Climate resilience: synergies between Disaster Risk Reduction and CSA

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Overview

This module looks at how the policies, institutional mechanisms and practices that have proven to be successful for disaster risk reduction can contribute to meeting the objectives of climate-smart agriculture. It considers how multi-hazard risk assessments, disaster risk governance, investments in disaster risk reduction, and emergency preparedness can be mobilized to scale up climate-smart agriculture.

Chapter C5-1 introduces the concept of disaster risk reduction and highlights the common ground it shares with sustainable development and climate change adaptation. Chapter C5-2 illustrates how a multi-hazard approach to risk assessment that examines the diversity of threats to agriculture can be effective for building resilient agricultural landscapes that are better able to withstand multiple shocks, particularly those associated with climate change. Chapter C5-3 outlines the institutional arrangements, and policy and planning frameworks required for effective disaster risk deduction at the regional, national, and local level. It highlights how these institutional arrangements can also be used to foster system-wide capacity development in support of climate-smart agriculture. Chapter C5-4 presents examples of methods, tools, and technologies for reducing disaster risks that can also be applied to climate-smart agriculture. Chapter C5-5 describes the role of disaster risk reduction in emergency response and recovery, and emphasizes how the 'building back better' approach promotes disaster risk reduction in recovery interventions and during the transition to risk-informed climate-smart agricultural development.

Key messages

- In developing countries, the agriculture sectors absorb about one-quarter of the economic impact of climate-related disasters. Droughts cause up to 84 percent of the total reported damage and losses in agriculture.
- Disaster risk reduction is key to sustainable agriculture development.
- Disaster risk reduction is the first line of action in adapting to climate change, particularly to the impacts of extreme weather events that are expect to increase in intensity and frequency.
- Multi-hazard risk assessment and mapping as applied in disaster risk reduction in combination with climate change scenarios provide a holistic framework for assessing the risks of multiple hazards to livelihoods in a given geographic area.
- Building on existing disaster risk reduction systems to advance climate-smart agriculture reinforces national and local capacities.
- Validated disaster risk reduction technologies and practices provide a valuable catalogue of resources and lessons learned that can be used to promote and increase investments in climate-smart agriculture.
- Community-based disaster risk management is a proven participatory approach for assessing and reducing local risks, and supporting local planning. It can also be a vehicle to promote climate-smart agriculture locally.
- Improved early warning and information systems for early action are a critical component of resilience to shocks, climate variability and change.
- Disaster risk reduction can help bridge the gap between humanitarian interventions and sustainable development programmes. Linking disaster risk reduction and climate-smart agriculture can facilitate the integration of short-, medium-, and long-term development actions in the recovery period after climate-related disasters.
- For farmers, there is little distinction between disaster risk reduction and climate change adaptation. Farmers' concerns are mainly linked to threats to their livelihoods and family food security.

Disaster risk reduction and climate change adaptation

The economic losses of natural disasters have reached levels of USD 250 to 300 billion per year. Out of more than 6 400 recorded major disasters over the last twenty years, 90 percent have been caused by weather-related events (UNISDR, 2015a). Agriculture and the people, who depend on it, are particularly exposed to climate and weather conditions. The impacts of climate-related extremes disrupt food production and water supply, and damage infrastructure. Between 2006 and 2016, 26 percent of the economic impact caused by climate-related disasters was recorded in the agriculture sectors in developing countries. In the case of droughts, up to 83 percent of the damage and losses are on agriculture (FAO, 2017).

Experience shows that the negative and cumulative impact of these disasters erodes livelihoods and coping capacities over time, reduces food production and increases hunger. The clear link between disasters and hunger is an indication of the fragility of food production systems and their vulnerability to natural hazards (FAO, 2011a). The most vulnerable groups – smallholder agricultural producers – are often the most food insecure and exposed to risks. They have smaller plots of land; they may have scarce water resources; and they may have limited access to seeds and planting materials. When a disaster strikes, vulnerable farmers can be deprived of their livelihoods not only in the immediate aftermath of the disaster, but for the entire production cycle, and perhaps beyond. Because farming households need more time to recover, they can be forced to adopt negative coping strategies, such as selling their assets, to meet their needs in the aftermath of a disaster. The cascading series of impacts set off by disasters can diminish or even reverse the gains that have been made in sustainable development and poverty reduction.

Household who depend on agriculture are particularly vulnerable to natural hazards and climate change. There is an urgent need to promote measures that reduce or even eliminate disaster risk in the agricultural sectors. In situations where all risks cannot be avoided, residual risks need to be anticipated and preparations must be made to limit these risks and cope with the potential impacts on livelihoods and food security.

C5 - 1.1 What is disaster risk reduction in agriculture?

Disaster risk reduction is defined as actions:

aimed at preventing new and reducing existing disaster risk and managing residual risk, all of which contributes to strengthening resilience and therefore to the achievement of sustainable development. (UNISDR, 2016a, p.16).

The international community has been constantly increasing its efforts to promoting proactive risk management (Box C5.1). In the Sendai Framework for Disaster Risk Reduction 2105-2030, the expected outcome of disaster risk reduction is described as:

The substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries. (UNISDR, 2015b, p12).

Box C5.1 From the Hyogo Framework for Action to Sendai Framework for Disaster Risk Reduction

Between 2005 and 2015, vigorous global efforts, which had been guided by the Hyogo Framework for Action (HFA) 2005-2015, helped strengthen the capacity of communities and nations to cope with natural hazards, and reduce their exposure and vulnerability.

Approved in 2015, the Sendai Framework for Disaster Risk Reduction (SFDRR) 2015-2030, was established as a direct follow-up mechanism to the HFA. The Sendai Framework emphasizes the importance of disaster risk reduction as a key aspect of sustainable development. Notable innovations of the SFDRR include the shift to a wider multi-hazard approach to risk management that covers transboundary, technological, and biological hazards and disasters. The SFDRR also stresses the need for stronger sectoral engagement in the planning and delivery of disaster risk reduction, and articulates the important role disaster risk governance plays in this regard. It highlights the importance of making greater use of science and technology in the policy-making process. It also promotes the value of disaster risk reduction by focusing on its contribution to 'building back better' during recovery, rehabilitation and reconstruction.

From a food security, nutrition and agriculture perspective, the innovative elements in the SFDRR include the call for more coherent development policies that integrate food security and and social safety net mechanisms. SFDRR specifically refers to the need for protecting livelihoods and productive assets, such as livestock, tools and seeds.

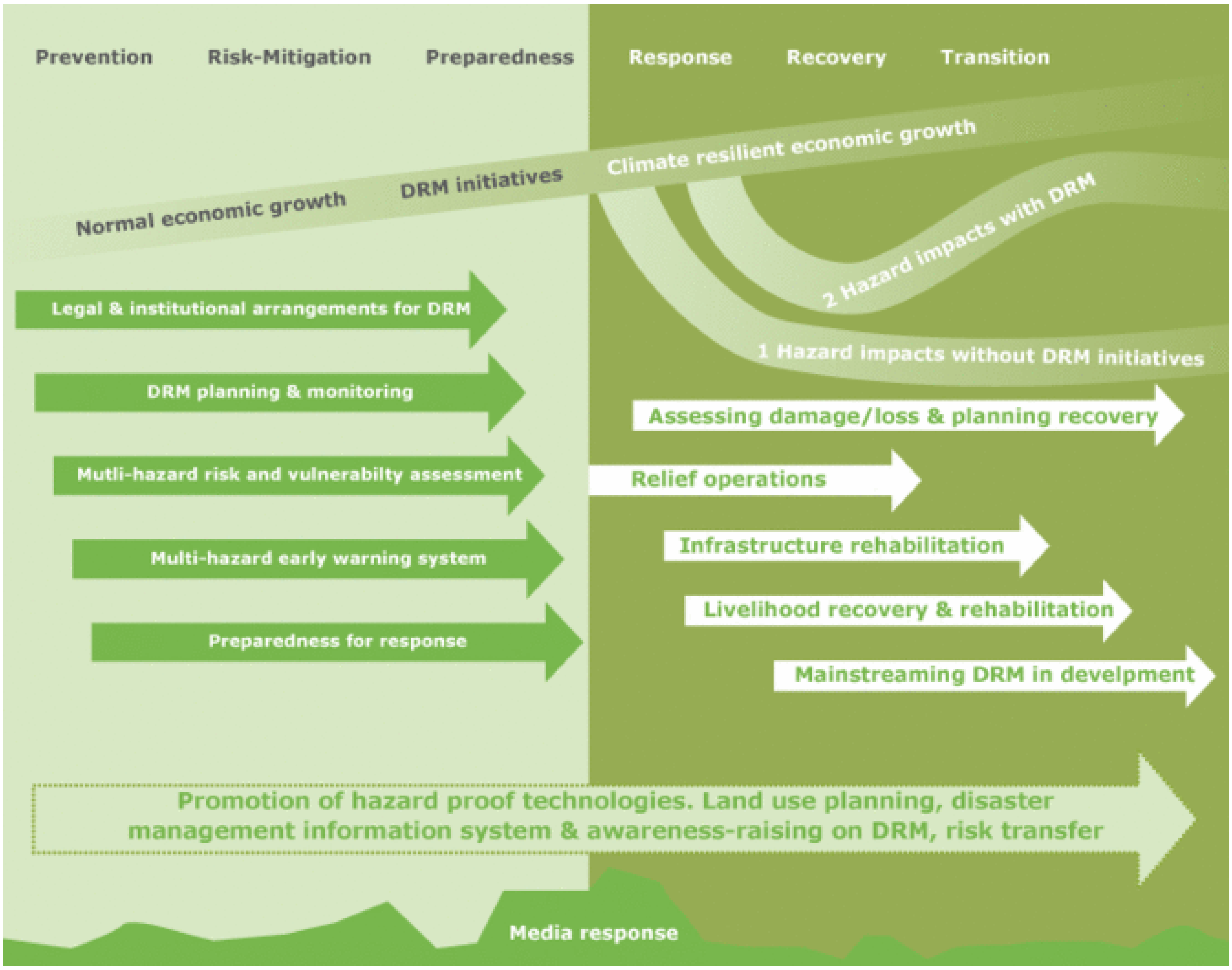
The SFDRR, like the HFA before it, emphasizes the need to address climate change as one of the drivers of increased risk of disaster. Actions in this area include linking risk assessment with climate change scenarios, building greater cross-sectoral coherence in policy implementation, and regularly updating of preparedness and contingency policies based on climate change scenarios and their impact on disaster risk. The principles and priorities agreed on in the SFDRR were taken up and reinforced in the World

Humanitarian Summit, the Sustainable Development Goals and the Paris Agreement.

To achieve these outcomes, disaster risk reduction encompasses a number of distinct activities, including disaster risk prevention, risk mitigation and preparedness. In the aftermath of disasters, disaster risk reduction activities support response and recovery interventions. Disaster risk reduction also involves building a wider understanding of risk and vulnerabilities through assessments, awareness raising campaigns and information management. The systematic integration of disaster risk reduction into wider sustainable development efforts depends on having an effective enabling environment in place that is supported by sound legal and institutional frameworks. Translating concepts and plans into action requires technical expertise and technologies that have been proven effective at reducing hazards; early warning systems that reach vulnerable communities; and practices to enhance preparedness. It also requires that attention be paid to the lessons that have been learned from previous disasters so that affected communities can build back better after future emergencies (Figure C5.1).

In the agricultures sectors, disaster risk reduction can involve using risk analysis and weather alerts to inform farm management. These actions are combined with good agricultural practices and technologies that increase the resilience of the farming system against common stresses and shocks, including those associated with climate change. At an institutional level, mainstreaming disaster risk reduction into agricultural development entails ensuring that disaster risk management measures, the agencies responsible for implementing them and the budgets allocations that make them possible are all integrated into sectoral strategies, plans and investments. Disaster risk reduction in agriculture builds bridges connecting humanitarian support and long-term development goals. For example, risk transfer mechanisms, such as crop insurance or contingency funds, can help keep resource-poor farmers from falling into a 'poverty trap and give them the opportunity to recover more quickly. Module C7 addresses social protection for climate-smart agriculture.

Figure C5.1. Processes of the disaster risk reduction and management (DRM) framework



Source: graphic updated, FAO 2016.

C5 - 1.2 Disaster risk reduction and climate-smart agriculture

Climate-related hazards, such as extreme temperatures, floods and droughts, heat waves, wild fires and storms, will become more frequent and intense as climate changes. Climate change will also reduce the predictability and alter the geographic distribution of these hazards. Existing vulnerabilities and risks will be compounded by other slow onset impacts of climate change, such as rising sea levels, increased glacier melt, more fragile ecosystems and the degradation of natural resources (IPCC, 2014). The impacts of climate change on food production are already evident in several regions of the world. The impacts on crop yields (addressed in module B1) are expected to be more negative than positive, especially in developing countries (IPCC, 2014). The specific nature of the impacts of climate change on the agriculture sectors will depend upon how much and how rapidly climate changes over time and on how natural ecosystems and societies respond. This uncertainty about the impacts of climate change is in part a function of the nature of climate-related hazards, and in part a function of the varied ways institutions manage the distribution of risks. As noted in module A2, effective decision-making regarding adaptation measures must acknowledge that it is difficult to predict the future. Extensive use of climate change scenarios are necessary to work out long-term approaches for adapting to change over the next 30 to 50 years that are valid under a variety of alternative futures (Groves, 2006).

Climate change makes the need to build community resilience against extreme events more urgent. Investing in prevention is much more cost-effective than responding to disasters after they have happened. Disaster risk reduction, by helping communities avoid disasters or lessening their impact, saves lives and protects the livelihoods. Investments in disaster risk reduction, which reduces the costs of rehabilitation and reconstruction, also supports sustainable agriculture development. The common focus of disaster risk reduction and climate change adaptation is to reduce exposure and vulnerability to the risks posed by climate change, and increase resilience to the potential adverse impacts of climate extremes (IPCC, 2012). In dealing with the uncertainty of the local impacts of climate change over the next decades, existing disaster risk deduction practices, tools, structures, and programmes provide a clear entry point for addressing climate-related extreme events that have already started to occur with greater frequency. Proceeding in this manner can provide the evidence needed to promote, scale up, and trigger investments for disaster risk reduction and climate change adaptation in the agriculture sectors, all of which are fundamental for making the transition to climate-smart agriculture.

The United Nations Secretary-General report on the implementation of the Sendai Framework for Disaster Risk Reduction 2015-2030 stresses that "reducing disaster risk is an essential part of efforts to address climate change" (UNISDR, 2016b). Recognizing the interconnectedness of disaster risk and climate change, the parties to the United Nations Framework Convention on Climate Change (UNFCCC, 2011) adopted the Cancun Adaptation Framework in 2010, which calls for enhanced climate change-related disaster risk reduction strategies that take into consideration the Hyogo Framework for Action where appropriate (Box C5.1). An important new element of the Paris Agreement is the increased emphasis on adaptation and reducing losses and damage resulting from climate change, which includes the impact of extreme events. Article 7 and 8 of the Paris Agreement highlight the importance of disaster risk reduction tools and methods, such as early warning systems, risk assessment and management and risk insurance. Other areas of cooperation include strengthening emergency preparedness, responding to slow onset events, and building the resilience of communities (FCCC/CP/2015/L.9/Rev.1).

It is clear that the experiences that have been gained and the capacities that have been developed in addressing disaster risks related to climate change are directly applicable to climate-smart agriculture.

While distinct in scope, disaster risk deduction and climate-smart agriculture share common concerns about the impacts of climate-related extreme events on livelihoods and production systems, and the environment. One of their shared objectives is the strengthening of resilience. Approaches and practices for reducing the risks of disaster specifically address and limit the damages and losses caused by extreme events. This contributes to sustaining agricultural production and livelihoods, in communities prone to shocks, and enhances adaptive capacities at the individual and institutional levels. A range of disaster risk reduction practices that enhance adaptation capacities also generate co-benefits for climate change mitigation, especially those practices that address underlying risk factors and the management of natural resources and ecosystems. However, reducing agriculture's contribution to climate change is not the primary objective of disaster risk reduction.

Understanding disaster risks to agriculture and food security

Understanding disaster risks and exposure is fundamental for policy formulation, planning, and decision-making in agriculture. This chapter outlines examples of risk assessment and analysis tools that complement climate change impact scenarios (see module C8). Given that effective strategies can only be achieved by understanding the disaster risks that farmers are already facing, these tools can also support planning for climate change adaptation and climate-smart agriculture.

Building resilience of livelihoods to shocks demands that stakeholders "grasp the dimension of multiple challenges" (High-level Panel on Global Sustainability, 2012). An examination of the diversity of natural hazards affecting agriculture and food security indicates that, even without climate change, many hazards are already eroding livelihoods and compromising gains made in food security. These hazards add to the challenge of reaching Sustainable Development Goal 2: "End hunger, achieve food security and improved nutrition and promote sustainable agriculture." Along with climate-related hazards, other natural hazards, such as earthquakes, tsunamis and volcanic eruptions, and human-induced hazards, such as conflict, economic crises, high food prices must also be taken into account. Examples described below of large-scale disasters caused by climate-related hazards highlight the magnitude of their impacts and the different types of recurring disaster risks.

In 2010, Pakistan experienced the worst flooding in over 80 years. Over 20 million people were affected. Heavy rains during the 2011 monsoon season caused renewed and devastating flooding that affected almost 10 million people (World Bank and Asian Development, 2010). Over 70 percent of farmers lost more than half of their expected income. The floods caused USD 5 billion in damage and losses to the agriculture sectors (FAO, 2015). In 2012, over 18 million people faced food insecurity in the Sahel region of West and Central Africa (FAO, 2012a; FAO, 2012b). In 2013, 2015 and 2016 several tropical cyclones had devastating effects on a number of countries, for example Typhoon Haiyan in Philippines, Cyclone Pam in Vanuatu and Winston in Fiji, Hurricane Mathew in Haiti. Typhoon Haiyan alone affected 14.1 million people, and caused damage and losses of about USD 1.4 billion (FAO, 2015). In 2015, the Nepal earthquakes affected millions of people in a total of 39 districts, out of 75 districts countrywide. In all these events, the impacts on food security and agricultural livelihoods were extremely high. Millions of hectares of standing crops were damaged. Families lost livestock, crops, food stocks and agricultural inputs. Markets were disrupted, and damaged infrastructure constrained the delivery of emergency assistance.

Climate change will increase the frequency and intensity of extreme weather events. It will also have slow onset impacts. All of these impacts, raise the probability of some countries becoming trapped in chronic crises situations. These crises can vary in their nature and complexity. In 'simultaneous crises' different hazards occur at the same time; in ‘sequential crisis’ hazards trigger series of cascading disasters; and in ‘synchronous failures’ different hazards converge and interact (FAO, 2008). It is becoming increasingly challenging to ensure food security in the face of multiple hazards and the impacts of climate change.

C5 - 2.1 Mapping multiple risk and vulnerabilities

The assessment of threats to agriculture is a necessary first step in designing effective risk reduction measures to safeguard food security. Multi-hazard risk and vulnerability assessments are vital to ensure sound decisions are made about disaster risk reduction and climate-smart agriculture. These assessments are needed not only for risk reduction and adaptation planning, but also for risk-informed sustainable intensification of production and the implementation of potential climate change mitigation measures.

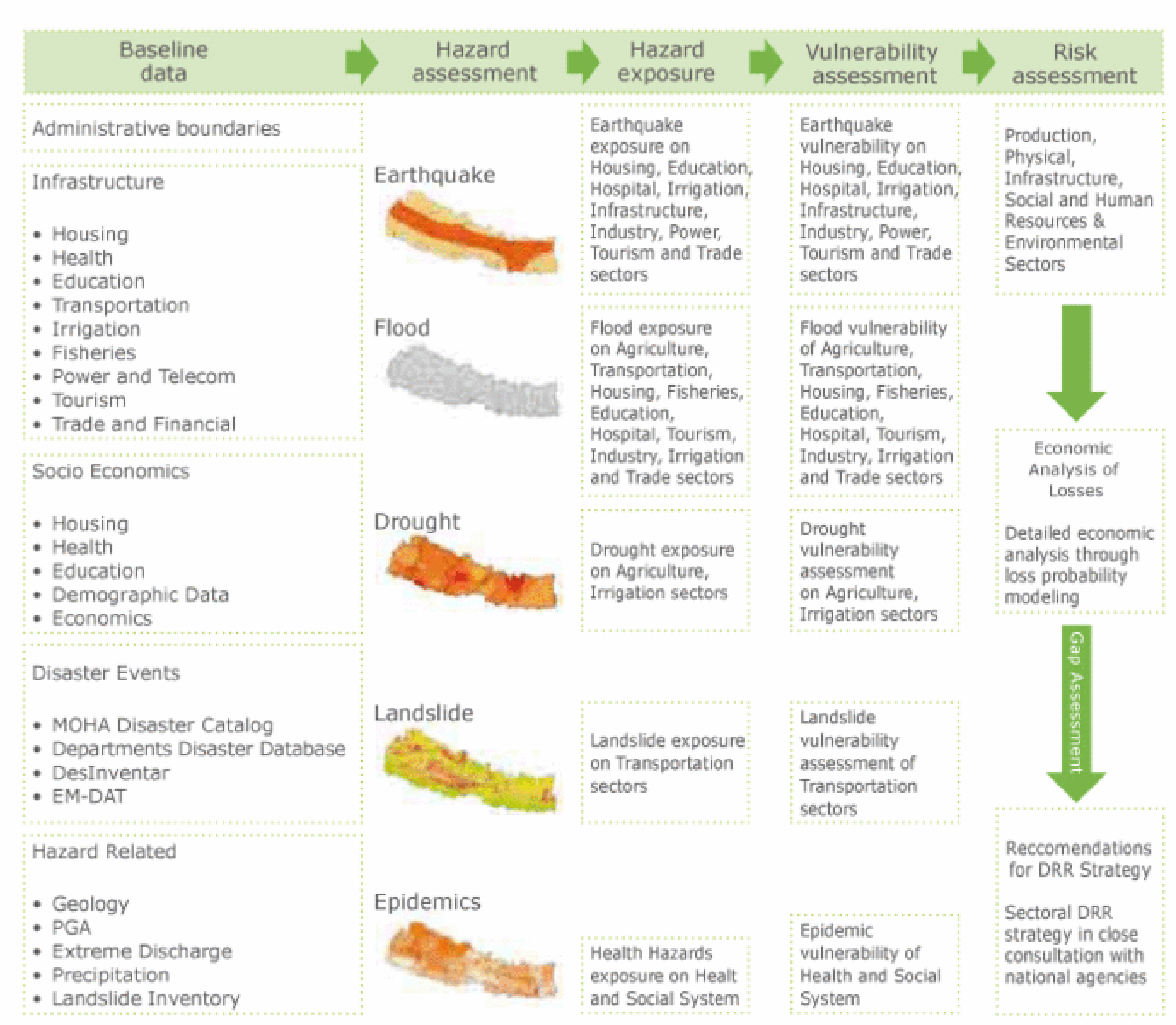
Hazard maps delineate the geographic areas exposed to a specific type of hazard. Typically, they indicate the likelihood of the hazard's occurrence, the frequency and its potential severity. Hazard maps are based on historical data and knowledge of past events.

Vulnerability mapping identifies the elements (e.g. populations, property, agricultural areas, livelihoods, services, health facilities) that are exposed to hazards and that may be adversely affected them. Vulnerability assessments also include social or economic dimensions, including livelihoods.

Risk is determined through the combined analysis of potential hazards and existing conditions of vulnerability. Hazard and risk maps can be developed at different spatial scales to display how risks are distributed across a given geographical area. These maps can be site-specific, encompass municipal or provincial administrative areas and subnational landscapes (e.g. river basins), or they can be national and even regional in scope.

Methodologies and tools used for hazard and risk assessment and mapping vary considerably, but some of the most advanced follow an all-hazards, all-risks approach. This approach makes it possible to assess the cumulative consequences of hazards and their interactions. For instance, some areas may be prone to drought during the dry season, but also to floods during the rainy season. This has important implications for the design of appropriate measures for disaster risk reduction and climate-change adaptation. Figure C5.2 provides an example of the comprehensive multi-hazard risk assessment framework used in Nepal to guide risk reduction measures.

Figure C5.2. Nepal risk assessment and mapping framework



Source: Adapted from Federal Democratic Republic of Nepal et al., 2011

The framework, which includes a national assessment of hazards, including of earthquakes, floods, droughts and landslides, is based on historical information, with maps indicating the spatial distribution of hazards in the country. The assessment was followed by an analysis of exposure, vulnerability and risk for various physical, social and infrastructural assets, including those related to the agriculture sectors.

The application of risk assessments for various planning objectives is growing. Disaster risk assessments are used in land-use planning and territorial development, investment planning, urban planning, the design of public infrastructure, scenario analysis, disaster preparedness and climate change adaptation.

C5 - 2.2 Combining risk assessment and climate change scenarios

Integrated landscape management requires an understanding of all natural hazards and risks affecting a given landscape and an assessment of the potential impact of climate change on agricultural ecosystems. This approach provides evidence-based geographic assessments of current disaster risks and future climate change scenarios that can be used to help countries design holistic climate-smart agriculture policies, strategies, and practices at the national or local level (see also module A3 on integrated landscape management). To give planners short-, medium- and long-term perspectives when designing and implementing appropriate measures, it is necessary to develop a harmonized framework that uses computer modelling to integrate data and analysis of natural hazards with projected climate change scenarios (see also module C8 on assessments for climate-smart agriculture policy). An example of such an approach can be found in a pilot project from Jamaica, which is illustrated in Box C5.2.

Box C5.2 Jamaica - the Risk and Vulnerability Assessment Methodology (RiVAMP)

The Risk and Vulnerability Assessment Methodology (RiVAMP), piloted in Negril on the west coast of Jamaica (Figure C5.3), is an evidence-based assessment tool that assists national and local decision-makers in making informed choices that can reduce risk and support sustainable development through improved ecosystem management. RiVAMP, which takes into account climate change factors, was designed particularly for land-use and spatial development planners, and key stakeholders involved in natural resource management and disaster risk management.

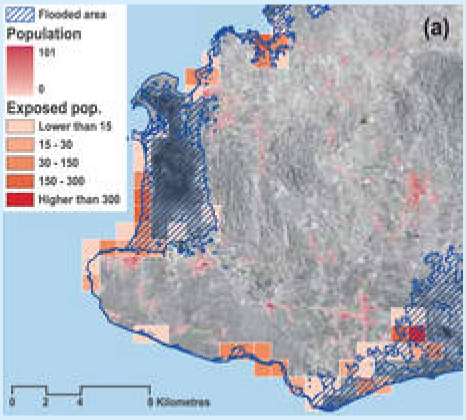
The project examined the impacts of tropical cyclones and their secondary effects, particularly storm surges and flooding, as well as the potential impacts of rising sea levels. Environmental features were analysed to determine the extent to which coral reefs and sea grasses serve as a natural protective barrier against storm surges and rising sea levels.

RiVAMP used a blend of proven scientific methods, including risk mapping with the use of the Geographic Information System (GIS); satellite imagery analysis and other remote sensing techniques; and statistical analyses and modelling of buffering effects of coral and sea grass. The science-based analysis was complemented by stakeholder interviews and consultation workshops.

Figure C5.3. Maps of Negril pilot area: Map of Negril pilot area, and flood hazard map 50-year return period exposure for a) population and b) assets

GIS mapping and analysis, which included population distribution, infrastructure and other exposed assets, assisted in calculating the exposure to storm surges and flooding associated with tropical cyclones (Figure C5.4). Remote sensing used high-resolution satellite images and aerial photographs from 1968 to determine the types and distribution of coral and sea grasses. These images and photographs were also used in the analysis of coastline erosion due to tropical cyclones and rising sea levels. An ensemble of six widely-used, numerical models were applied to assess the range of shoreline retreat of Negril beaches under various rates of sea level rise and storm surges. Multiple regression analyses were used to identify the positive influence of coral reefs and sea grass meadows on the beach erosion patterns along the Negril coastline.

Source: UNDP, 2010



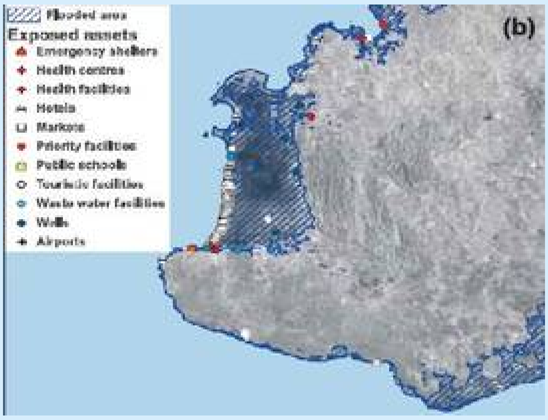
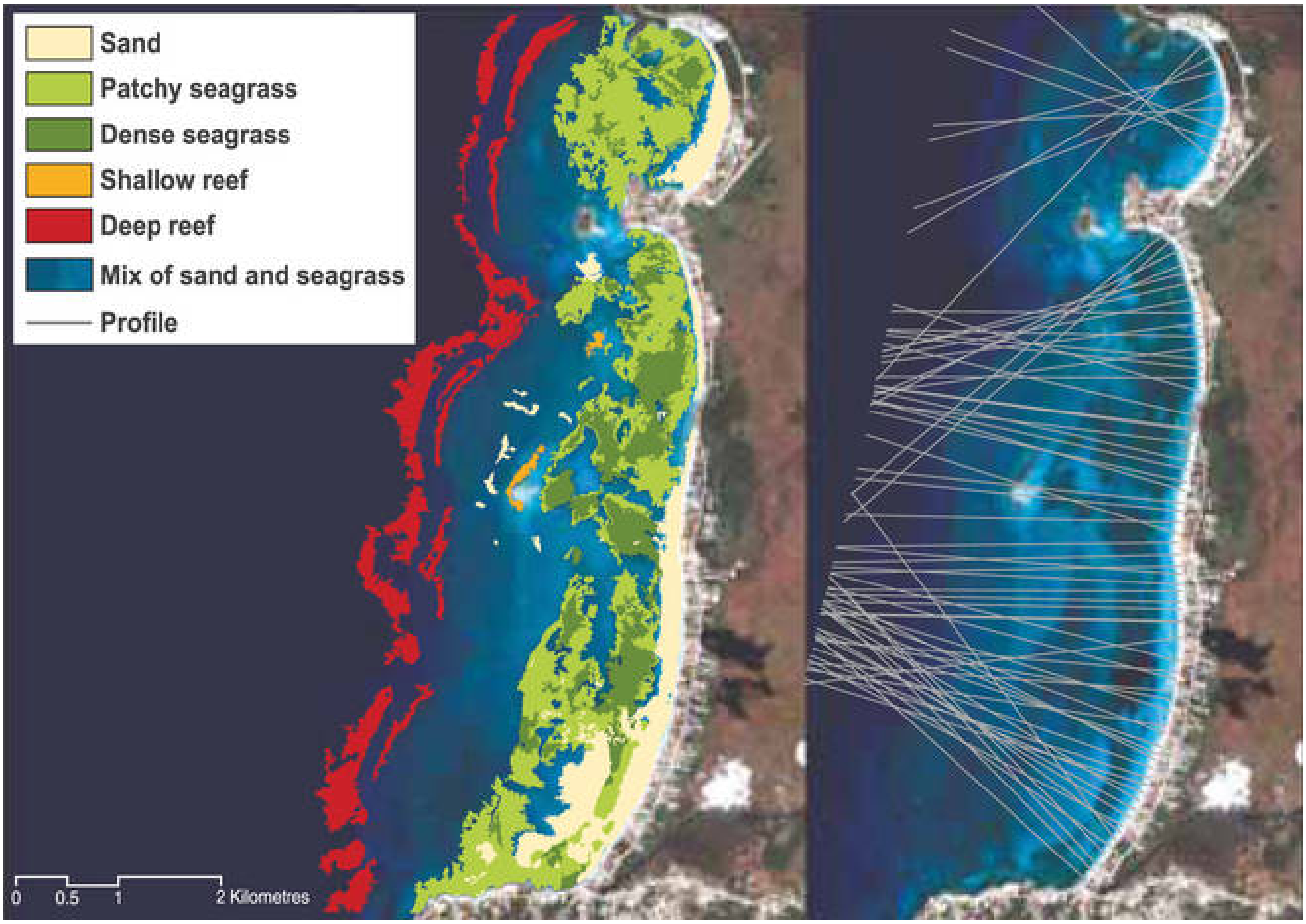


Figure C5.4. Distribution of coastal ecosystems and locations of the profiles used for the multiple regression analysis



GIS mapping and analysis assisted in the computation of exposure to storm surge and flooding associated with tropical cyclones. The analysis included population distribution, infrastructure and other exposed assets. Remote sensing used high resolution satellite images and aerial photographs from 1968 to determine the types and distribution of coastal ecosystems, especially coral and sea grasses. These images and photographs were also used in the analysis of coastline erosion due to tropical cyclones and rising sea levels. An ensemble of six widely-used, numerical models were applied to assess the range of shoreline retreat of Negril beaches under various rates of sea level rise and storm surges. Multiple regression analyses were used to identify the positive influence of coral reefs and sea grass meadows on the observed beach erosion patterns along the Negril coastline.

Estimations based on global projections of long-term or accelerated sea level rise (ASLR) together with local predictions of extreme storm waves and surges showed that by 2060, the combination of ASLR and extreme wave surges will have a devastating impact on Negril's beaches and the coastal infrastructure behind it. This has significant implications for risk reduction and adaptation planning. RiVAMP was intended to be used for Small Island Developing States (SIDS) with similar risks as Jamaica, and holds potential for other island states highly exposed to rising sea levels.

Source: UNEP, 2010

There are various initiatives and resources that combine multi-hazard risk assessment and climate change scenarios, such as the Probabilistic Risk Assessment Initiative (CAPRA), the Pacific Catastrophe Risk Assessment and Financing Initiative (PCRAFI) and the GeoNetwork.

Agriculture as a catalyst for synergies between Disaster Risk Reduction and climate change governance

Initiatives that integrate disaster risk reduction and climate-smart agriculture have to be implemented locally, but to do this requires a broader enabling environment that is supported by institutions capable of putting plans into action (see also module C1 on institutional capacity development and module C3 on policies and programmes). This chapter looks at the different elements of disaster risk governance, including institutional mechanisms, public investment, legislations, and accountability, which are needed for the systematic cross-sectoral mainstreaming of disaster risk management. It provides examples of synergies between the policies and institutional and planning frameworks that address disaster risks and the plans and programmes that address climate change in agriculture. Particular attention is paid to adaptation goals and the potential co-benefits they can deliver with regard to the sustainable intensification of agricultural production and climate change mitigation.

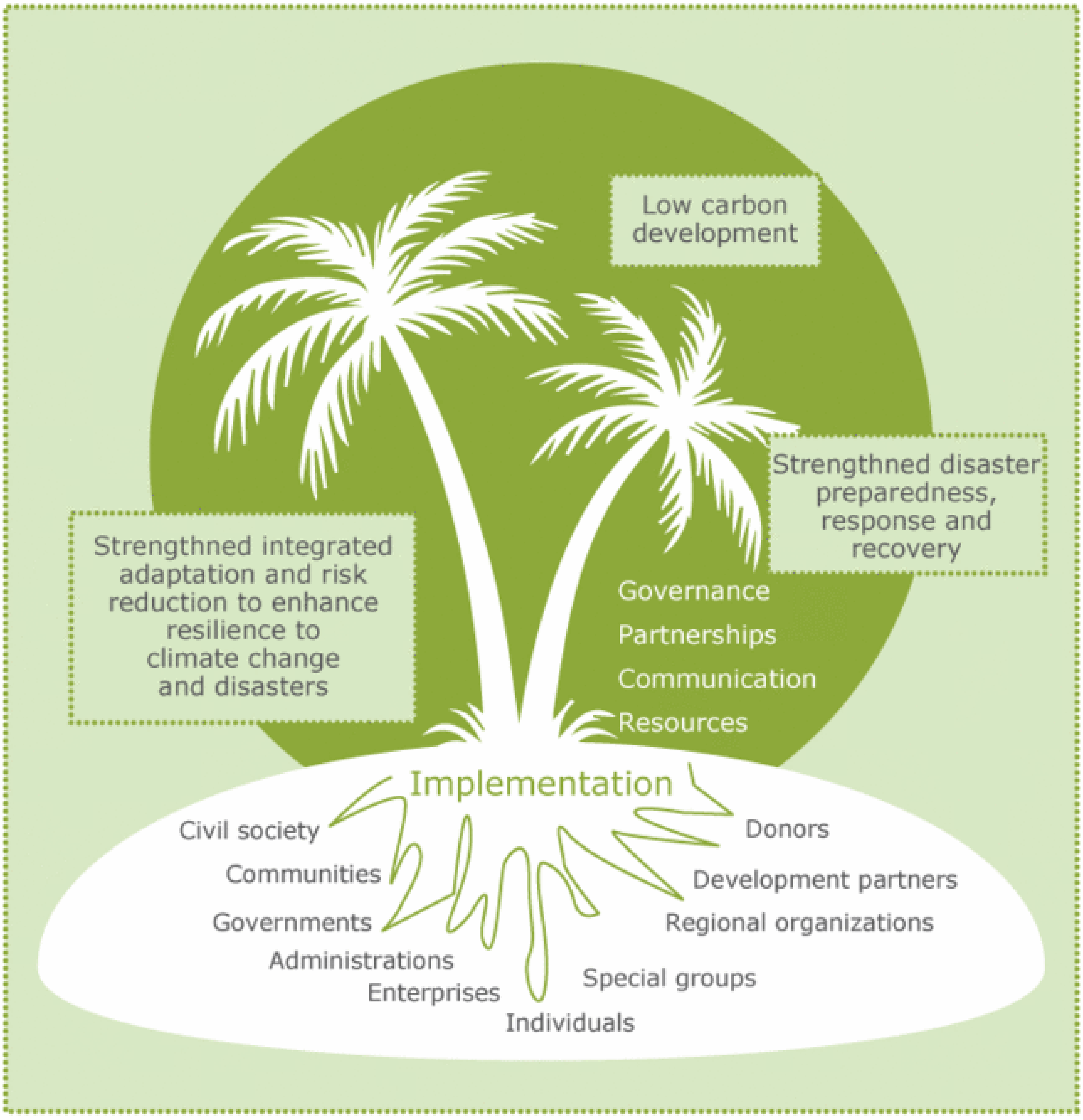
C5 - 3.1 Regional initiatives on integrated approaches to Disaster Risk Reduction, climate change, and resilience

Regional disaster risk reduction initiatives offer the potential for establishing collaborative international arrangements and catalysing climate-smart agriculture. There are six regional platforms for disaster risk reduction in place in Africa, the Americas, the Arab States, Asia, Europe, and the Pacific. The work carried out through or with these regional platforms enhances the coherence of different efforts, helps to build synergies and taps into existing expertise and practice.

In addition to the regional platforms, a number of intergovernmental organizations have developed disaster risk reduction strategies or frameworks for regional cooperation. Some examples are listed below.

- The Association of South East Asian Nations (ASEAN) has developed the Agreement on Disaster Management and Emergency Response (AADMER).
- The African Union has formulated the Africa Regional Strategy for Disaster Risk Reduction and adopted a Programme of Action for the Implementation of the Africa Regional Strategy for Disaster Risk Reduction. Africa's regional economic communities, including the Economic Community of Central African States, the Economic Community of West African States (ECOWAS), the Southern Africa Development Community and the Inter-Governmental Authority on Development are key partners in the implementation of the strategy (World Bank and GFDRR, 2010).
- In 2009, the Andean countries prepared the Andean Strategy for Disaster Prevention and Relief.
- In 2010, Central American heads of state adopted the legally binding Central American Integrated Policy on Disaster Risk Reduction, which aims at an improved regional commitment to disaster risk reduction through a common guiding framework (UNISDR, 2011).
- Framework for Resilient Development in the Pacific, 2017-2030 (FRDP) is a regional process that provides scope for linking disaster risk reduction and climate-smart agriculture. The Framework, which promotes an integrated approach for addressing climate change and disaster risk management, also provides voluntary guidelines for the Pacific Islands Region. The framework has three main goals (Figure C5.5): strengthened integrated adaptation and risk reduction to enhance resilience to climate change and disasters; low-carbon development; improved disaster preparedness, response and recovery. It recognizes the important role of different economic sectors, referring in particular to agriculture, fisheries, forestry, for implementing cross-cutting measures that address climate change and disaster risk reduction in tandem. However, the Framework does not enter deeply into sectoral issues. This is an area where disaster risk reduction and climate-smart agriculture could make a valuable contribution.

Figure C5.5. The three strategic goals, with the importance of a sound enabling environment for implementation and multistakeholder engagement.



Source: The Pacific Community (SPC), 2016.

C5 - 3.2 National institutional structures and policy frameworks for disaster risk reduction

The mainstreaming of disaster risk reduction in agriculture, and climate-smart agriculture in particular, requires legal and policy frameworks, national strategies and action plans, coordination mechanisms, adequate budget allocations, and technical capacities to implement action plans at all levels. This chapter provides examples of existing disaster risk reduction mechanisms that can be used as a basis for policies and programmes that support climate-smart agriculture. It also looks at the ways these institutional mechanisms need to be strengthened and the capacities of different stakeholders developed to ensure a country-driven and country-owned approach that can deliver sustainable results.

Legislation on disaster risk reduction

Legal frameworks provide guidance and direction to the implementation of disaster risk reduction at the national and local level. Enhanced risk and safety standards in all aspects of disaster risk reduction (e.g early warning systems) are crucial for enhancing the responsibilities of different sectors and ensuring their accountability.

A good example is the Namibia Disaster Risk Management Act of 2012. The law places a strong emphasis on disaster risk reduction. The law, which promotes an integrated and well-coordinated approach among government institutions, clearly outlines their respective responsibilities. The Directorate of Disaster Risk Management coordinates specific disaster risk reduction strategies, and each government institution is then responsible in providing training on disaster risk reduction to their staff in their decentralized offices and at the local level (IFRC and UNDP, 2014).

Despite increased commitments to climate change adaptation, especially in developing countries, relatively few countries have yet adopted legislation related to climate change adaptation or climate-smart agriculture. In countries where there is clear legislation on disaster risk reduction and management, this can form an essential component of the enabling environment that is needed to achieve climate-smart agriculture's multiple objectives. However, unlike many disaster risk reduction and management laws, climate change legislation (if it exists) is often administrated separately by the Ministry of Environment. This institutional gap creates an unfavourable situation where current risks linked with development are addressed in a way that is not aligned with efforts to reduce new emerging risks related to climate change. In practice, the integration of disaster risk reduction and climate-smart agriculture require a coherent institutional platform that can allow cross-sectoral coordination.

Multisectoral platforms for disaster risk reduction

In the 2015 Global Assessment Report on Disaster Risk Reduction countries reported substantial progress in developing national legislation, establishing institutional arrangements, and formulating policies and planning frameworks for disaster risk reduction. In 2015 14 countries had set up national institutional arrangements for disaster risk reduction. Since 2007, more than 120 countries have enacted legal or policy reforms in this area. Over 190 countries have created focal points for disaster risk reduction, and 85 have established national multistakeholder platforms that bring together various stakeholders (UNISDR, 2015c). (See module C1 on multistakeholder platforms). In Sri Lanka, the National Disaster Management Coordination Committee consists of 35 members from key sectors, including representatives of the Ministries of Environment, Home Affairs and Agriculture, the Department of National Planning, the Coastal Conservation Department, the Department for Irrigation and the Department of Meteorology (UNISDR, 2008). National disaster risk reduction platforms provide a solid foundation countries can use to build collaborative mechanisms to catalyse climate-smart agriculture. These multistakholder platforms are especially important, since in most countries, disaster risk reduction and climate change are coordinated through different specialized bodies or agencies, which are often responsible for leading efforts to mainstream of disaster risk reduction and climate change adaptation issues into different sectors. However, they tend to rely on their own coordination mechanisms and platforms rather than on deeply imbedded cross-sectoral mechanisms. There is a need for greater coordination and coherence between the institutional arrangements, policies and planning designed for climate change adaptation (e.g. National Adaptation Programmes) and those that have been set up for disaster risk reduction (IISD, 2011).

Addressing the humanitarian development divide

Adequate financing is another indispensable component in disaster risk governance (see module C4 on financing and investment). When a disaster hits, the willingness to invest in risk and vulnerability reduction is usually high. This explains why most of the disaster risk reduction funds come from humanitarian organizations. However, more than 95 percent of humanitarian finance is still spent on disaster response, with only the remaining five percent dedicated to reducing the risk of disasters (FAO, 2015). As with climate change adaptation, disaster risk reduction requires long-term commitments, which are often not possible to guarantee during emergency situations. Earmarked funding for disaster risk reduction from development and humanitarian budgets and other channels, such as climate financing, is needed. Making a shift to climate-smart agriculture can open up funding opportunities that allow for a more efficient and effective use of disaster risk reduction practices, tools, and methodologies and ensure that they contribute to sustainable development and climate change adaptation. There has been a recognition of the co-benefits that can be obtained from mutually supporting efforts to integrate disaster risk reduction and climate change adaptation, particularly in sectors that are sensitive to climatic hazards, such as agriculture. As a result, more countries are looking to initiatives that can achieve this sort of integration. The strong involvement of a range of sectors is crucial in shaping and implementing national integrated climate change and disaster risk reduction plans.

Many countries with national disaster risk reduction platforms have strategic national action plans for disaster risk reduction that set priorities for risk reduction and guide the direction of interventions. However, these plans do not necessarily call for the strong involvement of different sectors. A FAO study, Mainstreaming disaster risk reduction in agriculture: An assessment of progress made against the Hyogo Framework for Action, prepared as an input paper for the 2015 Global Assessment Report on Disaster Risk Reduction, noted that in 30 high-risk countries nearly half of the plans in agriculture refer to disaster risk reduction. Most of these plans explicitly refer to the linkages between disaster risk reduction and climate change adaptation. Bangladesh, Belize, Cambodia, Dominica, Guyana, Jamaica, Lao People's Democratic Republic Nepal, Paraguay, the Philippines, Saint Lucia and Saint Vincent and the Grenadines are examples of countries that have developed disaster risk management plans and climate change adaptation for the agriculture sectors. In Nepal, the Priority Framework for Action for Climate Change Adaptation and Disaster Risk Management in Agriculture promotes policy coherence by drawing on the actions previously outlined in the National Adaptation Programme of Action and in the National Strategy for Disaster Risk Management. The Philippines is also in the process of fully integrating climate change into its disaster risk reduction actions, including in the agriculture sectors. This approach builds a solid foundation for climate-smart agriculture. The policy environment in the Philippines that promotes a mutually supportive relationship between disaster risk reduction and climate change adaptation is described in Box C5.3.

Box C5.3 The enabling policy environment in the Philippines; linking disaster risk reduction and climate change adaptation

The Philippine's Climate Change Act, which was enacted in 2009, was the first of its kind in Southeast Asia. It recognizes that climate change and disaster risk reduction are closely intertwined, and that effective disaster risk reduction will enhance adaptive capacities to cope with climate change (UNISDR, 2011): The act also called for the establishment of a Climate Change Commission attached to the Office of the President and an advisory board composed of all relevant line ministries.

In 2010, the country enacted the Disaster Risk Reduction and Management Act, which includes a policy to mainstream disaster risk reduction and climate change into socio-economic development planning, budgeting, and governance, including the agriculture sectors. Under the act, local government units are obliged to use at least 5 percent of their budgets for disaster risk reduction. The act also institutionalized the obligatory formulation of integrated disaster risk reduction and climate change adaptation plans by the local government units, and forms the basis for the disbursement of disaster risk reduction and climate change adaptation funding at local levels.

The National Framework Strategy on Climate Change, 2010-2022 integrates disaster risk reduction, including the enhancement of monitoring, forecasting and hazard warning systems, and mainstreams disaster risk reduction and climate change adaptation into development and land-use planning based on disaster risk assessments. Similarly, one of the goals laid out in the country's National Development Plan is to increase the agriculture sectors' resilience to climate change risks (Republic of the Philippines National Economic and Development Authority, 2011).

In 2015, the above policy and legislative frameworks catalysed the development of two Regional Action Plans for Disaster Risk Reduction in Agriculture in Bicol and Caraga, and an overarching national, sector-specific Strategic Plan of Action for Disaster Risk Reduction in Agriculture and Fisheries, which is aligned to the Sendai Framework for Disaster Risk Reduction, national disaster risk reduction goals and the Climate Change Act developed. FAO provided technical support in this process.

In 2016, Cambodia adopted its Climate Change Priorities Action Plan for Agriculture, Forestry and Fisheries Sector (CCPAP) 2016-2020. The action plan, which promotes synergies between interventions related to climate change and disaster risk reduction, acknowledges that the impacts of climate change on the agricultural sectors are mainly felt through more frequent and intense weather hazards, and that most disaster risk reduction measures applied now will also enhance adaptation to climate change in the future.

The importance of integrating disaster risk management measures into adaptation planning has also been recognized in several Intended Nationally Determined Contributions (INDCs), the documents that Parties to the United Nations Framework Convention on Climate Change (UNFCCC) submitted as part of the foundation of the Paris Agreement in 2015. In total, 131 countries included priority areas for adaptation or adaptation actions in the agriculture sectors in their INDCs. Of these 131 countries, 47 countries, nearly half of which were least-developed countries, mentioned disaster risk management in the agriculture sectors. The majority of these countries are in sub-Saharan Africa, with many often referring to the need to invest in enhancing disaster preparedness and early warning systems. Asian countries also often refer to the agriculture sectors in the context of disaster risk management (62 percent of the countries in East Asia and Southeast Asia, 38 percent in South Asia) (FAO, 2016a).

Parties to the UNFCCC are currently ratifying their INDCs to turn them into Nationally Determined Contributions (NDCs) and developing national adaptation plans. These processes provide an important opportunity to further institutionalize the integration of disaster risk management and climate change adaptation. This integration helps reduce the resources required for supporting climate-smart agricultural development and often delivers climate change mitigation co-benefits.

Technical capacities for putting words into action

The state of existing technical capacities and expertise for disaster risk reduction within agriculture varies considerably from one country to another. Because activities related to disaster risk reduction (e.g. breeding of hazard-tolerant varieties and the monitoring and mitigation of plant pests and diseases) have long been part of regular development activities in agriculture, funding for these activities has often not been explicitly labelled as funding for disaster risk reduction. Enhancing technical capacities for disaster risk reduction at the individual and organizational levels and throughout the institutions that make up the enabling environment must be based on sound needs assessments. Capacity development will enable sectoral ministries to better carry out their responsibilities and proactively address disaster risk reduction planning and implementation at national, subnational and local levels. This would also involve subnational mechanisms and actions that support farming communities and promote resilient livelihoods (UN, 2014). See also module C1 on system-wide capacity development.

By aligning cross-sectoral development approaches so that they work together to simultaneously respond to the pressing need to intensify sustainable agricultural production and address climate change adaptation and mitigation, climate-smart agriculture can help agricultural sectors overcome what the High-level Panel on Global Sustainability (2012) has called “the legacy of fragmented institutions established around single-issue ‘silos’ and move towards integrated thinking and policymaking”. An inclusive and coherent pathway for climate-smart agriculture requires building bridges that connect the institutional architecture that supports disaster risk reduction and climate change adaptation, and promoting cross-sectoral dialogue and collective actions to benefit vulnerable agricultural communities (see module C3-4). A strategic approach for planning climate-smart agriculture programmes begins by taking stock of what is already in place at the country level and identifying the key gaps that need to be addressed to better manage risks and climate change in the agriculture sectors. Given the institutional constraints and limited resources in many developing countries, this is a sound, cost-effective approach.

C5 - 3.2 Community-based approaches to disaster risk reduction and climate change adaptation

Community disaster risk management is a process developed in the 1980s to allow communities at risk to become actively engaged in the identification, analysis, treatment, monitoring and evaluation of disaster risks in ways that reduce their vulnerabilities and enhance their capacities (Asian Disaster Preparedness Center, 2004).

Community based adaptation is similar process that has been promoted since late 1990s to support climate change adaptation at the local level. Both community disaster risk management and community based adaptation are key processes for building the resilience of livelihoods in agricultural areas. They both use a bottom-up grassroots approach, target the same populations and apply the same participatory methods. However, given the distinct history of climate change adaptation, community based adaptation and community disaster risk management are often distinct in the way they are put in practice. They are often carried out through separate projects and funding mechanisms. Bridging this gap is a challenge that needs to be overcome. As the example from Uganda in Box C5.7 indicates, the need for an integrated approach is clear at the local community level, where multiple risks converge and threaten the lives and livelihoods of households and farming communities.

Climate-smart agriculture should build on the valuable opportunities found in the short- and long-term measures that community disaster risk management and community based adaptation promote through projects and partnerships at the local level. Through existing community disaster risk management practices, climate-smart agriculture initiatives can support measures that farmers have prioritized because they address known and immediate risks and provide tangible improvements to household food security. At the same time, community based adaptation projects can complement these disaster risk reduction initiatives by using innovative measures to address the longer-term and gradual impact of climate change. For local authorities working in an environment facing institutional and financial constraints, an integrated approach to climate-smart agriculture will help reduce the administrative burden and cost of managing a wide range of community based adaptation and community disaster risk management projects. These win-win benefits optimize resources and make aid more cost-effective.

The case of Papua New Guinea presented in Box C5.4 indicates the value of combining disaster risk reduction and climate change adaptation at the community level to guide agricultural practice.

Box C5.4 Integrated community approaches to disaster risk reduction and

adaptation in Papua New Guinea

In Papua New Guinea, a community-based framework for disaster risk reduction used participatory techniques, such as guided discovery, mapping exercises, timelines and matrix rankings to collect information from community members on village history, hazards and event timelines, maps, and environmental and social trends. This baseline information was used to identify, in collaboration with communities, underlying vulnerability factors, both external and internal. Communities identified past and present indigenous and scientific strategies used, and prioritized possible strategies for reducing risk and vulnerability. This disaster risk reduction framework met short-term needs and addressed risks related to floods, storms, landslides, and volcanic eruptions.

The framework was then used as a practical entry point for discussing why and how communities are also vulnerable to climate change, and what measures could be taken to address these vulnerabilities. The concerns and priorities of communities identified in the disaster risk reduction framework were combined with assessments of climate change impacts, vulnerability, and adaptation on small island developing states prepared by Center for International Climate and Environmental Research - Oslo (CICERO) and the United Nations Environment Programme (UNEP) (CICERO and UNEP/GRID-Arendal, 2008). External scientific information on the historical and potential future consequences of climate variability and change (e.g. satellite observations and downscaled climate projections) were integrated to prepare short- and long-term scenarios. Invasive species were identified as an additional threat that could change the pest or disease profile of local agricultural systems. To identify indigenous strategies for reducing vulnerability to climate change, the focus was placed on determining how local communities had responded to longer-term changes in the past.

Source: Kelman *et al.*, 2009

Another community-driven approach to building resilience to shocks caused by natural or man-made disasters is Caisses de Résilience, which FAO has piloted together with its partners in a number of African countries (Burkina Faso, Burundi, Central African Republic, Chad, Democratic Republic of Congo, Guinea Bissau, Liberia, Malawi, Mali Senegal and Uganda). It promotes an integrated way of programming by working simultaneously on three mutually reinforcing dimensions: technical, financial, and social. This approach has shown to have a multiplier effect in the livelihoods of men and women farmers and pastoralists by increasing and diversifying incomes and household and community assets, two key elements for increasing livelihood resilience. The approach enables vulnerable households to address the root causes of their vulnerabilities and helps them build resilience to potential shocks related to protracted crisis and natural hazards, including those associated with climate change (FAO, 2016b; FAO Emergencies Website, 2014).

The expansion and institutionalization of community disaster risk management in many parts of Asia and Latin America offers a broad platform on which climate-smart agriculture can build. In Southeast Asia, progress has been made in mainstreaming community disaster risk management into socio-economic development policies, including national, subnational and local action plans, that build community resilience (European Commission *et al*., 2008).

Scaling up investments in disaster risk reduction in agriculture

Along with community disaster risk management and community based adaptation, there are several other approaches that can be used to enhance technical, financial, and social capacities to build community resilience to disasters and that can also contribute to reaching the objectives of climate-smart agriculture. This chapter looks at local disaster risk reduction practices and approaches that have generated evidence on the value that disaster risk reduction can add to broader climate-smart sustainable development. It proposes pathways for using good practices in disaster risk reduction to scale up climate-smart agriculture.

C5 - 4.1 Agriculture technologies and practices for disaster risk reduction with co-benefits for climate-smart agriculture

Reducing the vulnerability of people and the exposure and sensitivity of the systems to disaster risk and climate change are key element for increasing the resilience of livelihoods to threats and shocks.

In many societies, strengthening resilience has been a natural, evolving process for coping with shocks and adjusting to changes that have an impact on livelihoods (Pandey *et al*., 2003). An example of this process is can be seen in the ways indigenous peoples worldwide have cultivated an enormous diversity of traditional crop varieties using a variety of effective traditional practices (IIED, 2011). Numerous case studies have documented the importance of indigenous knowledge to disaster risk reduction. For example, in many regions of the world, a diversity of indigenous rainwater harvesting and management practices has evolved over millennia to cope with climate variability, particularly drought. In South Asia, rainwater harvesting dates back over 8 000 years. In India alone, more than 1.5 million traditional village tanks, ponds and earthen embankments harvest rainwater in 660 000 villages across the country (Pandey *et al*., 2003; IUCN, 2008).

In the rangelands of the Horn of Africa, pastoralism, which emerged thousands of years ago and has evolved in response to weather uncertainty, is a resilient livelihood strategy for coping with the harsh environment of arid and semi-arid lands and optimizing the use of natural resources. It allows rural communities to manage risk and conserve their resources (WISP *et al*., 2007; HPG, 2009). (see also module B2 on climate-smart livestock).

Traditional or local practices that help mitigate the impacts of extreme events can be combined with a wide range of new science-based technologies and practices for reducing the vulnerability of farming systems and building their resilience. Modern techniques include diversifying crop production; adjusting cropping calendars; developing drought- or flood-tolerant crop varieties; breeding more resistant livestock and improving the bio-security of animal production systems; building hazard-proof grain storage facilities and livestock shelters; setting aside strategic fodder reserves; creating water reserves as a buffer against droughts; and implementing crop insurance schemes, (FAO, 2011b). Because of their value in strengthening the adaptive capacities to extreme events and supporting sustainable agricultural livelihoods many of these practices are important for climate-smart agriculture. Some of these practices, such as conservation agriculture can contribute to reaching all of climate-smart agriculture's objectives. Conservation agriculture is particularly suitable for areas that are exposed to difficult climatic conditions (e.g. increasing unpredictability of the onset of the rainy season) and use technologies that offer flexibility in the timing of field operations (see module B1 on climate-smart crop production systems). Conservation agriculture is also a way to manage agricultural ecosystems to improve and sustain productivity and food security and at the same time preserve and enhance the natural resource base (FAO, 2011a).

Many technologies for disaster risk reduction are available to help farming communities prepare for climate variability and extreme weather events, and cope with their impacts. Climate change, however, also creates new hazards (e.g. rising sea levels, increased average temperatures and the expected spread of plant pests and diseases) that require additional measures that complement disaster risk reduction. This is one of the reasons, why local expertise should be combined with scientific knowledge, research and technological innovations. However, in some cases, practices based on traditional knowledge may be insufficient to cope with the full complexity of the impacts of climate change and carry a risk of evolving into maladaptation. The example in Box C5.5 on potatoes in the Andes illustrates how traditional risk reduction practices can be effectively combined with new adaptive technologies to address risks associated with the impacts of climate change.

Box C5.5 Building the resilience and adaptive capacity of potato farmers in the Andes

In some regions of the world, climate change is expected to increase plant diseases and pests that affect potato production. Late blight, the fungus responsible for the Irish potato famine in the 1800s, is expected to expand into previously unaffected areas. Increases in temperature will also put pressure on the potato's wild relatives. By the year 2055, it is forecasted that 16 to 22 percent of all wild potato species will be threatened with extinction. This is an urgent problem given the importance of wild relatives as gene pools for breeding new varieties. Potatoes constitute the fourth most important food crop after rice, wheat and maize.

A project by Association Andes supports Andean potato farmers through the protection of traditional knowledge and conservation efforts that prevent the disappearance of potato varieties from local fields. This ensures farmers have more options for dealing with the impact of climate change.

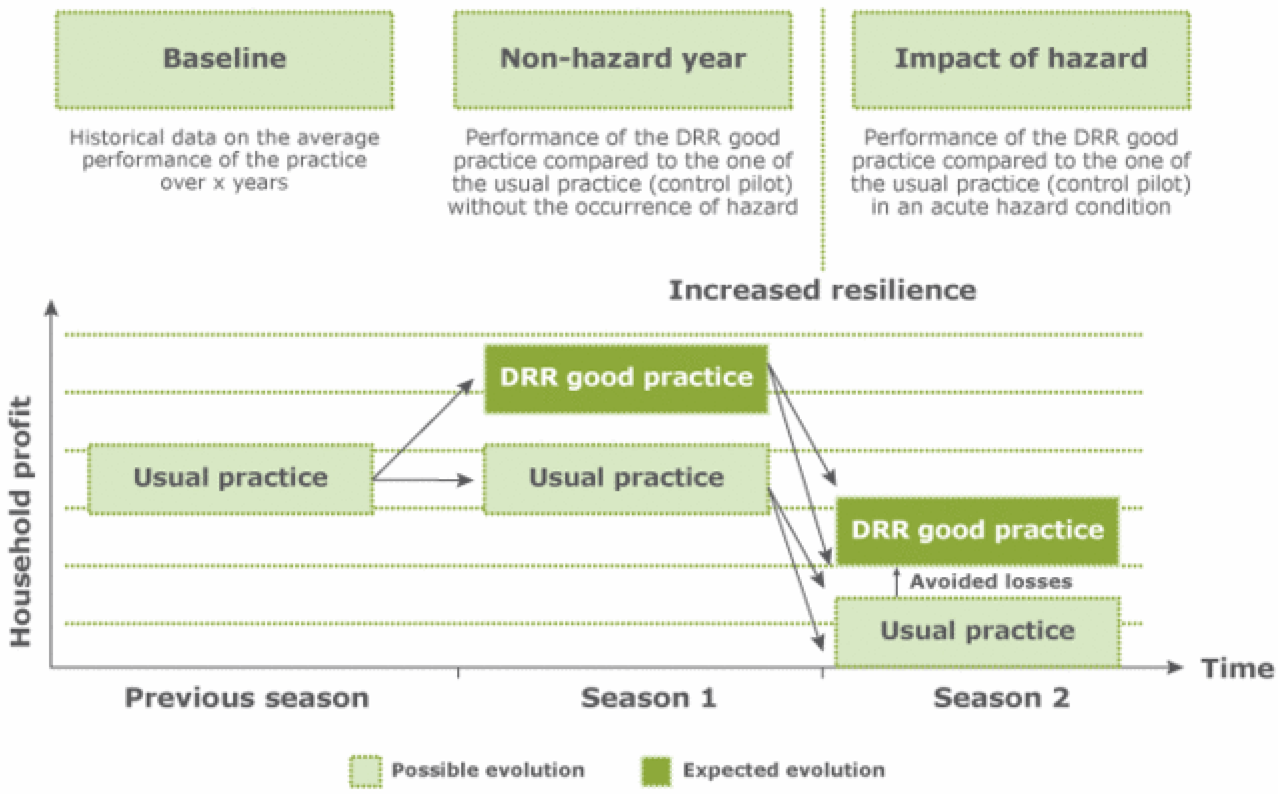
Another potato breeding initiative in Bolivia is helping local farmers cope with the increasingly shorter rainy seasons and the resulting declines in yields. The project, implemented by the International Potato Center (IPC) and the Fundación para Promoción e Investigación de Productos Andinos breeds potato varieties that are better adapted to the short rainy season without any loss in yield. With local farmers, the project tests new varieties in the field under real conditions.

The IPC, together with local organizations, is evaluating the tolerance to water and temperature stress of the genetic resources of its potato collection and those of new varieties that are being bred. The IPC can draw on the world's largest genetic reservoir of potato varieties. Its gene bank contains 5 000 distinct types of cultivated potatoes and more than 2 000 wild relatives of the potato belonging to around 140 wild species. The goal is to identify the desired key characteristics and genes that determine tolerance to abiotic stress. Climate change and other factors that increase pressure on ecosystems are threatening the existence of many wild relatives. The establishment and maintenance of gene banks is intended to curb the loss of this diversity in varieties. To date, the IPC has repatriated over 400 native potatoes varieties among communities across the Andes.

Sources: Centre for Development and Environment, 2008; International Treaty on Plant Genetic Resources for Food and Agriculture, 2011

Despite a wealth of knowledge on good practices on disaster risk reduction, there is still a long way to go toward identifying specific contexts where suitable practices can be piloted before replicating them on a wider scale. Before any disaster risk reduction practices can be recommended for scaling up, evidence from the field must be obtained to determine the returns of investment. There is a crucial need to quantify the percentage of damage and losses that can be reduced by implementing a particular disaster risk reduction practice. Cost-benefits analyses are used to assess the net benefits of a given intervention. For disaster risk reduction initiatives, they take into account their agro-ecological suitability, socio-economic feasibility, the potential to increase resilience of livelihoods to disasters, and their environmental impacts. The net benefits of the new practice are compared with baseline data on the historic performance of the current practice and with the investments that were made to implement the new practice. Results obtained during the observed time are then extrapolated over a longer time period. The cost-benefits analysis is used to calculate the Benefit Cost Ratio, which indicates the dividend (measured in monetary terms) that is returned on the financial investment. FAO supports countries in identifying, testing, and scaling up good practices and technologies in disaster risk reduction, and promotes a consistent approach for monitoring and evaluating these technologies at the local level. The cost-benefits analysis process is intended to help identify, under normal conditions and hazardous conditions, the most cost-effective disaster risk reduction practices and provide guidance on the socio-economic potential for scaling them up, (Figure C5.6). The calculation is based on primary farm level data collected on agricultural seasonal basis. For the cost-benefits analysis, the data collected on farms includes the costs of inputs, labour, maintenance and capital, and the benefits in terms of the gross value of production.

Figure C5.6. Analytical framework to measure the performance of disaster risk reduction good practices



Source: FAO, 2017

Preliminary results from studies conducted in Bolivia, Cambodia, the Lao People's Democratic Republic, the Philippines and Uganda indicate that, when hazards strike, the net economic benefits at the farm level that are gained from implementing good disaster risk reduction practices are 2.5 times higher than business-as-usual practices (FAO, 2017). Box C5.6 shows detailed results obtained from a specific disaster risk reduction technology tested in Uganda.

Box C5.6 Improved maize varieties in Uganda

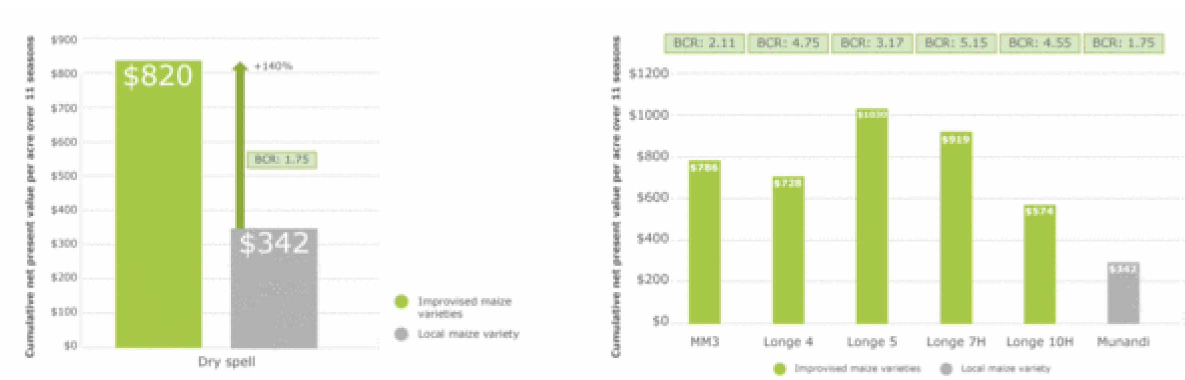
As part of the Global Climate Change Alliance (GCCA) project on Agriculture Adaptation to Climate Change farmers in Uganda were introduced to improved maize varieties that were more tolerant to drought and diseases and were trained on a set of good practices to enhance the resilience of maize production to increasing dry spells in the central cattle corridor of Uganda. During the 2016 dry season (June to August), the performance of the improved maize varieties was monitored in 19 farms in the Kiboga, Mubende and Nakasongola districts. All the farms were affected by dry spells during the monitoring period. Rainfall was between 50 to 100 percent below normal in August, and land surface temperatures were 3 to 7 C° above average, which reduced water availability. Figure C5.7 shows that, in dry spell conditions, the average net benefits delivered by improved varieties over 11 years are more than double those of the local maize variety (Munandi). Local maize varieties had higher labour costs than improved varieties, probably due to the higher resistance of improved varieties to weeds, pests and diseases. The higher seed and fertilizer costs associated with the cultivation of improved maize were more than compensated by the increase in yields. The benefit-cost ratio of improved varieties is 2.9, as compared to 1.75 for the local variety.

Source: Adapted from FAO 2017.

Figure C5.7. Preliminary Results: Cumulative Net Benefits and Benefit Cost Ratios of Good Practice

Added Benefits	Avoided losses	Co-benefits
Added benefits under non-hazard conditions could not be analyzed since all farms were affected by dry spell.	In farms affected by dry spells, the average net benefit of the good practice is more than two times higher than the local practice. This is largely due to enhanced drought resilience of the improved maize varieties.	The improved maize varieties mature faster than the local variety. Therefore, water use is lower under the good practice.

and Local Practice (US$ per acre per season) -2016 Dry Season (June to August)



Source: FAO, 2017.

Given the long history and wide range of potential disaster risk reduction practices, a cost-benefit validation that is based on sound evidence from the field can help select practices that have potential for scaling up. This involves validating practices that have been effective in a variety of landscapes and against different types of hazards. Once the evidence has been gathered and the practices validated, government investments for disaster risk reduction are essential for promoting the uptake of these practices on a larger scale.

Where disaster risk reduction technologies have been proven to be effective locally, they can be taken up and promoted through both disaster risk reduction and climate-smart agriculture initiatives. A main obstacle to the widespread adoption of climate-smart that also reduce the risk of disasters is the fact that the most vulnerable and poor agricultural producers have very limited access to the required technologies and resources.

C5 - 4.2 Landscape and ecosystem perspectives to local disaster risk reduction and climate-

smart agriculture actions

Effective disaster risk reduction depends in large part on sound environmental stewardship and natural resource management practices that can ensure the sustainable use of ecosystems. Deforestation, desertification the degradation of land, water and other natural resources, and marine and coastal environments reduce the capacity of vulnerable communities to defend themselves against climate-related hazards and aggravate the impact of disasters (FAO, 2011b). In turn, disasters can accelerate environmental degradation. On the island of Sumatra in Indonesia, the 2004 Asian Tsunami damaged approximately 20 percent of sea grass beds, 25 to 35 percent of wetlands, about 60 000 hectares of agricultural land, nearly 49 000 hectares of coastal forests, and 32 000 hectares of mangroves (UNEP, 2005; UNEP, 2007). Environmental degradation reduces the goods and services available to local communities, shrinks economic opportunities and livelihood options, and ultimately contributes to greater food insecurity and hunger (FAO, 2011b).

Conversely, healthy and diverse ecosystems are more resilient to natural hazards. Forests and trees provide windbreaks, and play an important role in stabilizing riverbanks and reducing soil erosion, which help protect communities against landslides, avalanches and floods. Wetlands store water and provide a buffer against storms, mitigate flooding, protect shorelines and control erosion (FAO, 2011b).

When strengthening resilience of vulnerable agricultural communities, interventions must necessarily take into account how natural resources are managed within the entire agriculture landscape or broader ecosystem (see also module A3 on integrated landscape management). A landscape or ecosystem approach is of critical importance for disaster risk reduction and climate-smart agriculture.

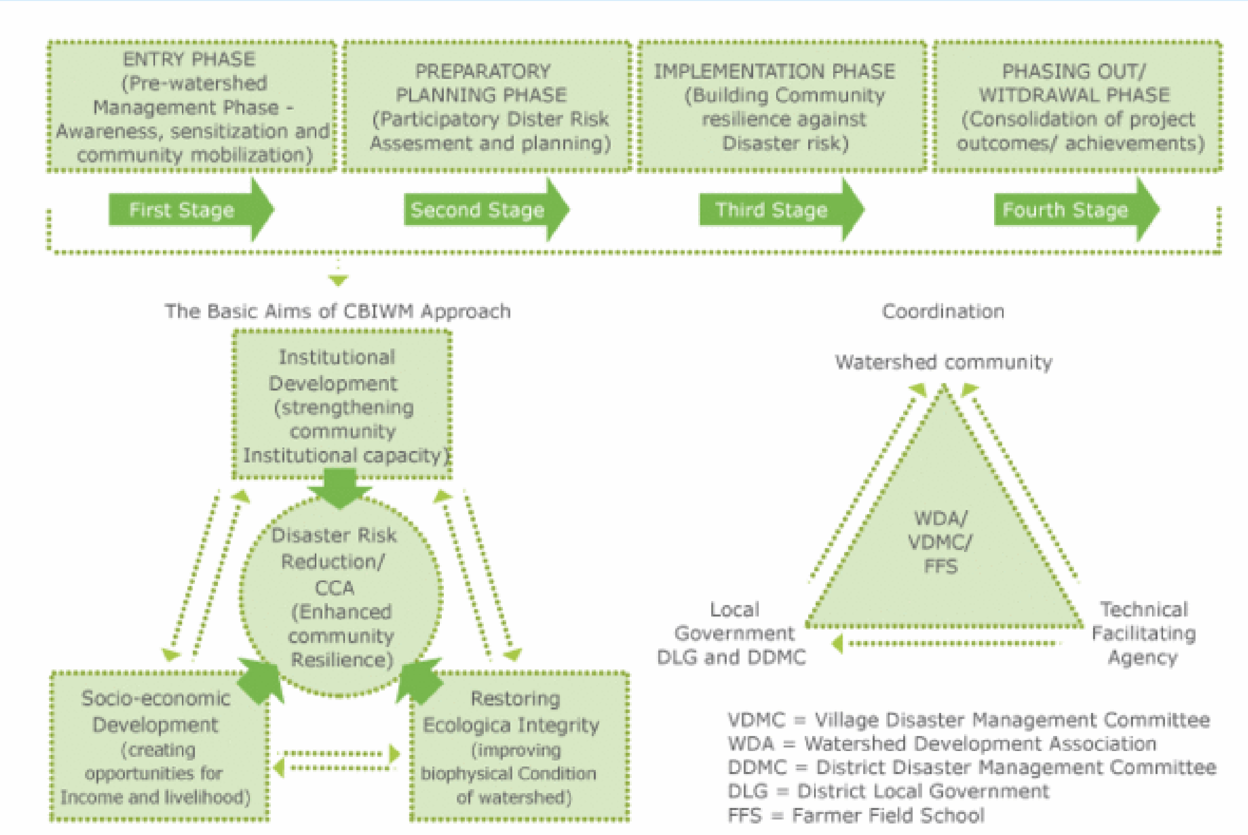
Sustainable ecosystem management provides the unifying base for successful disaster risk reduction and climate change adaptation. It also maximizes opportunities for safeguarding or diversifying rural livelihoods and improving food and nutrition security (PEDRR and The Council of Europe, 2010). Box C5.7 presents an example from Uganda of an integrated watershed management approach that brings together a diverse range of stakeholders in the pursuit of win-win options for disaster risk reduction and climate change adaptation.

Box C5.7 Community-based integrated watershed management approach to disaster risk reduction and climate change adaptation in Uganda

Uganda is prone to droughts, floods, windstorms and hailstorms, landslides and crop and livestock diseases. Water-related hazards account for over 90 percent of the natural disasters, destroying an average of 800 000 hectares of crops annually (UNDP *et al*., 2009). The impacts of these natural hazards are made worse by increasing environmental degradation. The most disaster-prone communities are located along the dry arid and semi-arid areas of the 'cattle corridor' that stretches across the country. FAO Uganda is promoting a community-based integrated watershed management approach, which integrates disaster risk reduction and climate change adaptation strategies, to address socio-economic development, the restoration of the environment’s ecological integrity and institutional capacity development. It places communities at the centre of the process and empowers them to make qualified decisions. Building and strengthening watershed organizations and linking them with District Disaster Management Committee and Village Disaster Management Committees is crucial. Farmer field schools are used to increase the knowledge and skills of farmers and pastoralists. Farmers can then solve problems for themselves and undertake their own initiatives in disaster risk reduction and climate change adaptation. Each district that participated prepared draft action plans on how to apply and replicate the approach in their local environment. As a result of the training, the local government of Moroto District has initiated an improved community-based watershed management programme in the Musopo watershed. The conceptual and operational framework of community-based integrated watershed management for disaster risk reduction and climate change adaptation is presented in Figure C5.8.

Source: FAO, 2013a.

Figure C5.8. The conceptual and operational framework of community-based integrated watershed management for disaster risk reduction and climate change adaptation



Source: FAO, 2013a.

As climate change affects rainfall patterns and increases surface temperatures, ecosystem services will become more vulnerable and fragile. The **Paris Agreement** and the Sendai Framework for Disaster Risk Reduction have both recognized the importance of ecosystem-based approaches as critical elements for building resilience to change (see Chapter C5.5). Ecosystem-based approaches are also a fundamental pillar of climate-smart agriculture. Existing ecosystem-based disaster risk reduction measures can strengthen adaptation and mitigation efforts in the agriculture sectors and play a large role in making the transition to climate-smart agriculture. Initiatives that combine disaster risk reduction and climate change adaptation objectives are beginning to emerge. For instance, agronomic practices with multiple benefits such as conservation agriculture and the System of Rice Intensification have been promoted to support disaster risk reduction, climate change adaptation and resilience. These crop production practices are describe in module B1.

C5 - 4.3 Financial risk management tools for agriculture

Risk Insurance schemes can buffer the costs of the impacts of disasters and climate change, including losses of agricultural assets. Insurance provides a risk transfer mechanism in which users pre-invest in risk reduction by ensuring repayment and timely recapitalization when affected by disasters. The Munich Climate Insurance Initiative and the Secretary General's Climate resilience initiative (A2R) are examples of global efforts to scale up support for increasing insurance coverage for risks associated with disaster and climate change. Many legal requirements, tools, and services to develop insurance products are based on existing disaster risk reduction techniques and practices, such methods for damage and loss assessments, disaster risk reduction agriculture practices, early warning systems tailored to end-users in the agriculture sectors, or standards for the reconstruction of irrigation systems. These are services that are in the mandates of various stakeholders in agriculture line ministries and other partners. The Palestinian Agricultural Disaster Risk Reduction and Insurance Fund (PADRRIF) (Box C5.8) is one example of an initiative to foster the holistic application of disaster risk reduction services in agriculture coupled with risk insurance and compensation schemes.

Box C5.8 Palestinian Agricultural Disaster Risk Reduction and Insurance Fund

Established by the Palestinian National Authority, the Palestinian Agricultural Disaster Risk Reduction and Insurance Fund (PADRRIF) is a non-profit semi-government organization that ensures prompt and efficient delivery of insurance and risk management services to Palestinian farmers. PADRRIF provides an umbrella that brings together stakeholders, tools, services and information on agricultural risk management, disaster risk reduction and insurance. It translates the Sendai Framework for Disaster Risk Reduction priorities for action into the agriculture sectors. Its activities include data collection and the management of agricultural risks to reduce damages and losses. It fosters cooperation and coordination with all partners to raise awareness about agricultural risk prevention, encouraging public and private investments to improve farmers' capacities to confront agricultural risks. It also develops mechanisms for transferring agricultural risks and a compensation system based on an agricultural insurances scheme.

The fund also develops mechanisms of transferring agricultural risks by establishing a system of compensations and agricultural insurances. The synergies between climate change adaptation and disaster risk reduction as well as the role of PADRIFF have been recognized in the National Adaptation Plan to Climate Change. (Environment Quality Authority, 2016)

Source: PADRRIF 2016

Agriculture risk insurance schemes require an analysis of production levels, the damage and losses caused by disasters over the past decades and current risk factors. They must also take into account the possible future impacts of climate change on insurable assets. Several successful agriculture insurance schemes have been put in place around the world, especially for medium and large-scale production systems. The design of index-based insurance for the agriculture sector have had to overcome some difficult challenges, such establishing processes to accurately verify damages to trigger bonus payments. Yet, for remote communities in many developing countries, the obstacles that need to be overcome to achieve a sufficient return on investment from agricultural risk insurance schemes and deliver them on a large scale have made it difficult to raise awareness of smallholder agriculture producers about the potential benefits of risk insurance schemes and provide them with access to these types of schemes. Designing and improving risk insurance products for smallholder producers will require the combined efforts of different groups of stakeholders working in the fields of disaster risk reduction, climate change adaptation, sustainable development and humanitarian assistance, but it will especially demand public-private partnerships. The multiple components of climate-smart agriculture, which link climate change adaptation and sustainable intensification of production, have the potential to complement and support disaster risk reduction and support climate change programmes and strategic partnerships that can establish risk transfer mechanisms for the agriculture sectors.

Preparedness for disaster response and 'building back better' in a changing climate

Climate resilient rural livelihoods require that agricultural communities have the capacities to reduce the risk of climate-related disasters and their vulnerabilities to their impacts, and the capacities to cope with disasters and recover quickly when emergency situations cannot be avoided. As the impacts of climate change become more apparent, there are many difficult and urgent issues that need to be resolved to provide this comprehensive support to vulnerable communities. As noted in Chapter C5-3, having separate institutional and funding mechanisms for disaster risk management and climate change adaptation makes the responses to these challenges less effective than they could be. The same is true the divide that often exists between disaster risk reduction and disaster management. Rapid responses, which are needed to save lives, often do not provide enough space for considering, strategically planning and implementing actions and measures that can support immediate livelihood recovery and at the same time reduce future risks and vulnerability. The demand for better integration of risk reduction and response operations has led to more attention being paid to the concept of 'building back better' (Lebel *et al*., 2012). The strategic links between preparedness, emergency response, and recovery that the Sendai Framework for Disaster Risk Reduction and other disaster risk reduction initiatives have highlighted is another area where disaster risk reduction can support climate-smart agriculture.

A major issue in practical operations on the ground is connecting humanitarian interventions with development programmes. Bridging this gap would allow a smooth transition from response, recovery and rehabilitation to sustainable development. The 2016 World Humanitarian Summit (WHS) highlighted the need for governments, as well as local responders, civil society, the private sector and the international community to overcome the “current fragmentation in managing risk” (WHS, 2016). The Secretary General’s report, One humanity: shared responsibility notes that “climate change continues to cause increased humanitarian stress as it exacerbates food insecurity, water scarcity, conflict, migration and other trends”. Referencing the joint objectives of the global agendas endorsed in 2015 and 2016, the report emphasizes that risk reduction is a cost-effective way of saving lives and that a sustainable approach is needed to deal with natural hazards and the impacts of climate change.

There are a number of good practices on the ground that can contribute to smoothing the transitions between disaster risk reduction, emergency response and development. The rest of this chapter presents the most relevant examples.

Risk monitoring and early warning systems in agriculture

Early earning systems, which are well established and highly successful tools for disaster risk reduction, also have the capacity to bridge the gap between risk reduction and emergency response. Early warning systems are essential for proactive decision-making at all levels. They can be used to reduce the impacts of extreme weather events by alerting vulnerable communities of the urgent need to protect their assets and preparing them for evacuation if necessary.

The FAO Agricultural Stress Index System (ASIS), which collects data on vegetation and land surface temperatures, contributes to essential early warning systems by monitoring vegetation indices and detecting hotspots where crops or livestock may be affected by drought. The analysis of meteorological data, together with information on plant development, soil and agricultural statistics, allows for the provision of near real-time information about the status of crops in terms of quality and quantity. Along with crop forecasting, ASIS also can provide early warning of possible emergencies, so that timely interventions can be planned and implemented. In many developing countries, warning systems for very sudden events, such as flash floods, landslides and storm surges are not yet readily available (FAO, 2016c).

Agro-meteorological monitoring systems are becoming more readily available. Nevertheless, the timely and effective delivery of warnings and information to end-users remains a challenge. To promote early warning systems that translate into early action in the agriculture sectors, the information must be tailored to the needs of end-users, and outreach activities must be undertaken to ensure that the information reaches vulnerable agriculture-dependent communities in remote areas. Box C5.9 provides an example from the Philippines of an early warning system that is tailored to agriculture producers' needs and can prompt early action.

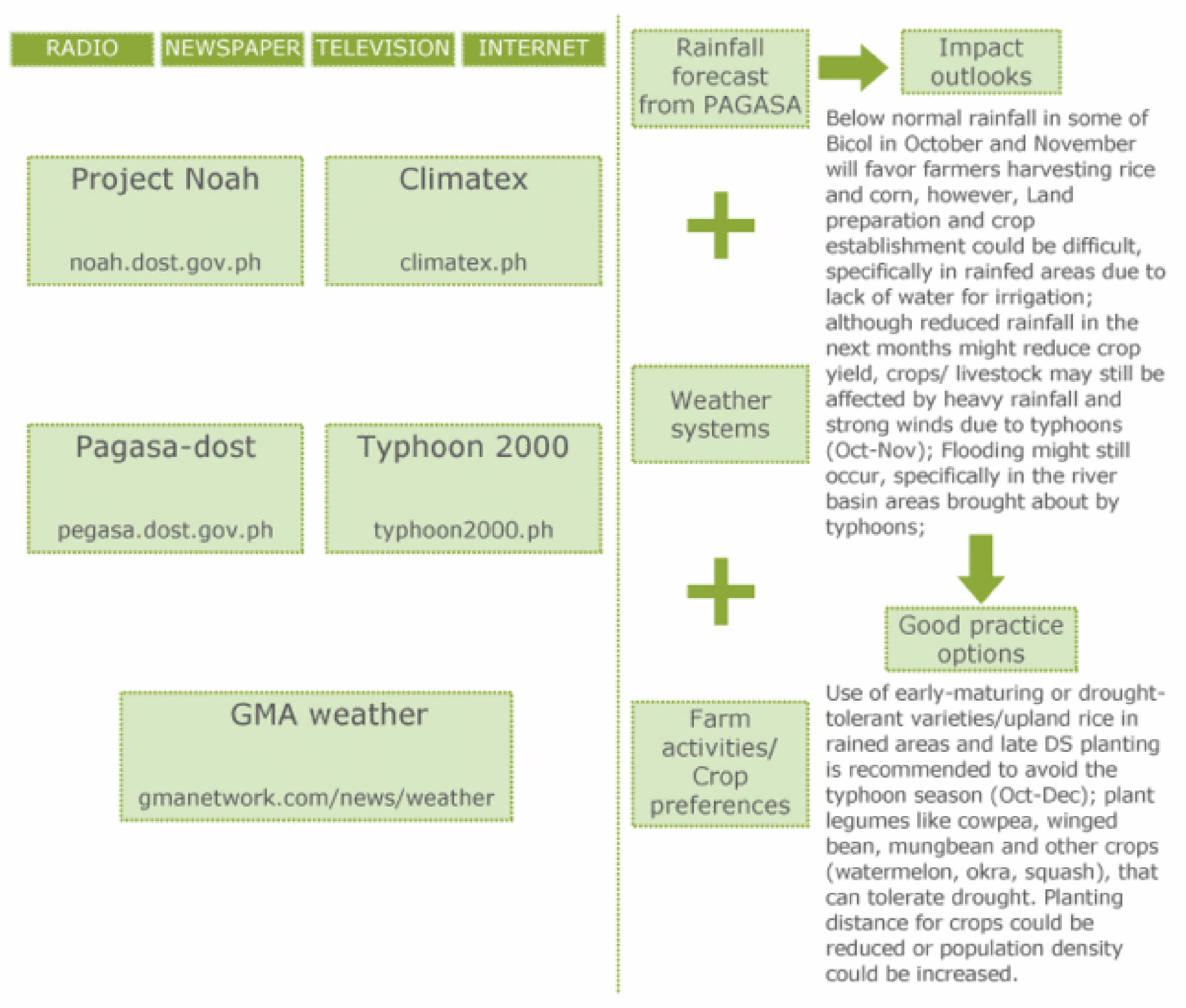
Box C5.9 Linking early warning systems with early action in agriculture in the Philippines

A partnership agreement between the Department of Agriculture and the Philippine Atmospheric, Geophysical and Astronomical Services Administration has led to the development of improved weather and climate services that interpret agricultural climate information at various temporal and spatial scales, and support and strengthen the implementation of good practices in climate change adaptation and disaster risk reduction.

In Bicol Region, regional and provincial seasonal climate advisories and farm weather bulletins have been produced and disseminated through electronic, print and broadcast media (Figure C5.9).

Further reading see: FAO, 2013b

Figure C5.9. Agro-climate information in the Philippines



Source: Philippine Department of Agriculture, 2015.

The recovery and rehabilitation periods after disasters when many reconstruction activities are carried out are also windows of opportunity for increasing preparedness towards future emergencies. This is especially important in light of climate change scenarios that suggest more intense and frequent weather extremes can be expected. The response to Typhoon Haiyan (Box C5.10) has increased efforts in the Philippines to integrate disaster risk reduction and longer-term support for sustainable development in agricultural communities in response to climate change.

Box C5.10 Typhoon Haiyan emergency and livelihoods recovery programme

In the Philippines, the FAO Haiyan emergency and livelihoods recovery programme supported more than 230 000 farming and fishing families in three regions. From the start, relief efforts were linked to the government's medium- and long-term development objectives. The goal was not simply to return to the pre-typhoon conditions but to 'build back better' and strengthen the resilience of the affected populations.

The first interventions focused on providing affected people with the means (e.g. seeds, tools, fertilizer, household farming kits, pumps) to plant rice and corn, or the tools (e.g fishing gear and aquaculture kits) to catch or raise fish. Soon after, other activities were carried out to adapt and improve farming and fishing practices, and make them more resilient and sustainable. Because typhoons will certainly strike again in the future, it was important to make sure the population was better prepared and less vulnerable than before. This was done by improving storage facilities for crops and seeds, and designing better, more durable boats and training boat builders. Support was also provided to protect marine areas as fish sanctuaries and rehabilitate mangrove forests.

More than two years after the typhoon, the farmers and fishers who survived the disaster are well on the road to recovery. Most of them have been able to rebuild their lives and have learned new techniques to make their production more sustainable and new ways to protect themselves and their environment.

Source: FAO in Emergencies website, 2016

The example of the Philippines (see Box C5.3, Box C5.9, Box C5.10) demonstrate that countries highly exposed to recurring weather extremes require holistic approaches that link disaster risk reduction, emergency response and climate-smart agriculture. Climate-smart agriculture can be a useful approach in supporting recovery interventions by promoting agriculture practices that add value to disaster risk reduction with a long-term objective of promoting sustainable production intensification and climate change adaptation in tandem.

Mainstreaming disaster risk reduction and climate change adaptation based on ost-disaster needs assessments

Systematized post-disaster needs assessments are another disaster risk reduction measure that is being increasingly used in recovery planning. Conducted directly after disasters, these cross-sectoral assessments quantify damage and losses, and estimate the investment needs for recovery. Post-disaster needs assessments and risk assessment methodologies can be combined to inform development programmes. These combined assessments support sound spatial planning and retro-fitting that can enable infrastructure, including agricultural infrastructure (e.g. silos, seed storage facilities, or irrigation systems) to be built back better.

Following the 2010 earthquake in Haiti, the United Nations Office of the Special Envoy, in partnership with government agencies and other international organizations, undertook a rapid multi-hazard analysis to map the risk of floods, wind, tsunamis, landslides and earthquakes in affected areas. The results have been used to guide the safe positioning of transitional shelters and support long-term recovery efforts. To date the integration of risk assessments and vulnerability mapping with post-disaster needs assessments has not been widely used to mainstream climate change adaptation and mitigation in post-disaster reconstruction and recovery. However, the Paris Agreement, which identifies early warning systems, emergency preparedness and risk insurance mechanisms as areas for cooperation, marks a major step forward in this regard (FCCC/CP/2015/L.9/Rev.1 Article 7 and 8).

Linking social protection schemes with disaster risk reduction

Social protection can also play an important role in supporting and integrating disaster risk reduction and climate-smart agriculture. Disaster risk reduction and social protection are closely connected. The increased frequency and intensity of extreme climate events will certainly have repercussions on the ability to reduce poverty, which is what social protection is intended to accomplish. Limited assets or the absence of social protection can cause households and communities to adopt negative coping mechanisms that increase their vulnerability to risks (HLPE, 2012). The value of scaling up cash-based programming and risk-informed, shock-responsive social protection systems is becoming more widely appreciated by organizations working the field of humanitarian assistance and sustainable development.

Table C5.1. Key components of a risk-informed and shock-responsive social protection system

- risk-informed strategies that consider economic, environmental and conflict-sensitive factors, and target poor and chronically food-insecure households in food-insecure or disaster-prone areas - the provision of direct transfers to households to smooth consumption and avoid the distress selling of asset in the face of recurrent risks, such as climatic shocks - public work interventions that can promote sustainable agriculture by creating or rehabilitating infrastructure	- a contingency funding mechanism that enables the rapid scaling up and response to unexpected transitory emergencies (e.g. food price peaks, loss of assets) - comprehensive early warning systems on food security, nutrition and climate that can trigger contingency mechanisms within broader humanitarian response structures - strong subnational and community-based institutions and coalitions that deal with health, sustainable economic an social development, community care and agricultural extension

Source: FAO, 2016d

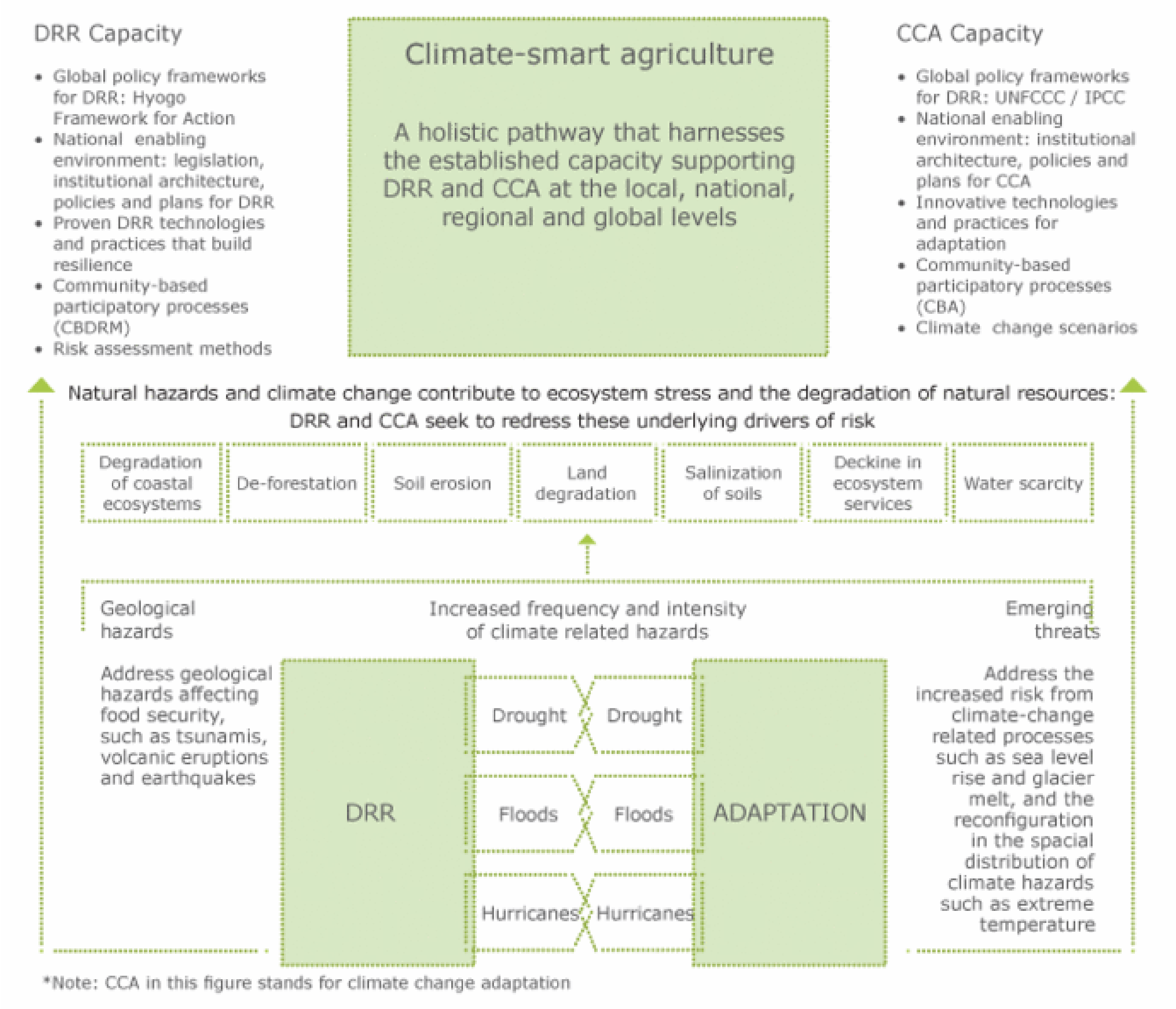
In post-disaster situations, cash-for-work programmes are a mechanism that can promote climate-smart agriculture and reduce the risk of disasters and climate-smart practices. For example, they can be used to support the building and improving of hazard-proofed agricultural infrastructure and carrying out other activities, such as soil and water conservation, reforestation and afforestation. See module C7 on social protection and decent rural employment for a climate-smart agriculture.

Conclusions

Disaster risk reduction can support climate-smart agriculture’s objectives, particularly in relation to improving climate change adaptation and building the resilience of agricultural communities and ecosystems to climate variability and change. Policies, programmes and practices for disaster risk reduction that have proven to be successful are a valuable set of resources that can be used for promoting and scaling up climate-smart agriculture. The key areas where disaster risk reduction that can support climate-smart agriculture are summarized in Figure C5.10.

Multi-hazard risk assessments and vulnerability mapping, which are essential elements of disaster risk reduction, identify the spatial distribution of climate-related hazards and geological hazards at different scales, and assess the exposure to and vulnerability of farming systems, and evaluate the overall level of risk. They can provide crucial support for the design of appropriate climate-smart agriculture initiatives, which are based on an integrated landscape management approach that requires a clear understanding of all natural hazards affecting a given territory. The combined analysis of multi-hazard risk assessment and mapping with downscaled climate change scenarios provides a harmonized framework for assessing all the potential hazards in specific geographic areas. Used in combination, they provide a complete picture of how food security is currently being affected today by hazards and how the impacts of climate change may be affected in the future. This combined analysis facilitates short- and long-term planning for climate-smart agriculture.

Figure C5.10. Climate-smart agriculture approaches that build on established disaster risk reduction and climate change adaptation capacities



*Note: CCA in this figure stands for climate change adaptation and DRR stands for Disaster Risk Reduction

At the national and regional levels, well-established legislations, institutional structures, policies and plans for disaster risk reduction can offer entry points for mainstreaming the climate-smart agriculture and create a strong supportive enabling environment that is essential for successful actions on the ground. By working in partnership with the national institutional architecture for disaster risk reduction, climate change adaptation and mitigation, climate-smart agriculture initiatives can increase the involvement of agriculture line agencies in cross-sectoral processes and strengthen synergies in the efforts to reach multiple sustainable development objectives.

Community disaster risk management, which is as a proven participatory method for the assessment of local risks and for guiding local planning, can serve as a vehicle and methodology for promoting climate-smart agriculture locally. Given the widespread application of community disaster risk management and its institutionalization in many countries, it can provide considerable scope for contributing to climate-smart agriculture. Combining community disaster risk management practices and climate change adaptation approaches builds links with existing local institutional networks and increases coherence within communities and local authorities. There are many examples of local knowledge and validated technologies and practices for reducing disaster risks that can used to scale up climate-smart agriculture practices. Sharing knowledge of these mutually supportive practices is vital to promoting climate-smart agriculture. By making use of technologies and practices that support both risk reduction and climate change adaptation, climate-smart agriculture can provide multiple benefits for farmers.

Disaster risk reduction can support efforts to promote climate-smart agricultural development in the recovery phase after a disaster. To build stronger collaboration between humanitarian interventions and sustainable development that can restore infrastructure and rehabilitate livelihoods, more consideration needs to be given to the underlying factors that determine current risks and the future risk associated with climate change. Combining the knowledge of proven disaster risk reduction practices and climate-smart agriculture has the potential to link short-, medium-, and long-term sustainable development goals in the aftermath of disasters. More work needs to be done to explore these opportunities. Table C5.2 presents suggestions for harnessing existing disaster risk reduction capacities to help reach climate-smart agriculture objectives.

Table C5.2. Strategic entry areas of disaster risk reduction for climate-smart agriculture

Enabling Environment	Practical Tools	Knowledge Sharing
Work with existing national platforms and institutional mechanisms for coordinating disaster risk reduction and adaptation. Promote multi-stakeholder dialogue between communities working in disaster risk reduction and climate change to identify opportunities, build partnerships, jointly address gaps and harmonize initiatives. Take stock of national policies and plans already developed for reducing disaster risk and adapting to climate change, including those that are hazard-specific (e.g. drought mitigation), and build coherence among them. Implement climate-smart agriculture locally using integrated community-based approaches for disaster risk reduction and climate change adaptation that combine short-term measures to reduce immediate risks with long-term adaptation measures that address the slow onset impacts of climate change.	Conduct integrated analysis of multiple risks to agriculture and food security, based on the collection of available information (data and maps) on hazards, vulnerabilities and risk assessments. Overlay and embed climate change impact scenarios with existing hazard early warning systems. Improve the tools that can integrate assessments of current risks and downscaled climate change scenarios for better and more holistic analysis. Enhance the access of vulnerable populations to risk transfer mechanisms and social protection. Design climate-smart agriculture project initiatives that complement adaptation and risk reduction measures, and that are in line with national disaster risk reduction and climate change adaptation goals.	Take stock of and promote proven traditional local knowledge. Map and promote disaster risk reduction technologies and practices that have been effective in reducing disaster risks and meet the objectives of climate-smart agriculture. Promote knowledge sharing among farmers, practitioners and policy makers on effective disaster risk reduction technologies, and climate change adaptation and mitigation technologies. Support the generation of integrated knowledge and practices. Support the stronger engagement of the disaster risk reduction community in climate-smart agriculture initiatives.

Source: adapted from UNISDR, 2009

The pace of climate change is increasing the urgency of building linkages between disaster risk reduction and climate-smart agriculture. Those working to advance climate-smart agriculture should make disaster risk reduction a core element of their strategies, and make use of the wealth of information about successful disaster risk reduction practices and forge strong partnerships with established institutions. Using and expanding the accumulated expertise in disaster risk reduction to advance climate-smart agriculture increases the efficiency of international aid and government investments. This is a critical factor given the already severely constrained human resources and institutional capacities in developing countries, and aid budgets that are increasingly less able to cope with recurring and simultaneous disasters.

Acknowledgements

Coordinating lead authors: Stephan Baas (FAO), Nina Koeksalan (FAO).

Reviewers: Astrid Agostini (FAO), Ada Ignaciuck (FAO), Patrick Kalas (FAO), Niccolo Lombardi (FAO), Monica Petri (FAO), Selvaraju Ramasamy (FAO).

Notes: The module is an update of Module 15 *Disaster risk reduction: Strengthening livelihood resilience in the Climate-Smart Agriculture* Sourcebook (2013) written by Monica Trujillo (FAO) with contributions from Stephan Baas (FAO) and reviewed by Jim Hancock (FAO) and Kennedy Igbokwe (FAO).

Acronyms

DRR	Disaster Risk Reduction
INDC	Intended Nationally Determined Contribution
UNFCCC	United Nations Framework Convention on Climate Change

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