



**Food and Agriculture
Organization of the
United Nations**

COMMISSION ON
GENETIC RESOURCES
FOR FOOD AND
AGRICULTURE



Voluntary Guidelines
to Support the Integration
of Genetic Diversity into National
Climate Change Adaptation Planning



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COMMISSION ON GENETIC RESOURCES FOR FOOD AND AGRICULTURE
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
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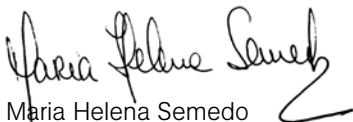
Foreword

Tackling climate change is central to achieving a sustainable future for the world's growing population and food security must lie at the heart of these efforts. Climate change is one of the key drivers of biodiversity loss. The stressors and risks posed by climate change to the various sectors of genetic resources for food and agriculture (plants, animals, forests, aquatic resources, invertebrates and micro-organisms) are manifold. However, genetic resources for food and agriculture are also expected to play a significant role in mitigation of and adaptation to the consequences of climate change in support of efforts to achieve food security and nutrition objectives. Genetic resources could contribute greatly to our efforts to cope with climate change, but in many cases the magnitude and speed of climate change will surpass our ability to identify, select, reproduce and – eventually – use these resources in the field.

Climate change is already affecting natural ecosystems and food production systems. In its Fifth Assessment Report, Climate Change 2014, the Intergovernmental Panel on Climate Change (IPCC) considers, among other things, the vulnerability of human and natural systems, the observed impacts of climate change and the potential for adaptation. The IPCC Synthesis Report recognizes that agriculture offers unique synergies that can contribute to efforts to meet the climate change adaptation and mitigation needs of the coming decades, in support of food security goals.

Decisions and actions related to the management of genetic resources for food and agriculture need to be taken in a timely manner if we want to adapt agriculture to the effects of a changing climate. Future use of genetic resources for food and agriculture in climate change adaptation and mitigation depends upon ensuring that the relevant resources remain available. The Commission on Genetic Resources for Food and Agriculture of the Food and Agriculture Organization of the United Nations (FAO) provides an intergovernmental forum for the discussion and development of knowledge and policies relevant to biodiversity for food and agriculture. Its work on climate change is of tremendous importance in supporting food global security and sustainable development, for present and future generations.

In June 2015, the Conference, the highest governing body of the FAO, approved the Voluntary Guidelines to Support the Integration of Genetic Diversity into National Climate Change Adaptation Planning. The Guidelines, developed under the aegis of FAO's Commission on Genetic Resources for Food and Agriculture, aim to assist countries in managing genetic resources as a pivotal reservoir and tool at their disposal to adapt agriculture and build resilience into agricultural and food production systems.



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INTRODUCTION

1. The Voluntary Guidelines to Support the Integration of Genetic Diversity into National Climate Change Adaptation Planning (Guidelines) were approved by the Conference of the Food and Agriculture Organization of the United Nations (FAO) at its 39th Session in June 2015 (FAO, 2015a). They were prepared under the guidance of FAO's intergovernmental Commission on Genetic Resources for Food and Agriculture (the Commission). The Commission, at its Fourteenth Regular Session in April 2013, had adopted a Programme of Work on Climate Change and Genetic Resources for Food and Agriculture (FAO, 2014a, Appendix D) and agreed on the development of such guidelines. In January 2015, the Commission endorsed the Guidelines for the approval by the FAO Conference.

2. Many countries will have already embarked on the development of plans to support the contribution of the conservation and use of genetic resources for food and agriculture (GRFA) to climate change adaptation. These plans are often linked to other national adaptation planning processes.

3. Within the United Nations Framework Convention on Climate Change (UNFCCC), the preparation of National Adaptation Programmes of Action has enabled least developed countries to identify and address urgent and immediate priorities with respect to adaptation¹ to climate change. To complement short-term planning, the

¹ **Adaptation:** human-driven adjustments in ecological, social or economic systems or policy processes, in response to actual or expected climate stimuli and their effects or impacts. Various types of adaptation can be distinguished, including anticipatory and reactive adaptation, private and public adaptation, and autonomous and planned adaptation. See: UNFCCC, 2012, p. 13: http://unfccc.int/files/adaptation/cancun_adaptation_framework/national_adaptation_plans/application/pdf/naptechguidelines_eng_low_res.pdf

UNFCCC established the National Adaptation Plan (NAP) process and several countries have already embarked on the formulation of their NAP. This process encourages countries to advance from short-term and other individual adaptation experiences to comprehensive, medium- and long-term planning for adaptation. The NAP will be the primary statement of national adaptation needs and priorities. The objectives of the NAP process are (a) to reduce vulnerability to the impacts of climate change, by building adaptive capacity and resilience;² and (b) to facilitate the integration of climate change adaptation into relevant new and existing policies, programmes and activities.

4. The UNFCCC Least Developed Countries Expert Group prepared technical guidelines (UNFCCC, 2012) which provide an overall approach that can be used by countries to identify and implement adaptation measures that help respond to the effects of climate change. The Guidelines presented in this document have the same structure as those prepared by the Least Developed Countries Expert Group, so that they can complement and contribute to the NAP process, addressing the genetic resources dimension of adaptation planning.

5. The Guidelines seek to ensure the relevance of GRFA to the overall national adaptation planning process in a country by identifying clear goals for conservation and use of GRFA as part of national adaptation to climate change, and ensuring the fullest involvement of all stakeholders. The process allows the identification of well-defined objectives and the development of plans to achieve these. In this way the Guidelines can support the identification of priority areas for future investments in conservation and use of GRFA.

6. The Guidelines build on, *inter alia*, previous work by the Commission on climate change, such as Background Study Papers Nos. 53-57, 60, and information obtained through a global survey, *Lessons learned about the ways and means to conserve and use genetic diversity to build resilience to climate change in food and agriculture systems* (FAO, 2015b). They take into account the Global Plans of Action (GPAs) for plant, animal and forest genetic resources (see *Annex B*) and of relevant documents covering aquatic genetic resources (FAO, 1995; FAO, 2008). They have been reviewed at an expert workshop and by the Commission's Intergovernmental Technical Working Groups on Animal, Forest and Plant Genetic Resources.

7. The Guidelines take into account the characteristics of different GRFA, which face different challenges and opportunities in respect to climate change. However,

² **Vulnerability:** The degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude and rate of climate variation to which a system is exposed, its sensitivity and its adaptive capacity. Therefore adaptation would also include any efforts to address these components. **Adaptive capacity** (in relation to climate change impacts): The ability of a system to adjust to climate change (including climate variability and extremes) in order to moderate potential damages, to take advantage of opportunities or to cope with the consequence. **Resilience:** The ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organization and the capacity to adapt to stress and change. See UNFCCC, 2012, p. 13.

they also aim to take account of the interconnected and cross-cutting nature of many aspects of conservation and use of GRFA, and of the benefits of adopting an integrated approach.



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RATIONALE

8. Tackling climate change is central to achieving a sustainable future for the world's growing population, and food security must lie at the heart of these efforts. Climate change presents significant threats and challenges to agriculture, forestry and fisheries. Rising temperatures, changing rainfall patterns, increasing climate variability and the greater frequency of extreme events present risks and increase vulnerability in production systems and natural ecosystems. The Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC, 2014) stressed that climate change is already having an impact on all aspects of food security, which suggests that the pace of adaptation needs to speed up.

9. The genetic resources that constitute biodiversity for food and agriculture include the variety and variability of animals, plants and micro-organisms that sustain the ecosystem structures, functions and processes in and around production systems, and that provide food and non-food agriculture products. The diversity found in and around production systems has been managed or influenced by farmers, pastoralists, forest dwellers and fisherfolk over many hundreds of generations and reflects the diversity of both human activities and natural processes. GRFA are the raw material that local communities and researchers rely upon to improve the quality and output of food production.

10. Climate change influences the extent and distribution of GRFA and the genetic diversity they possess. It threatens the continued existence of species, populations, varieties and breeds found in many parts of the world, and is changing the nature of the production systems in which these occur. At the same time, adaptation to climate

change involves the increased use of the genetic diversity present in these resources to, *inter alia*, sustain agricultural production, support the continuing provision of ecosystem services and maintain livelihoods under changing conditions. Loss of GRFA or failure to use their full potential limits the capacity of humankind to adapt to climate change. The importance of GRFA for climate change adaptation is highlighted in *Annex A*.

11. Climate change is an ongoing process and GRFA will have to be conserved and continuously mobilized to meet new challenges as conditions change over coming decades. Adaptation measures that make use of the full potential of GRFA need to become an integral part of national adaptation planning, linked to national development objectives and coordinated with the adaptation plans of agriculture, forestry, fisheries, the environment and health.



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OBJECTIVES AND PRINCIPLES

Objectives

12. The objectives of the Guidelines are:
- i. To promote the use of GRFA in climate change adaptation and support their integration into national climate change adaptation planning;
 - ii. To support genetic resources experts and those involved in climate change adaptation to identify and address the challenges and opportunities of GRFA in adaptation; and
 - iii. To promote the involvement of genetic resources stakeholders in the national climate change adaptation planning process.

Principles

13. The process of integrating genetic diversity into national climate change adaptation planning, in accordance with the principles for the NAP process (UNFCCC, 2012):
- i. Is not prescriptive. The Guidelines are a voluntary instrument that may assist countries to undertake the steps and activities that can ensure effective adaptation. According to their level of progress in developing and implementing adaptation plans, countries can select which steps and activities to undertake in order to move forward;
 - ii. Seeks to enhance the coherence of adaptation and development planning within countries, rather than duplicate efforts;
 - iii. Facilitates country-owned, country-driven action. Countries have full ownership of the national adaptation planning process. The process seeks

- to harness and build upon national-level capacity, with support from various partners, as appropriate;
 - iv. Is designed so that countries can monitor and review it on a regular basis, and update their adaptation plans in an iterative manner. This is important, given that better quality climate data and projections, as well as other information useful for the planning process, will increasingly become available, and the impacts of climate change in the medium- and long-term will be better understood;
 - v. Is designed to identify gaps in capacity and adaptation on an ongoing basis, and to address these gaps.
14. The process also seeks to:
- i. Integrate adaptation to climate change into GRFA sectoral national planning processes, strategies and monitoring processes;
 - ii. Adopt an inclusive approach that ensures the full participation of the many stakeholders involved in the conservation and use of GRFA. These are likely to include: relevant agencies, organizations and institutions; farmers, pastoralists, fisherfolk and forest dwellers and their representative organizations; traditional knowledge holders and scientists; and consumer groups;
 - iii. Take into account existing national efforts in the relevant GRFA sectors, build on national efforts to implement agreed GPAs and maximize synergies across GRFA sectors;
 - iv. Pilot approaches that promote an iterative process and be evidence based;
 - v. Reflect the international dimensions of GRFA and promote inter-country collaboration;
 - vi. Include measures that strengthen conservation, availability and use of GRFA and that reflect an ecosystem approach to GRFA management.



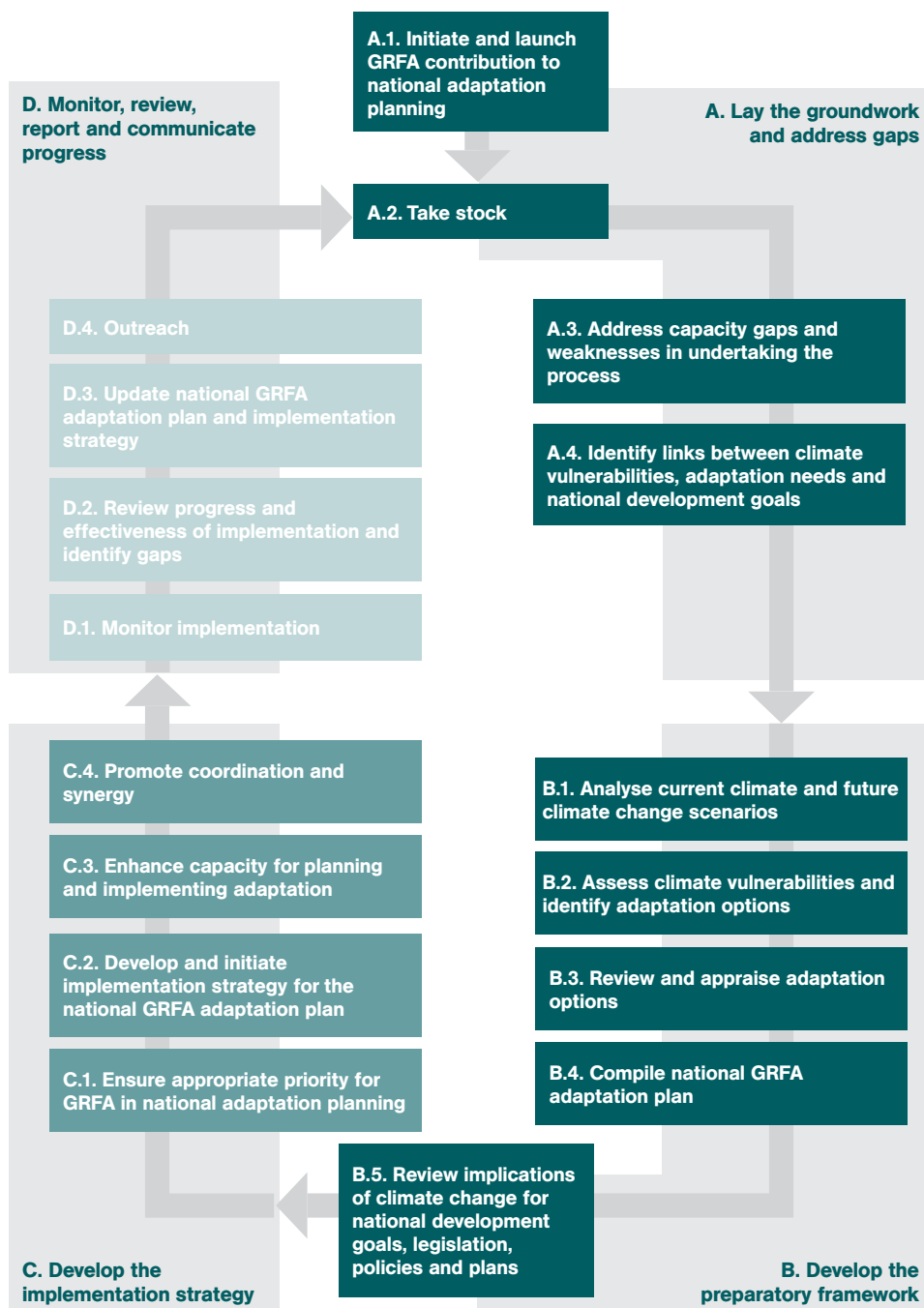
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ELEMENTS AND STEPS

15. To facilitate direct linkages with the NAP process, the Guidelines follow the structure and approach of the NAP technical guidelines. The process involves four main elements, in each of which a number of steps are proposed. The elements and steps should be seen as part of a connected iterative process where successes or failures are monitored and the results fed back into the process, as illustrated in Figure 1.

FIGURE 1

Elements and steps for integrating genetic resources for food and agriculture (GRFA) into national adaption planning



Overview of elements and steps

16. The main activities that will be undertaken in the different steps are summarized below. The steps are described in greater detail in the following section.



LAY THE GROUNDWORK AND ADDRESS GAPS

A.1. Initiate and launch GRFA contribution to national adaptation planning

Establish the institutional arrangements needed to strengthen the role of GRFA in national adaptation planning. Strengthen the collaboration between, *inter alia*, animal, aquatic, forest and plant genetic resources sectors, identify entry points for GRFA in climate change adaptation planning and engage with climate change focal points and policy makers.

A.2. Take stock

Conduct a stock-taking, including an analysis of the strengths, weaknesses, opportunities and threats (SWOT) of the current state of conservation and use of GRFA in the context of climate change adaptation.

A.3. Address capacity gaps and weaknesses in undertaking the process

Use the SWOT analysis to identify gaps in country capacity to undertake the work needed to support the conservation and use of GRFA in the context of climate change adaptation.

A.4. Identify links between climate vulnerabilities, adaptation needs and national development goals

Ensure that GRFA conservation and use concerns identified during the stock taking process take adequate account of national development goals in relevant areas, such as food security, nutrition and health, rural development and environmental management.



DEVELOP THE PREPARATORY FRAMEWORK

B.1. Analyse current climate and future climate change scenarios

Review available information on climate change scenarios with respect to the expected impact on GRFA taking into account the concerns of different genetic resources sectors and socio-economic implications for rural communities.

B.2. Assess climate vulnerabilities and identify adaptation options

Decide on the scope of the vulnerability and risk assessments and undertake them. Identify the expected impacts of non climate change related changes and the expected added impact of climate change on GRFA; identify and assess adaptation options and establish processes for monitoring and managing GRFA related risks.

B.3. Review and appraise adaptation options

Identify GRFA related adaptation options with respect to both conservation and use of GRFA. Review options against a set of agreed criteria and take account

of ongoing or proposed adaptation plans in relevant areas (e.g. food production) that will require enhanced GRFA use.

B.4. Compile national GRFA adaptation plan

Develop national GRFA adaptation plan using a participatory iterative approach linked to overall national adaptation planning. Identify actions needed to support both conservation and use of GRFA, taking into account existing GPAs for genetic resources or other GRFA related plans and of the opportunities for coordinated actions across GRFA sectors.

B.5. Review implications of climate change for national development goals, legislation, policies and plans

Review national development goals, legislation and policies; identify synergies, possible conflicts or trade-offs between the national GRFA adaptation plan and other aspects of national adaptation planning.



DEVELOP THE IMPLEMENTATION STRATEGY

C.1. Ensure appropriate priority for GRFA in national adaptation planning

Describe the contribution that GRFA can make to national priorities and engage with policy makers at local and national levels to ensure appropriate priority is given to GRFA.

C.2. Develop and initiate implementation strategy for the national GRFA adaptation plan

Formulate the key elements of the implementation strategy including coordination mechanisms, prioritization criteria, pathways to achieving major outputs and outcomes, implementation procedures, stakeholder engagement, resource mobilization and mechanisms to support congruence with the NAP, GPAs for genetic resources and other strategic planning processes.

C.3. Enhance capacity for planning and implementing adaptation

Strengthen capacity to support implementation using a multifaceted capacity development programme tailored to the needs of different interest groups (including farmers, fisherfolk, forest dwellers, policy makers, public administrators, and extension workers).

C.4. Promote coordination and synergy

Develop or strengthen links to appropriate regional and international processes and the activities that support them. Ensure effective links with programmes of relevant ministries, agencies and organizations, including those involved in agriculture and food production, environmental protection, health, energy use and water management.



MONITOR, REVIEW, REPORT AND COMMUNICATE PROGRESS

D.1. Monitor implementation

Establish monitoring procedures and indicators and assess progress in implementing the Guidelines and in achieving adaptation plan outputs and outcomes.

D.2. Review progress and effectiveness of implementation and identify gaps

Develop identified review process and use results of monitoring, together with available new information on climate change, and adaptation to review progress and effectiveness in implementing the Guidelines and national GRFA adaptation plan and to identify gaps and weakness in implementation.

D.3. Update national GRFA adaptation plan and implementation strategy

Update the national GRFA adaptation plan and the implementation strategy based on the results of monitoring and review, new information and the result of adaptation actions already implemented.

D.4. Outreach

Communicate results of implementing the Guidelines and national GRFA adaptation plan to policy makers, stakeholders and to the wider public and provide inputs to relevant international processes.

Description of elements and steps

ELEMENT

A

LAY THE GROUNDWORK AND ADDRESS GAPS

17. This first element focuses on the steps needed to develop an appropriate conceptual and operational framework, to identify entry points for GRFA in national adaptation planning and ensure recognition by relevant policy-making bodies of the importance of GRFA to adaptation.

A.1. Initiate and launch GRFA contribution to national adaptation planning

18. The following activities should be undertaken:
- i. Initiate or strengthen collaboration between, *inter alia*, the animal, aquatic, forestry and plant genetic resources sectors;
 - ii. Identify and review existing arrangements for national adaptation planning;
 - iii. Engage with climate change focal points, planners, policy makers and with policy-making processes to improve recognition of the potential contribution of GRFA to national adaptation;
 - iv. Identify existing entry points for GRFA perspectives and information within the national adaptation process and assess their effectiveness;
 - v. Identify and seek to establish institutional arrangements that ensure that relevant parts of the NAP are reflected in relevant GRFA plans and strategies and support:
 - Coordination and linkages between different organizations, agencies and ministries involved in conservation and use of GRFA and in climate change adaptation;
 - Analysis and assessment of vulnerability and risk and the identification of adaptation options;
 - Implementation actions that will be undertaken by a diversity of actors at national, regional and local levels;
 - Capacity development to ensure continuing ability to meet changing conditions;
 - Integration and mainstreaming of GRFA-based options into climate change adaptation as well as climate change perspectives into GRFA maintenance and use; and
 - Development and implementation of a communication strategy to increase the visibility of GRFA.
19. An integrated approach that brings together GRFA sectors is likely to strengthen the effectiveness of the GRFA contribution and the wider recognition by policy makers of the value of GRFA in adaptation. At the same time, the arrangements developed will need to take into account the different characteristics of genetic resources and the institutions involved in their conservation and use. The approach adopted can build on

existing GPAs, the collaborative arrangements developed to prepare country reports for *The State of the World's Biodiversity for Food and Agriculture* or other appropriate instruments and should take account of the different institutional arrangements that link GRFA sectors to national agricultural, environmental, health and planning entities or agencies.

A.2. Take stock

20. Integrating GRFA into national adaptation planning and developing a GRFA adaptation plan will require taking stock of the current situation with respect to climate change and the conservation and use of GRFA. The analysis should include assessments of the following:

- i. Status of different GRFA sectors and associated biodiversity for food and agriculture, including current patterns of GRFA use and conservation, e.g. *in situ* and *ex situ* (genebanks);
- ii. Institutions and institutional arrangements that support the conservation and use of GRFA, including the roles of civil society organizations and of local and informal institutions such as local markets;
- iii. The importance of international availability and flows of genetic resources for the country;
- iv. Overall observed and expected impacts of climate change in the country;
- v. Current or expected vulnerabilities to climate change;
- vi. Relevant research on GRFA and climate change;
- vii. Traditional knowledge on GRFA conservation and use relevant to adaptation;
- viii. Past and ongoing adaptation actions;
- ix. Actions or programmes relevant to adaptation, such as those undertaken to implement the GPAs or to achieve the Aichi Biodiversity Targets.

21. Sources of information for stock-taking include national reports prepared for the global assessments of the state of the world's plant, animal and forest genetic resources, national information systems and global systems such as the World Information and Early Warning System (WIEWS) on plant GRFA, the Domestic Animal Diversity Information System (DAD-IS) and the Worldwide Information System on Forest Genetic Resources (REFORGEN). The experiences gained in the implementation of the GPAs will also constitute an essential element, distilling past information and experience. Information on climate change vulnerability will come from national and international contributions to the Intergovernmental Panel on Climate Change and from national climate change assessments. International programmes such as the CGIAR Programme on Climate Change, Agriculture and Food Security will also provide relevant information, especially with respect to ongoing research.

22. The process of taking stock should involve an analysis of strengths, weaknesses, opportunities and threats (SWOT) that can inform and strengthen the activities developed under step A.1. above. The SWOT process will help identify priority concerns, capacity gaps and institutional barriers. A key aim will be to bring information

together across GRFA sectors so as to create an overall GRFA perspective that takes full account of the different contributions to adaptation that can be made by different GRFA sectors. The SWOT will need to involve stakeholders from all GRFA sectors and from a range of different institutions and organizations. It should include organizations representing farmers, pastoralists, fisherfolk and forest dwellers but also other sections of civil society, the private sector, scientists and others professionally involved in agriculture, fisheries and forestry. The SWOT process will provide opportunities for these different groups to be fully engaged and to provide inputs based on their different experiences.

A.3. Address capacity gaps and weaknesses in undertaking the process

23. The stock-taking process and the SWOT analysis in A.2. allow identification of gaps and weaknesses in the capacity to undertake the different actions associated with conservation and use of GRFA in support of climate change adaptation. Such gaps and weaknesses may be institutional and technical in nature, may relate to the arrangements that can support the role of GRFA, or may relate to participation of stakeholders and the wider public. This step will involve addressing the identified institutional and technical gaps, which will include training activities that aim to provide the skills needed for key organizations to fully participate in different activities. Weaknesses in the available supporting arrangements may be addressed through the establishment of the necessary operating systems and by supporting policies and programmes. The capacity of genetic resources stakeholders and the wider public to engage in adaptation actions can be strengthened through appropriate communication activities and through participatory approaches that support the involvement of the widest range of stakeholders, particularly farmers, pastoralists, fisherfolk and forest dwellers (see also step C.3.). The activities undertaken should be reflected in the institutional arrangements established under step A.1.

A.4. Identify links between climate vulnerabilities, adaptation needs and national development goals

24. The stock-taking process in A.2. also provides a basis for ensuring that the adaptation measures identified for GRFA take adequate account of national development goals. Relevant goals are likely to include improving food security and nutrition, rural livelihoods and incomes, sustainability, environmental health and strengthening national resilience. The ways in which GRFA contribute to these goals will need to be made explicit and the challenges and opportunities presented by climate change to securing the contribution of GRFA to these goals identified and described. Synergies between GRFA sectors in their contribution to development goals and opportunities for enhanced contributions should be placed in the national context and take into account the specific challenges faced by individual countries.

25. An important contribution to the success of this step will be an increasing awareness of policy makers of the value of GRFA. Policy relevant materials should be prepared and relevant policies that exist or will be needed should be identified. The

GPA's and the reports on the state of the world's genetic resources provide guidance on enhancing the contribution of GRFA to food security and other relevant objectives and should be used to support the findings of the SWOT analysis in the preparation of such materials.

ELEMENT

B**DEVELOP THE PREPARATORY FRAMEWORK**

26. The objective of this element is to ensure that there is knowledge of climate change expectations, of the risks and threats involved and of adaptation options. Based on this knowledge, a national adaptation plan for GRFA conservation and use can be developed that ensures an effective contribution of GRFA to national adaptation planning.

B.1. Analyse current climate and future climate change scenarios

27. This step includes an assessment of the different available scenarios for future climate change. It should take into account the uncertainties that have been recognized and complement other national planning activities by focusing primarily on aspects likely to be of greatest relevance to GRFA conservation and use. It should consider the likely effects of different scenarios for different GRFA sectors and whether projected plans for the sectors (e.g. livestock production growth) remain realistic. The assessment should also consider socio-economic implications for rural communities and take account of existing government mitigation or carbon reduction plans.

28. Much of the work on climate change scenarios has been concerned with changes at global or regional scales. However, there is increasing evidence of the need to consider the consequences of climate change at more local levels. The different agro-ecological zones and production systems³ present in a country may provide relevant and useful scales for the assessment process.

B.2. Assess climate vulnerabilities and identify adaptation options

29. A list of different activities to be included in assessing risks and vulnerabilities and of identifying adaptation options is set out in Figure 2 and includes: deciding on the frame and scope of the assessment; undertaking the required vulnerability and risk assessments; identifying the expected impacts of other changes and the expected added impact of climate change; identifying and assessing adaptation options; and, establishing processes for monitoring and managing GRFA related risks. The technical aspects of the assessment will require involvement of national research institutions and universities and should include expertise that cuts across GRFA sectors and can provide inputs on the possible consequences for food or water security or for health. The participation of farmers, pastoralists, fisherfolk and forest dwellers, their communities and organizations, and of the private sector should be actively encouraged and facilitated.

³ Agro-ecological zones are homogenous and contiguous areas with similar soil, land and climate characteristics. See more at: <http://www.fao.org/nr/gaez/programme/en/#sthash.CLjkW9wQ.dpuf>
An appropriate classification of production systems has been developed for the preparation of the first report of *The State of the World's Biodiversity for Food and Agriculture* (Annex 2 of the *Guidelines for the preparation of the country reports for The State of the World's Biodiversity for Food and Agriculture* http://www.fao.org/fileadmin/templates/nr/documents/CGRFA/Guidelines_SOWBFA_E.pdf)

30. The assessment should take account of risks to both conservation and use of GRFA. At-risk genetic resources that are not conserved cease to be available for future use and this may limit adaptation options. Risk and vulnerability assessment should evaluate risks to the genetic diversity within a production system, to the maintenance of key traits and to associated knowledge (particularly traditional knowledge).

31. In many cases information will be lacking with respect to the threats to particular resources, or their potential for adaptation. The analysis should therefore use whatever information is available, identify major information gaps and identify ways in which missing information can be obtained and how it can be included as it becomes available. The ways in which existing national information management systems might be adapted for this purpose should be explored.

32. Risk and vulnerability assessment should take into account the interconnected nature of many risks. This will involve exploring the nature and linked effects of many of the changes identified. For example, changes in pest and disease distribution may increase the vulnerability of many species, populations, breeds or varieties that are also at risk from direct changes in temperature or rainfall patterns. An ecosystem approach that takes account of associated biodiversity is recommended. The different GRFA sectors may well have developed different methods to assess risk and vulnerability that they will wish to use, but should nevertheless seek to integrate their findings, using widely tested methods that can help intersectoral analysis where possible.

B.3. Review and appraise adaptation options

33. Once vulnerabilities and risks have been ranked, adaptation options must be identified to address them. Adaptation options involving GRFA may include management and operational strategies, infrastructural changes, policy adjustments or capacity-building and are likely to be of two main types – those that provide adaptation to specific directional change (e.g. increased temperature, more frequent occurrence of drought or flooding) and those that help cope with uncertainty (e.g. variable rainfall, fluctuating temperatures or the occurrence of extreme events). Adaptation measures may need to adopt an approach that addresses these different aspects. A key element will be the identification of measures designed to improve adaptive capacity that can help to ensure that further climate related change can be addressed.

34. Traditional knowledge will also make a significant contribution to identifying adaptation options. Local practices often constitute an important component of adaptation measures and the identification, assessment and compilation of these practices should be promoted with full participation of indigenous and local communities.

35. The ways in which existing national or international policies and legislation might affect the adoption of different adaptation options will need to be considered. This is particularly the case for regulations that govern access to, and exchange of, crop and livestock varieties and breeds, forestry species provenances or fish populations, while

preventing the transfer of undesirable alien and invasive species. Policies that support the adoption of climate-friendly production will be particularly relevant, as will those that support sustainable intensification. Examples include policies that favour the increased use of agroforestry, the development of silvo-pastoral systems and the development of improved aquaculture practices using improved populations of fish species. Given the international character of conservation and use of GRFA, trade policies should also be included in the analysis.

36. Adaptation options that have been identified will need to be reviewed against a set of agreed criteria to prioritize the most promising measures for implementation. Important criteria for this evaluation include efficiency, effectiveness, equity, urgency, flexibility, robustness, practicality, legitimacy and co-benefits (UNFCCC, 2010). The evaluation should also include an assessment of the degree of uncertainty associated both with any identified vulnerability and with the likely effectiveness of any adaptation option.

B.4. Compile national GRFA adaptation plan

37. A national adaptation plan for conservation and use of GRFA will be needed

FIGURE 2

Undertaking a vulnerability and adaptation assessment

1

Identify the frame and scope of the assessment, including

- Decide on geographical region of concern
- Identify questions to be addressed and steps required
- Set policy context
- Establish project team and operational process
- Ensure stakeholder involvement
- Develop communication procedures or plan

2

Undertake vulnerability assessment – identify the risks from climate variability and climate change

- Analyse current and future climate change scenarios at the most relevant level (e.g. national, subnational)
- Assess direct risks to genetic resources present and/or conserved in the selected area
- Assess risks to agriculture and to crop, livestock, fish and forest species production
- Assess risks to the environment that are relevant to conservation and use of genetic resources
- Assess risks to food security and nutrition, rural livelihoods and income, health that are relevant to the conservation and use of genetic resources

in order to, *inter alia*, guide the contribution of GRFA to adaptation, help ensure the relevance of GRFA to national planning, provide an integrated and coherent programme of action and identify the scale of resources required. The plan should reflect the results of the assessment process, the analysis of policy dimensions and national goals. It will respond not only directly to specific adaptation planning but also to the longer-term aim of improving resilience, adaptability and sustainability in the country. It should identify the most urgent priorities and set out an approach that can take into account directional climate change, variability and extreme events. The plan should be part of a country's overall national adaptation planning and, where relevant, be part of a country's NAP.

38. The process of developing the national GRFA adaptation plan will be determined by the country, based on national context and needs and the nature of national GRFA institutions and programmes. The development of the plan should use an iterative approach that ensures participation of organizations representing farmers, pastoralists, fisherfolk and forest dwellers as well as other sections of civil society, women's groups, the private sector, scientists and those professionally involved in agriculture, fisheries and forestry. It should be cross-cutting and inclusive of perspectives from all GRFA sectors. The plan should involve a review of:

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Undertake impact assessment

- Analyse expected impacts of expected developmental or other changes irrespective of climate change
- Analyse added burden of climate change

Identify and assess adaptation options

- Identify and assess conservation options including *ex situ*, *in situ* or movement (including transboundary) of resources
- Identify and assess options for changing components of production systems or methods of production
- Identify and assess options for managing environmental changes
- Develop policy options that will be needed to implement adaptation programmes
- Identify financial resources needed to address adaptation challenges

Establish iterative process for monitoring and managing GRFA related risks

- Develop monitoring and evaluation programme that can take into account changes in vulnerability and of results of adaptation actions
- Establish feedback process to assess and modify vulnerability and adaptation assessment

- i. Existing patterns of use of genetic resources in agriculture and environment and the specificities of agriculture, forestry and fisheries in the country;
- ii. Governance and collaboration mechanisms for GRFA in agriculture, fisheries and forestry;
- iii. Capacity and capacity needs to support adaptation actions proposed;
- iv. Vulnerability and adaptation assessments undertaken;
- v. Ongoing monitoring and research programmes;
- vi. Communication practices, opportunities and needs;
- vii. Emergency preparedness and response; and
- viii. Monitoring, evaluation and feedback procedures.

39. The plan should also take account of:

A. The contribution of the different GRFA sectors and complementarity between them

While each GRFA sector will identify adaptation measures that are relevant to their specific resources, the plan should adopt an integrated approach. Complementarities, synergies and trade-offs between GRFA sectors should be explored and the ways in which overall adaptation to achieve wider goals will require measures that involve different types of GRFA.

B. Existing GPAs or other GRFA relevant plans or guides

Many countries have already developed GRFA plans that include actions relevant to climate change adaptation. International GRFA plans and guidelines also exist and identify priority actions of relevance, e.g. the GPAs. Relevant actions identified in these instruments should be embedded in the proposed national GRFA adaptation plan.

C. The different scales at which adaptation measures may be appropriate

Adaptation measures often involve intervention at different scales and, for example, be targeted at farm, village or community, landscape or country levels. Different types of adaptation reduce vulnerability and improve resilience at different scales and the plan should reflect the importance of interventions at all these levels.

D. The relative contribution of adaptation measures to conservation, availability and use of GRFA

The conservation, availability and use of GRFA are all essential aspects of adaptation to climate change and need to be embedded in any plan. The specific contribution of any planned measures to these different aspects will need to be identified to ensure that all are adequately addressed.

40. The plan should seek to identify not only the adaptation measures to be undertaken but also how they may be integrated and mainstreamed at country level. It will be a major planning tool to support the GRFA contribution to the country's NAP and will support effective communication with policy makers and a wider community of stakeholders that includes not only those involved in production but also consumers. Effective mainstreaming will require involvement of rural communities across the

country and their inclusion in the development of the adaptation plan is therefore essential. It is recommended that the plan include an evaluation of the overall costs and capacity development needs for implementing the plan, as well as an assessment of the likely benefits. The cost–benefit analysis should take into account the wider social and cultural costs and benefits, as well as providing economic estimates where these are possible.

B.5. Review implications of climate change for national development goals, legislation, policies and plans

41. The integration of GRFA adaptation planning into wider adaptation planning and the linkage to national development goals were initiated under Element A. The GRFA adaptation plan identified in B.4. should reflect that earlier process and will be a multi-year process involving different stakeholders, ensuring that the plan reflects national needs and objectives and that these take account of potential GRFA contributions.

42. To facilitate the integration of GRFA adaptation planning into other planning processes, a review of the implications of climate change for national development goals, legislation, policies and plans should be conducted. The review should assess synergies, complementarities or possible conflicts with other aspects of national adaptation planning. Trade-offs need to be identified and the consequences explored, with analysis of relevant costs and benefits where appropriate. This is likely to be particularly important in respect of the contribution of GRFA to wider societal goals such as nutrition or health and will need to take into account the consequences for GRFA of plans with respect to e.g. energy provision, transport or water management.

ELEMENT

C

DEVELOP THE IMPLEMENTATION STRATEGY

43. The objective of this element is to develop a strategy to support the implementation of the national GRFA adaptation plan.

C.1. Ensure appropriate priority for GRFA in national adaptation planning

44. Determining the contribution of GRFA to adaptation in the broader context of national development planning will help policy makers and relevant stakeholders to recognize the importance of GRFA-related adaptation measures given competing development needs. This will involve identifying national priorities and the criteria used to determine them and describing the contribution that can be made by GRFA to these priority actions. It will be important to engage with policy makers at local and national levels so as to understand the process of identifying priorities and the concrete actions that can be taken to ensure GRFA perspectives are included. The criteria used to evaluate adaptation options in B.3. will provide a relevant framework for identifying actions.

C.2. Develop and initiate implementation strategy

45. The implementation strategy that will be developed under this step describes the approach that can be used to deliver the objectives and outputs identified in the national GRFA adaptation plan. It will set out the mechanisms that can be used to secure implementation of the different activities identified in the plan, including the roles of different GRFA sectors, institutions and other stakeholders. The strategy will provide guidance on the ways in which new activities can be linked to ongoing initiatives that already support adaptation and establish how GRFA related initiatives will be linked to other national adaptation planning efforts in e.g. agriculture and food production, water management, health and energy use.

46. The strategy should be developed in cooperation with all relevant stakeholders (including scientists, extension workers, farmers, fisheries and forestry organizations, women's groups, relevant civil society organizations, breed societies and the private sector). It will need to identify the mechanisms that can ensure continuing involvement of appropriate stakeholders for specific measures.

47. Key elements that the strategy will need to address include that of securing adequate access to, and availability of, additional genetic diversity. Relevant activities in the GRFA adaptation plan are likely to include improving the availability of traditional breeds and varieties, provenances of forestry species likely to be more adapted to changed conditions and to populations of fish species with desirable adaptive characteristics. The strategy will need to take into account the fact that many of the

resources needed may need to come from other parts of the world. Thus, it should contain explicit actions that facilitate movement of materials and support regional and international collaboration.

48. The strategy should fully reflect existing national strategies and plans for implementing the GPAs and the measures identified in these. Some of the most important activities whose implementation the strategy should support include: improving *in situ* and *ex situ* conservation; characterization and evaluation of conserved materials; introducing new species, populations, varieties and breeds; strengthening production system adaptability and resilience through diversification; improving the quality of supporting and regulating ecosystem services such as pollination, pest and disease control and water quality; developing better methods of accessing new diversity; and breeding new crop, animal, forest and fish varieties and breeds and populations. Ways of building capacity, improving availability of materials and information and increasing awareness of the value of GRFA will also need to be integrated into the implementation strategy. *Annex B* lists some of the relevant actions identified in the GPAs for animal, forest and plant genetic resources. *Annex C* lists a selection of adaptation measures the strategy may need to ensure can be implemented and indicates the outputs that can be expected from them.

49. Experience to date suggests that many countries face serious limitations with respect to mobilizing the resources needed to implement adaptation measures. The implementation strategy should therefore address resource mobilization. Elements are likely to include ways of mobilizing national financial resources, the use of international support through the Global Environment Facility and other international agencies, and ways of mobilizing private-sector funding. Financial resources are not the only resources that can be mobilized in support of the implementation plan. Through public awareness campaigns and other methods opportunities may exist to develop publically supported monitoring programmes or community-based testing programmes for new materials using e.g. crowd-sourcing approaches.

C.3. Enhance capacity for planning and implementing adaptation

50. Strengthening capacity to support implementation will be essential. This involves developing an improved appreciation among genetic resources and climate change stakeholders of the likely effects of climate change on conservation and use of GRFA and of the contributions to adaptation that GRFA can make. A multifaceted capacity development programme tailored to the needs of different interest groups will be needed. Examples of appropriate capacity building activities might include:

- i. Working with farmers, fisherfolk and forest dwellers in participatory ways to identify relevant actions based on their own experiences and establishing local monitoring processes;
- ii. Strengthening the appreciation of the contributions of genetic resources among policy makers, public administrators in agriculture, environment and health; and

- iii. Providing training to extension workers and local administrators to support measures that are part of the implementation plan.

C.4. Promote coordination and synergy

51. While many (or most) of the measures needed will be undertaken within the framework of GRFA sector programmes, a country level coordination mechanism should be established to oversee and coordinate implementation linked, where appropriate, to relevant NAP mechanisms. Since implementation will involve actions undertaken over a number of years, the coordination mechanism should be able to oversee and monitor progress on a continuing basis.

52. Cross-sectoral GRFA perspectives and links to other areas such as agriculture, environment and health should be included in developing regional or multi-country aspects of the implementation strategy. Such cooperative elements of the strategy should include full ownership of all projects by all the countries and regional entities concerned and broad inclusiveness and involvement of all relevant partners.

53. It is important to take full account of regional and international dimensions in developing implementation strategies. The distributions of many important species or populations are not limited to a single country and ensuring adequate access and availability of GRFA constitutes an essential element in any implementation strategy. International agreements for access and benefit-sharing need to be taken into account and a large variety of regional mechanisms exist that support the conservation and use of GRFA and whose work programmes include concerns with climate change adaptation.

ELEMENT

D

MONITOR REVIEW, REPORT AND COMMUNICATE PROGRESS

54. The objective of this element is to develop procedures to assess progress in implementation, to allow review and updating of the different elements and actions undertaken and to support communication of progress to all relevant stakeholders and to appropriate international bodies.

D.1. Monitor implementation

55. A set of quantifiable metrics will be needed for a satisfactory monitoring and evaluation process. These metrics should be well defined with clear collection procedures, understood by all those involved and linked with the country's other national adaptation monitoring and evaluation processes. Ideally, the metrics used should be relatively few in number, easy to collect on a continuing basis, and fit with other monitoring and review processes (such as those connected with monitoring GPAs or progress towards achieving the Aichi Biodiversity Targets). They should clearly focus on assessing the conservation and use of GRFA in the context of climate change adaptation and include measures of change in risk and vulnerability.

56. Three levels of monitoring and evaluation can usefully be distinguished and included in the overall process:

- i. **Monitoring the process.** There should be a clearly established process for monitoring the process of implementing the Guidelines. This will need to be established under Element A and should include monitoring the extent to which GRFA-related measures become part of the overall national adaptation planning.
- ii. **Monitoring outputs.** Implementing the Guidelines will result in a number of activities and adaptation measures, and the extent to which these have achieved the desired outputs should be assessed.
- iii. **Monitoring outcomes.** The extent to which implemented adaptation measures provide adaptation to perceived climate change is possibly the most complex and difficult part of the monitoring process. It is recommended that this monitoring process be fully integrated into the overall national adaptation monitoring process.

57. The indicators developed by FAO under the guidance of the Commission provide a starting point for the process of developing an appropriate set of indicators to monitoring the adaptation measures adopted and can be combined with other indicators for monitoring the implementation of the Guidelines.

D.2. Review progress and effectiveness in implementation and identify gaps

58. The implementation of the Guidelines and of other related processes, such as the GPAs, will generate new knowledge on how best to conserve and use GRFA as part of national adaptation planning. The results of monitoring will also generate information

on the extent to which different actions are successful in reducing climate change risks and vulnerabilities. New knowledge will also come from international research or adaptation efforts. A review of the findings from these different sources will contribute to assessing progress in implementation and identifying gaps where new actions are needed. An identifiable process should be established to ensure that the review is undertaken in a coordinated way on a regular basis with full stakeholder involvement. The analysis of new information and the findings and proposals from the review should be made public.

D.3. Update national GRFA adaptation plan and implementation strategy

59. Adaptation to climate change is a continuing process and there are many uncertainties with respect to the most appropriate adaptation measures to be adopted and the extent to which different measures deliver the desired adaptation. New risks and areas of vulnerability are also likely to emerge, requiring new actions.

60. The results of monitoring and of the review process should be used to make any appropriate modifications to the GRFA adaptation plan and its implementation strategy. The modifications may be needed to take account of the achievement of specific outputs, to reflect the effects of further changes in GRFA that reflect continuing climate change or to build on successful experiences from other relevant actions in the country or elsewhere.

D.4. Outreach

61. The findings from the monitoring and review and updates in the national GRFA adaptation plan or implementation strategy should be communicated to all the relevant stakeholders involved. These include the management unit of the NAP at national level where this has been established, relevant ministries and international processes, as well as other stakeholders. Reporting on progress made is an essential part of identifying best practices and of supporting mainstreaming. The outreach programme should be integrated into the communication strategy developed under step A.1.

62. Outreach plans and activities should not be limited to the communication of results to stakeholders. An integrated communication plan that ensures a continuing flow of information to policy makers and the wider public should be developed and form a continuing part of the work involved in implementing the Guidelines.



ANNEX A

The importance of genetic resources for food and agriculture for climate change adaptation

The Fifth Assessment Report of the Intergovernmental Panel on Climate Change concluded that climate change is affecting all aspects of food security and agriculture and that impacts on crop yields are already evident across several regions of the world. This suggests that the pace of adaptation needs to speed up.

Genetic resources for food and agriculture (GRFA) will play a central role in meeting the challenges of climate change to food security and nutrition, and in maintaining and improving agricultural productivity, rural livelihoods, sustainability and resilience. It is therefore essential to secure and mobilize these resources as part of national and global climate change adaptation planning.

The challenge of climate change

Climate change presents significant threats and challenges to agriculture, forestry and fisheries. Rising temperatures, changing rainfall patterns, increasing climate variability, rising sea levels and the greater frequency of extreme events all present risks and increase vulnerability in production systems. The changes that are occurring require new and different crop, animal, forestry and fish types in many, if not most, production systems. In parts of the world, new combinations of temperature, moisture availability and day length are creating production environments not experienced previously for which adapted materials may not exist. Sea level rise will result in the loss of many of our most productive areas or lead to increased salinity and loss in the productive capacity of important, often highly productive, production systems.

The Fifth Assessment Report of the Intergovernmental Panel on Climate Change stressed that:

- Climate change is affecting the current abundance and distribution of freshwater and marine fish harvests.
- Recent price spikes for food have been related to climatic extremes in major production areas.
- Climate change has impacts on the nutritional quality and safety of food.
- Tropical crops, livestock and fisheries are most affected by current climate change; regions of major exposure to climate change coincide with high prevalence of poverty and food insecurity.
- Greater exposure to climate risks increases the vulnerability of food insecure individuals and households.

Genetic resources for food and agriculture

GRFA include the variety and variability of animals, plants and micro-organisms that provide our food and non-food agriculture products and sustain the ecosystem structures, functions and processes in and around production systems. These resources have been managed or influenced by farmers, pastoralists, forest dwellers and fishers and have given humanity the possibility of coping with environmental and social changes over hundreds of generations. GRFA provide the genetic diversity that will be needed for coping with climate change in a world of limited resources where improving sustainability and resilience become increasingly important.

Using genetic resources for food and agriculture to adapt to changing production environments

The crop varieties, animal breeds or fish and forest species populations that will be required for the changing climatic conditions will have to come from the existing pool of GRFA. Increased tolerance to abiotic stresses (e.g. heat, drought, flooding, frost, rising water temperatures) will be needed and new varieties, breeds and populations adapted to higher production temperatures and to increased or decreased amounts of rainfall are already being developed around the world. Some of the characteristics that will be needed are more complex or harder to predict. Increased temperatures and new rainfall patterns are changing pest and pathogen distributions and frequency and may alter the frequency and severity of epidemics, causing increased losses during food production or storage. New crop varieties, livestock, fish or forest species populations will often be needed and their development will depend on the successful conservation and use of GRFA. Changes are also occurring in the distribution and properties of pollinators and other species that make essential contributions to production through the ecosystem services they provide. Pollination was estimated to be worth €153 billion worldwide in 2015 (Gallai *et al.*, 2009) and contributes to the yield and quality of at least 70 percent of the world's major food crops, especially many nutritionally significant fruit and vegetable crops (Klein *et al.*, 2003). New crop varieties, livestock, fish or forest species populations will be needed to take account of the changes that are occurring and provide the adaptive capacity needed for future change. Our ability to develop these new varieties will depend to a significant extent on how successful the conservation, characterization and use of GRFA have been.

Adapting to increased variability

Adapting to the increasing variability in production systems that is being experienced in many parts of the world is more challenging still. Crop species and varieties, animals species and breeds, forestry and fish species and populations are needed that can cope with greater ranges of conditions than previously. In one year there may be rapid changes in available water and in another sudden changes in temperature. Year to year differences may also increase so that varieties, breeds or populations adapted to one year are less suitable the next. Traditional varieties and breeds are often considered to show the kind of adaptability needed to cope with these more variable conditions and to be adapted to a wider range of often suboptimum production conditions than many modern varieties. In many cases, rural communities are already using traditional

varieties and traditional knowledge to help adapt to the changing conditions they are experiencing.

Strengthening adaptive capacity

Climate change is a continuing process and adaptation will be a continuing process as temperatures continue to climb and other conditions continue to change. Even after (if) temperatures are stabilized, changes will continue to affect production systems over subsequent decades. The properties that are likely to become increasingly important in production systems include the potential to adapt to change over time (adaptive capacity), the capacity to provide different production benefits within a single system (option values), the ability of the different elements in a production system to compensate when conditions do not favour certain elements (complementarity and a portfolio effect) and the ability to bounce back after a series of climate challenges and develop new capacities in the face of change (resilience).

Securing the genetic diversity that will be needed

There are real dangers in assuming that just because GRFA are needed they will be there. GRFA are also at risk from climate change. Some varieties, breeds and populations may no longer be able to adapt to the changed environments in the places they currently are found and additional conservation efforts are required.

Conserving and mobilizing GRFA to ensure that they are available and can be used to meet the challenges of climate change require specific, focused actions. The actions will need to include:

- Effective conservation, *in situ* and *ex situ* of the varieties, breeds and populations of useful species, and of their wild relatives, that are at risk and that have the characteristics needed for climate change adaptation and mitigation;
- Improved information about GRFA and the characteristics of the different materials;
- Enhanced availability of GRFA within and between countries;
- Improved utilization pathways that allow for the development and distribution of new adapted materials and build on the roles that GRFA play in food security and nutrition, rural livelihoods, ecosystem services, sustainability and resilience.

Building sustainability and resilience

An essential aspect of adaptation to climate change will be that of increasing the diversity within production systems. This can take many forms: combining different types of production (crop, forest, fish and animal) in different ways; increasing the numbers of different species, populations, varieties or breeds, increasing the use of materials that are themselves genetically diverse such as crop multilines. These different approaches will help provide the complementarity, option values and risk avoidance strategies that will become increasingly important in the future. Finding ways to combine diversity-rich strategies with the production demands of the future is one of the major challenges for the future and the improved maintenance and use of GRFA will lie at the heart of meeting this challenge.

A collaborative endeavour

Securing and mobilizing GRFA to support national and global adaptation planning is a collaborative endeavour. Already, through the work of the Commission, the status of the resources is periodically assessed and monitored and Global Plans of Action have been developed for plant, animal and forest genetic resources that address climate change-related issues in the conservation and use of GRFA (see *Annex B*) (FAO, 1995; FAO, 2008). The Voluntary Guidelines to Support the Integration of Genetic Diversity into National Climate Change Adaptation Planning create a framework that can help build collaboration between all the different partners that need to be involved and ensure that GRFA make a full and effective contribution to national adaptation planning.



ANNEX B

The Global Plans of Action for animal, forest and plant genetic resources – selected actions of relevance to the implementation of the Voluntary Guidelines

The Commission on Genetic Resources for Food and Agriculture (Commission) negotiates Global Plans of Action (GPAs) that seek to create an efficient system for the conservation and sustainable use of genetic resources for food and agriculture. GPAs are intended as comprehensive frameworks to guide and catalyse action at community, national, regional and international levels through better cooperation, coordination and planning and by strengthening capacities. They contain sets of recommendations and priority activities that respond to the needs and priorities identified in global assessments: the reports on the state of the world's genetic resources for food and agriculture. GPAs are adopted by the relevant Governing Bodies of FAO, i.e. the FAO Conference or the FAO Council, or by special intergovernmental conferences convened at their request. The Commission oversees, monitors and evaluates the implementation of the GPAs.

i) The Global Plan of Action for Animal Genetic Resources

In 2007, the International Technical Conference on Animal Genetic Resources for Food and Agriculture, held in Interlaken, Switzerland, adopted the Global Plan of Action for Animal Genetic Resources (FAO, 2007) and the Interlaken Declaration. The outcomes of the Interlaken Conference were subsequently endorsed by the FAO Conference as a major contribution to the overall international framework on agricultural biodiversity. The FAO Conference requested the Commission to oversee and assess the implementation of the GPA. In 2009, the Commission adopted the Funding Strategy for the Implementation of the GPA for Animal Genetic Resources.

The different strategic priority areas in the GPA list a number of actions relevant to the conservation and use of animal genetic resources. In the context of climate change, these include (FAO, 2011a):

STRATEGIC PRIORITY AREA 1

Characterization, inventory and monitoring of trends and associated risks

- identifying potential climate change-related threats to specific animal genetic resources, ensuring that long-term threats (e.g. gradual environmental changes) are monitored and that urgent action is taken to address immediate threats (e.g. small populations at severe risk from climatic disasters);
- improving knowledge of breeds' current geographical distributions and production environments to support the above actions and to facilitate planning of climate-change adaptation measures and animal genetic resources conservation strategies;

- improving the availability of the above-described knowledge, including via DAD-IS and other animal genetic resources information systems;
- ensuring that monitoring strategies and early-warning systems for animal genetic resources are sensitive to climate-change-related trends and risks.

STRATEGIC PRIORITY AREA 2

Sustainable use and development

- reviewing and, if necessary, adapting breeding goals to account for the effects of climate change.

STRATEGIC PRIORITY AREA 3

Conservation

- ensuring that conservation strategies account for the observed and projected effects of climate change, including agro-ecological changes and disaster risk, and if relevant the effects of climate change mitigation policies;
- ensuring that *ex situ* collections are sufficiently comprehensive, well managed and well located to provide insurance against climatic and other disasters (incl. establishing backup samples).

STRATEGIC PRIORITY AREA 4

Policies, institutions and capacity-building

- ensuring that national strategies and action plans for animal genetic resources account for the effects of climate change and can be reviewed and amended as necessary to account for future climate-related developments;
- promoting exchange of information on climate-change adaptation strategies for livestock systems and animal genetic resources management, relevant breed adaptations and breed performance in specified production environments;
- improve use of transboundary breeds, especially regional breeds which are well adapted to harsh environments

ii) The Global Plan of Action for Forest Genetic Resources

The Global Plan of Action for the Conservation, Sustainable Use and Development of Forest Genetic Resources (FAO, 2014b) was agreed upon by the Commission at its Fourteenth Regular Session and adopted by the FAO Conference in 2013. Priority areas for action include improving the availability of, and access to, information on forest genetic resources; *in situ* and *ex situ* conservation of forest genetic resources; sustainable use, development and management of forest genetic resources; and policies, institutions and capacity building.

One strategic priority of the GPA specifically addresses issues of climate change and forest genetic resources.

STRATEGIC PRIORITY 14

Support climate change adaptation and mitigation through proper management and use of forest genetic resources

Rationale: The current growing concern about climate change and its effects on ecosystems and the performance of forest-related production systems, challenges stakeholders in forest genetic resources management to better understand forest species and mechanisms for adaptation to current and future climate changes.

Genetic diversity is needed in order to ensure that species can adapt, as well as to allow for artificial selection and breeding to improve productivity. Thus, genetic diversity, including diversity among species, is the key to the resilience of forest ecosystems and the adaptation of forest species to climate change.

Action: Develop subnational, national and regional standard methods and guidelines for the identification, selection and use of species population conservation units, based on environmental and sociocultural factors, which are the main determinants of the status of forest and agroforestry ecosystem diversity.

Assist countries in their efforts to improve the conservation and sustainable use of forest genetic resources in the face of climate change by:

- promoting best practices in forest genetic resources management, specifically in the fields of conservation, exploration, testing, breeding and sustainable use; and
- promoting forest genetic resources' contributions to environmental sustainability through the development and use of well-suited genetic material.

iii) The Second Global Plan of Action for Plant Genetic Resources for Food and Agriculture

The Second Global Plan of Action for Plant Genetic Resources for Food and Agriculture (FAO, 2011b) is a strategic framework for the conservation and sustainable use of plant genetic diversity. It was adopted by the FAO Council in November 2011 and reaffirms the commitment of governments to the promotion of plant genetic resources as an essential component of food security through sustainable agriculture in the face of climate change.

The introduction to the GPA identifies the following strategic elements to safeguard plant genetic resources for food and agriculture and use them optimally to help cope with climate change (FAO, 2011b):

- Greater emphasis on *in situ* conservation of genetically diverse populations, especially crop wild relatives, to allow evolution to continue and thus permit the continued generation of adaptive traits;
- A significantly expanded programme on *ex situ* conservation, especially of crop wild relatives, to ensure the maintenance of diversity of species, populations and varieties, including those adapted to extreme conditions and those from areas expected to be highly affected by climate change;
- Increased research and improved availability of information on the characteristics of material held *ex situ* that will become useful under new climatic conditions;
- Increased support for access to and movement of plant genetic resources for food and agriculture to meet the greater interdependence of countries resulting from new environmental conditions;
- More support for building capacity in plant breeding and seed-systems management that make effective and sustainable use of plant genetic resources for food and agriculture;
- Targeted and increased involvement of farmers and farming communities in national and local crop-improvement activities, including support for participatory research and plant breeding.

These elements are included in the relevant Priority Activities of the GPA.

ANNEX C

Indicative activities for consideration in implementation plans

Indicative activities	Indicative outputs
i) Conservation	
Prioritize species, varieties, breeds and populations (including useful wild relatives) for conservation on the basis of climate change expectations, including both species of direct socio-economic importance and associated species relevant to provision of ecosystem services (hereafter “targeted and associated species”)	Priority species (also “targeted and associated species”) and conservation actions defined
Collect information on distribution and frequency of priority species, crop varieties, animal breeds and forestry and fish populations; identify risks and vulnerabilities from current or future climate change for both targeted and associated species	Species, varieties, breeds and populations at risk identified for targeted and associated species
Collect scientific and traditional knowledge relevant to adaptation and use of species, varieties, breeds and populations	Current and potential use in adaptation identified
Develop or agree on standard methods for the identification, selection and use of potentially valuable material of targeted and associated species, populations, varieties and breeds in context of climate change	Standard methods defined and in use
Develop and implement <i>ex situ</i> conservation plans for targeted and associated species, populations, varieties and breeds (including wild relatives) and strengthen information systems to respond to needs of climate change adaptation options	Species, populations, varieties and breeds conserved <i>ex situ</i> and information on <i>ex situ</i> conserved material available
Strengthen passport data contained in <i>ex situ</i> collections by improving eco-geographic characterization and characters relevant to adaptation	Eco-geographic and other characteristics relevant to adaptation to climate change available for <i>ex situ</i> conserved materials

Indicative activities	Indicative outputs
i) Conservation (<i>cont.</i>)	
Develop and implement <i>in situ</i> conservation plans for targeted and associated species, populations, varieties and breeds (including wild relatives)	Species, varieties, breeds and populations conserved <i>in situ</i>
Identify agro-ecological systems that incorporate high levels of biological diversity and develop and implement mechanisms to maintain them	Priority agro-ecological systems where GRFA are likely to continue to evolve in response to climate change identified and supported (e.g. Global Important Agricultural Heritage Systems sites)
Establish monitoring programmes at national, sub-national and community levels to assess levels of risk and vulnerability of targeted and associated species, populations, varieties and breeds and to measure the effectiveness of the conservation measures put in place	Ongoing information on risks and vulnerability
ii) Improve production system adaptability and resilience	
Identify and strengthen community institutions related to management of GRFA; strengthen involvement of local communities in adaptation planning with emphasis on involvement of women and support for use of traditional knowledge	Stakeholders of adaptation actions identified at local level; Increased adoption of adaptation actions at local level; increased involvement of women; Mainstreamed participatory monitoring of climate change impacts and evaluation of potentially adapted crops, livestock, fish, trees, bio-control agents; Community access to technologies: to monitor climate change and impacts; and to identify, enhance and use GRFA useful for adaptation measures
Develop policies and increase investments to support the identification, availability and use of adapted GRFA and of increased diversity	Direct and indirect support for the development and use of biodiversity in agricultural production at farm and landscape levels; Investments in research and development; Reforms to access and benefit sharing, quality control, marketing, insurance regulations, etc., to support availability and use of GRFA diversity

Indicative activities	Indicative outputs
ii) Improve production system adaptability and resilience (<i>cont.</i>)	
Create or strengthen links between local, national and international organizations involved in adaptation planning and implementation using GRFA	Improved partnerships between community organizations and specialist organizations addressing climate change and agriculture issues
Identify and put in place measures to support diversification of production systems at landscape, village or community and farm levels. Actions can include support for: • agroforestry and enhanced use of perennial species; • introduction of new crops; • introduction of new animal species and breeds; • mixed plantings in forestry; • maintenance of mixed populations and introduction of new materials in fisheries.	Measures identified and in place aiming at improved adaptability, sustainability and resilience in production systems; Improved livelihood options for producers
Support the protection and restoration of diverse production systems with the aim to reduce vulnerability and enhance resilience. Actions can include support for: • increased use of traditional varieties and breeds; • agroforestry and maintenance of traditional forestry areas; • traditional fisheries management practices.	Measures to support and maintain ecosystem functions and services identified and implemented
Support adoption of improved soil management practices based on improved management and use of soil organisms e.g. through no till practices, conservation agriculture and other relevant soil management techniques	Practices for improved provision of ecosystem services especially soil properties implemented
Assess effectiveness of provision of pollination services, identify risks and vulnerabilities with respect to climate change and implement measures to maintain or improve pollination e.g. support for bee keeping, provision of materials	Production of pollination dependent species maintained or enhanced; Local income-generation opportunities created

Indicative activities	Indicative outputs
ii) Improve production system adaptability and resilience (cont.)	
Support increased contribution of GRFA to water management (quality and quantity) at landscape, village or community and farm scales through support for appropriate fish resources management, riparian corridors, appropriate management of aquatic plants etc.	Measures put in place for improved quality and quantity of water
Support research on use of GRFA to improve adaptability and resilience; Review, use and improve relevant technologies	Knowledge on GRFA contribution to adaptability and resilience enhanced
Strengthen innovation pathways through improved capacity and accessibility	Response to climate change enhanced
iii) Improve specific adaptation of crops, domestic animals, forest tree and aquatic species	
Identify major threats to crop and animal production	Main climate change related threats to crop and animal production identified
Identify adapted country GRFA or with potential for adaptation to threats for major crops, animals, tree and fish species through evaluation and characterization	GRFA identified for breeding or introduction programmes
Develop and implement crop, animal, tree or fish species improvement programmes to provide materials adapted to climate change e.g. through: • improved tolerance of abiotic stresses; • increased capacity to cope with variability production systems; • adaptation to changing production conditions and practices Programmes should favor maintenance of a broad genetic base and include specific useful traits for climate change adaptation Programmes should also include participatory breeding initiatives	Increased availability of breeds, varieties or populations adapted to changed conditions

Indicative activities	Indicative outputs
iii) Improve specific adaptation of crops, domestic animals, forest tree and aquatic species (<i>cont'd</i>)	
Identify, test and develop potential new crops or currently minor and neglected crops, animals, forestry or fish species with climate change adaptation potential	Increased range of useful materials available for production systems that can support diversification, livelihood improvement, adaptability and resilience
Provide long-term support for evaluation and use of wild relatives	Increased diversity available to breeding programmes
Support community programmes for the reintroduction, maintenance and improvement of traditional varieties and locally adapted breeds	Improved community ability to cope with climate change; Improved conservation and use of traditional varieties and locally adapted breeds; Adaptability, sustainability and resilience of production systems improved
Improve the connection between the enhancers/improvers and the users of GRFA, by supporting extension services and/or other mechanisms for the exchange of information and technologies	Improved awareness of needs of users and improved response to those needs; Increased mainstreaming of adapted materials and of appropriate technologies
iv) Availability and accessibility	
Put in place appropriate mechanisms to facilitate access and benefit sharing, in agreement with existing national and international legislation	Appropriate mechanisms for access and benefit sharing in place;
Establish and support community conservation and sharing systems and practices	Local communities have direct access to adapted materials
Improve GRFA information systems and access to them	Identification of potentially useful GRFA facilitated
Improve within and between country methods for cooperation to identify, enhance and use GRFA for adaptation, including through transfers of GRFA, information sharing and transfers of related technologies	Availability of potentially useful GRFA and relevant information improved

Indicative activities	Indicative outputs
v) Supporting actions	
Develop continuing stakeholder involvement programmes and increase participation of all relevant agencies, organizations, societies, civil society groups, communities and producers including women at all levels	Strengthened involvement of all actors in adaptation actions
Create linkages between genetic resources databases and climate change scenarios to improve identification of potentially vulnerable or useful species, populations, varieties and breeds	Identification of potentially vulnerable or useful GRFA improved
Engage with and inform policy makers on the importance of GRFA in adaptation	Increased recognition of importance of GRFA at policy level
Undertake public awareness actions to improve understanding by society of the importance of GRFA to climate change adaptation; specifically engage with major civil society organizations (church, trade unions, etc.) and the private sector involved in food production	Increased recognition of importance of GRFA at national level
Support training, extension, exchange programmes, farmers' schools and other activities aiming to strengthen the capacity of GRFA workers and rural communities on implementing adaptation plans and actions	GRFA workers able to undertake effective adaptation implementation activities
Identify and mobilize resources and finance	Implementation measures adequately supported



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The *Voluntary Guidelines to Support the Integration of Genetic Diversity into National Climate Change Adaptation Planning* (Guidelines), prepared under the guidance of the Commission on Genetic Resources for Food and Agriculture and approved by the Thirty-ninth Session of the FAO Conference in 2015, address the genetic resources dimension of adaptation planning.

The Guidelines take into account the characteristics of different genetic resources for food and agriculture, which face different challenges and opportunities in respect to climate change. The objectives of the guidelines are to promote the use of genetic resources for food and agriculture in climate change adaptation and support their integration into national climate change adaptation planning; to support genetic resources experts and those involved in climate change adaptation to identify and address the challenges and opportunities of genetic resources for food and agriculture in adaptation; and to promote the involvement of genetic resources stakeholders in the national climate change adaptation planning process.

The Guidelines follow the structure and approach of the technical guidelines for the National Adaptation Plan process prepared by the Least Developed Countries Expert Group of the United Nations Framework Convention on Climate Change. The process involves four main elements in each of which a number of steps are proposed.

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