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COMMISSION ON GENETIC RESOURCES FOR FOOD AND AGRICULTURE

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INTERGOVERNMENTAL TECHNICAL WORKING GROUP ON FOREST GENETIC RESOURCES

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DRAFT GUIDELINES TO SUPPORT THE INTEGRATION OF GENETIC DIVERSITY INTO NATIONAL CLIMATE CHANGE ADAPTATION PLANNING

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ABBREVIATIONS AND ACRONYMS

CGIAR	Consultative Group on International Agricultural Research
CGRFA	Commission on Genetic Resources for Food and Agriculture
DAD-IS	Domestic Animal Diversity Information System
GPA	Global Plan of Action
GRFA	Genetic resources for
NAP	National Adaptation Plan
REFORGEN	Worldwide Information System on Forest Genetic Resources
SWOT	strengths, weaknesses, opportunities and threats
UNFCCC	United Nations Framework Convention on Climate Change
WIEWS	World Information and Early Warning System on Plant Genetic Resources for Food and Agriculture

I. INTRODUCTION

1. 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. Climate change influences the extent and distribution of genetic resources for food and agriculture (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.

2. The FAO Commission on Genetic Resources for Food and Agriculture (the Commission), at its Fourteenth Regular Session in April 2013, reaffirmed the importance of GRFA for coping with climate change and the need for raising awareness of their potential roles. At the same Session, the Commission adopted its Programme of Work on Climate Change and Genetic Resources for Food and Agriculture[1] and agreed on the development of guidelines for the integration of genetic diversity considerations into climate change adaptation planning.

II. PURPOSE OF THE GUIDELINES

3. The aim of the guidelines contained in this document is to strengthen the contribution of the conservation and use of GRFA (plant, forest, animal, aquatic, micro-organism and invertebrate) to adaptation[2] to climate change.

4. The approach presented seeks to ensure the relevance of GRFA to the overall national adaptation planning process in a country, to identify clear goals for conservation and use of GRFA as part of national adaptation to climate change, and to ensure 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.

5. The guidelines support countries to take account of the characteristics of different GRFA that are presented with different challenges and opportunities in respect to climate change. However, the guidelines also encourage to take account of the interconnected and cross-cutting nature of many of the aspects of conservation and use of GRFA, and of the benefits of adopting an integrated approach to secure the fullest benefits of GRFA in national adaptation.

6. The guidelines build on, *inter alia*, previous work by the Commission on climate change, such as Background Study Papers[3], information obtained through a global survey[4], and a workshop organized in

[1] CGRFA-14/13/Report Appendix D. For information see: www.fao.org/nr/cgrfa/cross-sectorial/climate-change

[2] *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.*
Definition as in UNFCCC NAP Technical Guidelines, p. 13:
http://unfccc.int/files/adaptation/cancun_adaptation_framework/national_adaptation_plans/application/pdf/naptechguidelines_eng_low_res.pdf

April 2014, at FAO Headquarters in Rome, Italy. The guidelines also take account of the Global Plans of Action (GPAs) for plant, animal and forest genetic resources[5] and of relevant documents covering aquatic genetic resources[6].

7. Many countries will have already embarked on the development of plans to support the contribution of the conservation and use of GRFA to adaptation. These plans will often be linked to other national adaptation planning processes. The guidelines aim to complement these processes and present an overall description of the activities that will need to be undertaken to secure the maintenance and use of GRFA in supporting national adaptation to climate change.

8. Within the United Nation Framework Convention on Climate Change (UNFCCC), the preparation of National Adaptation Programme of Action has enabled least developed countries to identify and address urgent and immediate priorities with respect to adaptation to climate change. To complement the short-term planning, the 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[7]; and (b) to facilitate the integration of climate change adaptation into relevant new and existing policies, programmes and activities.

9. The UNFCCC Least Developed Countries Expert Group prepared technical guidelines[8] which provide an overall approach that can be used by countries to identify and implement the adaptation measures that help respond to the effects of climate change. The guidelines presented in this document follow a similar approach and can therefore complement the NAP process, addressing the genetic resources dimension of adaptation planning.

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[3] FAO CGRFA Background Study Papers No. 53, 54, 55, 56, 60; http://www.fao.org/nr/cgrfa/cgrfa-back
FAO CGRFA Thematic Background Study – Climate change and its effect on conservation and use of plant genetic resources for food and agriculture and associated biodiversity for food security.

[4] FAO CGRFA Forthcoming. Survey on "Lessons learned about the ways and means to conserve and use genetic diversity to build resilience to climate change in food and agriculture systems"; conducted August/September 2013.

[5] FAO CGRFA 2013. Global Plan of Action for Forest Genetic Resources: Appendix F in CGRFA-14 Report www.fao.org/docrep/meeting/028/mg538e.pdf;
FAO CGRFA 2009. Second Global Plan of Action for Plant Genetic Resources for Food and Agriculture: www.fao.org/docrep/015/i2624e/i2624e00.htm;
FAO CGRFA 2007. Global Plan of Action for Animal Genetic Resources: ftp://ftp.fao.org/docrep/fao/010/a1404e/a1404e00.pdf

[6] FAO Code of Conduct for Responsible Fisheries: http://www.fao.org/docrep/005/v9878e/v9878e00.htm.
FAO Technical Guidelines for Responsible Fisheries; Volume 5; Supplement 3; Aquaculture development; Genetic resource management: http://www.fao.org/docrep/011/i0283e/i0283e00.htm

[7] *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.*
Definitions as in UNFCCC 2012. NAP Technical Guidelines, p. 13.

[8] UNFCCC 2012. NAP Technical Guidelines: http://unfccc.int/files/adaptation/cancun_adaptation_framework/national_adaptation_plans/application/pdf/naptechguidelines_eng_low_res.pdf

III. GENETIC RESOURCES AND CLIMATE CHANGE ADAPTATION

10. The Fifth Assessment Report of the Intergovernmental Panel on Climate Change[9] stressed that climate change is already having an impact on all aspects of food security and that the pace of adaptation will need to speed up. 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. GRFA are also at risk from climate change. Some varieties, breeds and populations may no longer be able to adapt to the changed environments and additional conservation efforts are required. At the same time, the changing environments of production systems around the world require new and different species, varieties, breeds and populations that are adapted to the new conditions. GRFA are therefore central to meeting the challenges of climate change in agriculture, forestry and fisheries. Securing the maintenance and enhancing the use of GRFA are essential to achieving food security, improved livelihoods and other national development goals in an era of changing climates and production conditions.

11. GRFA will need to meet a wide range of different challenges. Increased tolerance of abiotic stresses (e.g. heat, drought, flooding, frost, rising water temperatures) and resistance to new and emerging pest and diseases (whose distribution patterns are changing as temperature and rainfall patterns change) are becoming increasingly important to food and agriculture production. Production systems also need to cope with greater variability in climates, and crop varieties, animal breeds and forestry or fish populations are required with improved adaptability or resilience. Climate change is an ongoing process and GRFA will have to be continuously mobilized to meet new challenges as conditions change over coming decades, making improved access to GRFA especially important. Resilience, adaptability and evolutionary capacity will become essential to maintaining and improving production and are likely to require increased diversity in production systems and to be accompanied with diversification of crop, animal, forestry or fish production systems. GRFA will also be needed to provide materials that are adapted to new production techniques, which are introduced as part of the climate change adaptation process.

12. Securing the contribution of GRFA to climate change adaptation involves:

i. Securing the maintenance of GRFA for the long term;
ii. Supporting their availability so that they continue to provide the necessary resource base for adaptation; and
iii. Facilitating their continuing use through the role they play in contributing to food security and nutrition, rural livelihoods, ecosystem services, sustainability and resilience.

13. The Commission has negotiated GPAs for plants, animals and forest genetic resources. Those identify priority areas for the conservation and sustainable use of genetic resources and provide a variety of activities that strengthen the conservation and use of genetic resources in support to climate change adaptation. The implementation of the GPAs at national level provides an important basis for strengthening the contribution of GRFA to adaptation (see Appendix 1). While a GPA has not yet been developed for aquatic genetic resources a similar approach has been taken in other agreed instruments such as the FAO Code of Conduct for Responsible Fisheries[10].

[9] Intergovernmental Panel on Climate Change 2014. Fifth Assessment Report: http://www.ipcc.ch/
[10] FAO Code of Conduct for Responsible Fisheries: http://www.fao.org/docrep/005/v9878e/v9878e00.htm

IV. OBJECTIVES, PRINCIPLES, ELEMENTS AND STEPS OF THE GUIDELINES

OBJECTIVES

14. The objectives of the guidelines are:
   i. 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;
   ii. To support the genetic resources community 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
   iii. To support the participation of genetic resources stakeholders in the national climate change adaptation planning process.

PRINCIPLES

15. The process of integrating genetic diversity into national climate change adaptation planning, in accordance with the principles for the NAP process[11]:
   i. Is not prescriptive. The guidelines 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 within their countries. 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.

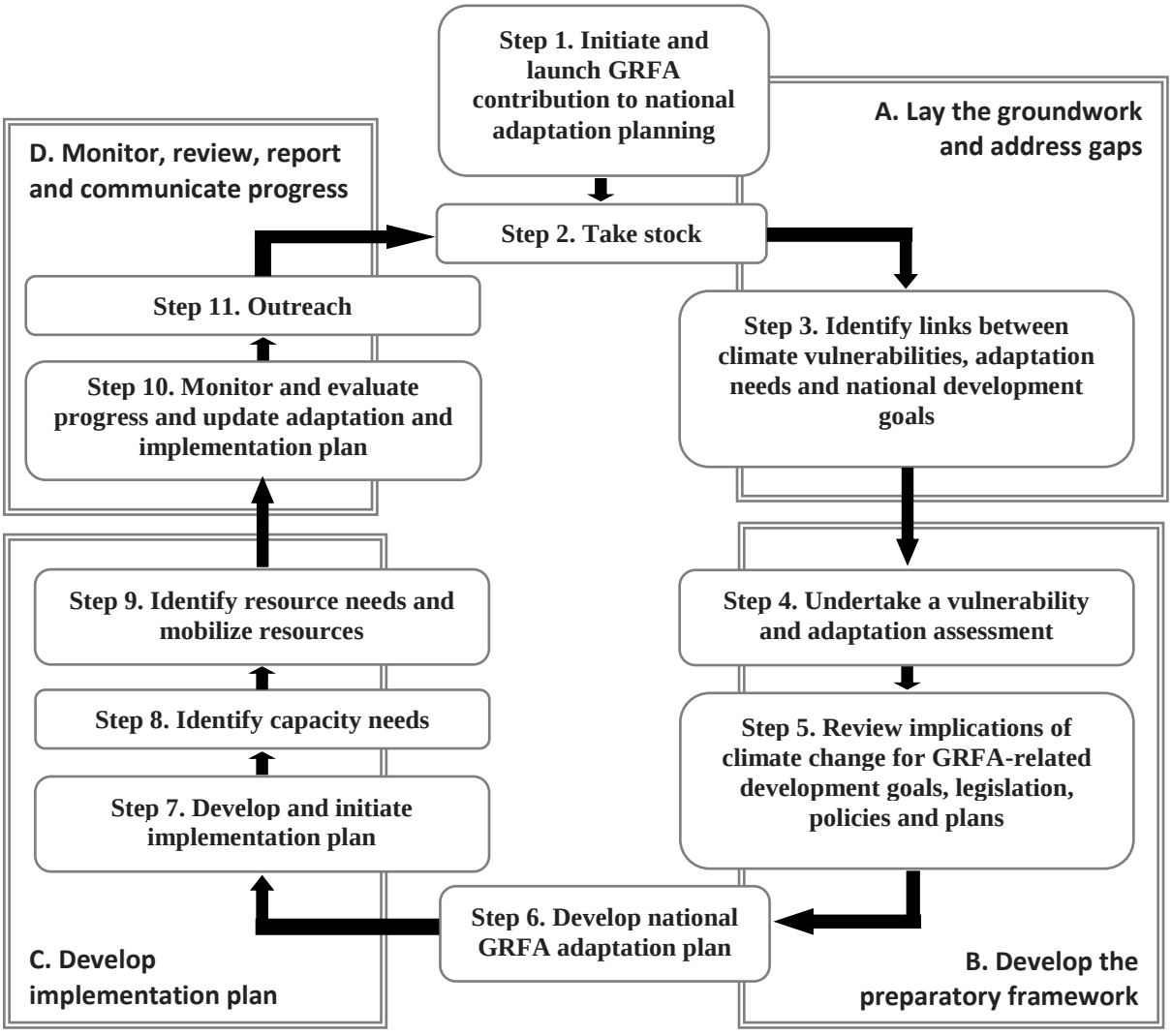
16. The process should also seek to:
   i. Integrate adaptation to climate change into sector national planning processes, strategies and monitoring processes;
   ii. Adopt an inclusive approach that ensures the full participation of the many stakeholders involved in the conservation and use of GRFA. 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 account of existing national efforts in the relevant sectors, build on national efforts to implement agreed GPAs and maximize synergies across 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.

[11] UNFCCC NAP Technical Guidelines, p. 16

ELEMENTS AND STEPS

17. To facilitate direct linkages between the integration of GRFA in national adaptation planning and the NAP process, the elements and steps proposed follow the general structure and approach of the NAP Technical Guidelines, with some modifications that reflect the nature of GRFA conservation and use (see Table 2 of Appendix 2 for a comparison of both guidelines). Within each of the four elements (A. Lay the groundwork and address gaps; B. Develop the preparatory framework; C. Develop implementation plan; and D. Monitor, review, report and communicate progress) a number of steps are proposed. The elements and steps are described in the following sections and an overview, which includes selected indicative activities to achieve each step, is presented in Table 1 of Appendix 2. They should be seen as 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 into national adaptation planning



Element A. Lay the groundwork and address gaps

18. The guidelines seek to ensure that GRFA adaptation measures form an integrated part of national adaptation planning, coordinated with agricultural, environmental and other relevant adaptation strategies and plans and contributing fully to national development objectives. 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.

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

19. This step will include identifying the arrangements that have been made in the country to develop and implement its NAP and the different institutions that are involved. It will also involve engaging with these institutions and with the planners involved, and establishing long-term arrangements that can ensure that GRFA are included in the planning process.

20. The following activities should be undertaken:

i. Initiate or strengthen collaboration between 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 will support the inclusion of GRFA in the NAP development process;
vi. Identify and seek to establish institutional arrangements that can help with coordination, implementation and mainstreaming of GRFA in national adaptation planning;
vii. Develop institutional arrangements that can ensure that NAPs are reflected in all relevant GRFA plans and strategies.

21. The process of ensuring the inclusion of GRFA in national adaptation planning will require an analysis at national level of the contribution of GRFA to adaptation and to achieving wider development goals. An integrated approach that brings together genetic resources 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 account of the different characteristics of sector genetic resources and the institutions involved in their conservation and use. The approach adopted can build on existing GPAs 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.

22. The institutional arrangements established will need to support the following activities:

A. Coordination

The arrangements need to ensure that there are effective linkages between different organizations, agencies and ministries and sectors. This is particularly important (and challenging) because GRFA sectors are often covered by different ministries (e.g. responsible for terrestrial agriculture, inland fisheries, coastal and marine fisheries, aquaculture and forestry) and organizations that may have no links or traditions of collaboration.

B. Analysis

An important ongoing activity will be the analysis of the likely effects of climate change, assessment of vulnerability and risk and identification of adaptation options. Both sector specific

and inter-sectoral approaches will be needed to ensure that interactions, trade-offs and synergies are identified and that costs and benefits of different options properly evaluated.

C. Implementation
The institutional arrangements need to support the various aspects of implementation and implementation arrangements need to be included in the planning process. Although implementation plans may be developed at the highest level, the actions will be undertaken by a diversity of actors at national, regional and local levels.

D. Capacity development
Adaptation is an ongoing process and new adaptation measures are likely to be needed as climate changes. The development of a continuing capacity to meet changing conditions is therefore as important as the identification of a specific adaptation measure.

E. Integration and mainstreaming
There are two dimensions to mainstreaming. On the one hand arrangements need to support the integration of GRFA into climate change adaptation programmes. On the other hand GRFA climate change adaptation activities need to be mainstreamed into the agricultural, environmental and other programmes in a country. The established institutional arrangements need to support both dimensions.

F. Communication
A communication strategy will provide effective communication with different stakeholders and reflect their concerns and interests. A major target group will be rural communities including farmers, pastoralists, fishers and forest dwellers and their organizations. The communication strategy should support two-way communication and ensure that experiences on adaptation measures and their effectiveness are shared. The strategy should also be used to increase the visibility of GRFA and to help ensure adequate information exchange with different interest groups (e.g. agriculture, environment and health agencies).

Step 2. Take stock

23. An important step in the process of integrating GRFA into national adaptation planning and developing a GRFA adaptation plan is a full analysis of the current situation with respect to climate change and the conservation and use of GRFA. This should include assessment of the following:

i. Status of different genetic resources sectors and associated biodiversity for food and agriculture, including current patterns of GRFA use;
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 Targets.

24. National reports prepared for the global assessments[12] of the state of the world's plant, animal and forest genetic resources are likely to be a major source of information, together with existing information

[12] FAO CGRFA: http://www.fao.org/nr/cgrfa/cgrfa-global/cgrfa-globass/en/

systems such as World Information and Early Warning System (WIEWS)[13] on plant GRFA, Domestic Animal Diversity Information System (DAD-IS)[14] and the Worldwide Information System on Forest Genetic Resources (REFORGEN)[15]. The GPAs will also constitute an essential element distilling past information and experience. Information on climate change vulnerability will come from international and national 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.

25. The process of taking stock will involve an analysis of strengths, weaknesses, opportunities and threats (SWOT) that will inform and strengthen the framework developed under Step 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 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 genetic resources sectors. The compilation and analysis of information needed to undertake the SWOT will involve stakeholders from all sectors and from a range of different institutions and organizations. It will include organizations representing farmers, pastoralists, fisherfolk and forest dwellers but also other sections of civil society, the private sector, scientists and those professionally involved in agriculture, fisheries and forestry. The SWOT process should provide opportunities for these different groups to remain engaged and to provide inputs based on their different experiences.

26. The SWOT process should result in the identification of key actions that will be needed to support the implementation of the guidelines. These should include building institutional and technical capacity to participate in the process, developing improved collaborative arrangements between sectors and developing a communication strategy that will respond to the needs of different sectors and stakeholders. An important concern should be the development of public awareness components of the communication strategy.

Step 3. Identify links between climate vulnerabilities, adaptation needs and national development goals

27. The stock-taking process and the SWOT analysis provide a basis for ensuring that the adaptation measures identified for GRFA take adequate account of national development goals. Relevant national 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 the use of GRFA identified and described. The potential contributions of GRFA should also be placed in the framework of national adaptation planning and the NAP. The synergies and opportunities that exist with respect to the contribution of GRFA should be placed in the national context and take account of the specific challenges faced by individual countries.

28. An important part of this step will be that of increasing awareness of policy makers. Thus, this step should include the preparation of policy relevant materials and the identification of relevant policies that exist or will be needed. The GPAs 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.

[13] WIEWS: http://apps3.fao.org/wiews/wiews.jsp
[14] DAD-IS: http://dad.fao.org/
[15] REFORGEN: http://foris.fao.org/reforgen/

Element B. Develop the preparatory framework

29. Essential steps in the process of strengthening the contribution of the conservation and use of GRFA to adaptation to climate change include conducting a comprehensive vulnerability and adaptation assessment for GRFA, reviewing the implications of climate change for food, agricultural and environmental development goals, and developing a national adaptation plan for GRFA conservation and use. The objective of this element is to ensure that there is appropriate knowledge of risks and threats, and of adaptation options to ensure an effective contribution of GRFA to national adaptation planning.

Step 4. Undertake a vulnerability and adaptation assessment

30. This step involves analyzing current and future climate change scenarios, assessing climate risks and vulnerabilities and identifying adaptation options from the perspective of conservation and use of GRFA. It should be based on the best available information from national and international sources and take account of current research findings. Many countries will already have undertaken assessments in relation to the effect of climate change on agriculture, fisheries and forestry but few are comprehensive or specifically address genetic resources perspectives. Still fewer deal with genetic resources in a way that integrates information from the different sectors and includes associated biodiversity. The technical aspects of the assessment will require involvement of national research institutions and universities and should also include expertise that cuts across sectors and can reflect 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 facilitated. A summary list of the different steps that might be involved in conducting the assessment is set out in Figure 2. These steps include: 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 adaptations options; and, establishing processes for monitoring and managing GRFA related risks.

31. The assessment of vulnerability and adaptation should take account of the different but often inter-related aspects of both conservation and use of GRFA. At-risk genetic resources that are not conserved, e.g. genetic resources no more actively used, cease to be available for use, limiting the availability of certain adaptation options. Risk and vulnerability assessment should consider risks to GRFA themselves, to their availability or use in agriculture, to the maintenance of key traits and to associated knowledge (particularly traditional knowledge). Considering the links between conservation and use is as important in the assessment process as identifying the ways in which specific vulnerabilities or adaptation options impact on either conservation or use.

32. In many cases information will be lacking with respect to the threats to particular resources or their potential for adaptation. The process adopted should take account of this, using whatever information is available, identifying major information gaps that need urgent attention and creating a framework that can allow for new information to be used as it becomes available. The ways in which existing national information management systems might be adapted for this purpose should be explored. The methods used should be chosen to allow for updating. The different sectors may well have developed different methods to assess risk and vulnerability that reflect the nature of the resources concerned and this should be taken into account in developing the analysis and formulating the main conclusions of the assessment. Where possible methods that have been widely tested and may help cross-cutting or inter-sectoral analysis should be used.

33. Risk and vulnerability assessment should, as far as possible, take account of the inter-connected 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.

34. Climate-smart agriculture, fisheries and forestry provide an important entry point for the identification of adaptation options. Many of the options[16] involve the use of genetic resources and the assessment of vulnerability and adaptation will benefit from taking account of these. Examples include the increased use of agroforestry, the development of silvo-pastoral systems and the development of improved aquaculture practices using improved fish species populations. All these approaches presuppose the maintenance and availability of the genetic resources required to deploy climate smart approaches.

35. Much of the work on climate change scenarios has been concerned with changes at global or regional scales. At the same time, there is increasing evidence of the need to assess the consequences of climate change at more local levels. The different agro-ecological zones and production systems[17] present in a country may provide relevant and useful scales for the assessment process.

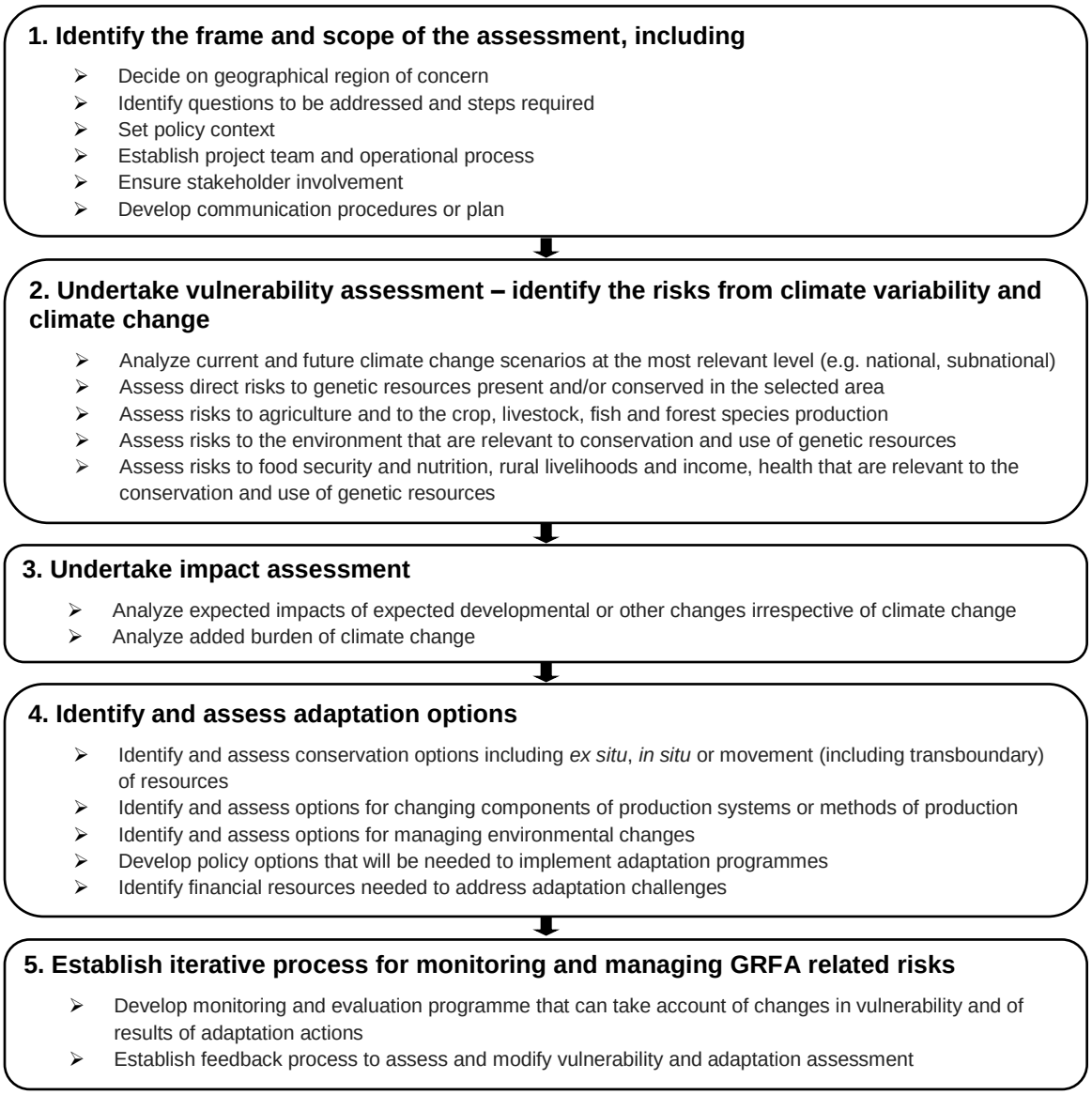
36. Traditional knowledge will also make a significant contribution to adaptation. Local practices can often constitute an important component of adaptation measures. Identification, assessment and compilation of these practices should be promoted with full participation of indigenous and local communities.

[16] FAO 2013. Climate-Smart Agriculture Sourcebook: http://www.fao.org/docrep/018/i3325e/i3325e.pdf

[17] 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)

Figure 2. Undertaking a vulnerability and adaptation assessment



37. Vulnerability and adaptation assessments will need to involve consideration of the importance and scale of vulnerability and adaptation options, both with respect to GRFA themselves and wider socio-economic perspectives. While the findings of the assessments may largely have a sectoral focus, cross-sectoral aspects should be identified and the consequences evaluated. The degree of uncertainty associated with any identified vulnerability or of the effectiveness of any adaptation option will also be important. Adaptation options need to be identified and reviewed against a set of agreed criteria to prioritize the most promising measures for implementation. In this regards, important criteria include the degree of uncertainty associated with adoption of a specific adaptation option, the risk that it may not prove to be an appropriate pathway, the costs, the realization of additional benefits, likely effectiveness and the time-frame for achieving a response (see Table 1).

Table 1. Criteria for appraising adaptation options

Criteria	Adaptation measure should
Probability of success	- have a high likelihood that it will be successful in providing adaptation to different climate change scenarios.
Risk	- involve little risk that it will result in a negative effect in the event of different change scenarios or no change.
Cost	- not bear higher costs (in social and economic terms) than costs associated with the absence of the adaptation measure.
Urgency	- be needed urgently to meet an identified risk or threat.
Time-frame	- deliver the desired result within an appropriate time-frame.
Additional benefits	- deliver additional benefits in addition to its direct contribution to adaptation.
Flexibility	- be capable of modification or alteration as circumstances change.
Feasibility	- be technically and scientifically feasible.
Acceptability	- be acceptable to society and to the communities involved.
Capacity	- be within the capacity of relevant institutions and actors.

Source: Adapted from UNFCCC NAP Technical Guidelines, pp. 74-75

38. Adaptation options involving GRFA are likely to be of two main types – those that provide adaptation to specific directional change (e.g. increased 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 a portfolio approach to address these different possibilities. Adaptation measures should be designed to improve adaptive capacity and ensure that further climate related changes can be addressed. For example, the development of breeding and selection capacity to provide varieties or breeds may be as important as the delivery of varieties or breeds with a specific adaptive trait. Appendix 1 provides examples of adaptation activities identified in the different GPAs that might be considered as possible options. The GPAs also provide a perspective on the use of GRFA that can help in the development of adaptation options.

Step 5. Review implications of climate change for GRFA-related development goals, legislation, policies and plans

39. The adaptation options identified in Step 4 will need to be reviewed in the context of existing national policies and legislation. The final stage of the assessment process will therefore include an analysis of how existing national or international policies and legislation might affect the adoption of the adaptation options identified. Questions will need to be answered as to whether, for example, current seed legislation allows the distribution of the materials needed or, whether national regulations on exchange of materials allow access to the forestry species provenances or fish populations that may be needed, while still preventing the transfer of undesirable alien and invasive species. Policies that support the adoption of climate smart production will be particularly relevant, as will those that support sustainable intensification. Given the international character of conservation and use of GRFA, trade policies should also be included in the analysis.

40. The adaptation options will also need to be placed in the context of the wider process of national adaptation planning. The analysis 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 account of the consequences for GRFA of plans with respect to e.g. energy provision, transport or water management.

Step 6. Develop national GRFA adaptation plan

41. A national adaptation plan for conservation and use of GRFA will need to be developed. The plan should take full account of the contribution of each sector and the specific actions needed to secure the contribution of GRFA to climate change adaptation by each sector. It should bring these sector contributions together and identify the benefits of an integrated approach. The plan should be placed in the context of national adaptation planning and, where relevant be part of a country's NAP. This approach should help ensure the availability of the necessary resources and relevance to national policy making. 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 account of directional climate change, variability and of extreme events.

42. 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.

43. 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 account of wider social and cultural costs and benefits as well as provide economic estimates where these are possible.

44. The plan should involve a review of:

i. Existing patterns of use of genetic resources in agriculture and environment and the specificities of agriculture, forestry, 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. Climate-smart programmes for agriculture, fisheries and forestry;
viii. Emergency preparedness and response;
ix. Monitoring, evaluation and feedback procedures.

45. The plan should also take account of:

A. The contribution of the different sectors and complementarity between them
While each GRFA sector will identify adaptation measures that are relevant to their specific resources, there will also be a need to explore complementarities, synergies and trade-offs between them 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, which 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 adaptation plan.

C. The different scales at which adaptation measures may be appropriate
Three levels of intervention have been identified – farm, village or community and landscape. Different types of adaptation reduce vulnerability and improve resilience at different scales.

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.

46. 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.

47. The plan should take full account of other relevant plans or programmes on climate change adaptation. It should be developed with full participation of those involved in broader aspects of agricultural, environmental and health adaptation planning, be fully integrated into the overall national adaptation planning process, and integrated into the country's NAP.

Element C. Develop implementation plan

48. The objective of this element is to identify the actions needed, establish the operational systems and develop the capacity required to ensure implementation. The implementation plan should be developed from the national adaptation plan, taking account of country goals and priorities as well as GRFA vulnerabilities and needs. It should take account of ongoing actions and provide a coherent framework for action.

Step 7. Develop and initiate implementation plan

49. Planned adaptation measures should preferably form an integral part of national adaptation planning. Links with other relevant adaptation actions (e.g. in support of climate-smart agriculture, fisheries and forestry) should be developed. This will improve the likelihood that resources are available to carry out the work and secure better outcomes in terms of adoption and mainstreaming of the actions identified. The implementation plan 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) and include effective coordination mechanisms that ensure continuing involvement of appropriate groups for specific measures. The implementation plan should identify priorities and establish procedures for reviewing these on an on-going basis as circumstances change.

50. While many (or most) of the measures will be undertaken within the framework of sector programmes, a country level coordination mechanism should be established to oversee and coordinate implementation, linked where appropriate, to national adaptation planning and any relevant NAP mechanisms. Since implementation will involve actions undertaken over a number of years, the

coordination mechanism should be able to oversee the process on a continuing basis. An ongoing process for monitoring implementation activities will therefore need to be developed. The results of monitoring should be used to make any appropriate modifications to the implementation plan as different measures begin to take effect and as climate changes require additional or different measures to be undertaken.

51. The implementation plan should involve activities that support the access and availability of additional genetic diversity. These activities should 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 implementation plan will need to take account of 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.

52. The measures should fit within existing national strategies and plans for implementing the GPAs and be prioritized and evaluated based on national criteria, taking account of national development goals and priorities. The measures are likely to include: improving *in situ* and *ex situ* conservation supported by 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. Supporting measures to build capacity, improve availability of materials and information and increase awareness of the value of GRFA will also need to be integrated into the implementation plan. Appendix 1 lists some of the relevant actions identified in the GPAs for animal, forest and plant genetic resources. Appendix 3 lists a selection of possible adaptation measures and indicates the outputs that can be expected from them.

Step 8. Identify capacity needs

53. Strengthening capacity to support implementation will be essential. This involves developing an improved appreciation among the genetic resources and climate change communities of the likely effects of climate change on conservation and use of GRFA and of the contributions to adaptation that GRFA can make. A multi-faceted capacity development programme will be needed tailored to the needs of different interest groups. 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
iii. Providing training to extension workers and local administrators to support measures that are part of the implementation plan.

Step 9. Identify resource needs and mobilize resources

54. Experience to date suggests that many countries face serious limitations with respect to mobilizing the resources needed to implement adaptation measures. The implementation plan should therefore include resource mobilization activities. These could include mobilizing national financial resources through, for example, the contribution made by adaptation measures to national development plans or livelihood objectives. International support is also likely to be important for many countries and may be obtained to cover the incremental cost of achieving global climate change or conservation objectives e.g. through the Global Environment Facility. 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 crowd sourcing approaches.

Element D. Monitor, review, report and communicate progress

55. 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. The objective of this element is to develop procedures to assess the effectiveness of the implementation actions. The assessment process should embed monitoring and evaluation and include elements of outreach designed to ensure that GRFA and its contributions to climate change adaptation are recognized both within countries and internationally.

Step 10. Monitor and evaluate progress and update adaptation and implementation plan

56. A set of quantifiable metrics will be needed for a satisfactory monitoring and evaluation process. These will need to be well defined with clear collection procedures, understood by all those involved and should be 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 GPA progress or those towards achieving the Aichi 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.

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

i. Monitoring the process. The importance of monitoring has been noted at various points in the guidelines (e.g. for the implementation plan). There should also be a clearly established process for monitoring the process of implementing the guidelines. This will need to be established under Element A and used to provide constant feedback on the process. It should include monitoring the extent to which GRFA related measures become part of the overall national adaptation planning and a country's NAP.

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 is fully integrated into the overall national adaptation monitoring process.

58. The indicators developed by FAO under the guidance of the Commission[18] provide a starting point for the process of developing a set appropriate to monitoring the adaptation measures adopted and can be combined with other indicators for monitoring the implementation of these guidelines.

Step 11. Outreach

59. The findings from the monitoring and review process need to be seen as part of the country's overall review process of national adaptation planning, and the progress made should be communicated to the relevant organizations involved. These include the management unit of the NAP at national level where this has been established as well as relevant ministries and 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 Element A.

[18] FAO CGRFA: http://www.fao.org/nr/cgrfa/cross-sectorial/targets-indicators

APPENDIX 1: The Global Plans of Action for animal, forest and plant genetic resources - selected actions of relevance to the implementation of the guidelines

The Commission on Genetic Resources for Food and Agriculture 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 catalyze 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*[19] 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[20]:

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;

[19] FAO CGRFA 2007. Global Plan of Action for Animal Genetic Resources: ftp://ftp.fao.org/docrep/fao/010/a1404e/a1404e00.pdf

[20] The examples are extracted from FAO CGRFA 2011 Background Study Paper 53, in which selected activities of the GPA are placed in the climate change context (http://www.fao.org/docrep/meeting/022/mb386e.pdf)

- 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*[21] 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.

[21] FAO CGRFA 2013. Global Plan of Action for Forest Genetic Resources: Appendix F in CGRFA-14 Report www.fao.org/docrep/meeting/028/mg538e.pdf

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[22] 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[23]:

- 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.

[22] FAO CGRFA 2009. Second Global Plan of Action for Plant Genetic Resources for Food and Agriculture: http://www.fao.org/agriculture/crops/core-themes/theme/seeds-pgr/gpa/en/
[23] *ibid.* paragraph 10

APPENDIX 2. Elements and steps

Table 1. Overview of proposed elements and steps to integrate genetic diversity into national adaptation planning with objectives and selected indicative activities[24]

Elements and steps	Indicative activities
A. Lay the groundwork and address gaps Objective: Develop appropriate conceptual and operational framework and identify entry points for GRFA in national adaptation planning	
Step 1. Initiate and launch GRFA contribution to national adaptation planning	– Brief policy makers and relevant agencies, institutions, partners and stakeholders – Identify coordinating mechanism – Develop agreed vision for process – Identify actors for each of the following steps
Step 2. Take stock	– Take stock of past or ongoing adaptation activities – Review status of GRFA and of institutions involved – Assess observed and expected impacts of climate change in the country and of current and expected vulnerability – Review current knowledge (including traditional knowledge and research) – Undertake SWOT analysis
Step 3. Identify links between climate vulnerabilities, adaptation needs and national development goals	– Identify links between GRFA conservation and use and national development goals – Use results of SWOT analysis to identify future activities
B. Develop the preparatory framework Objective: Ensure appropriate knowledge of risks, threats and adaptation options and develop an overall framework to ensure contribution of GRFA conservation and use to national adaptation planning	
Step 4. Undertake a vulnerability and adaptation assessment	– Assess vulnerability and risks to GRFA using available climate change scenarios – Identify possible adaptation measures – Undertake stakeholder review of findings and options
Step 5. Review implications of climate change for GRFA-related development goals, legislation, policies and plans	– Review development plans and policies – Review current legislation and policies relevant to GRFA and adaptation
Step 6. Develop national GRFA adaptation plan	– Draft national GRFA adaptation plan – Hold consultation meetings with stakeholders – Present plan to policy makers

[24] The indicative activities are not intended to be a comprehensive list but to indicate the kinds of activities that might be undertaken to achieve each step.

Elements and steps	Indicative activities
C. Develop implementation plan Objective: Identify actions needed, establish operational systems and develop capacity to ensure their implementation	
Step 7. Develop and initiate implementation plan	– Agree overall management, oversight and coordination procedures – Identify actions needed to implement plan and responsible institutions – Set out time lines and expected outputs from implementation activities – Establish participatory stakeholder involvement process
Step 8. Identify capacity needs	– Identify capacity needs for different GRFA sectors and areas of operation – Develop national training plan
Step 9. Identify resource needs and mobilize resources	– Develop resource mobilization plan and identify and access sources of finance
D. Monitor, review, report and communicate progress Objective: Assess the effectiveness of implementation actions in the context of the adaptation plan and communicate findings	
Step 10. Monitor and evaluate progress and update adaptation and implementation plan	– Establish monitoring procedures for metrics and assign monitoring responsibilities – Review and evaluate progress and provide assessments to relevant authorities and stakeholder groups – Amend adaptation and implementation plans as needed
Step 11. Outreach	– Provide information to policy makers, stakeholders and to wider public – Provide inputs to relevant international processes

Table 2. Comparison of elements and steps proposed by the NAP Technical Guidelines and the guidelines for the integration of genetic diversity into national adaptation planning

Elements and steps of NAP Technical Guidelines	Elements and steps of guidelines for the integration of genetic diversity into national adaptation planning
A. Laying the groundwork and addressing gaps	A. Lay the groundwork and address gaps
A.1. Initiating and launching the NAP process	Step 1. Initiate and launch GRFA contribution to national adaptation planning
A.2. Stocktaking: identifying available information on climate change impacts, vulnerability and adaptation and assessing gaps and needs of the enabling environment for the NAP process	Step 2. Take stock
A.3. Addressing capacity gaps and weaknesses in undertaking the NAP process	
A.4. Comprehensively and iteratively assessing development needs and climate vulnerabilities	Step 3. Identify links between climate vulnerabilities, adaptation needs and national development goals
B. Preparatory Elements	B. Develop the preparatory framework
B.1. Analyzing current climate and future climate change scenarios	Step 4. Undertake a vulnerability and adaptation assessment
B.2. Assessing climate vulnerabilities and identifying adaptation options at the sector, subnational, national and other appropriate levels	Step 5. Review implications of climate change for GRFA-related development goals, legislation, policies and plans
B.3. Reviewing and appraising adaptation options	
B.4. Compiling and communicating national adaptation plans	Step 6. Develop national GRFA adaptation plan
B.5. Integrating climate change adaptation into national and subnational development and sectoral planning	
C. Implementation Strategy	C. Develop implementation plan
C.1. Prioritizing climate change adaptation in national planning	Step 7. Develop and initiate implementation plan
C.2. Developing a (long-term) national adaptation implementation strategy	
C.3. Enhancing capacity for planning and implementing adaptation	Step 8. Identify capacity needs
	Step 9. Identify resource needs and mobilize resources (Note: in NAP Technical Guidelines considered in A.1 and C.2)
C.4. Promoting coordination and synergy at the regional level and with other multilateral environmental agreements	(Note: considered in Step 7)
D. Reporting, Monitoring and Review	D. Monitor, review, report & communicate progress
D.1. Monitoring the NAP process	Step 10. Monitor and evaluate progress and update adaptation and implementation plan
D.2. Reviewing the NAP process to assess progress, effectiveness and gaps	
D.3. Iteratively updating the national adaptation plans	
D.4. Outreach on the NAP process and reporting on progress and effectiveness	Step 11. Outreach

APPENDIX 3: Indicative activities for considerations in implementation plan

Table1. Indicative activities for considerations in implementation plan by area of intervention

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 *ex situ* conservation plans for targeted and associated species, populations, varieties and breeds (including wild relatives)	Species, populations, varieties and breeds conserved *ex situ*
Develop and implement *in situ* conservation plans for targeted and associated species, populations, varieties and breeds (including wild relatives)	Species, varieties, breeds and populations conserved *in situ*
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. GIAHS 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

Indicative activities	Indicative outputs
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
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
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
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

Indicative activities	Indicative outputs
ii) Improve production system adaptability and resilience (cont.d)	
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
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 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 favour 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 (cont.d)	
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	
Ratify and implement the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity, the International Treaty for Plant Genetic Resources for Food and Agriculture, and develop other relevant protocols supporting access and movement of GRFA, in agreement with existing national and international legislation	Procedures for access and benefit sharing in place; Increased access to Annex 1 crop genetic resources
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