Updating the *Global Plan of Action for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture*

Working Document prepared by the Plant Production and Protection Division of FAO for the Regional Consultations on the Update of *Global Plan of Action for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture*

Introduction

Since 1996, the *Global Plan of Action for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture* (*Global Plan of Action*) has provided a coherent framework for the conservation and sustainable utilization of PGRFA, including institutional strengthening and capacity-building. As a strategic framework, the *Global Plan of Action* needs to be periodically reviewed and updated as necessary to ensure that it continues to best serve country needs.

At its Twelfth Regular Session, the Commission on Genetic Resources for Food and Agriculture requested FAO to prepare the updated *Global Plan of Action* based primarily on the *Second Report on the State of the World's Plant Genetic Resources for Food and Agriculture* (*Second Report)*, and in particular, on the identified gaps and needs, taking into account further contributions from Governments, as well as inputs received from regional meetings and consultations. It decided that the updated *Global Plan of Action* would be considered at its Thirteenth Regular Session to be held in 2011.

This document presents the 20 priority activity areas of the *Global Plan of Action* adopted in 1996 and contains, in addition, those sections of the *Second Report* which identify gaps and needs, as well as those summarizing changes since the *First Report on the State of the World's Plant Genetic Resources for Food and Agriculture*, and in some cases text other than from the above mentioned two sections. The sections from the *Second Report* appear where relevant and appropriate; some of them appear in more than one place; they are all presented with a grey background. Gaps and needs from the *Second Report* are marked with "➢", while changes are marked with "⇮"; the location in the *Second Report* is indicated for each of them (e.g. SOW-2 page 44 bullet 10).

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1. Surveying and inventorying plant genetic resources for food and agriculture

14. **Assessment:** Rational conservation (both in situ and ex situ) ideally begins with the surveying and inventorying of existing resources. In order to elaborate policies and strategies for the conservation and utilization of plant genetic resources for food and agriculture, national programmes need to know what resources exist in their countries. Countries that have ratified the Convention on Biological Diversity have acknowledged certain needs and responsibilities concerning this subject. Country Reports indicate that little systematic work has been done in this regard for many crops and their wild relatives.

- A large number of surveys and inventories of PGRFA have been conducted (SOW-2 p.43 b.1);
- A number of new tools, especially in the area of molecular genetics, have become available and training materials have been developed for assessing genetic diversity on farm (SOW-2 p.43 b.7); ALSO PA-9 & PA-18
- With modern molecular genetic techniques, it has been possible to generate a large amount of data on the extent and nature of genetic erosion and vulnerability in particular crops in particular areas. The picture that is emerging is complex and it is not possible to draw clear conclusions about the magnitude and extent of these effects (SOW-2 p.17 b.5); ALSO PA-18

Since the publication of the first SoW report, most countries have carried out specific surveys and inventories, either as part of their National Biodiversity Action Plans or, more commonly, within the framework of individual projects. (SOW-2 p. 28)

Most surveys, however, have been limited to single crops, small groups of species or to limited areas within the national territory. (SOW-2 p.28)

Very little survey or inventory work has been carried out on PGRFA in protected areas compared to other components of biodiversity in these areas. (SOW-2 p.28)

Compared to the first SoW report in which only four countries reported that they had surveyed the status of CWR, the past decade has seen significant progress in this area, with CWR inventories compiled in at least 28 countries. Some also reported that specific sites for *in situ* conservation of CWR had been identified. (SOW-2 p.28)

At the regional and global level, efforts have been made by several international organizations to carry out inventories and to determine the conservation status of wild plants. (SOW-2 p.29)

While a global survey of *in situ* conservation of wild PGRFA, as well as an analysis of the country reports reveal that relatively few countries have been active in conserving PGRFA in protected areas, some progress has been made. (SOW-2 p.30)

15. **Long-term objectives:** To identify, locate, inventory, and as feasible assess any threats to those species, ecotypes, cultivars and populations of plants relevant to food and agriculture, especially those that are of anticipated use.

16. To facilitate the development of complementary conservation strategies (e.g., weighing the need and importance of collecting for ex situ conservation and/or continued conservation in situ) and national policies related to the conservation and sustainable use of plant genetic resources for food and agriculture.

17. **Intermediate objectives:** To develop useful methodologies for surveying and inventorying plant genetic resources for food and agriculture.

18. **Policy/strategy:** The surveying and inventorying of plant genetic resources for food and agriculture should be considered as a step in the process of conservation and of reducing the rate of loss of biodiversity. Without the capacity to conserve and/or use, however, such work may have marginal utility. Thus, surveying and inventorying should ideally be linked to specific objectives and a plan, such as one for in situ conservation, or collecting, ex situ conservation, and use.

- There is a need to promote standard definitions and means of assessing genetic vulnerability and genetic erosion, as well as to agree on more and better indicators, including `higher level indicators`, for genetic erosion and genetic vulnerability need further development and application, in order to be able to establish national, regional and global baselines for monitoring diversity and changes in it. (SOW-2 p.20 b.4) ALSO PA-2 & PA-7 & PA-18

Many country reports expressed continuing concern over the extent of genetic vulnerability and the need for a greater deployment of diversity. However, better techniques and indicators are needed for monitoring genetic diversity, for establishing baselines and monitoring trends. (SOW-2 p. xvi)

The 2010 Biodiversity Indicators Programme brings together a large number of international organisations to develop indicators relevant to the CBD, including ones for monitoring trends in genetic diversity. However, to date no really practical, informative and generally accepted indicators of genetic erosion are available and their development should be a priority. (SOW-2 p.14); ALSO PA-18

19. Local and indigenous knowledge should be recognized as important components of surveying and inventorying activities and should be properly considered in all such efforts.

20. **Capacity:** Countries should provide and may need financial and technical support to survey and inventory plant genetic resources for food and agriculture.

21. Countries should provide and may need assistance in having appropriate access to existing and planned Geographic Information System facilities and information

22. Training and capacity-building should be undertaken in areas such as taxonomy, population biology, ethnobotany, and eco-regional and agro-ecological surveying.

- Strengthened research capacity is required in many areas, and in particular in taxonomy of CWR, and conducting inventories and surveys using new molecular tools (SOW-2 p.44 b.9); ALSO PA-4 & PA-7 & PA-18 & PA-19

Many of the country reports listed major obstacles to systematic national inventorying and surveying of PGRFA. These include: lack of funding, lack of human resources, skills and knowledge, lack of coordination and unclear responsibilities, low national priority, inaccessibility of *in situ* areas, and difficulties in obtaining necessary permissions. (SOW-2 p.30)

23. **Research/technology:** Adequate support should be given to developing better methodologies for the surveying and assessment of intra- and infra-specific diversity in agroecological systems.

24. Existing information sources should be used in research to determine to what extent wild relatives of domesticated species are already in protected areas.

- Specific research needs relating to on farm management or in situ conservation of PGRFA include:

  • The need for better inventories and characterization data on land races, CWR and other useful wild species, including forages, in order to better target *in situ* conservation action; (SOW-2 p.44 b.10) ALSO PA-4 & PA-7 & PA-8 & PA-9 & PA-18

25. **Coordination/administration:** Most coordination must take place within country. Regional and global level coordination is needed to provide linkages with existing ex situ and in situ conservation efforts.

26. Strong linkages need to be established with national, regional and crop networks and with the users of plant genetic resources for food and agriculture (breeders and farmers) in order to inform, direct and prioritize the entire conservation process. Countries should collaborate in surveying and inventorying activities in order to build in-country capacity.

27. Coordination between relevant international organizations, inter alia, FAO, UNEP, UNESCO, IUCN and international agricultural research centres, should be further strengthened.

28. **This activity is closely linked with:**

- Promoting in situ conservation of wild crop relatives and wild plants for food production
- Supporting on-farm management and improvement of plant genetic resources for food and agriculture
- Supporting planned and targeted collecting of plant genetic resources for food and agriculture
- Sustaining existing *ex situ* collections
- Developing monitoring and early warning systems for loss of plant genetic resources for food and agriculture

2. Supporting on-farm management and improvement of plant genetic resources for food and agriculture

29. **Assessment:** Modern plant breeding has been remarkably successful in helping raise yields, and to improve resistance to pests and diseases and quality of food products, especially in favorable environments. Farmers choose to grow new cultivars for many reasons including market conditions, family food security and environmental sustainability. Unfortunately, these choices often result in significant on-farm genetic erosion. Still, in some countries, the overwhelming majority of farmers, as a matter of choice or necessity, engage in de facto conservation and development of plant genetic resources for food and agriculture as they select and save seed for the next planting season. These farmers typically practice low-input farming. Such farmers often lack access to new and diverse genetic materials which could be integrated into existing crops to improve production. Historically, farmer access to a broad range of germplasm in developed countries has contributed to yield increases and greater crop adaptability through farmer selection. It has also led in many cases to the rise of local seed enterprises. -

30. Without appropriate and creative approaches, prospects of markedly increasing the productivity of low-potential and low-input farms through genetic improvements alone also would appear limited.

Yet, increased productivity is important for food security and to reduce pressure on fragile environments. Neither the private sector nor public agricultural research institutions presently have the capacity of serving this large, economically disadvantaged population completely. Many governments are seeking to realize farmers' rights through national legislation, as appropriate.

31. Initiatives focusing on participatory, on-farm management and improvement of plant genetic resources for food and agriculture may offer the potential to reach large numbers of farmers and promote further agricultural development. And it would necessarily recognize the central role that rural women play in agricultural production in most developing countries. Efforts to provide farmers greater access to appropriate genetic resources and training could assist farmers in improving various characteristics of their planting materials (such as disease or pest resistance), and in increasing food production. A number of governments, research institutes, and NGOs are now engaged in projects researching and promoting on-farm management and improvement of plant genetic resources for food and agriculture. Significant technical and methodological questions remain. The capacity of these projects is limited, however, and the numbers of farmers they are reaching is relatively small. Thus, it would appear the full potential of on-farm improvement may not yet be realized.

- Scientific understanding of the on farm management of genetic diversity has increased, and this approach to the conservation and use of PGRFA has become increasingly mainstreamed within national programmes (SOW-2 p.17 b.2); ALSO PA-20

- While many countries have reported an increase in the number of *in situ* and on farm conservation activities, they have not always been well coordinated (SOW-2 p.43 b.4);

- The last decade has seen an increase in the use of participatory approaches and multi-stakeholder teams implementing on farm conservation projects (SOW-2 p.43 b.6);

- New legal mechanisms enabling farmers to market genetically diverse varieties, coupled with legislation supporting the marketing of geographically identified products have provided additional incentives for farmers to conserve and use local crop genetic diversity in a number of countries (SOW-2 p.43 b.8); ALSO PA-14

- Concerns about the potential impact of climate change have grown substantially over the past decade. Agriculture is both a source and a sink for atmospheric carbon. PGFRA are becoming recognised as being critically important for the development of farming systems that capture more carbon and emit fewer greenhouse gasses, and for underpinning the breeding of the new varieties that will be needed for agriculture to adapt to the anticipated future environmental conditions (SOW-2 p.198 b.3); ALSO PA-11

- A lack of adequate characterization and evaluation data and the capacity to generate and manage it, remain a serious constraint to the use of many germplasm collections, especially of under-utilized crops and wild relatives (SOW-2 p.116 b.8); ALSO PA-4 & PA-9 & PA-19

32. **Long-term objectives:** To better understand and improve the effectiveness of existing on-farm conservation, management, improvement, and use of plant genetic resources for food and agriculture. To achieve a better balance between ex situ and in situ conservation. To realize Farmers' Rights as defined in FAO Resolution 5/89 at the international, regional, and national levels. To promote the equitable sharing of benefits from plant genetic resources for food and agriculture as called for in the Convention on Biological Diversity. To foster the future emergence of public or private seed companies and cooperative enterprises as an outgrowth of successful on-farm selection and breeding. To encourage traditional seed exchange and supply systems.

33. **Intermediate objectives:** To gain greater knowledge about the dynamics, methodologies, effects, and potential of on-farm conservation and plant improvement. To establish or strengthen programmes and networks for on-farm management of farmer's varieties, wild relatives of food crops, harvested food plants and rangeland genetic resources. To extend the role of national, regional and international genebanks to include support for and provision of materials to on-farm improvement programmes. To build onfarm and garden programmes based on local systems of knowledge, institutions, and management, ensuring local participation in planning, management and evaluation. To focus greater public and scientific attention on the diverse roles that women play in production and resource management in rural households.

34. **Policy/strategy:** On-farm activities are a means to improve existing practices in selected communities. They are complementary to and not a substitute for more formal varietal development and seed supply systems. Institutional flexibility will be needed in working with farming communities.
No single plan or recipe is possible or advisable. Working examples must be identified of conservation and sustainable use of plant genetic resources for food and agriculture that support and maintain the social, economic and cultural values of local and indigenous communities and improve the quality of life.

35. Governments should consider how production, economic incentive, and other policies, as well as agricultural extension and research services might facilitate and encourage on-farm management and improvement of plant genetic resources for food and agriculture.
36. Where appropriate, national research systems should consider strengthening local level capacity to participate in all stages of breeding, including on-farm selection and adaptation.

37. Governments, donor agencies, international agricultural research centres, NGOs, and others should incorporate gender and socio-cultural factors into the design and implementation of agricultural research and plant genetic resources for food and agriculture activities.

- There is a need for specific strategies to be developed for conserving PGRFA *in situ* and for managing crop diversity on farm. Special attention needs to be given to conservation of CWR in their centres of origin, major centres of diversity and biodiversity hotspot areas (SOW-2 p.44 b.5); ALSO PA-4 & PA-11 & PA-15

- There is a need for more effective policies, legislation and regulations governing the *in situ* and on farm management of PGRFA, both inside and outside of protected areas (SOW-2 p.44 b.3); ALSO PA-4 & PA-15

- The involvement of local communities is essential in any *in situ* conservation or on farm management effort and traditional knowledge systems and practices need to be fully taken into account. Collaboration between all stakeholders needs to be strengthened in many countries (SOW-2 p.44 b.4); ALSO & PA-4 & PA-11 & PA-15 & PA-18 & PA-20

- There have been growing efforts to strengthen the relationship between agriculture and the provision of ecosystem services (PES). Schemes that promote PES - such as the *in situ* or on farm conservation of PGRFA - are being set up in an attempt to encourage and reward farmers and rural communities for their stewardship of the environment. However, the fair and effective implementation of such schemes remains a major challenge (SOW-2 p.198 b.2); ALSO PA-11

- A better understanding of, and support for, farmers' management of diversity is still needed, in spite of significant advances in this area. Opportunities exist for improving the livelihoods of rural communities an essential element of such efforts (SOW-2 p.17 b.2); ALSO PA-11 & PA-12 & PA-20

- Greater attention is needed regarding the conservation and use of PGRFA of neglected and under-utilised crops and non-food crops. Many such species can make a valuable contribution to improving diets and incomes (SOW-2 p.20 b.4); ALSO PA-5 & PA 7 & PA-8 & PA-10 & PA 11 & PA-12 & PA-14 & PA-20

- In order to capture the potential market value of native crops, local varieties, underutilized crops and the like, there is a need for greater integration of the efforts of individuals and institutions having a stake in different parts of the production chain, from the development and testing of new varieties, through value added activities, to the opening up of new markets (SOW-2 p.116 b.7); ALSO PA-4 & PA-9 & PA-14 & PA-12

- Greater attention needs to be given to the development of more decentralized, participatory and gender sensitive approaches to plant breeding in order to more effectively generate varieties that are specifically adapted to the particular production environments and socio-economic situations of the poor in less favoured environments (SOW-2 p.200 b.8); ALSO PA-10 & PA-11 & PA-12

- In order to promote and strengthen the use of participatory breeding, many countries need to reconsider their policies and legislation, including developing appropriate intellectual property protection and seed certification procedures for varieties bred through PPB. Greater attention is also needed to capacity building and to ensuring PPB is integrated in national breeding strategies (SOW-2 p.116 b.10); ALSO PA-10 & PA-12 & PA-15

- Considerable opportunities exist for strengthening cooperation among those involved in the conservation and sustainable use of PGRFA, at all stages of the seed and food chain. Stronger links are needed, especially between plant breeders and those involved in the seed system, as well as between the public and private sectors (SOW-2 p.116 b.4); ALSO PA-11 & PA-13

- The need for greater awareness among policy makers, donors and the general public of the value of PGRFA, and the importance of crop improvement, in meeting future global challenges (SOW-2 p.115 b.2); ALSO PA-4 & PA-10 & PA-11 & PA-15 & PA-18 & PA-20

- Many countries still lack national strategies and/or action plans for the management of diversity - or if they have them, they do not fully implement them. Areas that require particular attention include setting priorities, enhancing national and international cooperation, the further development of information systems and identifying gaps in the conservation of PGRFA, including CWR (SOW-2 p.20 b.6); ALSO PA-11 & PA-15 & PA-17

- There is a need for countries to adopt appropriate and effective strategies, policies, legal frameworks and regulations that promote the use of PGRFA, including appropriate seed legislation (SOW-2 p.116 b.3); ALSO PA-11 & PA-12 & PA-13 & PA-15

38. **Capacity:** Adequate support should be given to community-based institutions and user groups engaged in providing practical assistance to on-farm conservation and improvement work.

39. Considering the needs of and numbers of the farmers served, genebanks and national/international institutes should consider identifying appropriate landraces/farmers' varieties for multiplication and/or developing new breeding populations incorporating specific characteristics into locally adapted materials for on-farm improvement activities. Step-by-step incorporation and improvement should be encouraged rather than the hasty replacement of existing on-farm diversity. As a general practice, quantities of seed and planting materials distributed should encourage research and experimentation by farmers, and not be so large as to displace normal seed supply sources or on-farm seed management.

40. Interdisciplinary training programmes should be developed for extension workers, NGOs and others in facilitating and catalyzing on-farm activities, including selection and breeding techniques appropriate to supplement and improve those already used by farmers.

41. The focus of training programmes should be to help farmers better incorporate new knowledge and technologies and indeed become better technicians, and researchers become better enablers and supporters of farmers. Training should be aimed at four different groups: scientists, technical support staff, extension agents (including NGOs), and farmers. Support for advanced degree work should include relevant work in the biological and social sciences. Training of extension agents should aim to increase their skills in crop identification, selection and breeding, and seed maintenance in order to provide the important bridge between national agricultural research staff and farmers.

42. Training of (and by) farmers should emphasize enhancing the identification of plant traits, selection/breeding, utilization and maintenance of local crops. It is important to develop farmers' skills in selection of plants in the vegetative state and not only after harvest.

43. Training programmes should be designed in close collaboration with NARS and farmers and their organizations and be based on particular needs as they see them. Such programmes should not neglect the central role that women play in both influencing and directing the evolution of crops. Programmes should consider the different uses of biological resources by women and men, including women's concern for the multiple uses and processing requirements of crops.

- There is a need to strengthen the ability of farmers, indigenous and local communities and their organizations, as well as extension workers and other stakeholders, to sustainably manage agricultural biodiversity (SOW-2 p.43 b.2); ALSO PA-11 & PA-12 & 15

- There is an urgent need to increase plant breeding capacity worldwide in order to be able to adapt agriculture to meet the rapidly expanding demand for more and different food, as well as non-food products, under substantially different climatic conditions from those prevailing today. The training of more breeders, technicians and field workers, and the provision of better facilities and adequate funds are all essential (SOW-2 p.115 b.1); ALSO PA-4 & PA-10 & PA-11 & PA-12 & PA-15 & PA-19

- Greater efforts are needed in order to mainstream new biotechnological and other tools within plant breeding programmes (SOW-2 p.116 b.5); ALSO PA-10 & PA-11

More investment is needed in the improvement of under-utilized crops as well as of traits in major crops that are likely to assume greater importance in the future as increased attention is paid to health and dietary concerns and as the effects of climate change intensify (SOW-2 p.116 b.6); ALSO PA-4 & PA-10 & PA-11 & PA-12 & PA-14 & PA-20

44. **Research/technology:** Four basic types of rigorous, multi-disciplinary scientific research are needed:

(a) ethnobotanical and socio-economic research to understand and analyze farmer knowledge, selection/breeding, utilization, and management of plant genetic resources for food and agriculture, consistent with the approval of the farmers involved and with applicable requirements for protection of their knowledge and technologies;

(b) population and conservation biology to understand the structure and dynamics of genetic diversity in local landraces/farmers' varieties (including population differentiation, gene flow, degree of inbreeding, and selective pressures)

(c) crop improvement research, including research in mass selection and simple breeding as a means of increasing crop yields and reliability without significant losses of local biodiversity.

(d) research and extension studies for little known crops will be promoted, including seed production, marketing and distribution.

- Specific research needs relating to on farm management or *in situ* conservation of PGRFA include (SOW-2 p.44 b.10):

  - Studies on the extent and nature of possible threats to existing diversity on farm and *in situ*; ALSO PA-3 & PA-4 & PA-7 & PA-8 & PA-11 & 15 & PA-18

  - Ethnobotanical and socio-economic studies, including the study of indigenous and local knowledge, to better understand the role and limits of farming communities in the management of PGRFA; ALSO PA-11 & PA-12

  - Studies of the dynamic balance between *in situ* and *ex situ* conservation. What combination works best, where, under what circumstances, and how should the balance be determined and monitored; ALSO PA-5 & PA-8 & PA-11

  - Studies on the mechanisms, extent, nature and consequences of geneflow between wild and cultivated populations; ALSO PA-18

  - Studies of the effectiveness of different mechanisms for managing genetic diversity and how to improve them; ALSO PA-18

  - Further research to provide information to underpin the development of appropriate policies for the conservation and use of genetic diversity, including the economic valuation of PGRFA. ALSO PA-4 & PA-5 & PA-8 & PA-11 & PA-15 & PA-20

45. Scientific research should, when possible, be coupled with on-farm activities in order that the context and purpose of the work are fully appreciated. Research should assist in the monitoring, evaluation, and improvement of on-farm efforts. Research should be undertaken in a participatory and collaborative manner to foster interaction and cooperation between rural people and the staff of national institutions. Other institutions must be involved appropriately whenever necessary.

46. Methods should be developed and assistance provided for recording and linking *in situ* farm and garden management and conservation of plant genetic resources for food and agriculture with national and regional genebanks and research institutes.

47. **Coordination/administration:** National and international coordination efforts in this area should allow for and encourage local, community-level initiatives in proposing programmes. Small, grass-roots projects should receive priority in funding and support services. Priority should be placed on farmers with a technical project promoting the maintenance of pre-existing diversity and to collaboration between communities and research institutions. Subject to satisfactory progress, programmes should be sufficiently long (10 years or more) to achieve results.

48. Efforts should be coordinated closely with NARS, international agricultural research centres, including IPGRI and with NGOs and farmers organizations. Collaborative programmes with other agencies, including UNDP, UNEP, IFAD, and the World Bank, should be undertaken, as feasible.

- The links between institutions concerned primarily with the conservation of PGRFA and those concerned primarily with its use are weak or even absent in many countries and need to be strengthened (SOW-2 p.137 b.2); ALSO PA-2 & PA-4 & PA-6 & PA-8 & PA-12 & PA-15 & PA-18

49. **This activity is closely linked with:**

- Constructing comprehensive information systems for plant genetic resources for food and agriculture
- Supporting planned and targeted collecting of plant genetic resources for food and agriculture
- Developing new markets for local varieties and "diversity-rich" products
- Expanding characterization and evaluation and number of core collections to facilitate use
- Increasing genetic enhancement and base-broadening efforts
- Promoting sustainable agriculture through diversification of crop production and broader diversity of crops
- Promoting development and commercialization of under-utilized crops and species
- Supporting seed production and distribution

3. Assisting farmers in disaster situations to restore agricultural systems

50. **Assessment:** In the modern world and especially in developing countries, people are threatened with and vulnerable to natural disasters, civil strife and war. Such calamities pose huge challenges to the resilience of agricultural systems. Often, adapted crop varieties are lost and cannot be recuperated locally. Food aid, combined with the importation of often poorly adapted seed varieties, can lower yields and keep them low for years. While addressing the immediate crisis, such practices can exacerbate hunger conditions, undermine food security and increase costs of donor assistance well into the future. Indigenous landraces/farmers' varieties lost during calamities can frequently be found in ex situ collections outside the effected country. Properly multiplied, such stocks can be returned to reconstitute locally adapted planting material, an essential component of sustainable agricultural systems. Partnerships are important in such efforts and can include government and non-governmental organizations.

- While there are still high levels of duplication globally for a number of crops, especially major crops, much of this is unintended and many crops and important collections remain inadequately safety duplicated. The situation is most serious for vegetatively propagated species and species with recalcitrant seeds (SOW-2 p.87 b.3); ALSO PA-5 & PA-6 & PA-8 & PA-16

- ... for many other crops, especially many neglected and under-utilized species and CWR, comprehensive collections still do not exist and considerable gaps remain to be filled (SOW-2 p.87 b.5); ALSO PA-4 & PA-7 & PA-8

- There has been an increasing move to integrate local seed systems within emergency responses aimed at supporting farmers in the aftermath of natural disasters and civil conflicts (SOW-2 p.115 b.13); ALSO PA-13 & PA-18

- There has been a substantial increase in awareness over the past decade of the extent and nature of the threats posed by climate change, and of the importance and potential of PGFRA in helping agriculture to remain productive under the new conditions through their underpinning of efforts to breed new, adapted crop varieties (SOW-2 p.115 b.8); ALSO PA-9 & PA-11 & PA-18 & PA-20

- The extent of interdependence among countries with respect to their need to have access to materials held by others is arguably more important than ever. This is especially true in the face of the need to develop varieties that are adapted to the new environmental conditions and pest and disease spectra that will result from climate change. The ITPGRFA has provided a sound basis for improving and facilitating such access (SOW-2 p.17 b.6). ALSO PA-16

51. **Long-term objectives:** To support farmers' and rural peoples' livelihoods and sustainable agriculture options through the rehabilitation of agricultural systems based on locally adapted plant genetic resources, including the restoration of pre-existing germplasm in cases of disaster-induced loss of plant genetic resources for food and agriculture.

52. **Intermediate objectives:** To establish capacity to deliver seed of adapted local varieties as needed to help re-establish indigenous agricultural systems in areas affected by natural disasters, war, and civil strife.

53. To establish institutional responsibilities and mechanisms for the identification, acquisition, multiplication, and re-introduction of appropriate genetic materials.

54. **Policy/strategy:** Governments with the co-operation of relevant farmers' organizations and communities and UN bodies and regional, intergovernmental and nongovernmental organizations should establish necessary policies at all levels which will allow unhindered implementation of seed security activities in response to calamities.

55. To minimize genetic loss, governments should ensure duplication of plant genetic resources for food and agriculture outside of the country, such as in genebanks of neighboring countries, and/or regional or international genebanks and crop genebank networks. Where such ex situ collections do not exist outside the affected country, support should be given to undertake emergency collections of local varieties as soon as possible within the country, so that they may be multiplied for immediate use and also may be conserved in national and international ex situ collections for future use.

- There is a need in all countries to develop and put in place early warning systems for genetic erosion (SOW-2 p.44 b.7); ALSO PA-18

- There is still an ongoing need to improve the coverage of diversity in *ex situ* collections, including CWR and farmers' varieties, coupled with better characterization, evaluation and documentation of the collections (SOW-2 p.17 b.1); ALSO PA-5 & PA-7 & PA-9

- There is a need to step up efforts to conserve landraces, farmers' varieties and CWR before they are lost as a result of changing climates. Special efforts are needed to identify those species and populations that are most at risk and that are most likely to harbour traits that will be important in the future (SOW-2 p.199 b.2); ALSO PA-7 & PA-8 & PA-9 & PA-10 & PA-11 & PA-18

- There is a need to promote standard definitions and means of assessing genetic vulnerability and genetic erosion, as well as to agree on more and better indicators, in order to be able to establish national, regional and global baselines for monitoring diversity and changes in it, and for establishing effective early warning systems (SOW-2 p.20 b.5); ALSO PA-2 & PA-7 & PA-18

56. **Capacity:** FAO should establish agreements with appropriate agencies, especially national and international agricultural research institutions, for rapid acquisition and multiplication, restoration and provision of materials to countries in need. Such institutes should endeavour to ensure that their capacity is sufficient for the task. Cooperation with non-governmental and private organizations can

be an important component of efforts to distribute suitably adapted germplasm into regions that are recovering from disasters.

57. Adequate information systems must be established to identify and track appropriate germplasm for reintroduction.

58. Governments should consider making available adequate funds to set in motion the multiplication of seed and to initiate other related activities in response to emergencies, after approaching existing international emergency funds to determine if they could effectively plan ahead to cover action related to the restoration of plant genetic resources for food and agriculture after disaster situations.

59. Governments should strengthen farmers' abilities to cope with disasters by supporting the re-emergence of local seed supply networks.

60. **Research/technology:** Previous experience should be reviewed and options developed to enhance preparedness for rescue of ex situ collections and emergency seed collecting in the context of calamities, including war, civil strife, industrial accidents, and natural disasters. These efforts could benefit from close collaboration among governments of countries affected, donor governments, non-governmental and private organizations, the national, regional and international agricultural research centres, regional plant genetic resource networks as well as relevant inter-governmental agencies such as FAO, WFP, UNHCR and UNDRO.

- Studies are needed on the extent and nature of possible threats to existing diversity on farm and *in situ*; (SOW-2 p.44. b10) ALSO PA-2 & PA-4 & PA-7 & PA-8 & PA-11 & PA-15 & PA-18

61. **Coordination/administration:** This programme should be coordinated administratively by FAO in close collaboration with WFP, UNHCR, UNDRO, IPGRI, national and the international agricultural research centres, regional plant genetic resources networks, governments of the countries affected, donor countries and NGOs.

62. Public awareness efforts are needed to sensitize the donor community and NGOs to the importance of adapted plant genetic resources for food and agriculture in relief and rehabilitation efforts and to inform them of this programme. Such efforts should also increase awareness of the need for safety duplication of materials in other countries.

- There is a need for closer collaboration and coordination, nationally and internationally, especially between the agriculture and environment sectors (SOW-2 p.44 b.4); PA-3 & PA-4 & PA-15 & PA-16 & PA-18

63. **This activity is closely linked with:**

- Sustaining existing *ex situ* collections
- Constructing comprehensive information systems for plant genetic resources for food and agriculture
- Promoting public awareness of the value of plant genetic resources for food and agriculture conservation and use
- Developing monitoring and early warning systems for loss of plant genetic resources for food and agriculture
- Supporting on-farm management and improvement of plant genetic resources for food and agriculture

4. Promoting *in situ* conservation of wild crop relatives and wild plants for food production

64. **Assessment:** Natural ecosystems hold important plant genetic resources for food and agriculture, including endemic and threatened wild crop relatives and wild plants for food production. Many are not managed sustainably. This genetic diversity, because of interactions which generate new biodiversity, is potentially an economically important component of natural ecosystems and cannot be maintained *ex situ*. Unique and particularly diverse populations of these genetic resources must be protected *in situ* when they are under threat. Most of the world's 8500 national parks and other protected areas, however, were established with little specific concern for the conservation of wild crop relatives and wild plants for food production. Management plans for protected and other areas are not usually broad enough to conserve genetic diversity for these species to complement other conservation approaches.

65. Many protected areas are under threat of degradation and destruction. Moreover, they cannot now provide comprehensive geographical and biological coverage of the diversity of many species. It is thus necessary to complement the conservation in protected areas with measures aimed at conserving genetic diversity which lies outside such areas. *In situ* conservation implies comprehensive planning in which protection, production and genetic conservation aspects are considered and made complementary.

- Interest in and awareness of the importance of conserving CWR, both *ex situ* and *in situ,* and its use in crop improvement have increased substantially (SOW-2 p.17 b.3); ALSO PA-7 & PA-12 & PA-14 & PA-20

- There is growing interest in hitherto 'neglected' and under-utilised species such as traditional vegetables and fruits (SOW-2 p.17 b.4); ALSO PA-12 & PA-14

- In spite of the growing awareness of the importance of CWR, there is still a need in many countries for appropriate policies, legislation and procedures for collecting CWR, for establishing protected areas for CWR, and for better national coordination of these efforts. (SOW-2 p.20 b.7) ALSO PA-7 & PA-20

- CWR have received much more attention. A global strategy for CWR conservation and use has been drafted, protocols for the *in situ* conservation of CWR are now available, and a new Specialist Group on CWR has been established within IUCN/SSC (SOW-2 p.43 b.3);

- There has been little progress on the development of sustainable management techniques for plants harvested from the wild, which are still largely managed following traditional practices (SOW-2 p.43 b.5); ALSO PA-18

- A lack of adequate characterization and evaluation data and the capacity to generate and manage it, remain a serious constraint to the use of many germplasm collections, especially of under-utilized crops and wild relatives (SOW-2 p.116 b.8); ALSO PA-2 & PA-9 & PA-19

- There has been little change in the crop focus of the breeding programmes as well as in the principal traits sought by plant breeders. Major crops still receive the most attention and yield per unit area continues to be the primary trait sought. However, recently more attention has been paid to under-utilized crops and to the use of CWR (SOW-2 p.114 b.2); ALSO PA-10 & PA-12

- The *in situ* conservation of PGRFA (in particular CWR) in wild ecosystems still occurs mainly in protected areas. Less attention has been given to conservation elsewhere. There has been a significant increase in the number and coverage of protected areas (SOW-2 p.43 b.2);

- Interest in collecting and maintaining collections of CWR is growing as land-use systems change, concerns about the effects of climate change grow and techniques for using the material become more powerful and more readily available (SOW-2 p.86 b.4); ALSO PA-5 & PA-7 & PA-9 & PA-18 & PA-20

- The number of botanical gardens around the world now in exceeds 2,500, maintaining samples of some 80,000 plant species, including CWR. Botanical gardens took the lead in developing the Global Strategy for Plant Conservation adopted by the CBD in 2002 (SOW-2 p.86 b.8); PA-8

66. **Long-term objectives:** To promote conservation of genetic resources of wild crop relatives and wild plants for food production in protected areas and on other lands not explicitly listed as protected areas.

67. **Intermediate objectives:** To initiate planning and management practices which take into account wild crop relatives and wild plants for food production. To clearly identify which wild crop relatives and wild plants for food production need to be protected *in situ*. To gain knowledge of the uses, in particular by women, of wild plants for food production as sources of income and food.

68. To create a better understanding of the contributions of plant genetic resources for food and agriculture to local economies, food security, and environmental health. To improve management and planning and promote complementarity between conservation and sustainable use in parks and protected areas by inter alia broadening the participation of local communities in these processes.

69. To establish better communication and coordination between various institutes and organizations engaged in *in situ* conservation and land use management, nationally and regionally. To conserve genetic diversity for these species to complement other conservation approaches.

70. **Policy/strategy:** Governments, subject to national legislation, with the cooperation of the relevant UN bodies and regional, intergovernmental and non-governmental organizations and taking into account the views of farmers and communities living near protected areas should:

(a) include as appropriate, among the purposes and priorities of national parks and protected areas, the conservation of plant genetic resources for food and agriculture, including appropriate forage species, wild relatives of crop plants and species gathered wild for food;

(b) consider integrating conservation and management of plant genetic resources for food and agriculture in national land use plans;

(c) support the establishment of national and local objectives for protected area management through broad based participation, involving in particular, where they are present, groups most dependent on wild plants for food production;

(d) support the creation of advisory panels at the appropriate levels, that where appropriate, involve farmers, indigenous communities, plant genetic resources scientists, local government officials, and community leaders, to guide management of protected areas, according to national rules and regulations;

(e) recognize the rights of indigenous communities to PGRFA in protected areas;

(f) recognize that women are a valuable source of information on the feasibility of *in situ* conservation and management practices;

(g) support indigenous and local communities efforts to manage wild crop relatives and wild plants for food production in protected areas, or where existing aboriginal or treaty rights are recognized;

(h) review existing environmental impact statement requirement to incorporate an assessment of the likely effect of the proposed activity on local biodiversity for food and agriculture, particularly on wild crop relatives;

(i) integrate genetic conservation objectives in the sustainable management of wild crop relatives and wild plants for food production in protected areas and other managed resource areas.

71. Governments with the cooperation of the relevant UN bodies and regional, intergovernmental and non-governmental organizations and the farming, indigenous and local communities living in non-protected areas, should seek, where possible and appropriate, to:

(a) Establish conservation of wild crop-relatives and wild plants for food production as an integral component of land-use planning;

(b) Encourage local communities to conserve and manage wild crop relatives and wild plants for food production, and provide for their participation in decisions relating to such local conservation and management.

72. As appropriate and feasible, protected area policies should promote and sustain rather than restrict those human activities that maintain and enhance genetic diversity within and among plant species. Participatory approaches to protected and related area management should also be encouraged to reconcile the sometimes conflicting goals of conservation and local livelihood security.

- *In situ* and *ex situ* conservation strategies need to be better linked to ensure that a maximum amount of genetic diversity is conserved in the most appropriate way, and that biological and cultural information is not lost inadvertently (SOW-2 p.87 b.7); ALSO PA-5 & PA-7 & PA-8 & PA-15 & PA-18

- The draft global strategy on the conservation of CWR needs to be finalized and adopted by governments as a basis for action (SOW-2 p.43 b.1); ALSO PA-12 & PA-18

- There is a need for more effective policies, legislation and regulations governing the *in situ* and on farm management of PGRFA, both inside and outside of protected areas (SOW-2 p.44 b.3); ALSO PA-2 & PA-15

- There is a need for specific strategies to be developed for conserving PGRFA *in situ* and for managing crop diversity on farm. Special attention needs to be given to conservation of CWR in their centres of origin, major centres of diversity and biodiversity hotspot areas (SOW-2 p.44 b.5); ALSO PA-2 & PA-11 & PA-15

- The involvement of local communities is essential in any *in situ* conservation or on farm management effort and traditional knowledge systems and practices need to be fully taken into account. Collaboration between all stakeholders needs to be strengthened in many countries (SOW-2 p.44 b.6); ALSO PA-2 & PA-11 & PA-15 & PA-18 & PA-20

- Greater measures are needed in many countries to counter the threat of alien invasive species (SOW-2 p.44 b.8); ALSO PA-15 & PA-18

- Specific research needs relating to on farm management or *in situ* conservation of PGRFA include (SOW-2 p.44 b.10):

  - Studies on the extent and nature of possible threats to existing diversity on farm and *in situ*; ALSO PA-3 & PA-4 & PA-7 & PA-8 & PA-11 & 15 & PA-18

- The need for better inventories and characterization data on land races, CWR and other useful wild species, including forages, in order to better target *in situ* conservation action; ALSO PA-1 & PA-7 & PA-8 & PA-9 & PA-18

- Studies on the reproductive biology and ecological requirements of CWR and other useful wild species; ALSO PA-18

- Further research to provide information to underpin the development of appropriate policies for the conservation and use of genetic diversity, including the economic valuation of PGRFA. PA-2 & PA-4 & PA-5 & PA-8 & PA-11 & PA-15 & PA-20

➢ For several major crops, such as wheat and rice, a large part of the genetic diversity is now represented in collections. However, for many other crops, especially many neglected and under-utilized species and CWR, comprehensive collections still do not exist and considerable gaps remain to be filled (SOW-2 p.87 b.5); ALSO PA-7 & PA-8 & LAST SENTENCE IN PA-3 AS WELL

➢ The need for greater awareness among policy makers, donors and the general public of the value of PGRFA, and the importance of crop improvement, in meeting future global challenges (SOW-2 p.115 b.2); ALSO PA-2 & PA-11 & PA-15 & PA-18 & PA-20

➢ There is a need for countries to adopt appropriate and effective strategies, policies, legal frameworks and regulations that promote the use of PGRFA, including appropriate seed legislation (SOW-2 p.116 b.3); ALSO PA-2 & PA-11 & PA-13 & PA-15

73. **Capacity:** Governments should, whenever possible, and as appropriate:

(a) Develop a prioritized plan, particularly for those ecosystems in which high levels of diversity related to plant genetic resources for food and agriculture are found, and conduct national reviews to identify those management practices needed to protect the desired level of genetic diversity for wild crop-relatives and wild plants for food production

(b) Assist local communities in their efforts to identify, catalogue and manage wild crop relatives and wild foods

(c) Monitor the holdings, the distribution and diversity of wild crop relatives and wild plants for food production, integrate and link data and information from in situ conservation programmes with that of ex situ programmes and encourage private and nongovernmental organizations to do likewise

➢ In the effort to mobilize additional resources for *ex situ* conservation, greater efforts are needed in raising awareness among policy makers and the general public, of the importance of PGRFA and the need to safeguard it (SOW-2 p.87 b.9). ALSO PA-5 & PA-6 & PA-7 & PA-8 & PA-20

➢ Strengthened research capacity is required in many areas, and in particular in taxonomy of CWR, and conducting inventories and surveys using new molecular tools (SOW-2 p.44 b.9); ALSO PA-1 & PA-7 & PA-18 & PA-19

➢ There is an urgent need to increase plant breeding capacity worldwide in order to be able to adapt agriculture to meet the rapidly expanding demand for more and different food, as well as non-food products, under substantially different climatic conditions from those prevailing today. The training of more breeders, technicians and field workers, and the provision of better facilities and

adequate funds are all essential (SOW-2 p.115 b.1); ALSO PA-2 & PA-10 & PA-11 & PA-12 & PA-15 & PA-19

- More investment is needed in the improvement of under-utilized crops as well as of traits in major crops that are likely to assume greater importance in the future as increased attention is paid to health and dietary concerns and as the effects of climate change intensify (SOW-2 p.116 b.6); ALSO PA-2 & PA-10 & PA-11 & PA-12 & PA-14 & PA-20

- In order to capture the potential market value of native crops, local varieties, underutilized crops and the like, there is a need for greater integration of the efforts of individuals and institutions having a stake in different parts of the production chain, from the development and testing of new varieties, through value added activities, to the opening up of new markets (SOW-2 p.116 b.7); ALSO PA-2 & PA-9 & PA-12 & PA-14

74. **Coordination/administration:** Governments should, as appropriate:

(a) Link protected area planning and management with institutions responsible for the conservation and sustainable use of wild relatives of crop plants and wild plants for food production, such as centres for crop genetic resources, national crop genetic resources coordinators, and botanical gardens

(b) Designate focal points, as appropriate, to catalyze coordination of *in situ* protection programmes and liaise with other countries in the region

(c) Establish mechanisms for periodically reviewing and modifying conservation plans

- There is a need for closer collaboration and coordination, nationally and internationally, especially between the agriculture and environment sectors(SOW-2 p.44 b.4); ALSO PA-3 & PA-15 & PA-16 & PA-18

- The links between institutions concerned primarily with the conservation of PGRFA and those concerned primarily with its use are weak or even absent in many countries and need to be strengthened (SOW-2 p.137 b.2); ALSO PA-2 & PA-6 & PA-8 & PA-12 & PA-15 & PA-18

75. **This activity is closely linked with:**

- Surveying and inventorying plant genetic resources for food and agriculture
- Building strong national programmes
- Constructing comprehensive information systems for plant genetic resources for food and agriculture
- Supporting on-farm management and improvement of plant genetic resources for food and agriculture
- Promoting development and commercialization of under-utilized crops and species
- Supporting planned and targeted collections of plant genetic resources for food and agriculture
- Promoting public awareness of the value of plant genetic resources for food and agriculture conservation and use

Ex Situ Conservation

5. Sustaining existing *ex situ* collections
6. Regenerating threatened *ex situ* accessions
7. Supporting planned and targeted collecting of plant genetic resources for food and agriculture
8. Expanding *ex situ* conservation activities

5. Sustaining existing *ex situ* collections

76. **Assessment:** The number of genebanks in the world and the size of *ex situ* collections grew tremendously during the 1970 and 1980s in response to increasing awareness of threats to plant genetic resources for food and agriculture. While most countries still lack long-term storage facilities, storage space is thought to be available today in many individual genebanks and globally, and could be expanded through elimination of unnecessary duplication in the collections.

77. Globally, governments and donor agencies have made insufficient provisions for ongoing maintenance costs of conservation infrastructure. The result has been a steady deterioration of many facilities and their ability to perform even basic conservation functions. The severity of the threat to *ex situ* collections can be seen in the high percentage of accessions presently in need of regeneration and in reports by many countries of significant technical and administrative problems in genebanks. In addition, many genebanks house far more species than national breeding programmes are developing, and options exist for less costly conservation.

78. With a more rational system based on better planning and more coordination and cooperation, costs could be reduced and conservation work placed on a scientifically sound and financially sustainable foundation. This would lay the groundwork for expanded utilization of plant genetic resources for food and agriculture, in the context of more effective conservation. To realize such a system, conservation options must be made available, particularly to the many countries presently lacking sufficient capacity to ensure the on-going *ex situ* conservation of plant genetic resources for food and agriculture at the international standards.

- More than 1.4 million germplasm accessions have been added to *ex situ* collections, bringing the total number now conserved worldwide to about 7.4 million. The majority of these are maintained in seed genebanks (SOW-2 p.86 b.1);

- More than 240,000 new accessions have been collected and are now being conserved *ex situ*. This number, however, is believed to be a considerable underestimate in that many countries did not provide figures on the number of accessions collected (SOW-2 p.86 b.2);

- Fewer countries account for a larger percentage of the total world *ex situ* germplasm holdings than was the case in 1996 (SOW-2 p.86 b.3);

- Interest in collecting and maintaining collections of CWR is growing as land-use systems change, concerns about the effects of climate change grow and techniques for using the material become more powerful and more readily available (SOW-2 p.86 b.4); PA-4 & PA-9 & PA-18 & PA-20

- Interest is also growing in neglected and under-utilized crops in recognition of their potential to produce high-value niche products and as novel crops for the new environment conditions that are expected to result from climate change (SOW-2 p.86 b.5); PA-9 & PA-14 & PA-20

- *Ex situ* collections have grown substantially, both through new collecting and through exchange among genebanks. The latter has contributed to the continuing problem of unplanned duplication (SOW-2 p.17 b.1); ALSO PA-7 & PA-8

- The SGSV, which opened in 2008, represents a major new international collaborative initiative to improve the safety of germplasm collections, through providing secure facilities for storing duplicate samples of seed accessions (SOW-2 p.161 b.12); ALSO PA-3

- The CGIAR Centres have continued to work collaboratively with a very large number of partners, especially in developing countries, and have continued to make available a wide range of genetic materials. A major programme has been undertaken to upgrade the collections and genebank facilities. (SOW-2 p.161 b.10); ALSO PA-16

The overall needs of *ex situ* conservation remain largely the same as those listed in the first SoW report. This does not suggest that good progress has not been made, but that progress has not been complete and that many of the most important constraints can only be addressed through long-term commitments and action. (SOW-2 p.87)

79. **Long-term objectives:** To give high priority to safeguarding as much existing unique and valuable diversity as possible in *ex situ* collections of plant genetic resources for food and agriculture. To develop an efficient goal-oriented, economically efficient and sustainable system of *ex situ* conservation. To develop and strengthen cooperation among national programmes and international institutions to sustain *ex situ* collections, recognizing that states have sovereign rights over their own plant genetic resources for food and agriculture.

80. **Intermediate objectives:** To develop and strengthen national, regional and international networks, including the existing FAO *Ex situ* Network within the FAO Global System, and in accordance with policies and strategies set out by the Commission on Genetic Resources for Food and Agriculture. To assemble therein sufficient capacity to provide options to countries for the voluntary storage – preferably within each region – of appropriate genetic materials and their duplicates. To provide for the transfer and on-going conservation of this material under applicable international legal agreements, which ensure the sovereign rights of the countries of origin, and with appropriate technical and financial support.

81. To reduce unnecessary and unplanned redundancy in current programmes, and promote access to and exchange of information about plant genetic resources for food and agriculture in line with applicable international agreements, including the Convention on Biological Diversity. To provide for the planned replication and safe storage of materials not currently duplicated.

82. **Policy/strategy:** The international community has interests in and responsibilities for the *ex situ* conservation of plant genetic resources for food and agriculture. It is this understanding which provides the basis for an effective, integrated and rational global plan to secure existing collections. Countries have national sovereignty over, and responsibility for, their own plant genetic resources for food and agriculture.

83. Full use should be made of appropriate existing facilities, including national, regional and international centres. Conserved materials should be, as appropriate, replicated and stored in long-term facilities meeting international standards, in accordance with applicable international agreements. Unintended and unnecessary duplications between collections within the networks should be reduced to promote cost efficiency and effectiveness in global conservation efforts. Countries could be assisted in identifying which genetic resources are already stored and duplicated in long-term facilities.

84. FAO in co-operation with countries and with relevant institutions should facilitate the formalizing of agreements to safeguard diversity in *ex situ* collections in conformity with applicable international agreements This would allow those countries so desiring to place collections voluntarily in secure facilities outside their boundaries.

- There is still a need for greater rationalization of the global system of *ex situ* collections, as called for in the GPA and the ITPGRFA, and as reflected in initiatives such as those of the GCDT and AEGIS (SOW-2 p.20 b.3); ALSO PA-8

- *In situ* and *ex situ* conservation strategies need to be better linked to ensure that a maximum amount of genetic diversity is conserved in the most appropriate way, and that biological and cultural information is not lost inadvertently (SOW-2 p.87 b.7); ALSO PA-4 & PA-7 & PA-8 & PA-15 & PA-18

- In the effort to mobilize additional resources for *ex situ* conservation, greater efforts are needed in raising awareness among policy makers and the general public, of the importance of PGRFA and the need to safeguard it (SOW-2 p.87 b.9). PA-4 & PA-7 & PA-8 PA-15 & PA-18

- There is still an ongoing need to improve the coverage of diversity in *ex situ* collections, including CWR and farmers' varieties, coupled with better characterization, evaluation and documentation of the collections (SOW-2 p.17 b.1); ALSO PA-3 & PA-7 & PA-9

85. **Capacity:** Appropriate personnel, at all levels, for implementing and monitoring the above policies and agreements should be recruited and trained, as appropriate. National institutions should evaluate current genebank management practices in light of the need to create more rational, efficient, and user-oriented ex situ conservation systems. As appropriate, proper facilities, human resources and equipment should be made available to national programmes.

86. Ongoing conservation of collections of plant genetic resources for food and agriculture should be secured. Particular care must be taken to safeguard the original accessions of threatened collections.

87. Support should be given where appropriate to defray expenses incurred by institutions providing designated storage and related conservation and research/documentation services for other countries. This support could help to allow for all unique material to be identified, suitably duplicated, stored safely, and characterized, regenerated, evaluated, and documented. This would include the identification of materials
both inadequately and excessively duplicated. Materials not yet duplicated should be suitably multiplied and placed appropriately in secure storage, with the full observance of applicable international agreements and national legislation. Additional *ex situ* duplications of accessions would be maintained at the discretion of countries. Expansion of some existing storage facilities and the creation of new facilities may be desirable.

- Many countries, although aware of the importance of collecting, conserving, regenerating characterizing, documenting and distributing plant genetic resources, do not have adequate human capacity, funds or facilities to carry out the necessary work to the required standards. Many valuable collections are in jeopardy because their storage and management are sub-optimal (SOW-2 p.87 b.1); PA-6 & PA-7 & PA-8 & PA-9 & PA-19

88. **Research/technology:** Research should be aimed at the development of improved conservation methods including as appropriate *in vitro* and cryopreservation and in particular reliable low-cost techniques appropriate to local operating conditions. Technologies and procedures transferred from temperate climates may not be appropriate for conditions in tropical countries and vice versa.

89. Research based on the improved documentation and information foreseen under this Plan, should be undertaken to inform decisions upon which a rational, effective system must be based. This might

include, *inter alia*, research on identifying priority germplasm and duplications, on methods of identifying duplicates as well as of testing viability of accessions, procedures for the rational conservation and duplication of vegetatively-propagated species, and on the modalities and technologies of conserving genes, genotypes and gene complexes.

90. **Coordination/administration:** Coordination should take place within the country, between the national *ex situ* genebank, national crop working groups, and all users of PGRFA (breeders, farmers and NGOs). Strong links need to be established with regional networks and international centres

91. Oversight of the implementation of this activity should be supported by guidance of the FAO Commission on Genetic Resources for Food and Agriculture.

92. Periodic administrative and technical reviews should be encouraged to assess the effectiveness of the actions taken. Subject to these reviews as well as the specific provisions of relevant agreements, financial support should foster long-term security and allow for efficient planning.

- Greater efforts are needed to build a truly rational global system of *ex situ* collections. This requires, in particular, strengthened regional and international trust and cooperation (SOW-2 p.87 b.2); ALSO PA-8 & PA-16

93. **This activity is closely linked with:**

- Regenerating threatened *ex situ* collections
- Assisting farmers in disaster situations to restore agricultural systems
- Constructing comprehensive information systems for plant genetic resources for food and agriculture
- Expanding the characterization, evaluation and number of core collections to facilitate use
- Building strong national programmes
- Promoting networks for plant genetic resources for food and agriculture

6. Regenerating threatened *ex situ* accessions

94. **Assessment:** As accessions in *ex situ* storage decline in viability, both genes and genotypes are lost. Even under optimal *ex situ* storage conditions, all accessions eventually require regeneration. Capacity for regenerating was often not considered when assembling collections and disseminating accessions, with the unintended consequence that much material collected in the past cannot now be properly maintained.

Consequently, a large backlog of materials requiring regeneration exists today. An average of 50 percent of current national collections are in need of regenerating, according to substantial but incomplete data provided in Country Reports. Good planning and coordination will minimize the amount of material to be regenerated. But, without prompt and significant intervention, much of the stored genetic diversity of food and agricultural crops in the world – as well as the large public investment made in assembling the collections – will be lost forever.

95. Low initial sample size and low viability as well as frequent demand for samples from long-term facilities can shorten the regeneration cycle. But, because proper long-term storage conditions should obviate the need for regeneration for decades, one might expect average, routine, on-going annual regeneration requirements (as opposed to multiplication needs) to amount to fewer than 10 percent of accessions so conserved. However, some 95 percent of countries responding with specific information on regeneration report a far higher level of need, and most countries, both developed and developing, report technical, financial or other constraints to regenerating their material. Perhaps one million accessions may need to be regenerated to conserve the material in *ex situ* programmes. No global

coordinating mechanism exists. Lack of information on accessions constitutes an additional constraint impeding rational regeneration. Most developing and many developed countries cite lack of long-term storage facilities, lack of facilities for handling cross-pollinated species, and inadequate funds and manpower, as major problems to overcome.

- Significant advances have been made in regeneration: at the international level largely as a result of funding provided to the CGIAR Centres for the 'Global Public Goods' project, and at the national level in part as a result of a funding by the GCDT. However, much more remains to be done (SOW-2 p.86 b.6);

- Documentation and characterization data on collections have progressed somewhat, although there are still large data gaps and much of the existing data is not accessible electronically (SOW-2 p.86 b.7); ALSO PA-9 & PA-17

- In spite of significant advances in the regeneration of collections, many countries still lack the resources needed to maintain adequate levels of viability (SOW-2 p.87 b.4); ALSO PA-16

One area that hasn't seen much change in technology is in orthodox seed-storage conditions. Current recommendations for temperature and humidity are still the same as those developed before the first SoW report. Since then, however, the country reports that are part of this second SoW report and the Global Crop Diversity Trust's crop-specific conservation strategies call attention to the concerns for backlogs in accession testing and regeneration. Where there is testing, need for regeneration after a shorter period of storage that anticipated is often found. Given the money and resources that less frequent regeneration would save, it is probably time to apply the innovation of the genomics age to the mundane concern of seed storage containers and temperature/humidity regimes. (SOW-2 p.265 Sec. A 3.6)

96. **Long-term objectives:** To establish the infrastructure needed for periodic regeneration.

97. **Intermediate objectives:** To formulate a strategy, establish coordinating mechanisms, identify locations for regeneration, complete agreements needed to formalize cooperation among institutions, improve capacity and infrastructure as needed, and initiate action to regenerate targeted accessions. To complete the first world-wide regeneration of accessions in *ex situ* storage, under conditions designed to preserve the genetic integrity of material.

98. **Policy/strategy:** Priority should be given to:

- regeneration needs of samples currently in long-term storage or intended for placement in long-term conditions and experiencing a loss of viability as opposed to those in need of multiplication for other reasons. (Proper management will assure that accessions in long-term conditions will be regenerated mainly due to loss of viability and those in active collections multiplied due to loss of numbers.)
- samples which meet the criteria of being globally unique, threatened, and having the potential of maintaining the diversity of the original sample.

99. Input from crop and regional networks should be sought in the refining of priorities and identification of appropriate germplasm for regeneration.

100. Identification of specific samples should be made in cooperation with national programme breeders and curators, who often have intimate and detailed knowledge of collections and of the possible availability of similar materials from *in situ* locations.

101. As appropriate and feasible, regeneration efforts should strive to maintain the allelic and genotypic diversity and adapted complexes of the original sample.

102. Efforts should be encouraged to reduce unneeded redundancies within and between collections as a means of improving efficiency and minimizing on-going conservation costs. Regeneration should not be viewed as a means of maintaining collections in sub-standard conditions on a long-term basis. In this regard, it is noted that minimizing the frequency of regeneration is an important goal and consequence of other activities under the *Global Plan of Action.*

103. Governments, the private sector, institutions, including in particular the CGIAR, and NGOs should:

- cooperate to make efficient use of existing capacity and to ensure that regeneration can take place, if scientifically, technically and administratively feasible, at sites closely approximating the origin of the original sample; and,
- promote and facilitate access to plant genetic resources for food and agriculture stored *ex situ* to minimise the need for storing identical samples in several locations, and the consequent need to regenerate each of them.

104. Characterization activities should be undertaken in conjunction with regeneration, as feasible, without compromising the effectiveness or scientific goals of the regeneration exercise.

105. **Capacity:** As appropriate and cost efficient, proper facilities, human resources, appropriate technology, and equipment should be made available to national programmes and international institutions involved in regeneration activities undertaken as part of the Global Plan. Particular attention should be given to establishing or strengthening capacity for the regeneration of cross-pollinated species. Consideration should be given to involving the private sector, farmers, and NGOs in this activity.

106. Genebanks should ensure monitoring and have the capacity for determining the status of their accessions and prioritizing those in need of regeneration.

107. Training programmes should take into consideration the need for personnel trained in the execution of the procedures of germplasm regeneration and in the unique regeneration requirements of specific species.

- Many countries, although aware of the importance of collecting, conserving, regenerating characterizing, documenting and distributing plant genetic resources, do not have adequate human capacity, funds or facilities to carry out the necessary work to the required standards. Many valuable collections are in jeopardy because their storage and management are sub-optimal (SOW-2 p.87 b.1); ALSO PA-5 & PA-7 & PA-8 & PA-9 & PA-19

108. **Research/technology:** Guidelines for regeneration, and as appropriate, standards and specific technologies should continue to be developed. Guidelines should, *inter alia*, provide guidance on how accessions are chosen for regeneration. They should take planning and management into account as well as applicability to different institutional situations and collection purposes.

109. Scientific methodologies for identifying and prioritizing choices of accessions to be regenerated through national as well as global efforts should be further developed.

110. There is a need to reinforce research to improve conservation technologies in various fields: lengthening of the interval between two regeneration cycles (orthodox seeds), physiological

mechanisms linked to low temperature tolerance and dehydration (recalcitrant seeds), and *in vitro* conservation technologies.

111. Research should be undertaken to increase the effectiveness and efficiency of regeneration efforts, including methodologies for minimizing genetic drifts, the identification of markers associated with seed longevity to assist in devising regeneration strategies, to develop an understanding of the causes of mutations in conserved germplasm, to eliminate seed borne pests, and to answer various questions regarding breeding systems, reproductive biology, and dormancy mechanisms and technical problems associated with regeneration practices.

112. Data on existing accessions in *ex situ* collections should be assembled and analysed in order to assist in planning and implementation.

113. **Coordination/administration:** An operational plan for a coordinated, global regeneration effort should be developed, and implemented by the appropriate agency or agencies. It should include identification of institutions and locations for regeneration, be based on sound scientific practices, and consider the need for cost efficiency. The active involvement of crop and regional networks is important to the success of regeneration efforts, particularly in the identification and prioritization of germplasm to be regenerated. Similarly, national plans for regeneration should be formulated particularly in regard to plant genetic resources for food and agriculture of purely national importance.

114. There should be on-going monitoring of the need for regeneration, including consideration of the necessity of adequate duplication, storage behaviour of the species, storage conditions, and individual accession viability.

115. **This activity is closely linked with:**

- Sustaining existing *ex situ* collections
- Constructing comprehensive information systems for plant genetic resources for food and agriculture
- Expanding the characterization, evaluation and number of core collections to facilitate use
- Building strong national programmes
- Promoting networks for plant genetic resources for food and agriculture

7. Supporting planned and targeted collecting of plant genetic resources for food and agriculture

116. **Assessment:** Potential for loss and the opportunities for use are the prime motivating forces behind most collecting. The materials currently being conserved do not represent the total variation in plants. Global needs for collecting are not, however, as high now as 20 years ago due to progress made in the past two decades. CGIAR centres report that major crops have generally been well collected though gaps exist in some collections. Collecting of certain regional, minor, and subsistence crops is much less complete. However, in the absence of comprehensive analysis of the genetic diversity represented in the world's genebanks, these conclusions can only be deemed tentative.

117. Past collecting missions conducted with inadequate methodologies may not have successfully sampled diversity. Conditions in genebanks may also have led to the loss of collected materials, leading to a need for re-collection. In some cases, collecting is needed to rescue materials under imminent threat *in situ*. In others, clear utilitarian needs – for disease or pest resistance or other adaptive characteristics – make further collection warranted.

- Interest in collecting and maintaining collections of CWR is growing as land-use systems change, concerns about the effects of climate change grow and techniques for using the material become

more powerful and more readily available (SOW-2 p.86 b.4); ALSO PA-4 & PA-5 & PA-9 & PA-18 & PA-20

- Interest is also growing in neglected and under-utilized crops in recognition of their potential to produce high-value niche products and as novel crops for the new environment conditions that are expected to result from climate change (SOW-2 p.86 b.5); ALSO PA-5 & PA-9 & PA-14 & PA-20

- *Ex situ* collections have grown substantially, both through new collecting and through exchange among genebanks. The latter has contributed to the continuing problem of unplanned duplication (SOW-2 p.17 b.1); ALSO PA-5 & PA-8

118. **Long-term objectives:** To collect those species, ecotypes, landraces/farmers' varieties, or other cultivars, and associated information, that are under threat or are of anticipated use.

119. **Intermediate objectives:** To begin to fill gaps in the genetic diversity of existing collections with well targeted and prioritized collecting.

120. **Policy/strategy:** Collecting practices should be developed with regard to the objectives and obligations set forth in the Convention on Biological Diversity, for example the right of Contracting Parties to require prior informed consent before providing access to genetic resources and the obligations of Contracting Parties, subject to their national legislation, to respect the knowledge of indigenous communities regarding the conservation and sustainable use of biological diversity.

- For several major crops, such as wheat and rice, a large part of the genetic diversity is now represented in collections. However, for many other crops, especially many neglected and under-utilized species and CWR, comprehensive collections still do not exist and considerable gaps remain to be filled (SOW-2 p.87 b.5); ALSO PA-4 & PA-8 & LAST SENTENCE IN PA-3 AS WELL

- Greater efforts are needed to promote the use of the genetic resources maintained in collections. Stronger links are needed between the managers of collections and those whose primary interest lies in using the resources, especially for plant breeding (SOW-2 p.87 b.8); ALSO PA-12

- There is also a need to step up efforts to conserve landraces, farmers' varieties and CWR before they are lost as a result of changing climates. Special efforts are needed to identify those species and populations that are most at risk and that are most likely to harbour traits that will be important in the future (SOW-2 p.199 b.2); ALSO PA-3 & PA-8 & PA-9 & PA-10 & PA-11 & PA-18

- There is still an ongoing need to improve the coverage of diversity in *ex situ* collections, including CWR and farmers' varieties, coupled with better characterization, evaluation and documentation of the collections (SOW-2 p.17 b.1); ALSO PA-3 & PA-5 & PA-6 & PA-9

- In spite of the growing awareness of the importance of CWR, there is still a need in many countries for appropriate policies, legislation and procedures for collecting CWR, for establishing protected areas for CWR, and for better national coordination of these efforts (SOW-2 p.20 b.7). ALSO PA-4 & PA-8 & PA-20

- *In situ* and *ex situ* conservation strategies need to be better linked to ensure that a maximum amount of genetic diversity is conserved in the most appropriate way, and that biological and cultural information is not lost inadvertently (SOW-2 p.87 b.7); ALSO: PA-4 & PA-5 & PA-8 & PA-15 & PA-18

121. **Capacity:** Material so collected should be deposited in facilities which have the capacity to manage them in the country of origin, and possibly elsewhere, as agreed by the country of origin prior to collection. Where such facilities do not exist in the country of origin, they should be developed, where desired, and in the meantime, the materials could be managed in other countries as agreed in the country of origin prior to collection.

122. Before collecting is initiated, full consideration should be given to the ability to conserve the material collected effectively and sustainably.

123. Training should be undertaken in scientific collecting methods for plant genetic resources for food and agriculture.

- Many countries, although aware of the importance of collecting, conserving, regenerating characterizing, documenting and distributing plant genetic resources, do not have adequate human capacity, funds or facilities to carry out the necessary work to the required standards. Many valuable collections are in jeopardy because their storage and management are sub-optimal (SOW-2 p.87 b.1); ALSO PA-5 & PA-6 & PA-8 & PA-9 & PA-19

- Specific research needs relating to on farm management or *in situ* conservation of PGRFA include (SOW-2 p.44 b.10):

  • Studies on the extent and nature of possible threats to existing diversity on farm and *in situ*; PA-3 & PA-4 & PA-8 & PA-11 & PA-15 & PA-18

  • The need for better inventories and characterization data on land races, CWR and other useful wild species, including forages, in order to better target *in situ* conservation action; PA-1 & PA-4 & PA-8 & PA-9 & PA-18

124. **Coordination/administration:** Coordination, as appropriate, should take place within a country. International level coordination, as appropriate, is needed to provide linkages with *ex situ* collections and gap-filling and regeneration efforts. Such coordination might concern the identification of global needs or specific needs of one country that could be met by plant genetic resources for food and agriculture in another.

125. Strong linkages need to be established with regional and crop networks and with the users of plant genetic resources for food and agriculture (breeders and farmers) in order to inform, direct and prioritize the entire conservation process, including surveying, inventorying and collecting.

126. Mechanisms need to be developed at all levels for emergency collection of plant genetic resources for food and agriculture. These mechanisms should make full use of and therefore should be closely linked with information and early warning systems at all levels.

127. As part of national plant genetic resources programmes, governments may designate a focal point for administering requests for collecting.

128. **This activity is closely linked with:**

- Surveying and inventorying plan genetic resources for food and agriculture
- Sustaining existing *ex situ* collections
- Promoting in situ conservation of wild crop relatives and wild plants for food production

8. Expanding *ex situ* conservation activities

129. **Assessment:** The diversity of many species of plants cannot be conserved conveniently or effectively as seed. Some species are vegetatively propagated and others have "recalcitrant" seed. A number of major staple food crops, tropical fruits, and export crops, fall into these categories. Due to technical difficulties, the conservation of genetic resources of such plants is often not given appropriate attention.

130. Many plants of local importance for food and agriculture have been virtually neglected by traditional genebanks. Collections are ad hoc and no coordinated efforts have been made to ensure that adequate germplasm samples are maintained for conservation and further development.

131. Botanic gardens, field genebanks, and the use of new technologies, including *in vitro* methods, could be developed more fully to complement and expand conservation of plant genetic resources for food and agriculture.

According to a preliminary analysis, the lowest level of duplication is associated with vegetatively propagated and recalcitrant seeded plants, including cassava, yam and taro, cashew and rubber. ... CWR, neglected and underused crops and newly domesticated crops also appear more vulnerable in terms of lack of safety duplication. (SOW-2 p. 71)

Worldwide, over 800 botanical gardens specifically focus on conservation, and their ex situ collections include a wide range of socio-economically important species. (SOW-2 p. 85)

- The number of botanical gardens around the world now in exceeds 2,500, maintaining samples of some 80,000 plant species, including CWR. Botanical gardens took the lead in developing the Global Strategy for Plant Conservation adopted by the CBD in 2002 (SOW-2 p.86 b.8); ALSO PA-4

- While there are still high levels of duplication globally for a number of crops, especially major crops, much of this is unintended and many crops and important collections remain inadequately safety duplicated. The situation is most serious for vegetatively propagated species and species with recalcitrant seeds (SOW-2 p.87 b.3); PA-3 & PA-16

- For several major crops, such as wheat and rice, a large part of the genetic diversity is now represented in collections. However, for many other crops, especially many neglected and under-utilized species and CWR, comprehensive collections still do not exist and considerable gaps remain to be filled (SOW-2 p.87 b.5); ALSO PA-4 & PA-7 & PA-3 IN PART

- With the establishment of the highly innovative SGSV, a last resort safety back-up repository is now freely available to the world community for the long-term storage of duplicate seed samples. (SOW-2 p.86 b.10)

132. **Long-term objectives:** To conserve plant genetic resources for food and agriculture so that they will be available for use.

133. **Intermediate objectives:** To develop management strategies for *ex situ* conservation of vegetatively propagated and recalcitrant seeded plants, as well as for species neglected in current conservation activities.

134. To promote the development and transfer of appropriate technologies for the conservation of such plants.

135. To encourage and strengthen the involvement of botanic gardens in the conservation of plant genetic resources for food and agriculture, particularly for those species for which they already have a comparative advantage.

136. **Policy/strategy:** Governments, international agricultural research centres, NGOs, and funding agencies, should provide adequate, appropriate, and balanced support for the conservation of vegetatively propagated and recalcitrant seeded plants.

- There is still a need for greater rationalization of the global system of *ex situ* collections, as called for in the GPA and the ITPGRFA, and as reflected in initiatives such as those of the GCDT and AEGIS (SOW-2 p.20 b.3); ALSO PA-5

- Greater efforts are needed to build a truly rational global system of *ex situ* collections. This requires, in particular, strengthened regional and international trust and cooperation (SOW-2 p.87 b.2); ALSO PA-8 & PA-16

- Greater attention is needed regarding the conservation and use of PGRFA of neglected and under-utilised crops and non-food crops. Many such species can make a valuable contribution to improving diets and incomes (SOW-2 p.20 b.4) ALSO PA-5 & PA-8 & PA-10 & PA-11 & PA-12 & PA-14 & PA-20

- There is also a need to step up efforts to conserve landraces, farmers' varieties and CWR before they are lost as a result of changing climates. Special efforts are needed to identify those species and populations that are most at risk and that are most likely to harbour traits that will be important in the future (SOW-2 p.199 b.2); ALSO PA-3 & PA-7 & PA-9 & PA-10 & PA-11 & PA-18

- *In situ* and *ex situ* conservation strategies need to be better linked to ensure that a maximum amount of genetic diversity is conserved in the most appropriate way, and that biological and cultural information is not lost inadvertently (SOW-2 p.87 b.7); ALSO PA-4 & PA-5 & PA-7 & PA-15 & PA-18

- In the effort to mobilize additional resources for *ex situ* conservation, greater efforts are needed in raising awareness among policy makers and the general public, of the importance of PGRFA and the need to safeguard it (SOW-2 p.87 b.9). ALSO PA-4 & PA-5 & PA-6 & PA-7 & PA-20

- Special efforts are needed in many countries to educate senior managers and policy makers about the complex legal and policy issues relating to the conservation, exchange, and use of PGRFA (SOW-2 p.137 b.7); ALSO PA-19

- Greater attention is needed in many countries to the development of appropriate, non-conflicting and complementary national policies and legislation relating to the conservation, exchange, and use of PGRFA, including such areas as phytosanitary regulations, intellectual property protection, farmers' rights, and biosafety, and taking into account the needs and concerns of all stakeholders (SOW-2 p.137 b.10). ALSO PA-12 & PA-15

137. **Capacity:** Botanic gardens and field genebanks should be strengthened, particularly in relation to their capacity to conserve species neglected by more agriculturally-related facilities. In this regard, capacity building is especially needed in developing countries. As appropriate, genebank facilities of botanic gardens might be strengthened.

138. Simple, low-cost botanic gardens, arboreta and field genebanks associated with universities, schools and other institutions should, as appropriate, be strengthened and encouraged to promote education and public awareness.

139. Support should be given to training in *in vitro* techniques and to other new and appropriate technologies. In accordance with national, sub-regional and regional needs and priorities, support should be given to establishing the capacity to use such technologies.

- Many countries, although aware of the importance of collecting, conserving, regenerating characterizing, documenting and distributing plant genetic resources, do not have adequate human capacity, funds or facilities to carry out the necessary work to the required standards. Many valuable collections are in jeopardy because their storage and management are sub-optimal (SOW-2 p.87 b.1); ALSO PA-5 & PA-6 & PA-7 & PA-9 & PA-19

- Efforts to raise additional resources to support work on PGRFA require new and innovative approaches, better coordination in fundraising among the different institutions and sectors, and greater efforts to increase awareness among policy makers, donors, and the private sector as to the actual and potential value of PGRFA (SOW-2 p.137 b.9); ALSO PA-15 & PA-20

140. **Research/technology:** Protocols should be developed for *in vitro* conservation and other conservation technologies for important vegetatively propagated and nonorthodox seed plants.

141. An assessment should be made of the conservation needs of other species for food and agriculture which are not adequately conserved, including a survey of activities as a prerequisite for further planning and coordination of collecting and conservation.

- Specific research needs relating to on farm management or *in situ* conservation of PGRFA include: (SOW-2 p.44 b.10)

  • Studies on the extent and nature of possible threats to existing diversity on farm and *in situ*; ALSO PA-2 & PA-3 & PA-4 & PA-7 & PA-11 & PA-15 & PA-18

  • The need for better inventories and characterization data on land races, CWR and other useful wild species, including forages, in order to better target *in situ* conservation action; ALSO PA-1 & PA-4 & PA-7 & PA-9 & PA-18

  • Studies of the dynamic balance between *in situ* and *ex situ* conservation. What combination works best, where, under what circumstances, and how should the balance be determined and monitored; ALSO PA-2 & PA-5 & PA-11

  • Further research to provide information to underpin the development of appropriate policies for the conservation and use of genetic diversity, including the economic valuation of PGRFA. ALSO PA-2 & PA-4 & PA-5 & PA-11 & PA-15 & PA-20

142. **Administration/coordination:** Crop and regional networks as well as relevant international botanic garden organizations, with the support of international agricultural research centres and national agricultural research systems, should regularly assess the state of conservation of vegetatively propagated and non-orthodox seeded plants, and make recommendations and take action as appropriate.

143. Botanic Gardens should be encouraged to participate actively in the activities of international botanic gardens associations. Links between international botanic garden organizations (such as the International Association of Botanic Gardens and Botanic Gardens Conservation International) and those responsible for and engaged in conservation of food and agriculture species (*inter alia*, FAO, IPGRI and other international agriculture research centres) should be strengthened. Similar links should be made between institutions, including the private sector (such as the nursery trade), at the national level. Practical cooperation should be encouraged as a matter of priority.

- The links between institutions concerned primarily with the conservation of PGRFA and those concerned primarily with its use are weak or even absent in many countries and need to be strengthened (SOW-2 p.137 b.2); ALSO PA-2 & PA-4 & PA-6 & PA-12 & PA-15 & PA-18

144. **This Activity is Closely Linked With:**

- Sustaining Existing *Ex Situ* Collections
- Promoting *In Situ* Conservation of Wild Crop Relatives and Wild Plants for Food Production
- Building Strong National Programmes

Utilization of Plant Genetic Resources

9. Expanding the characterization, evaluation and number of core collections to facilitate use;
10. Increasing genetic enhancement and base-broadening efforts;
11. Promoting sustainable agriculture through diversification of crop production and broader diversity in crops;
12. Promoting development and commercialization of under-utilized crops and species;
13. Supporting seed production and distribution; and
14. Developing new markets for local varieties and "diversity-rich" products.

9. Expanding the characterization, evaluation and number of core collections to facilitate use

145. **Assessment:** Genebank collections should enable users to respond to new challenges and opportunities. Typically, most genebank accessions have not been well characterized and evaluated, a situation that leads to the under-use of collections and failure to realise their full value, resulting in high conservation costs in relation to derived benefits. In Country Reports, lack of characterization and evaluation is cited as a major constraint to use of plant genetic resources in breeding programmes.

146. Plant breeders and most other users are interested in having a manageable number of genotypes that possess or are likely to possess the traits needed in their breeding programmes. Identification of those traits through characterization, and the establishment of core collections (a subset selected to contain the maximum available variation in a small number of accessions), are measures that can encourage greater and more efficient use of collections. Evaluation can also aid identification of germplasm of potential for more direct use by farmers.

147. In addition, characterization and evaluation data, as well as the wise use of core collections are important in the overall efficient and effective management of collections.

- The number of accessions characterized and evaluated, and the number of countries where characterization and evaluation are carried out have increased in all regions but not in all individual countries. An increasing number of countries use molecular markers to characterize their germplasm (SOW-2 p.114 b.3);

- A lack of adequate characterization and evaluation data and the capacity to generate and manage it, remain a serious constraint to the use of many germplasm collections, especially of under-utilized crops and wild relatives (SOW-2 p.116 b.8); ALSO PA-2 & PA-4 & PA-19

- Documentation and characterization data on collections have progressed somewhat, although there are still large data gaps and much of the existing data is not accessible electronically (SOW-2 p.86 b.7); ALSO PA-6 & PA-9 & PA-17

148. **Long-term objectives:** To increase and improve the ease of use of conserved plant genetic resources. To facilitate innovative progress in plant breeding through promoting the identification of useful accessions or their component genes for introduction into genetic enhancement and plant breeding programmes. To promote plant breeding that results in higher levels of genetic diversity in crops and agricultural systems. To identify germplasm of potential value for direct use by farmers in on-farm programmes.

149. To promote the coordination of conservation, exploration and improvement activities by targeting collecting expeditions, optimising sampling strategies, optimising regeneration methodologies, identifying gaps in collections, rationalizing collections, establishing priorities for conservation, forming core collections, and quantifying the relative effectiveness of *ex situ* and *in situ* conservation.

150. **Intermediate objectives:** To give high priority to the development of crop specific characterization and evaluation programmes to identify accessions and genes that counter those biotic and abiotic stresses which are limiting production of those crops.

151. To improve the efficacy of the evaluation process by developing and adapting new technologies for reliably identifying valuable accessions and detecting valuable genes that have been identified as valuable.

152. To establish international core collections for crops of global importance and promote establishment of genebank-based core collections for key national crop collections in national facilities. To promote, improve and test methodologies and technologies for important core collections.

153. **Policy/strategy:** Governments with the co-operation of the relevant UN bodies and regional, intergovernmental and non-governmental organizations, international agricultural research centres, and including the private sector, and taking into consideration views of the scientific community and farmers' organizations and their communities should:

(a) define priorities and periodically assess progress in evaluation in relation to the different needs of the various users of plant genetic resources for food and agriculture, with emphasis on identifying traits that counter limits to production in staple crops and of crops of national economic importance;

(b) promote collaboration and complementarity between breeders, researchers, farmers and genebanks;

(c) encourage exchange of characterization and evaluation information;

(d) note that access to plant genetic resources for food and agriculture is subject to applicable international agreements. In compliance with such agreements, users of plant genetic resources for food and agriculture should be encouraged to agree to provisions for sharing relevant evaluation data with source institutes, giving also due regard to the special needs of commercial users for appropriate confidentiality;

(e) give appropriate financial support for characterization and evaluation programmes for crop species of primary or exclusive importance to food security in their countries, given the importance of medium and long-term financing.

154. Crop networks and genebanks should proceed carefully to develop core collections of crops of major interest to the national systems. While core collections provide guidance on the constitution of genebank collections, they do not replace them. Genebanks should not use the existence of a core collection as an excuse for allowing conservation conditions for other accessions in the collection to deteriorate.

- There is still an ongoing need to improve the coverage of diversity in *ex situ* collections, including CWR and farmers' varieties, coupled with better characterization, evaluation and documentation of the collections (SOW-2 p.17 b.1); ALSO PA-3 & PA-5 & PA-6 & PA-7 & PA-9

- The need for better inventories and characterization data on land races, CWR and other useful wild species, including forages, in order to better target *in situ* conservation action; (SOW-2 p.44 b.10) ALSO PA-1 & PA-4 & PA-7 & PA-8 & PA-18

- To better serve the management of collections and encourage an increased use of the germplasm, documentation, characterization and evaluation all need to be strengthened and harmonized and the data need to be made more accessible. Greater standardization of data and information management systems is needed (SOW-2 p.87 b.6); ALSO PA-6 & PA-16 & PA-17

- Greater attention is needed in the development of core collections and other collection subsets, as well as in pre-breeding and base broadening efforts, as effective ways to promote and enhance the use of PGRFA (SOW-2 p.116 b.9);

155. **Capacity:** Support should be given to begin a step-by-step, targeted characterization and evaluation programme for selected priority germplasm. The characterization and evaluation process would begin with an assessment of current information and an effort to assemble, collate, computerize and make available existing information contained in notes, reports, punched cards, etc. Much evaluation work needs to be done in a use-oriented, site-specific manner.

156. Governments and appropriate organizations should identify institutions and individuals who may have the capacity and expertise to carry out germplasm characterization and evaluation for specific stresses and should develop a national portfolio of such expertise, including farmers in high stress areas who may perform preliminary evaluation to identify subsets of accessions that hold promise for further evaluation under more stringent scientific conditions. The cost efficiency of sub-contracting evaluation work should also be investigated as well as cooperative programmes between national programmes and the private sector, such as the LAMP (Latin American Maize Project) project.

157. National programme staff should receive training in germplasm characterization and evaluation techniques on a crop-specific basis. Such training should begin with crops deemed important nationally, and for which there are current or planned breeding programmes.

158. Support training of farmers, including women farmers, participating in on-farm evaluation programmes, in the necessary relevant skills. As their responsibilities often extend from the propagation, production and harvesting of crops to the processing, storage and preparation of foods, women's knowledge of the uses and usefulness of plants is often extensive.

159. Appropriate technical and financial support should be given for multiplication of core collection germplasm.

160. **Research/technology:** Various kinds of research must be undertaken if the cost effective use of current collections is to be encouraged. This could include access to the latest technology and support for scientific research to improve characterization and evaluation techniques.

161. Research priorities relating to core collections include developing:

(a) improved methods of germplasm characterization using, inter alia, biochemical and molecular biological methods;

(b) improved diversity stratification procedures;

(c) methods for validating core collection selections;

(d) methods for linking core collection to the main collection (sampling strategies);

(e) improved methods of using plant genetic resources for food and agriculture, including targeted trait detection.

162. Promote regional and international symposia of germplasm experts to discuss the many technical issues involved in developing and using core collections and to stimulate activity in this area and complementarity with other aspects of the *Global Plan of Action.*

163. **Coordination/administration:** Characterization and evaluation efforts should be planned and implemented with the active participation of national programmes, and crop and regional networks. As appropriate, farmers' organizations, private companies and their associations, and others might also be involved.

164. Core collections should be developed with the active participation of breeders and crop networks for major crops. Work on core collections must be considered within and integrated firmly in the context of the entire effort to improve utilization.

165. Cooperation and exchange of information are needed, especially by developing country genebanks that manage collections of wide species diversity without corresponding specialization among staff for all species.

166. There should be periodic assessments of the use of core collections to guide future work and assist in setting priorities. Such assessments should be made in conjunction with plant breeders and in consultation with appropriate international agencies, institutions, and NGOs.

167. **This activity is closely linked with:**

- Sustaining existing *ex situ* collections;
- Supporting on-farm management and improvement of plant genetic resources for food and agriculture;
- Regenerating threatened *ex situ* accessions;
- Supporting planned and targeted collecting of plant genetic resources for food and agriculture;
- Increasing genetic enhancement and base-broadening efforts;
- Constructing comprehensive information systems for plant genetic resources for food and agriculture

10. Increasing genetic enhancement and base-broadening efforts

168. **Assessment:** Broadening the genetic base of crops can contribute to increasing stability and performance in crops. However, from the perspective of any individual breeder, company or institute, the costs of incorporating new and diverse germplasm into already adapted material may outweigh the benefits they could realise. Such benefits are often realised only in the long-term and accrue to society in general as well as to other plant breeders. Due to the nature of many genetic enhancement and general pre-breeding activities, international collaboration and public support are warranted.

- Concerns about the potential impact of climate change have grown substantially over the past decade. Agriculture is both a source and a sink for atmospheric carbon. PGFRA are becoming recognised as being critically important for the development of farming systems that capture more carbon and emit fewer greenhouse gasses, and for underpinning the breeding of the new varieties that will be needed for agriculture to adapt to the anticipated future environmental conditions (SOW-2 p.198 b.3); ALSO PA-2 & PA-11

- There has been a substantial increase in awareness over the past decade of the extent and nature of the threats posed by climate change, and of the importance and potential of PGFRA in helping agriculture to remain productive under the new conditions through their underpinning of efforts to breed new, adapted crop varieties (SOW-2 p.115 b.8); ALSO PA-3 & PA-9 & PA-11 & PA-18 & PA-20

Considerably more attention and capacity building is still needed to strengthening plant breeding capacity in most developing countries. The Global Partnership Initiative for Plant Breeding Capacity building (GIPB), for example, aims to enhance the sustainable use of PGRFA in developing countries through helping build capacity in plant breeding and seed systems. p. xviii

The Generation Challenge Programme (GCP) is an initiative of the CGIAR that aims to create improved crops for small farmers through partnerships among research organizations. It focuses on using biotechnology to counter the effects of drought, pests, diseases and low fertility of soil through sub-programmes on genetic diversity, genomics, breeding, bioinformatics and capacity building. The GIPB is a multi-stakeholder partnership of public and private sector parties from developing and developed counties. It aims to enhance the plant breeding capacity and seed delivery systems of developing countries and improve agricultural production through the sustainable use of PGRFA. It is an internet-based initiative facilitated by FAO, and provides a major portal for information dissemination and sharing. SOW-2 p.117

169. Approaches to genetic enhancement include:

(a) introgression of useful agronomic traits identified through characterization or evaluation into locally adapted or elite material for further use in breeding programmes; and

(b) base-broadening of breeders' material through incorporation of wide genetic diversity.

- Overall global plant breeding capacity has not changed significantly; a modest increase in the number of plant breeders has been reported by certain national programmes and a decline by others (SOW-2 p.114 b.1); ALSO PA-19

- There has been little change in the crop focus of the breeding programmes as well as in the principal traits sought by plant breeders. Major crops still receive the most attention and yield per unit area continues to be the primary trait sought. However, recently more attention has been paid to under-utilized crops and to the use of CWR (SOW-2 p.114 b.2); ALSO PA-4 & PA-12

- Progress has been made in genetic enhancement and base broadening with several countries now reporting the use of these techniques as a way to introduce new traits from non-adapted populations and wild relatives (SOW-2 p.114 b.4);

- While country reports from all five regions indicated an increase in farmer participation in plant breeding activities over the past decade, farmers' involvement is still largely limited to priority setting and selecting from among advanced lines or finished varieties (SOW-2 p.114 b.5);

- The constraints (human resources, funding and facilities) to greater use of PGRFA and their relative importance are similar to those reported in the first SoW report. However, issues such as the lack of fully effective linkages between researchers, breeders, curators, seed producers and farmers, and lack of comprehensive information systems were also highlighted this time (SOW-2 p.114 b.6); ALSO PA-13 & PA-17

170. **Long-term objectives:** To increase food security and improve farmers' livelihoods through the development of better plant varieties. To increase the utilization of genetic resources and thereby provide incentives for their conservation. To reduce genetic uniformity in crop varieties through the utilization of wild relatives, local materials and/or modern varieties. To increase sustainability of agricultural systems and the capacity for adaptation to unexpected environmental changes

171. **Intermediate objectives:** To increase the genetic diversity available in breeders' populations through appropriate strategies of introgression (base-broadening).

172. **Policy/strategy:** Governments, international organizations, non-government organizations and funding sources should recognize the importance of providing long-term funding and logistical support to pre-breeding, genetic enhancement and base-broadening activities.

- Considerable opportunities exist for strengthening cooperation among those involved in the conservation and sustainable use of PGRFA, at all stages of the seed and food chain. Stronger links are needed, especially between plant breeders and those involved in the seed system, as well as between the public and private sectors (SOW-2 p.116 b.4); ALSO PA-2 & PA-11 & PA-13

- Greater efforts are needed in order to mainstream new biotechnological and other tools within plant breeding programmes (SOW-2 p.116 b.5); ALSO PA-2 & PA-11

- More investment is needed in the improvement of under-utilized crops as well as of traits in major crops that are likely to assume greater importance in the future as increased attention is paid to health and dietary concerns and as the effects of climate change intensify (SOW-2 p.116 b.6); ALSO PA-2 & PA-4 PA-11 & PA-12 & PA-14 & PA-20

- In order to promote and strengthen the use of participatory breeding, many countries need to reconsider their policies and legislation, including developing appropriate intellectual property protection and seed certification procedures for varieties bred through PPB. Greater attention is also needed to capacity building and to ensuring PPB is integrated in national breeding strategies (SOW-2 p.116 b.10); ALSO PA-2 & PA-11 & PA-12 & PA-15

- Greater attention needs to be given to the development of more decentralized, participatory and gender sensitive approaches to plant breeding in order to more effectively generate varieties that are specifically adapted to the particular production environments and socio-economic situations of the poor in less favoured environments (SOW-2 p.200 b.8); ALSO PA-2 & PA-11 & PA-12

- The growing consensus on the nature, extent and rate of climate change makes it imperative that far greater attention be paid to anticipating and preparing for its effects. Given the time needed to breed a new crop variety (around ten years), it is essential that additional plant breeding capacity be built now, especially in developing countries, and that breeding programmes expand their efforts to develop the traits and varieties needed to meet the challenge (SOW-2 p.199 b.1);

173. **Capacity:** Support should be given to national systems, regional networks, International Agricultural Research Centres, non-government organizations, universities and other relevant organizations to carry out pre-breeding and genetic enhancement projects. Priority should be given to addressing problems identified by crop and regional networks, other competent scientific bodies and institutions, and farmers' organizations. Initial efforts should focus on the most pressing problems identified in 15 crops of international and regional significance.

- There is an urgent need to increase plant breeding capacity worldwide in order to be able to adapt agriculture to meet the rapidly expanding demand for more and different food, as well as non-food products, under substantially different climatic conditions from those prevailing today. The training of more breeders, technicians and field workers, and the provision of better facilities and adequate funds are all essential (SOW-2 p.115 b.1); ALSO PA-2 & PA-4 & PA-10 & PA-12 & PA-15 & PA-19

- FAO has further strengthened its activities in the PGRFA area, for example it established the GIPB in 2006 (SOW-2 p.161 b.8);

Overall the difficulties of mitigating against and adapting to climate change are likely to make it considerably more difficult to meet the increased demand for food in the future. The challenge will be exacerbated further by growing competition for land for other uses, such as urban development or for growing new crops. In order to meet such challenges it is essential that greater attention be devoted to conserving genetic diversity, and in particular to targeting the collection and conservation of landraces and crop wild relatives that have traits that are likely to become more important in the future. Coupled with this, it is essential that plant breeding efforts be stepped up around the world, and especially in those developing countries likely to be hardest hit by climate change. This will require greatly enhanced attention to capacity building in traditional as well as modern plant genetic improvement techniques. (SOW-2 p.191)

174. **Research/technology:** Institutions, should further develop methodologies for genetic enhancement including pre-breeding, and broadly disseminate these methodologies.

175. **Coordination/administration:** Activities should be planned and undertaken in close collaboration with national programmes with the collaboration of crop and regional networks, other scientific bodies and institutions, and farmers' organizations. Close communication with plant breeders and other scientists in both the public and private sector should be encouraged.

Not only is there an ongoing need for training in conventional plant breeding, but with the growing importance of molecular biology and information science, the need has grown for capacity building in these areas as well. Capacity building efforts cannot be effective unless incentives are provided, such as structured career opportunities, to help ensure that experienced staff are retained and remain productive. As with other constraints, improved international collaboration could help cut training costs and reduce unnecessary duplication of investments. In this regard, the use of regional centres of excellence has been suggested as one means of reducing costs and duplication. (SOW-2 p.104)

176. **This activity is closely linked with:**

- Constructing comprehensive information systems for plant genetic resources for food and agriculture
- Expanding the characterization, evaluation and number of core collections to facilitate use
- Supporting on-farm management and improvement of plant genetic resources for food and agriculture

11. Promoting sustainable agriculture through diversification of crop production and broader diversity in crops

177. **Assessment:** Many major crops are, to quote an early National Academy of Sciences assessment of the US situation, "impressively uniform genetically and impressively vulnerable." Uniformity does not equate with nor necessarily lead to vulnerability. And the lack of perfect assessment and forecasting tools and methodologies means that the degree of vulnerability cannot be precisely identified. Nevertheless, it is important to monitor this situation in order to take remedial or precautionary actions when warranted.

178. In the future agricultural systems will need to incorporate a broader range of crops including inter alia crops which produce raw material or are sources of energy. As a precaution, some actions are warranted now to encourage and facilitate the use of more diversity in breeding programmes and in the varieties and species used on farms. Innovative approaches in plant breeding for the purposes of domesticating new crops, the development of new plant varieties and the promotion of higher levels of genetic diversity in crops and on farms, such as planting mixtures of adapted varieties, are recognized as means for adding stability in agricultural systems and promoting agricultural production and food security.

- Since the publication of the first SoW report several new challenges have been recognized and these are beginning to be addressed in national analysis and strategies. The ones highlighted in this report include: sustainable agriculture and ecosystem services, new and under-utilized crops, biofuel crops, health and dietary diversity, and climate change (SOW-2 p.115 b.7);

- There has been a substantial increase in awareness over the past decade of the extent and nature of the threats posed by climate change, and of the importance and potential of PGFRA in helping agriculture to remain productive under the new conditions through their underpinning of efforts to breed new, adapted crop varieties (SOW-2 p.115 b.8); ALSO PA-3 & PA-9 & PA-18 & PA-20

- There have been growing efforts to strengthen the relationship between agriculture and the provision of ecosystem services. Schemes that promote PES - such as the *in situ* or on farm conservation of PGRFA - are being set up in an attempt to encourage and reward farmers and rural communities for their stewardship of the environment. However, the fair and effective implementation of such schemes remains a major challenge (SOW-2 p.198 b.2); ALSO PA-2

- Many countries still lack national strategies and/or action plans for the management of diversity - or if they have them, they do not fully implement them. Areas that require particular attention include setting priorities, enhancing national and international cooperation, the further development of information systems and identifying gaps in the conservation of PGRFA, including CWR (SOW-2 p.20 b.6); ALSO PA-2 & PA-15 & PA-17

- Many countries lack nationally endorsed strategies and plans for the conservation and use of PGRFA. These are important for setting priorities, distributing roles and responsibilities, and allocating resources (SOW-2 p.137 b.3); ALSO PA-12 & PA-15

- The area sown to transgenic crops has increased substantially since 1996 and the seed market has grown in value in step with this. In 2007, 114.3 million hectares were planted to GM-crops, mainly soybean, maize, cotton and oilseed rape (SOW-2 p.115 b.9);

- In spite of the on-going controversy, GM-crops are being grown on an expanding area in a growing number of countries (SOW-2 p.199 b.9).

- Organic agricultural production is receiving greater attention in response to increasing concerns by consumers regarding their diet, health and the environment (SOW-2 p.199 b.8);

- Concerns about the potential impact of climate change have grown substantially over the past decade. Agriculture is both a source and a sink for atmospheric carbon. PGFRA are becoming recognised as being critically important for the development of farming systems that capture more carbon and emit fewer greenhouse gasses, and for underpinning the breeding of the new varieties that will be needed for agriculture to adapt to the anticipated future environmental conditions (SOW-2 p.198 b.3); ALSO PA-2

179. **Long-term objectives:** To promote sustainable agriculture and reduce genetic erosion and possible genetic vulnerability by diversifying crop production and increasing genetic diversity in crops.

180. **Intermediate objectives:** To review periodically genetic vulnerability in crops and encourage breeders and appropriate groups, to take mitigating action nationally and internationally, as appropriate.

181. To promote the goal of higher levels of genetic diversity consistent with productivity increase and agronomic needs, including in crop production, plant breeding and biotechnological research and development settings.

182. **Policy/strategy:** Governments and relevant intergovernmental organizations in cooperation with crop networks, research institutions, extension agencies, the private sector, farmers' organizations and NGOs, should:

(a) Regularly monitor genetic uniformity and assess vulnerability in crops;

(b) review policies which may affect the level of diversity in agricultural systems, and specifically the degree of genetic uniformity and vulnerability of major crops.

(c) increase heterogeneity by planting mixtures of adapted varieties and species as appropriate.

183. Funding agencies should be encouraged to continue to provide support to international agricultural centres, national agricultural research systems, and other relevant research bodies and NGOs, for work aimed at enhancing levels of genetic diversity in agricultural systems. The release by the international centres of unfinished varieties to national programmes for further development, including on-farm improvement, and in accordance with an appropriate strategy, is one measure which could bring higher levels of diversity, adaptation and stability to crops. The selection of high yielding landraces/farmers' varieties is another measure.

- The need for greater awareness among policy makers, donors and the general public of the value of PGRFA, and the importance of crop improvement, in meeting future global challenges (SOW-2 p.115 b.2); ALSO PA-2 & PA-4 & PA-15 & PA-18 & PA-20

- There is a need for countries to adopt appropriate and effective strategies, policies, legal frameworks and regulations that promote the use of PGRFA, including appropriate seed legislation (SOW-2 p.116 b.3); ALSO PA-2 & PA-4 & PA-12 & PA-13 & PA-15

- A better understanding of, and support for, farmers' management of diversity is still needed, in spite of significant advances in this area. Opportunities exist for improving the livelihoods of rural communities an essential element of such efforts (SOW-2 p.17 b.2); ALSO PA-2 & PA-12 & PA-20

- There is also a need to step up efforts to conserve landraces, farmers' varieties and CWR before they are lost as a result of changing climates. Special efforts are needed to identify those species and populations that are most at risk and that are most likely to harbour traits that will be important in the future (SOW-2 p.199 b.2); ALSO PA-3 & PA-7 & PA-8 & PA-9 & PA-10 & PA-18

- Greater attention is needed regarding the conservation and use of PGRFA of neglected and under-utilised crops and non-food crops. Many such species can make a valuable contribution to improving diets and incomes (SOW-2 p.20 b.4); ALSO PA-2, PA-5 & PA-7 & PA-8 & PA-12 & PA 14 & PA-20

- Greater attention needs to be given to the development of more decentralized, participatory and gender sensitive approaches to plant breeding in order to more effectively generate varieties that are specifically adapted to the particular production environments and socio-economic situations of the poor in less favoured environments (SOW-2 p.200 b.8); ALSO PA-2 & PA-12

- There is a need for specific strategies to be developed for conserving PGRFA *in situ* and for managing crop diversity on farm. Special attention needs to be given to conservation of CWR in their centres of origin, major centres of diversity and biodiversity hotspot areas (SOW-2 p.44 b.5); ALSO PA-2 & PA-4 & PA-15

- Considerable opportunities exist for strengthening cooperation among those involved in the conservation and sustainable use of PGRFA, at all stages of the seed and food chain. Stronger links are needed, especially between plant breeders and those involved in the seed system, as well as between the public and private sectors (SOW-2 p.116 b.4); ALSO PA-2 & PA-10 & PA-11 & PA-13

- Greater efforts are needed in order to mainstream new biotechnological and other tools within plant breeding programmes (SOW-2 p.116 b.5); ALSO PA-2 & PA-10 & PA-11

- More investment is needed in the improvement of under-utilized crops as well as of traits in major crops that are likely to assume greater importance in the future as increased attention is paid to health and dietary concerns and as the effects of climate change intensify (SOW-2 p.116 b.6); ALSO PA-2 & PA-4 & PA-10 & PA-11 & PA-12 & PA-14 & PA-20

- There is a need for more efficient, strategic and integrated approaches to the management of PGRFA at the national level. Links need to be strengthened between those individuals and institutions in both the private and public sectors who are primarily responsible for conservation, and those who are primarily concerned with genetic improvement and seed production and distribution (SOW-2 p.199 b.3); ALSO PA-12 & PA-15 & PA-18

184. **Capacity:** Governments, and their national agricultural research systems, supported by the International Agricultural Research Centres, and other research and extension organizations should:

(a) increase their capacity to develop and use multilines, mixtures and synthetic varieties, as appropriate;

(b) increase their capacity to use integrated pest management strategies, including the use of race-non-specific (or horizontal) resistances, the pyramiding of race-specific resistances, and the strategic deployment of resistance genes;

(c) facilitate the strategic use of a range of varieties;

(d) explore and, in appropriate circumstances, make use of decentralized and "participatory" plant breeding strategies to develop plant varieties specifically adapted to local environments;

(e) make use of modern biotechnological techniques as feasible, to facilitate broadening of the genetic base of crops.

- There is a need to strengthen the ability of farmers, indigenous and local communities and their organizations, as well as extension workers and other stakeholders, to sustainably manage agricultural biodiversity (SOW-2 p.43 b.2); ALSO PA-2 & PA-12 & PA-15

- There is an urgent need to increase plant breeding capacity worldwide in order to be able to adapt agriculture to meet the rapidly expanding demand for more and different food, as well as non-food products, under substantially different climatic conditions from those prevailing today. The training of more breeders, technicians and field workers, and the provision of better facilities and adequate funds are all essential (SOW-2 p.115 b.1); ALSO PA-2 & PA-4 & PA-10 & PA-12 & PA-15 & PA-19

185. **Research/technology:** Support efforts to identify those activities used in plant breeding, plant research and farming systems that foster on-farm diversity. Such research might include a review of non-homogenous farming systems such as those based on intercropping, polycropping, integrated pest management, and integrated nutrient management, for their possible wider applicability, as well as research to develop appropriate plant breeding methodologies.

186. Support should be encouraged for developing improved tools and methodologies for assessing genetic vulnerability and identifying, if possible, the ideal equilibria in crops between genetic uniformity and diversity consistent with practical, technical and economic considerations that sustain ecosystems.

- Specific research needs relating to on farm management or *in situ* conservation of PGRFA include (SOW-2 p.44 b.10):

  • Studies on the extent and nature of possible threats to existing diversity on farm and *in situ*; ALSO PA-3 & PA-4 & PA-7 & PA-8 & PA-15 & PA-18

  • Further research to provide information to underpin the development of appropriate policies for the conservation and use of genetic diversity, including the economic valuation of PGRFA. ALSO PA-2 & PA-4 & PA-5 & PA-8 & PA-12 & PA-15 & PA-20

187. **Administration/coordination:** The Commission on Genetic Resources for Food and Agriculture, or an appropriate subsidiary body designated by the Commission, should be regularly informed of the state of diversity in collections and breeding populations of major crops of significance to world food security. The Commission should make such information available to other relevant intergovernmental bodies such as the Conference of the Parties to the Convention on

Biological Diversity, the International Plant Protection Convention, and the Commission for Sustainable Development.

- The involvement of local communities is essential in any *in situ* conservation or on farm management effort and traditional knowledge systems and practices need to be fully taken into account. Collaboration between all stakeholders needs to be strengthened in many countries (SOW-2 p.44 b.6); ALSO PA-2 & PA-4 & PA-15 & PA-18 & PA-20

188. **This activity is closely linked with:**

- Developing monitoring and early warning systems for loss of plant genetic resources for food and agriculture
- Supporting on-farm management and improvement of plant genetic resources for food and agriculture
- Increasing genetic enhancement and base-broadening efforts
- Developing new markets for local varieties and "diversity-rich" products

12. Promoting development and commercialization of underutilized crops and species

189. **Assessment:** While a small number of species provides a large proportion of global food needs, hundreds of other species are utilised at a local level, either through cultivation or harvesting. These under-utilised species contribute substantially to household food and livelihood security; they are often managed or harvested by women. Knowledge concerning the uses and management of these species is likewise often localized and specialized. Many under-utilised plants have potential for more widespread use, and their promotion could contribute to food security, agricultural diversification, and income generation, particularly in areas where the cultivation of major crops is economically marginal. However, current programmes for conservation, research and development tend to neglect these species.

- Interest in and awareness of the importance of conserving CWR, both *ex situ* and *in situ,* and its use in crop improvement have increased substantially (SOW-2 p.17 b.3); ALSO PA-4 & PA-7 & PA-14 & PA-20

- There is growing interest in hitherto 'neglected' and under-utilised species such as traditional vegetables and fruits (SOW-2 p.17 b.4); ALSO PA-4 & PA-14

- There has been little change in the crop focus of the breeding programmes as well as in the principal traits sought by plant breeders. Major crops still receive the most attention and yield per unit area continues to be the primary trait sought. However, recently more attention has been paid to under-utilized crops and to the use of CWR (SOW-2 p.114 b.2); ALSO PA-4 & PA-10

- Many countries lack nationally endorsed strategies and plans for the conservation and use of PGRFA. These are important for setting priorities, distributing roles and responsibilities, and allocating resources (SOW-2 p.137 b.3); ALSO PA-11 & PA-15

190. **Long-term objectives:** To contribute to agricultural diversification, increased food security, and improved farmers' livelihoods; to promote the conservation and sustainable management of under-utilised species and their genetic resources.

191. **Intermediate objectives:** To develop appropriate conservation strategies and sustainable management practices for under-utilised species; to improve selected species; to improve the marketing of under-utilised crops.

192. **Policy/strategy:** Governments and their national agricultural research systems, with the support of the international agricultural research centres, and non-governmental organizations, and taking into account the views of farmers' organizations and their communities, are encouraged to promote policies consistent with the sustainable use, management and development of under-utilized species, including land use policies, as appropriate, identified as having a potential to make significant contributions to local economies and food security.

- Greater attention is needed regarding the conservation and use of PGRFA of neglected and under-utilised crops and non-food crops. Many such species can make a valuable contribution to improving diets and incomes (SOW-2 p.20 b.4) ALSO PA-2 & PA-5 & PA-8 & PA-14 & PA-20

- A better understanding of, and support for, farmers' management of diversity is still needed, in spite of significant advances in this area. Opportunities exist for improving the livelihoods of rural communities an essential element of such efforts (SOW-2 p.17 b.2); ALSO PA-2 & PA-11 & PA-20

- Greater efforts are needed to promote the use of the genetic resources maintained in collections. Stronger links are needed between the managers of collections and those whose primary interest lies in using the resources, especially for plant breeding (SOW-2 p.87 b.8); ALSO PA-7

- There is an urgent need to increase plant breeding capacity worldwide in order to be able to adapt agriculture to meet the rapidly expanding demand for more and different food, as well as non-food products, under substantially different climatic conditions from those prevailing today. The training of more breeders, technicians and field workers, and the provision of better facilities and adequate funds are all essential (SOW-2 p.115 b.1); ALSO PA-2 & PA-4 & PA-10 & PA-11 & PA-15 & PA-19

- There is a need for countries to adopt appropriate and effective strategies, policies, legal frameworks and regulations that promote the use of PGRFA, including appropriate seed legislation (SOW-2 p.116 b.3); ALSO PA-2 & PA-11 & PA-13 & PA-15

- More investment is needed in the improvement of under-utilized crops as well as of traits in major crops that are likely to assume greater importance in the future as increased attention is paid to health and dietary concerns and as the effects of climate change intensify (SOW-2 p.116 b.6); ALSO PA-2 & PA-4 & PA-10 & PA-14 & PA-20

- In order to capture the potential market value of native crops, local varieties, underutilized crops and the like, there is a need for greater integration of the efforts of individuals and institutions having a stake in different parts of the production chain, from the development and testing of new varieties, through value added activities, to the opening up of new markets (SOW-2 p.116 b.7); ALSO PA-4 & PA-14

- Greater attention is needed in many countries to the development of appropriate, non-conflicting and complementary national policies and legislation relating to the conservation, exchange, and use of PGRFA, including such areas as phytosanitary regulations, intellectual property protection, farmers' rights, and biosafety, and taking into account the needs and concerns of all stakeholders (SOW-2 p.137 b.10). ALSO PA-8 & PA-15

- Greater attention needs to be given to the development of more decentralized, participatory and gender sensitive approaches to plant breeding in order to more effectively generate varieties that

are specifically adapted to the particular production environments and socio-economic situations of the poor in less favoured environments (SOW-2 p.200 b.8); ALSO PA-2 & PA-11

- There is a need for more efficient, strategic and integrated approaches to the management of PGRFA at the national level. Links need to be strengthened between those individuals and institutions in both the private and public sectors who are primarily responsible for conservation, and those who are primarily concerned with genetic improvement and seed production and distribution (SOW-2 p.199 b.3); ALSO PA-11 & PA-15 & PA-18

193. **Capacity:** Training and capacity building for scientists and extension specialists and for farmers and local communities, with particular emphasis on women, should be provided in:

(a) identifying under-utilised species with potential for increased sustainable use;

(b) developing and implementing sustainable management practices for under-utilized species of importance to food and agriculture;

(c) developing post-harvest processing methods;

(d) developing marketing methods.

- Greater efforts are needed to encourage and support entrepreneurs and small-scale enterprises concerned with the sustainable use of PGRFA (SOW-2 p.116 b.11). ALSO PA-13 & PA-14 & PA-15

- There is a need to strengthen the ability of farmers, indigenous and local communities and their organizations, as well as extension workers and other stakeholders, to sustainably manage agricultural biodiversity (SOW-2 p.43 b.2); ALSO PA-2 & PA-11 & PA-15

194. **Research/technology:** Research should be undertaken to:

(a) develop sustainable management practices for under-utilized species of importance to food and agriculture and their genetic resources;

(b) develop post-harvest processing and other methods to improve marketing possibilities.

- Specific research needs relating to on farm management or *in situ* conservation of PGRFA include (SOW-2 p.44 b.10):

  • Ethnobotanical and socio-economic studies, including the study of indigenous and local knowledge, to better understand the role and limits of farming communities in the management of PGRFA; ALSO PA-2

  • Further research to provide information to underpin the development of appropriate policies for the conservation and use of genetic diversity, including the economic valuation of PGRFA. ALSO PA-2 & PA-4 & PA-5 & PA-8 & PA-11 & PA-15 & PA-20

195. **Coordination/administration:** Regional networks together with national programmes and in cooperation with international agricultural research centres, NGOs and other relevant organizations, should regularly review the status of under-utilised species in their region, to:

(a) identify possibilities for greater sustainable use;

(b) identify common research and development needs;

(c) facilitate and, as appropriate, coordinate requests for relevant financial and technicalassistance.

- The links between institutions concerned primarily with the conservation of PGRFA and those concerned primarily with its use are weak or even absent in many countries and need to be strengthened (SOW-2 p.137 b.2); ALSO PA-2 & PA-4 & PA-8 & PA-15 & PA-18

196. **This activity is closely linked with:**

- Supporting on-farm management and improvement of plant genetic resources for food and agriculture
- Promoting *in situ* conservation of wild crop relatives and wild plants for food production
- Developing new markets for local varieties and "diversity-rich" products
- Promoting public awareness of the value of plant genetic resources for food and agriculture conservation and use

13. Supporting seed production and distribution

197. **Assessment:** Farmers benefit from having a wide range of seed varieties and other planting materials. Availability can be constrained by: (a) poor harvests, inadequate on-farm storage facilities, insufficient means to multiply quality seed, and (b) poor seed distribution systems. These problems can apply to seed of both local and commercially-bred varieties. Parastatal and commercial seed companies sometimes have difficulty supplying seed of varieties specifically adapted to unique and local conditions. Often they cannot offer the range of varieties, or seed of so-called "minor" crops, on which many farmers rely, because of high transaction costs and low purchasing power of farmers. There is thus a need to strengthen local capacity to produce and distribute seed of many crop varieties, including some landraces/farmers' varieties, that are useful for diverse and evolving farming systems.

- Significant progress has been made in understanding the value of local seed systems and in strengthening their role in maintaining genetic diversity on farm (SOW-2 p.43 b.9);

- There have been three main trends in national seed legislation and policy over the past decade: the emergence of voluntary arrangements on seed certification and variety release; the growing use of accreditation principles alongside official national rules and standards; and the regional harmonization of seed laws (SOW-2 p.136 b.11);

- There has been a major increase in the international seed trade, which is dominated by fewer and larger multinational seed companies than in 1996. The focus of interest of these companies remains primarily on the development of improved varieties, and the marketing of high quality seeds of major crops for which farmers replace seed yearly (SOW-2 p.115 b.10);

- Investment by the public sector in seed production, already at a low level in most developed countries at the time of first SoW report, has since then also decreased significantly in many developing countries. In many countries access to improved varieties and quality seed remains

limited, especially by non-commercial farmers and the producers of minor crops (SOW-2 p.115 b.11);

- There has been an increasing move to integrate local seed systems within emergency responses aimed at supporting farmers in the aftermath of natural disasters and civil conflicts (SOW-2 p.115 b.13); ALSO PA-3 & PA-18

- There is a growing market for specialized 'niche' seeds, such as for 'heritage' varieties (SOW-2 p.115 b.14).

- There is a trend to harmonize seed regulations at the regional level (Europe, East Africa, Southern Africa and West Africa) in order to facilitate seed trading and foster the development of the seed sector (SOW-2 p.115 b.12);

198. **Long term objectives:** To increase the availability of good quality seed of a wider range of plant varieties.

199. To contribute to the maximization of both agro-biodiversity and productivity.

200. **Intermediate objectives:** To improve the complementarity between governmental (or parastatal), commercial, and small scale enterprises in plant breeding, seed production, and seed distribution.

201. To develop and expand viable local-level seed production and distribution mechanisms for varieties and crops important to small-scale farmers;

202. To help make new crop varieties available to farmers. To make suitable materials that are stored *ex situ* available for multiplication and distribution to farmers.

203. **Policy/strategy:** Governments and their national agricultural research systems, subject to national laws and regulations as appropriate, with support from international agricultural research centres, regional cooperation programmes and NGOs, and taking into account the views of the private sector, farmers' organizations and their communities, should:

(a) Develop appropriate policies concerning governmental, commercial and informal enterprises in, seed production, and seed distribution, to help focus efforts of government supported initiatives on the varietal needs of resource-poor farmers in particular, with attention, where necessary, on the needs of women farmers. Such an approach should be complemented by encouraging the private sector to meet the needs
of larger-scale, commercial farmers. Government involvement with major or minor crops that are inadequately covered by the private sector should not be precluded;

(b) Provide, and promote as appropriate, an enabling environment, where such an environment does not already exist, for the development of small-scale seed enterprises, including through appropriate incentives;

(c) strengthen linkages between genebanks, plant breeding organizations, seed producers, and small-scale seed production and distribution enterprises;

(d) consider seed quality control schemes particularly those appropriate to small scale enterprises.

(e) Consider legislative measures which allow distribution and commercialization of landraces/farmers' varieties and obsolete varieties, if they meet the same distribution and commercialization criteria for disease, pests, health and the environment, as conventional or registered

varieties. These measures should meet quality standards of seed distribution and commercialization, in accordance with national legislation or applicable regional agreements, as appropriate.

- There is a need for countries to adopt appropriate and effective strategies, policies, legal frameworks and regulations that promote the use of PGRFA, including appropriate seed legislation (SOW-2 p.116 b.3); ALSO PA-2 & PA-4 & PA-11 & PA-12 & PA-15

- Considerable opportunities exist for strengthening cooperation among those involved in the conservation and sustainable use of PGRFA, at all stages of the seed and food chain. Stronger links are needed, especially between plant breeders and those involved in the seed system, as well as between the public and private sectors (SOW-2 p.116 b.4); ALSO PA-11

- Greater efforts are needed to encourage and support entrepreneurs and small-scale enterprises concerned with the sustainable use of PGRFA (SOW-2 p.116 b.11). ALSO PA-12 & PA-14 & PA-15

204. **Capacity:** Governments, subject to national laws, regulations and policies as appropriate, and in conjunction with international aid agencies, NGOs and existing seed enterprises should:

(a) Encourage existing seed enterprises to improve the range and quality of planting materials they offer;

(b) Provide appropriate incentives, credit schemes, etc., to facilitate the emergence of seed enterprises, paying attention as appropriate in each country, to the needs of the small farming sector, of women and of vulnerable or marginalized groups;

(c) Provide support to and strengthen farmers' organizations in order that they can more effectively express demand for their seed requirements, paying particular attention to the needs of women and of vulnerable or marginalized groups; and

(d) Provide training and infrastructural support to farmers in seed technology, in order to improve the physical and genetic quality of farmer-saved seed.

- The constraints (human resources, funding and facilities) to greater use of PGRFA and their relative importance are similar to those reported in the first SoW report. However, issues such as the lack of fully effective linkages between researchers, breeders, curators, seed producers and farmers, and lack of comprehensive information systems were also highlighted this time (SOW-2 p.114 b.6); ALSO PA-10 & PA-17

205. **Research/technology:** Governments should:

(a) Assess current incentives and disincentives as well as needs for support to seed production and distribution enterprises, including small-scale, farmer-level efforts;

(b) Develop approaches to support small-scale, farmer-level seed distribution, learning from the experiences of community and small-scale seed enterprises already underway in some countries.

206. **Coordination/administration:** National capacity for farmers to acquire appropriate seed should be regularly monitored by governments.

207. The potential for integrating this activity into agricultural development projects should be explored in collaboration *inter alia*, with FAO, UNDP, the World Bank and IFAD.

14. Developing new markets for local varieties and "diversity-rich" products

208. **Assessment:** Increasingly, diversity is being replaced by uniformity in the agricultural market place. Changes in traditional cultures and in consumer preferences are one explanation. Concentration on productivity, the effects of advertising and the rise of global consumer markets leading to stringent requirements being imposed on farmers and the inadvertent disincentives arising from legislation, policies, programmes and other institutional activities offer additional explanations. Farmers worldwide are losing once strong incentives to provide an array of varieties. Both in developed and developing countries, economic and social incentives could be offered to encourage farmers who continue to grow distinct, local varieties and produce "diversity-rich" agricultural products.

209. A programme to assist in the creation of specialized niche markets for biodiverse food crops could act as a positive stimulus to farmers to grow landraces/farmers' varieties, obsolete varieties, and other under-utilized food crops. Such a programme should include the identification and removal of systemic institutional barriers and disincentives to biodiversity conservation and production/marketing

- Interest in and awareness of the importance of conserving CWR, both *ex situ* and *in situ,* and its use in crop improvement have increased substantially (SOW-2 p.17 b.3); ALSO PA-4 & PA-12 & PA-20

- There is growing interest in hitherto 'neglected' and under-utilised species such as traditional vegetables and fruits (SOW-2 p.17 b.4); ALSO PA-4 & PA-12

- Greater attention is needed regarding the conservation and use of PGRFA of neglected and under-utilised crops and non-food crops. Many such species can make a valuable contribution to improving diets and incomes (SOW-2 p.20 b.4); ALSO PA-2, PA-5 & PA-8 & PA-11 & PA-12 & PA-20

- New legal mechanisms enabling farmers to market genetically diverse varieties, coupled with legislation supporting the marketing of geographically identified products have provided additional incentives for farmers to conserve and use local crop genetic diversity in a number of countries (SOW-2 p.43 b.8); ALSO PA-2

- Strong consumer demand for cheap food has continued, resulting in a sustained focus on the development of more cost-efficient production systems. Multinational food companies have gained in influence and, especially in industrialized countries, food is increasingly being produced beyond national borders in order to keep prices low (SOW-2 p.199 b.4); ALSO PA-10

- A simultaneous trend has seen the share of so-called niche or high-value markets expand. In many countries, consumers are increasingly willing to pay higher prices for better quality or novel food, from sources they know and trust. Certification schemes such as 'fair trade', and 'organic' or 'protected designation of origin' have been established to help ensure standards and provide reliable source information (SOW-2 p.199 b.5);

- In most developed countries, and in a growing number of developing countries, commercial food production is responsible for the supply of most food products to the majority of people. Crop varieties have been bred to meet the needs of high-input production systems, industrial processing and strict market standards. There has been an increasing disconnect between rural producers and the growing numbers of predominantly urban consumers (SOW-2 p.199 b.6);

- In many developing countries, incentives are provided for farmers to shift to more commercial agricultural systems. This is having a major impact on livelihood strategies, culture, and on the genetic resources managed by farmers. Initiatives such as the establishment of commodity exchanges in an increasing number of countries, are also resulting in more farming communities being linked to world markets (SOW-2 p.199 b.7);

- Interest is also growing in neglected and under-utilized crops in recognition of their potential to produce high-value niche products and as novel crops for the new environment conditions that are expected to result from climate change (SOW-2 p.86 b.5); ALSO PA-5 & PA-7 & PA-20

210. **Long-term objectives:** Stimulate stronger demand and more reliable market mechanisms for landraces/farmers' varieties and related agricultural products.

211. **Intermediate objectives:** To encourage farm suppliers, food processors, food distributors, and retail outlets to support the creation of niche markets for diverse foods, varieties and products.

212. **Policy/strategy:** Governments should consider, and as appropriate, adopt policies in extension, training, pricing, input distribution, infrastructure development, credit and taxation which serve as incentives for crop diversification and the creation of markets for biodiverse food crops, including standards for labeling of foods which allow the highlighting of use of non-standard crop varieties. Consideration should be given to developing appropriate niche variety registration systems to permit and promote the perpetuation, trial, evaluation and commercial distribution of local, obsolete varieties and to monitoring regulations enacted for other purposes to ensure that they do not inadvertently lead to the extinction of varieties.

213. As feasible and appropriate, institutions should be encouraged to purchase "diversity-rich" foods for internal use.

- In order to capture the potential market value of native crops, local varieties, underutilized crops and the like, there is a need for greater integration of the efforts of individuals and institutions having a stake in different parts of the production chain, from the development and testing of new varieties, through value added activities, to the opening up of new markets (SOW-2 p.116 b.7); ALSO PA-2 & PA-4 & PA-12

214. **Capacity:** Processes and activities which have or are likely to have significant adverse impacts on the conservation and sustainable use of biodiversity should be identified and their effects on crop diversification monitored.

215. Appropriate bodies, including NGOs, should promote public awareness in various media and through appropriate mechanisms, such as street fairs, initiatives in schools, etc.

- More investment is needed in the improvement of under-utilized crops as well as of traits in major crops that are likely to assume greater importance in the future as increased attention is paid to health and dietary concerns and as the effects of climate change intensify (SOW-2 p.116 b.6); PA-10 & PA-11 & PA-12 & PA-20

- Greater efforts are needed to encourage and support entrepreneurs and small-scale enterprises concerned with the sustainable use of PGRFA (SOW-2 p.116 b.11). PA-12 & PA-13 & PA-15

216. **Coordination/administration:** National and local level coordination and administration should be most effective.

217. **This activity is closely linked with:**

- Supporting on-farm management and improvement of plant genetic resources for food and agriculture
- Promoting public awareness of the value of plant genetic resources for food and agriculture conservation and use

Institutions and Capacity Building

15. Building strong national programmes;
16. Promoting networks for plant genetic resources for food and agriculture;
17. Constructing comprehensive information systems for plant genetic resources for food and agriculture;
18. Developing monitoring and early warning systems for loss of plant genetic resources for food and agriculture;
19. Expanding and improving education and training;
20. Promoting public awareness of the value of plant genetic resources for food and agriculture conservation and use.

15. Building strong national programmes

218. **Assessment:** National programmes are the foundation of regional and global plant genetic resources efforts; they are also a means to promote international cooperation on access to plant genetic resources and the fair and equitable sharing of the benefits arising from their use. Effective national programmes provide a link between in-country activities and those at the regional and global levels. Many existing national programmes suffer from poor planning and management exacerbated by lack of resources and isolation from related activities.

219. Many of the countries which do not have strong national programmes, or appropriate long-term storage facilities, are those which have the most urgent food security problems. They are also often countries with rich and variable plant genetic resources in farmers' fields and in the wild. Also, the often limited capacity of national programmes, particularly those located in developing countries, in assessing, utilizing and updating technologies for the conservation, characterization and sustainable utilization of plant genetic resources for food and agriculture is an important cause of inefficient management of collections and a limiting factor for their further utilization.

➢ Many countries still lack national strategies and/or action plans for the management of diversity - or if they have them, they do not fully implement them. Areas that require particular attention include setting priorities, enhancing national and international cooperation, the further development of information systems and identifying gaps in the conservation of PGRFA, including CWR (SOW-2 p.20 b.6); ALSO PA-2 & PA-11 & PA-17

➢ Although the first SoW report classified national programmes into three categories, since then it has become clear that such a typology is too simplistic and that there is huge heterogeneity among national programmes in terms of their goals, functions, organization, and structure (SOW-2 p.136 b.1);

- There has been considerable progress in establishing national programmes, at least in part as a consequence of the adoption of the ITPGRFA and GPA. Of the 112 countries that provided information for both the first and second SoW reports, 54% had a national programme in 1996 whereas 71% now have one (SOW-2 p.136 b.2);

- Even in countries with active and well-coordinated national programmes, certain elements are still often missing. National, publicly accessible databases, for example are still comparatively rare as are coordinated systems for safety duplication and collaborative public awareness (SOW-2 p.136 b.3);

- Almost half of the country reports indicated that they had no NISM for PGRFA, and thus lack an effective tool for promoting both internal as well as international collaboration (SOW-2 p.137 b.4);

- The new NISM on the implementation of the GPA was mentioned by many country reports as a valuable tool for establishing and improving national programmes (SOW-2 p.136 b.4);

- Although several countries, especially in Europe, reported that overall funding has increased since 1996, many of the country reports noted that their national programme received inadequate and unreliable funding, making it difficult to plan over multiple years (SOW-2 p.136 b.5);

- While in most countries national government institutions are the principal entities involved in national programmes, the inclusion of other stakeholders has expanded, especially of private for-profit companies, NGOs, farmer organizations, and educational institutions (SOW-2 p.136 b.6);

- Public-private research and development partnerships appear to have grown in importance, especially in plant breeding and biotechnology, not only in developed but also in many developing countries (SOW-2 p.136 b.7);

- Since the first SoW report was published, most countries have enacted new national phytosanitary legislation, or revised old legislation, in large part in response to the adoption in 1997 of the revised IPPC (SOW-2 p.136 b.10);

- Most developing and Eastern European countries that now provide legal protection to new plant varieties, have done so in the last decade. A few others are drafting legislation (SOW-2 p.137 b.12)

- The importance of farmers as custodians and developers of genetic diversity was recognized in the ITPGRFA through the provisions of Article 9 on Farmers' Rights. A few countries have adopted regulations covering one or more aspects of farmers' rights (SOW-2 p.137 b.13);

- Since the first SoW report, biosafety has emerged as an important issue, and many countries have now either adopted national biosafety regulations or frameworks, or are currently developing them. As of February 2010, 157 countries had ratified the Cartagena Protocol on Biosafety (SOW-2 p.137 b.14).

- Many countries lack nationally endorsed strategies and plans for the conservation and use of PGRFA. These are important for setting priorities, distributing roles and responsibilities, and allocating resources (SOW-2 p.137 b.3); ALSO PA-11 & PA-12

- With the strengthening of the regional and global fora on agricultural research, their influence with national policy makers has grown and they offer valuable opportunities for promoting appropriate national and regional policies in areas of importance to the conservation and use of PGRFA (SOW-2 p.162 b.4); PA-15

220. Plant genetic resources for food and agriculture activities involve public and private institutions and companies, non-governmental organizations, communities and individuals from the agriculture, environment and development sectors. The integration of existing plant genetic resources for food and agriculture activities in the framework of a unified national programme provides the opportunity to enhance such diverse efforts within a country.

221. National *ex situ* collections are an integral part of national plant genetic resources programmes for food and agriculture. Genebanks should not be viewed as closed repositories, but as dynamic centres. The integration of conservation, characterization, evaluation information and use will facilitate the valorization of plant genetic resources for food and agriculture. Too strong an emphasis on centralized genebank conservation facilities, however, can distract attention away from utilization and lead to isolation, preventing genebanks from providing optimal benefits to the country. While conservation and plant breeding in developing countries are generally undertaken by public institutions, practical and institutional linkages between the two are often poor. Clearly articulated goals are frequently absent. The lack of holistic, goal-oriented planning mitigates the rational use of existing resources and results in
inefficiencies, reduced benefits and lost opportunities.

222. **Long-term objectives:** To identify and meet national needs through instituting rational, sustainable, effective, and equitable approaches to the conservation and use of plant genetic resources for food and agriculture for the benefit of present and future generations.

223. To ensure adequate national capacity to participate in global efforts to conserve and use plant genetic resources for food and agriculture and to share in the benefits arising from their use.

224. **Intermediate objectives:** To give high priority to establishing the essential elements of integrated national programmes: a recognized national status; appropriate policy and institutional frameworks including mechanisms for coordinated planning and action; and a programme strategy; benefiting from help to do so. Where appropriate, to upgrade conservation facilities at the national or regional level.

225. To improve institutional and sectoral linkages and strengthen integration of institutional and community efforts.

226. To develop national capacities in the technical, managerial and policy areas.

227. **Policy/strategy:** National programmes should have a formally recognized status. The ecological, economic, social and aesthetic values of plant genetic resources for food and agriculture should be recognized in national planning and policies and in the prioritization and deployment of financial and other resources including financial incentives for the retention of qualified staff. Specific funding allocations should be made to plant genetic resources for food and agriculture programmes in the budget process of national governments.

228. National commitment to provide sustainable funding for national programmes and projects is essential; however regional or international support is a complement to domestic efforts.

229. National programmes should develop the capability to assess and determine the plant genetic resources for food and agriculture required to meet national conservation and development needs and related international obligations and should have supporting policies on conservation, access and use of plant genetic resources for food and agriculture. National programmes should make available, as appropriate, the widest possible representative collection of plant genetic resources for food and agriculture to meet farmers' needs, and for the improvement of local varieties. Governments, in cooperation with national, regional and international institutions should monitor the development of new technologies relevant to the conservation, characterization and sustainable utilization of plant

genetic resources for food and agriculture. In addition, governments should establish quarantine and other regulations regarding the import and export of plant genetic materials which offer adequate protection
without unduly restricting appropriate transfers of materials.

230. As appropriate to the level of development and complexity of existing institutional efforts, a national programme should encourage or provide for coordination amongst all relevant institutions and organizations in the country and link national work to regional and international activities. Integrated, holistic national strategies address more than genebank operations. They should effectively encompass conservation, development and utilization of plant genetic resources for food and agriculture and the linkages between these areas. Establishment of broadly-comprised national committees will be an important means of organizing and coordinating efforts in most countries.

231. The actual structure and organization of the national programme will depend on the infrastructure and capacities available in the country; policy decisions will determine programme strategy and mode of operation, in particular regarding international collaboration. In countries where capacities are limited, the strategy may include use of the physical facilities and technical expertise of other national programmes or of international institutions.

232. Existing programmes should consider establishing stronger partnerships with private enterprises, non-government organizations, rural and indigenous communities. Cross-sectoral links should be forged with agencies engaged in national planning and other programmes concerning agriculture, land reform, and environment protection.

233. Institutional links should be promoted, as appropriate, among national institutions and entities specialized in technology transfer, in order to assist national institutions in the negotiation for the acquisition of technologies for the conservation, characterization and sustainable utilization of plant genetic resources for food and agriculture and associated data processing, under fair and most favourable terms, including on concessional and preferential terms, as mutually agreed to by all parties to the transaction. In the case of technology subject to patents and other intellectual property rights, access and transfer of technology should be provided on terms which recognize and are consistent with the adequate and effective protection of intellectual property rights.

- There is a need for specific strategies to be developed for conserving PGRFA *in situ* and for managing crop diversity on farm. Special attention needs to be given to conservation of CWR in their centres of origin, major centres of diversity and biodiversity hotspot areas (SOW-2 p.44 b.5); ALSO PA-2 & PA-4 & PA-11

- Whether a national PGRFA programme is centralized, sectorial, or even regional, it is vital that there be effective coordination and collaboration among its elements, including ministries, government institutions, universities, private companies, NGOs, farmers' groups, and others (SOW-2 p.137 b.1);

- Greater measures are needed in many countries to counter the threat of alien invasive species (SOW-2 p.44 b.8); ALSO PA-4 & PA-18

- There is a need for more efficient, strategic and integrated approaches to the management of PGRFA at the national level. Links need to be strengthened between those individuals and institutions in both the private and public sectors who are primarily responsible for conservation, and those who are primarily concerned with genetic improvement and seed production and distribution (SOW-2 p.199 b.3); ALSO PA-11 & PA-12 & PA-18

- One way to realize farmers' rights is through making available better varieties. Plant breeding and seed dissemination systems need to be strengthened and greater attention paid to the needs and

circumstances of resource-poor farmers, the guardians of much genetic diversity. Regulatory systems also need to be responsive to the needs of famers (SOW-2 p.176 b.7).

- The need for greater awareness among policy makers, donors and the general public of the value of PGRFA, and the importance of crop improvement, in meeting future global challenges (SOW-2 p.115 b.2); ALSO PA-2 & PA-4 & PA-11 & PA-18 & PA-20

- There is a need for countries to adopt appropriate and effective strategies, policies, legal frameworks and regulations that promote the use of PGRFA, including appropriate seed legislation (SOW-2 p.116 b.3); ALSO PA-2 & PA-11 & PA-12 & PA-13

234. **Capacity:** Where appropriate, assistance upon request should be given to facilitate regular national planning and priority setting. High priority should be placed on the assessment and improvement of management practices in facilities such as genebanks and research stations.

235. Other measures needed to develop effective national programmes are contained in the recommendations associated with other activities.

236. Research activities in national programmes focus mainly on scientific and technical research described within the other activity areas. Research is also needed on missions and management of national PGRFA programmes including testing of institutional frameworks; and evaluating use needs and the efficiency of alternative responses; data base management; and the economic efficiency of different approaches to conservation.

237. Certain policy, legal and institutional issues, *inter alia*, those related to ownership, intellectual property rights, exchange, transfer and trade in plant genetic resources, are confronting national programmes increasingly. Coordination is needed to provide national programmes with information on these issues and to assess the impact of international developments in these fields on the conservation and exchange of plant genetic resources, and to incorporate new research developments, as appropriate, into national systems and practices.

- Several countries have expressed the need for assistance in developing policies, legislation, regulations and practical measures for implementing farmers' rights. While a few countries are experimenting in this area, to date there are no well-proven models that could be widely adopted. Existing examples of such legislation need to be evaluated and information made available on their effectiveness and how they function in practice (SOW-2 p.176 b.6);

- Efforts to raise additional resources to support work on PGRFA require new and innovative approaches, better coordination in fundraising among the different institutions and sectors, and greater efforts to increase awareness among policy makers, donors, and the private sector as to the actual and potential value of PGRFA (SOW-2 p.137 b.9); ALSO PA-8 & PA-20

- There is a need for more effective policies, legislation and regulations governing the *in situ* and on farm management of PGRFA, both inside and outside of protected areas (SOW-2 p.44 b.3); ALSO PA-4

- Specific research needs relating to on farm management or *in situ* conservation of PGRFA include (SOW-2 p.44 b.10):

  • Studies on the extent and nature of possible threats to existing diversity on farm and *in situ*; ALSO PA-3 & PA-4 & PA-7 & PA-8 & PA-11 & PA-18

- Further research to provide information to underpin the development of appropriate policies for the conservation and use of genetic diversity, including the economic valuation of PGRFA. ALSO PA-2 & PA-4 & PA-5 & PA-8 & PA-11 & PA-12 & PA-20

- There is a need to strengthen the ability of farmers, indigenous and local communities and their organizations, as well as extension workers and other stakeholders, to sustainably manage agricultural biodiversity (SOW-2 p.43 b.2); ALSO PA-2 & PA-11 & PA-12

- In order to promote and strengthen the use of participatory breeding, many countries need to reconsider their policies and legislation, including developing appropriate intellectual property protection and seed certification procedures for varieties bred through PPB. Greater attention is also needed to capacity building and to ensuring PPB is integrated in national breeding strategies (SOW-2 p.116 b.10); ALSO PA-2 & PA-10 & PA-11 & PA-12

- There is an urgent need to increase plant breeding capacity worldwide in order to be able to adapt agriculture to meet the rapidly expanding demand for more and different food, as well as non-food products, under substantially different climatic conditions from those prevailing today. The training of more breeders, technicians and field workers, and the provision of better facilities and adequate funds are all essential (SOW-2 p.115 b.1); ALSO PA-2 & PA-4 & PA-10 & PA-11 & PA-12 & PA-19

- Greater efforts are needed to encourage and support entrepreneurs and small-scale enterprises concerned with the sustainable use of PGRFA (SOW-2 p.116 b.11). ALSO PA-12 & PA-13 & PA-14

- There is a need for more accurate and reliable measures, standards, indicators and baseline data for sustainability and food security that will enable a better monitoring and assessment of the progress made in these areas. Of particular need are standards and indicators that will enable the monitoring of the specific role played by PGRFA (SOW-2 p.200 b.7); ALSO PA-17

- Agricultural markets play a vital role in helping achieve food security and sustainable agricultural development. They can help increase the diversity of PGRFA in the seed supply chain and provide outlets for the products of neglected and under-utilized crops, leading to greater dietary diversity. Better access by resource poor farmers to markets and strengthened market information systems are needed (SOW-2 p.200 b.9).

238. **Coordination/Administration:** Implement coordination mechanisms within countries to ensure the most effective prioritization in the deployment of financial and other resources. Governments should periodically review their policies to evaluate their effectiveness. Coordinated and prioritized action at the national level should be complemented by an international system that is likewise coordinated and prioritized. International collaboration is necessary in a world where countries are interdependent and where they wish to establish practical, rational and economical means to conserve plant genetic resources for food and agriculture, enhance their use, encourage access and share benefits.

- The involvement of local communities is essential in any *in situ* conservation or on farm management effort and traditional knowledge systems and practices need to be fully taken into account. Collaboration between all stakeholders needs to be strengthened in many countries (SOW-2 p.44 b.6); ALSO PA-2 & PA-4 & PA-11 & PA-18 & PA-20

- Greater attention is needed in many countries to the development of appropriate, non-conflicting and complementary national policies and legislation relating to the conservation, exchange, and use of PGRFA, including such areas as phytosanitary regulations, intellectual property protection,

farmers' rights, and biosafety, and taking into account the needs and concerns of all stakeholders (SOW-2 p.137 b.10). ALSO PA-8 & PA-12

- There is a need for stronger coordination in the development of policies, legislation and regulations among the various ministries, state, regional or provincial governments and other institutions having responsibility for different aspects of PGRFA (SOW-2 p.176 b.5);

- The links between institutions concerned primarily with the conservation of PGRFA and those concerned primarily with its use are weak or even absent in many countries and need to be strengthened (SOW-2 p.137 b.2); ALSO PA-2 & PA-4 & PA-8 & PA-12 & PA-18

- *In situ* and *ex situ* conservation strategies need to be better linked to ensure that a maximum amount of genetic diversity is conserved in the most appropriate way, and that biological and cultural information is not lost inadvertently (SOW-2 p.87 b.7); ALSO PA-4 & PA-5 & PA-7 & PA- 8 & PA-18

- In order to benefit from many of the regional and international opportunities for collaboration, there is a need in many countries for greater internal coordination among different ministries and institutions, and between the public and private sectors (SOW-2 p.162 b.6).

- There is a need for closer collaboration and coordination, nationally and internationally, especially between the agriculture and environment sectors (SOW-2 p.44 b.4); ALSO PA-3 & PA-4 & PA-16 & PA-18

- At the international level there is also a need for greater coordination and cooperation among agencies and institutions concerned with international and intergovernmental aspects of the conservation and use of PGRFA and those concerned with agricultural production, protection, sustainability and food security, as well as related areas such as health and the environment (SOW-2 p.200 b.4); ALSO PA-16

- In order to underpin such funding strategies[1], increased efforts are needed to raise awareness among policy makers and the general public of the value of PGRFA, the interdependence of nations and the importance of supporting increased international collaboration (SOW-2 p.161 b.2); ALSO PA-16 & PA-20

- Greater collaboration is also needed among policy and funding bodies at the international level, and a greater awareness of the need for long-term financial support (SOW-2 p.162 b.3); ALSO PA-20

239. Plant genetic resources for food and agriculture networks and international fora (*inter alia*, the FAO Commission on Genetic Resources for Food and Agriculture, the Conference of the Parties to the Convention on Biological Diversity, UNEP, UNDP, UNESCO, and CSD) provide useful mechanisms through which countries can coordinate activities and agree on common policies, as appropriate.

240. **This activity is closely linked with:**

- All other activities

[1] It refers to the previous paragraph "Although several new networks have been formed, many others have suffered from a lack of funds. At least one has ceased to function. New and innovative funding strategies and mechanisms are needed" SOW-2 p.161 b.1

16. Promoting networks for plant genetic resources for food and agriculture

241. **Assessment:** Networks are important platforms for scientific exchange, information sharing, technology transfer, research collaboration, and for the determination and sharing of responsibilities for such activities as collecting, conservation, distribution, evaluation and genetic enhancement. By establishing links between those involved in the conservation, management, development and utilization of plant genetic resources for food and agriculture, networks can promote exchange of materials on the basis of mutually agreed terms and enhance the utilization of germplasm. In addition, they can serve to help set priorities for action, develop policy, and provide means whereby crop-specific and regional views can be conveyed to various organizations and institutions.

242. Currently, a number of regional and crop-based networks are operating. Some networks, especially certain crop networks, are not fully functional. These are in need of strengthening. A number of new networks need to be organized in order to ensure that all regions benefit from the existence of active networks covering the crops/plants of importance to the region. The participation of countries with limited national capacity in plant genetic resources for food and agriculture (*inter alia*; many of the least developed countries and small island states) is particularly important, as it gives them access to information, technology and materials.

- The extent of interdependence among countries with respect to their need to have access to materials held by others is arguably more important than ever. This is especially true in the face of the need to develop varieties that are adapted to the new environmental conditions and pest and disease spectra that will result from climate change. (SOW-2 p.17 b.6). ALSO PA-3

- Several new regional PGRFA networks have been established, including GRENEWECA for West and Central Africa, NORGEN for North America, CAPGERNET for the Caribbean, PAPGREN for the Pacific, SeedNet for Southeastern Europe, and CACN-PGR for the Central Asia and Caucasus region (SOW-2 p.160 b.2);

- Other regional PGRFA networks have significantly strengthened their activities, e.g. SANPGR in South Asia, SADC-PGRN in southern Africa, and the AEGIS and EURISCO initiatives of the European network ECPGR (SOW-2 p.160 b.3);

- Many other regional PGRFA networks have not fared as well. While almost all networks need additional resources, insufficient funding was a major factor in the demise of WANANET and represents a major constraint for most of the networks in the Americas as well as Southeast Asia and West Africa (SOW-2 p.160 b.4);

- Several new crop-specific networks have been established that have significant activities on PGRFA. These include, for example, international networks on cacao, the coffee genome, the rice genome, and bamboo and rattan. New or reformed regionally-focused crop networks include ones on banana and plantain, cassava in the Americas, cereals and legumes in Asia, cassava in the Pacific and cotton in Asia and North Africa (SOW-2 p.160 b.5);

- Several new thematic networks have been established, focusing on a range of different topics. For example, a number of networks have been created on biotechnology, both globally (e.g. the GCP) and in many regions. Other topics have included the on farm management of genetic diversity, and seed production. Three seed networks have been established in Africa alone (SOW-2 p.160 b.6);

- The CGIAR Centres have continued to work collaboratively with a very large number of partners, especially in developing countries, and have continued to make available a wide range of genetic materials. A major programme has been undertaken to upgrade the collections and genebank

facilities. In 2000 the CGIAR Centres established the Central Advisory Service on Intellectual Property (CAS-IP) (SOW-2 p.161 b.10); ALSO PA-5

- Several other new international institutes have been established that undertake research involving PGRFA. These include Crops for the Future and the ICBA (SOW-2 p.161 b.11);

- Another significant development since the first SoW report was published is the creation in 1999 of the GFAR. The Forum promotes discussion and collaboration among different stakeholder groups concerned with agricultural research. GFAR has identified genetic resources management and biotechnology as one its four priority areas (p.161 b.13);

- The trend towards stronger cooperation is reflected in the growing number of regional agreements covering such areas as conservation, plant variety protection, access to genetic resources and benefit sharing. One area that has seen particular progress is in phytosanitary regulations (SOW-2 p.161 b.14);

243. **Long-term objectives:** To ensure that all countries are served by active regional and international networks and an appropriate complement of crop-based, thematic and *in situ* oriented networks.

244. As a matter of high priority, promote scientific exchange and cooperation, and to promote coordination, planning, and priority setting at the regional level, as a means to avoid duplication, to strengthen and make more efficient existing work in plant genetic resources for food and agriculture, and to minimize costs of conservation and utilization.

245. To facilitate the setting of regional goals and priorities and the implementation of these through existing national and regional institutions.

246. To facilitate consideration of integrated, eco-regional approaches to conservation of plant genetic resources for food and agriculture, including wild relatives of crops.

247. **Intermediate objectives:** To strengthen existing regional, crop and thematic networks.

248. To establish active regional networks in areas not currently covered by such. To establish and strengthen 5 to 15 international crop and thematically-oriented networks, including *in situ* conservation networks, with broad participation, open to any country.

249. To facilitate and promote the participation of countries in these networks.

250. **Policy/strategy:** Governments should as a matter of policy support the active participation of public and private institutions in regional, crop and thematic networks. Cost of such networks should be met by participants in the networks according to their ability, complemented, as appropriate, by support from governments and other sources. Participation should be seen as benefiting the country and as a means for pooling efforts among countries faced with similar challenges and for promoting the sharing of benefits with other countries. Both cash and in-kind contributions by governments to the networks should be considered as meeting these obligations and contributing to the implementation of the *Global Plan of Action*. Countries should have appropriate oversight over the activities carried out under the aegis of the networks.

251. Governments, national research institutions, international agricultural research centres, in particular IPGRI, and/or crop-specific scientific organizations, may convene existing and/or new crop or thematically oriented networks and/or facilitate their work. Networks may cooperate closely with, offering guidance as appropriate, to international agricultural research centres and regional institutions and efforts in order to ensure higher levels of communication, accountability and synergy.

252. Networks should identify the opportunities for working with non-governmental organizations, and develop concrete actions, particularly in the areas of training, access to reproductive material, coordination of local initiatives, information and public awareness.

- Greater efforts are needed to build a truly rational global system of *ex situ* collections. This requires, in particular, strengthened regional and international trust and cooperation (SOW-2 p.87 b.2); ALSO PA-5 & PA-8

- While there are still high levels of duplication globally for a number of crops, especially major crops, much of this is unintended and many crops and important collections remain inadequately safety duplicated. The situation is most serious for vegetatively propagated species and species with recalcitrant seeds (SOW-2 p.87 b.3); PA-3 & PA-8

- There is a need for closer collaboration and coordination, nationally and internationally, especially between the agriculture and environment sectors (SOW-2 p.44 b.4); ALSO PA-3 & PA-4 & PA-15 & PA-18

- To better serve the management of collections and encourage an increased use of the germplasm, documentation, characterization and evaluation all need to be strengthened and harmonized and the data need to be made more accessible. Greater standardization of data and information management systems is needed (SOW-2 p.87 b.6); ALSO PA-6 & PA-9 & PA-17

- In order to underpin such funding strategies[2], increased efforts are needed to raise awareness among policy makers and the general public of the value of PGRFA, the interdependence of nations and the importance of supporting increased international collaboration (SOW-2 p.161 b.2); ALSO PA-15 & PA-20

- Given that international germplasm exchange is a key motivation behind many networks, additional attention is needed both to promote the effective implementation of ITPGRFA, and in particular its multilateral system of access and benefit sharing, as well as to develop arrangements for those other crops that are not currently included in the system but that are within the overall scope of the ITPGRFA (SOW-2 p.162 b.5)

253. **Capacity:** The building of networks requires not only technical expertise, but substantial communication and organization skills. It is first and foremost a problem of organizing, coordinating and facilitating. Resources should be provided for such activities as: planning; communication, including travel; meetings; network publications such as newsletters and reports of meetings; servicing and strengthening of the network.

- Although several new networks have been formed, many others have suffered from a lack of funds. At least one has ceased to function. New and innovative funding strategies and mechanisms are needed (SOW-2 p.161 b.1);

- In spite of significant advances in the regeneration of collections, many countries still lack the resources needed to maintain adequate levels of viability (SOW-2 p.87 b.4); ALSO PA-6

[2] It refers to the previous paragraph "Although several new networks have been formed, many others have suffered from a lack of funds. At least one has ceased to function. New and innovative funding strategies and mechanisms are needed" SOW-2 p.161 b.1

- In spite of the expansion of education and training opportunities over the past decade, they remain inadequate overall. More opportunities are needed both for the training of young researchers and development workers, and for upgrading the knowledge and skills of existing staff (SOW-2 p.137 b.6); ALSO PA-19

254. For regional networks, priority should be given to strengthening existing networks or integrating countries not presently served into them, and to establishing new networks in the following regions:

(a) Pacific

(b) Caribbean

(c) CIS states of Central Asia

(d) West and Central Africa

(e) East Africa

(f) Indian Ocean Islands

(g) Black Sea, or Caucasus and other regions, when necessary.

- Although much progress has been made, enhanced South-South cooperation has the potential to contribute much more to the conservation and use of PGRFA, and to strengthening its role in achieving food security and sustainable agricultural development (SOW-2 p.200 b.5);

255. **Research/technology:** Networks provide a vehicle for implementing collaborative research in mutually agreed priority areas. As appropriate and feasible, research, training and technology transfer should be planned and/or implemented in collaboration with the networks.

256. **Coordination/administration:** Resources should be made available to continue to service existing networks as appropriate and to organize and facilitate the development of new regional and crop-based networks.

At the international level there is also a need for greater coordination and cooperation among agencies and institutions concerned with international and intergovernmental aspects of the conservation and use of PGRFA and those concerned with agricultural production, protection, sustainability and food security, as well as related areas such as health and the environment (SOW-2 p.200 b.4); ALSO PA-15

257. **This activity is closely linked with:**

- All other activities

17. Constructing comprehensive information systems for plant genetic resources for food and agriculture

258. **Assessment:** Many of the world's plant genetic resources for food and agriculture are insufficiently and/or poorly documented relative to what should be known about them for optimal conservation, access and use. Documentation of wild relatives of crops and on-farm genetic resources located *in situ* is particularly poor. In *ex situ* collections, basic identification such as accession number and taxonomic name; where and how material originated; descriptions of basic morphological and agronomic characters; current viability test results; regeneration cycles; where the material has been distributed; and pertinent ethno-botanical information, farmer and indigenous knowledge, has been maintained on material conserved. A genebank or *in situ* programme lacking sufficiently trained personnel, proper infrastructure or sustainable resources to manage genetic resources data cannot fully conserve or promote the full use of its plant genetic resources for food and agriculture. This situation is exacerbated due to the fact that at the national and institutional level, data management and documentation activities are often given an inappropriately low priority in the allocation of funding. In the proper format, data can be used not only to assist conservation efforts, but to "add value" to plant genetic resources for food and agriculture.

259. Historically, development in agriculture has not included a strong linkage to development in communication infrastructure, information use and information management. With rapid changes in information technology, development could proceed more quickly by providing sustainable communication and information access. Lack of access isolates individuals and institutes and prevents their being part of a visible framework in which their work can be seen as an integral component.

The ability to measure and monitor the state of diversity has benefited from huge advances in information and communications technologies during the past decade, in the form of faster and cheaper computer processors with larger memory and storage capacities, incorporated into a wide range of instruments and devices, with more advanced software and better user interfaces. The speed and effectiveness of communication and of gathering, managing and sharing data have improved dramatically since 1996 as a result of the incorporation of computers into data capture devices, improvements in data and database management software, and the expansion of local computer networks and the Internet. These improvements have also resulted in rapid advances in the ability to undertake sophisticated processing and analysis of large complex datasets as, for example, in the emergence and application of the science of bioinformatics for molecular data. (SOW-2 p.74 SEC.1.2.4.3)

There has been an overall improvement in the accessibility of information. A number of national genebanks have published collection data on the web or are in the process of doing so, often with the facility of being able to order materials on-line. However, a significant imbalance exists among regions and countries within regions. The large majority of countries do not yet maintain an integrated national information system on germplasm holdings. (SOW-2 p.74-75)

- Documentation and characterization data on collections have progressed somewhat, although there are still large data gaps and much of the existing data is not accessible electronically (SOW-2 p.86 b.7); ALSO PA-6 & PA-9

- Many countries still lack national strategies and/or action plans for the management of diversity - or if they have them, they do not fully implement them. Areas that require particular attention include setting priorities, enhancing national and international cooperation, the further development of information systems and identifying gaps in the conservation of PGRFA, including CWR (SOW-2 p.20 b.6); ALSO PA-2 & PA-11 & PA-15

260. **Long-term objectives:** To facilitate increased access to and better management and utilization of plant genetic resources for food and agriculture through the assembly, exchange, and provision of useful information.

261. To establish a reliable and accurate plant genetic resources for food and agriculture data exchange network through the development of expertise and infrastructure at the global, regional, national and facility levels.

262. To help countries assemble and better manage their existing information and to facilitate their access to internationally and regionally held information.

263. **Intermediate objectives:** To assemble available data and information in a usable form using effective methodologies, databases and protocols.

264. To establish regional and crop based data management and exchange networks between genebanks and other partners in plant genetic resources for food and agriculture PGR programmes to assist with provision of documentation systems and training of personnel.

265. To develop data and documentation system strategies with and for genebanks and other partners in PGR programmes and breeding programmes and establish, as feasible, genebank database management systems at appropriate genebanks.

266. To support access to the international electronic communication infrastructure by genebanks and other partners in PGR programmes and breeding programmes.

267. **Policy/strategy:** High priority should be given at all levels to developing, staffing, and maintaining useful and user-friendly documentation and information systems.

268. Documentation, information and dissemination systems which are cost effective and easy to access, should also be developed in order to facilitate technology transfer.

269. Information on plant genetic resources for food and agriculture will be acquired and disseminated in accordance with Article 8(j) of the Convention on Biological Diversity.

- To better serve the management of collections and encourage an increased use of the germplasm, documentation, characterization and evaluation all need to be strengthened and harmonized and the data need to be made more accessible. Greater standardization of data and information management systems is needed (SOW-2 p.87 b.6); ALSO PA-9 & PA-16

- There is a need for more accurate and reliable measures, standards, indicators and baseline data for sustainability and food security that will enable a better monitoring and assessment of the progress made in these areas. Of particular need are standards and indicators that will enable the monitoring of the specific role played by PGRFA (SOW-2 p.200 b.7); ALSO PA-15

270. **Capacity:** Planning assistance should be provided to national programmes to encourage the development of rational and compatible strategies for information management. Such strategies need not be electronic or computer-based, but computerization and linkages to other institutions and programmes through Internet should be an ultimate goal for many facilities.

271. Existing data and information should be assembled and put in a usable and easily accessible form and verified. Such material is often found in genebanks and research stations in scientists' notebooks and reports or contained in antiquated, inaccessible systems.

272. Access by national programmes to basic scientific, research and bibliographic information should be facilitated.

273. Genebanks should have sufficient personnel to manage information and make it easily and widely accessible to users according to national goals. Education and training in data management and electronic communications should be provided at the genebank level, with emphasis on data management and analysis, connectivity and data exchange. Such activities (including training of staff) should be supported as appropriate and feasible while considering the need to rationalize genetic resources efforts at the global and regional levels.

274. Appropriate self-teaching manuals should be developed as needed. Technical support should be provided on a continuing basis to improve management of data and information and to allow for adoption of new, appropriate technologies.

The constraints (human resources, funding and facilities) to greater use of PGRFA and their relative importance are similar to those reported in the first SoW report. However, issues such as the lack of fully effective linkages between researchers, breeders, curators, seed producers and farmers, and lack of comprehensive information systems were also highlighted this time (SOW-2 p.114 b.6); ALSO PA-10 & PA-13

275. **Research/technology:** Research should be supported to:

(a) develop appropriate and low-cost methodologies and technologies for compilation and exchange of data;

(b) develop methods for adapting these technologies at the local level as appropriate;

(c) develop means to facilitate easy access and use of data by electronic means and through Internet;

(d) develop means and methodologies to make useful information easily available to nonspecialists, including NGOs, farmers' and indigenous peoples' organizations.

276. **Coordination/administration:** Coordination and collaboration should be further developed in the context of the World Information and Early Warning System being developed by FAO, and building upon available expertise in national programmes as well as the SINGER initiative within the CGIAR, the documentation work being done regionally by IPGRI, UNEP's Geographical Information System, UNESCO's Biosphere Information System, work being undertaken through the Convention on Biological Diversity. Such coordination should also seek to involve regional and crop networks and other users and conservers of plant genetic resources for food and agriculture, including the private sector and other NGOs, as active participants and partners.

277. Global and regional assessment, oversight, planning, and coordination is needed to promote cost efficiency and effectiveness.

278. **This activity is closely linked with:**

- All other activities

18. Developing monitoring and early warning systems for loss of plant genetic resources for food and agriculture

279. **Assessment:** Erosion of plant genetic resources for food and agriculture can occur in *ex situ* collections, in farmers' fields and in nature. The former depends on the quality of the original material stored, and on the conditions under which the material is maintained and multiplied. The loss of wild relatives can occur through loss or disturbance of habitat or natural disasters. Loss of genetic resources in crops occurs mainly through adoption of new crops or new varieties of crops with the consequent abandonment of traditional ones without appropriate conservation measures.

280. Various factors, both natural phenomena and the results of human behaviour, including urban expansion, agricultural modernization, civil strife and war, can put plant genetic resources for food and agriculture at risk. Several countries were unable to submit Country Reports or participate in the preparatory process for the International Technical Conference due to these factors. Despite the implications of this, no formal mechanisms exist to monitor such situations, assemble information and initiate appropriate actions.

Many country reports expressed continuing concern over the extent of genetic vulnerability and the need for a greater deployment of diversity. However, better techniques and indicators are needed for monitoring genetic diversity, for establishing baselines and monitoring trends. (SOW-2 SEC. THE STATE OF DIVERSITY p. xvi)

The 2010 Biodiversity Indicators Programme brings together a large number of international organisations to develop indicators relevant to the CBD, including ones for monitoring trends in genetic diversity. However, to date no really practical, informative and generally accepted indicators of genetic erosion are available and their development should be a priority. (SOW-2 p.14); ALSO PA-1

- A number of new tools, especially in the area of molecular genetics, have become available and training materials have been developed for assessing genetic diversity on farm (SOW-2 p.43 b.7); ALSO PA-1

- There is evidence that more attention is now being paid to increasing the levels of genetic diversity within production systems as a means of reducing risk, particularly in the light of the predicted effects of climate change (SOW-2 p.43 b.10). ALSO PA-20

- There has been a substantial increase in awareness over the past decade of the extent and nature of the threats posed by climate change, and of the importance and potential of PGFRA in helping agriculture to remain productive under the new conditions through their underpinning of efforts to breed new, adapted crop varieties (SOW-2 p.115 b.8); ALSO PA-3 & PA-9 & PA-11 & PA-20

- Interest in collecting and maintaining collections of CWR is growing as land-use systems change, concerns about the effects of climate change grow and techniques for using the material become more powerful and more readily available (SOW-2 p.86 b.4); ALSO PA-4 & PA-5 & PA-20

- There has been little progress on the development of sustainable management techniques for plants harvested from the wild, which are still largely managed following traditional practices (SOW-2 p.43 b.5); ALSO PA-4

- With modern molecular genetic techniques, it has been possible to generate a large amount of data on the extent and nature of genetic erosion and vulnerability in particular crops in particular areas. The picture that is emerging is complex and it is not possible to draw clear conclusions about the magnitude and extent of these effects (SOW-2 p.17 b.5); ALSO PA-1

- There has been an increasing move to integrate local seed systems within emergency responses aimed at supporting farmers in the aftermath of natural disasters and civil conflicts (SOW-2 p.115 b.13); ALSO PA-3 & PA-13

281. **Long-term objectives:** To minimise genetic erosion and its impact on sustainable agriculture by monitoring key elements of genetic resources conservation and the various factors causing genetic erosion, and assembling information to enable remedial or preventive action to be taken.

282. **Intermediate objectives:** To determine the underlying causes of genetic erosion. To encourage monitoring at the national, regional and global levels. To establish mechanisms to ensure that information is transferred to appropriate points designated as responsible for analysis, coordination and action.

283. **Policy/strategy:** In accordance with Agenda 21, governments should periodically review and report on the situation of plant genetic resources for food and agriculture. Governments should designate/re-confirm a focal point to convey this information to FAO, the Conference of the Parties to the Convention on Biological Diversity, and other appropriate bodies.

284. Information from appraisals and environmental impact assessments of major development projects, which may have a significant impact on plant genetic resources for food and agriculture, should be made available to relevant national authorities.

- There is a need to promote standard definitions and means of assessing genetic vulnerability and genetic erosion, as well as to agree on more and better indicators, in order to be able to establish national, regional and global baselines for monitoring diversity and changes in it, and for establishing effective early warning systems (SOW-2 p.20 b.5); ALSO PA-3

- There is a need in all countries to develop and put in place early warning systems for genetic erosion (SOW-2 p.44 b.7); ALSO PA-3

- There is also a need to step up efforts to conserve landraces, farmers' varieties and CWR before they are lost as a result of changing climates. Special efforts are needed to identify those species and populations that are most at risk and that are most likely to harbour traits that will be important in the future (SOW-2 p.199 b.2); ALSO PA-3 & PA-7 & PA-8 & PA-11

- Specific research needs relating to on farm management or *in situ* conservation of PGRFA include (SOW-2 p.44 b.10):

  • Studies on the extent and nature of possible threats to existing diversity on farm and *in situ*; ALSO PA-2 & PA-3 & PA-4 & PA-7 & PA-8 & PA-11 & 15

  • The need for better inventories and characterization data on land races, CWR and other useful wild species, including forages, in order to better target *in situ* conservation action; ALSO PA-1 & PA-4 & PA-6 & PA-7 & PA-8 & PA-9

  • Studies on the reproductive biology and ecological requirements of CWR and other useful wild species; ALSO PA-4

  • Studies on the mechanisms, extent, nature and consequences of geneflow between wild and cultivated populations; ALSO PA-2

- There is a need to promote standard definitions and means of assessing genetic vulnerability and genetic erosion, as well as to agree on more and better indicators, in order to be able to establish

national, regional and global baselines for monitoring diversity and changes in it, and for establishing effective early warning systems (SOW-2 p.20 b.5); ALSO PA-3

- There is a need in all countries to develop and put in place early warning systems for genetic erosion (SOW-2 p.44 b.7); ALSO PA-3

- The draft global strategy on the conservation of CWR needs to be finalized and adopted by governments as a basis for action (SOW-2 p.43 b.1); ALSO PA-4

- There is a need for closer collaboration and coordination, nationally and internationally, especially between the agriculture and environment sectors (SOW-2 p.44 b.4); ALSO PA-3 & PA-4 & PA-15 & PA-16

- The involvement of local communities is essential in any *in situ* conservation or on farm management effort and traditional knowledge systems and practices need to be fully taken into account. Collaboration between all stakeholders needs to be strengthened in many countries (SOW-2 p.44 b.6); ALSO PA-2 & PA-4 & PA-11 & PA-15 & PA-20

- Greater measures are needed in many countries to counter the threat of alien invasive species (SOW-2 p.44 b.8); ALSO PA-4 & PA-15

- *In situ* and *ex situ* conservation strategies need to be better linked to ensure that a maximum amount of genetic diversity is conserved in the most appropriate way, and that biological and cultural information is not lost inadvertently (SOW-2 p.87 b.7); ALSO PA-4 & PA-5 & PA-7 & PA 8 & PA-15

- Many countries lack nationally endorsed strategies and plans for the conservation and use of PGRFA. These are important for setting priorities, distributing roles and responsibilities, and allocating resources (SOW-2 p.137 b.3); ALSO PA-11 & PA-15

285. **Capacity:** National programme personnel and allied workers at more local levels should receive short training in methods of gathering and interpreting information on plant genetic resources for food and agriculture and the various threats to these resources.

286. Realizing the importance of global monitoring and early warning of loss of plant genetic resources for food and agriculture, the efficiency, purpose and value of the FAO World Information and Early Warning System (WIEWS) should be evaluated. In the light of the results of that review, WIEWS should be improved.

- Strengthened research capacity is required in many areas, and in particular in taxonomy of CWR, and conducting inventories and surveys using new molecular tools (SOW-2 p.44 b.9); ALSO PA-1 & PA-19

- The need for greater awareness among policy makers, donors and the general public of the value of PGRFA, and the importance of crop improvement, in meeting future global challenges (SOW-2 p.115 b.2); ALSO PA-2 & PA-4 & PA-11 & PA-15 & PA-20

287. **Research/technology:** Research to determine the underlying causes and dynamics of genetic erosion. Research applicable to improving methods for surveying of plant genetic resources for food and agriculture will also be useful to early warning systems.

288. Technical experts, representatives of national programmes, UNEP, UNDRO, the CGIAR, IUCN, NGOs, and the private sector, should be invited by FAO to participate in and contribute to discussions on developing an early warning system.

289. The utility of using remote sensing technologies should be investigated.

290. **Coordination/administration:** WIEWS should collaborate closely with national focal points, national coordinators, regional and crop networks, the international agricultural research centres, UNEP, UNDRO, and other relevant organizations.

291. Governments and aid agencies should ensure communication and cooperation between plant genetic resources programmes, development programmes, and organizations and agencies such as the World Bank, FAO, UNDP, UNEP, UNESCO, IFAD and the CGIAR.

- The links between institutions concerned primarily with the conservation of PGRFA and those concerned primarily with its use are weak or even absent in many countries and need to be strengthened (SOW-2 p.137 b.2); ALSO PA-2 & PA-4 & PA-8 & PA-12 & PA-15

- There is a need for more efficient, strategic and integrated approaches to the management of PGRFA at the national level. Links need to be strengthened between those individuals and institutions in both the private and public sectors who are primarily responsible for conservation, and those who are primarily concerned with genetic improvement and seed production and distribution (SOW-2 p.199 b.3); ALSO PA-11 & PA-12 & PA-15

292. **This activity is closely linked with:**

- Surveying and inventorying plant genetic resources for food and agriculture
- Supporting planned and targeted collecting of plant genetic resources for food and agriculture
- Constructing comprehensive information systems for plant genetic resources for food and agriculture

19. Expanding and improving education and training

293. **Assessment:** The importance of training in achieving sustainable improvements in plant genetic resources for food and agriculture conservation and use is widely accepted. At a time when financial support to many programmes is threatened, funding for training has become particularly tenuous. Governments do not always ensure that individuals receiving such training are appropriately utilized and remunerated.

294. The dearth of well-trained personnel is evident at virtually all levels and in all scientific and technical specialities in many developing countries. Every sub-regional meeting in the preparatory process called attention to this. Both university programmes and short specialized courses offered by a variety of institutions, are typically oversubscribed. There is a great disparity in the educational and training opportunities available in the various regions. Moreover, programmes which combine technical training with exposure to the many disciplines, including management, policy and legal fields, associated with plant genetic resources for food and agriculture, appear not to exist very often.

Since 1996, a number of developments have taken place in training and education, with significant new opportunities opening up in several countries. Collaboration in training between national programmes and international and regional organizations, especially with FAO and the CGIAR Centres, has expanded and capacity building opportunities have increased. Much of this has been the

result of additional funding becoming available from bilateral and multilateral donors for research projects that have a human resources development component. More universities are now offering short-term informal courses as well as longer-term M.Sc. and Ph.D. courses in areas related to PGRFA. New training materials are becoming available and field and laboratory facilities for training have improved in a number of countries. However, in spite of these developments, there is a still a need for greater capacity in education and training to meet the expanding demand for new, well-trained professionals and for upgrading the skills and expertise of those already engaged in the conservation or use of PGRFA. (SOW-2 P.126)

Most national programmes concerned with on farm management of PGRFA aim to build both their own professional capacity as well as that of the farmers with whom they work. However, many NGOs and development agencies lack sufficient qualified personnel to impart the necessary training to farming communities. (SOW-2 P.126)

- Universities have become increasingly involved in research on PGRFA, especially in the application of biotechnology to conservation and crop improvement (SOW-2 p.136 b.8);

- New education and training opportunities have opened up in several countries and more universities now offer M.Sc. and Ph.D. courses. Collaboration in training between national programmes and international and regional organizations has become stronger and new training materials have been developed (SOW-2 p.136 b.9);

- Many countries, although aware of the importance of collecting, conserving, regenerating characterizing, documenting and distributing plant genetic resources, do not have adequate human capacity, funds or facilities to carry out the necessary work to the required standards. Many valuable collections are in jeopardy because their storage and management are sub-optimal (SOW-2 p.87 b.1); ALSO PA-6 & PA-5 & PA-7 & PA-8

- Overall global plant breeding capacity has not changed significantly; a modest increase in the number of plant breeders has been reported by certain national programmes and a decline by others (SOW-2 p.114 b.1); ALSO PA-10

- A lack of adequate characterization and evaluation data and the capacity to generate and manage it, remain a serious constraint to the use of many germplasm collections, especially of under-utilized crops and wild relatives (SOW-2 p.116 b.8); ALSO PA-2 & PA-4 & PA-9

295. **Long-term objectives:** To make available to every country according to their needs and priorities, training in all the relevant functions of conservation and utilization, as well as management and policy.

296. **Intermediate objectives:** To develop regional capacity for advanced training and to establish effective collaborative arrangements between relevant institutions in developed and developing countries.

297. To develop appropriate short courses and educational modules in subjects identified as priorities regionally.

298. To foster access to external training for those countries lacking national capacity.

299. To encourage institutions to include plant genetic resources for food and agriculture aspects in related courses and programmes in biological sciences.

300. **Policy/strategy:** Governments should recognize the appropriateness and importance of education concerning plant genetic resources for food and agriculture at all levels.

301. Governments and institutions should commit themselves to providing training and advanced educational opportunities for existing staff.

- There is a need to assess human resource capacity and needs in the various aspects of conserving and using PGRFA, and to use this as the basis for drawing up national (and ultimately regional and global) education and training strategies (SOW-2 p.137 b.5);
- In spite of the expansion of education and training opportunities over the past decade, they remain inadequate overall. More opportunities are needed both for the training of young researchers and development workers, and for upgrading the knowledge and skills of existing staff (SOW-2 p.137 b.6); ALSO PA-16
- Special efforts are needed in many countries to educate senior managers and policy makers about the complex legal and policy issues relating to the conservation, exchange, and use of PGRFA (SOW-2 p.137 b.7); ALSO PA-8
- Greater efforts are needed to include the concepts of conservation biology, especially with respect to agrobiodiversity, in biological sciences curricula at all levels (SOW-2 p.137 b.8);

302. **Capacity:** As feasible, support should be given to the development of institutions and/or programmes in each region, capable of providing advanced education in plant genetic resources and plant breeding. Support should also be given to students to complete degree programmes at these institutions and/or programmes. Collaboration between developed and developing country academic institutions, as well as relevant internships, should be encouraged. Educational programmes should have access to and should use the Internet for professional communication and data and information acquisition.

303. As regional institutions are being strengthened, existing capacity in developed countries should be used and supported, particularly if it is specifically tailored to the needs of developing countries.

304. In addition to current efforts, specialized training courses should be developed and regularly held for each region in a number of technical topics as well as in management, policy and public awareness.

305. Technology transfer expertise related to the conservation, characterization and sustainable utilization of plant genetic resources for food and agriculture should be enhanced, particularly in developing countries. National institutions from both developing and developed countries and international organizations all have a very important role to play in facilitating this process.

306. Consideration should be given to developing the courses in a module form so as to be widely applicable and usable in different regions, while maintaining a distinctive regional focus. As feasible, courses should be offered in the language most appropriate for the region.

307. Special consideration should be given to on-site training for rural women, as they play a significant but sometimes unrecognized role in maintaining and developing plant genetic resources for food and agriculture and associated knowledge and traditions.

308. At the international level, capacity to develop training materials and offer or coordinate training courses should be enhanced.

- Strengthened research capacity is required in many areas, and in particular in taxonomy of CWR, and conducting inventories and surveys using new molecular tools (SOW-2 p.44 b.9); ALSO PA-1 & PA-4 & PA-18

- There is an urgent need to increase plant breeding capacity worldwide in order to be able to adapt agriculture to meet the rapidly expanding demand for more and different food, as well as non-food products, under substantially different climatic conditions from those prevailing today. The training of more breeders, technicians and field workers, and the provision of better facilities and adequate funds are all essential (SOW-2 p.115 b.1); ALSO PA-2 & PA-4 & PA-10 & PA-11 & PA-12 & PA-15

309. **Research/technology:** Institutions should endeavour to link training with ongoing research.

310. **Coordination/Administration:** Training courses should be developed and offered in close collaboration with regional networks and national programmes. In addition, advanced programmes should be developed in cooperation with relevant regional academic consortia or associations.

311. **This activity is closely linked with:**

- All other activities

20. Promoting public awareness of the value of plant genetic resources for food and agriculture conservation and use

312. **Assessment:** Public awareness is the key to mobilising popular opinion and to generating and sustaining appropriate political action within countries and internationally. The capacity to communicate the impact of genetic resources activities to key target audiences is critical to the success of any conservation programme.

313. A targeted public awareness programme can promote the development of international linkages and collaborative mechanisms such as networks. Within countries, public awareness can facilitate efforts to involve communities and local and non-governmental organizations in national genetic resources activities, thus ensuring a broader base for conservation. Strong linkages between public awareness work done by international organizations and national programmes and organizations can increase effectiveness and reduce costs.

- Scientific understanding of the on farm management of genetic diversity has increased, and this approach to the conservation and use of PGRFA has become increasingly mainstreamed within national programmes (SOW-2 p.17 b.2); ALSO PA-2

- Interest in and awareness of the importance of conserving CWR, both *ex situ* and *in situ,* and its use in crop improvement have increased substantially (SOW-2p.17 b.3); ALSO PA-4 & PA-12 & PA-14

- A better understanding of, and support for, farmers' management of diversity is still needed, in spite of significant advances in this area. Opportunities exist for improving the livelihoods of rural communities an essential element of such efforts (SOW-2 p.17 b.2); ALSO PA-2 & PA-11 & PA-12

- There is evidence that more attention is now being paid to increasing the levels of genetic diversity within production systems as a means of reducing risk, particularly in the light of the

predicted effects of climate change (SOW-2 p.43 b.10). ALSO PA-18

- Interest in collecting and maintaining collections of CWR is growing as land-use systems change, concerns about the effects of climate change grow and techniques for using the material become more powerful and more readily available (SOW-2 p.86 b.4); ALSO PA-4 & PA-5 PA-18

- Interest is also growing in neglected and under-utilized crops in recognition of their potential to produce high-value niche products and as novel crops for the new environment conditions that are expected to result from climate change (SOW-2 p.86 b.5); ALSO PA-5 & PA-7 & PA-14

- There has been a substantial increase in awareness over the past decade of the extent and nature of the threats posed by climate change, and of the importance and potential of PGFRA in helping agriculture to remain productive under the new conditions through their underpinning of efforts to breed new, adapted crop varieties (SOW-2 p.115 b.8); ALSO PA-3 & PA-9 & PA-11 & PA-18

- The need for greater awareness among policy makers, donors and the general public of the value of PGRFA, and the importance of crop improvement, in meeting future global challenges (SOW-2 p.115 b.2); ALSO PA-2 & PA-4 & PA-11 & PA-15 & PA-18

- Several new foundations now support activities in PGRFA internationally. A special fund to support agricultural research in Latin America (FONTAGRO) was set up in 1998 and in 2004 the GCDT was established as a specialized fund dedicated to supporting the conservation of PGRFA and promoting its use worldwide (SOW-2 p.161 b.15).

314. **Final objectives:** To integrate fully public awareness into all local, national, regional and international programme activities.

315. **Intermediate objectives:** To support mechanisms, particularly in developing countries, for coordinated public awareness activities at all levels.

316. **Policy/strategy:** National policies and planning should recognize the role that public awareness can play in establishing a firm basis for sustainable genetic resources conservation and use. Public awareness should be considered in the development of all national programme activities.

317. National strategies should identify objectives and strategies for public awareness, defining target audiences, partners and tools for public outreach. Governments should recognize and encourage the work of NGOs in raising public awareness.

318. Adequate consideration should be give to production of public awareness materials in appropriate languages to facilitate broad use within countries.

- Greater attention is needed regarding the conservation and use of PGRFA of neglected and under-utilised crops and non-food crops. Many such species can make a valuable contribution to improving diets and incomes (SOW-2 p.20 b.4); ALSO PA-5 & PA-8 & PA 11 & PA-12 & PA-14

- In spite of the growing awareness of the importance of CWR, there is still a need in many countries for appropriate policies, legislation and procedures for collecting CWR, for establishing protected areas for CWR, and for better national coordination of these efforts (SOW-2 p.20 b.7). ALSO PA-4 & PA-7

- The involvement of local communities is essential in any *in situ* conservation or on farm management effort and traditional knowledge systems and practices need to be fully taken into

account. Collaboration between all stakeholders needs to be strengthened in many countries (SOW-2 p.44 b.6); ALSO PA-2 & PA-4 & PA-11 & PA-15 & PA-18

- More investment is needed in the improvement of under-utilized crops as well as of traits in major crops that are likely to assume greater importance in the future as increased attention is paid to health and dietary concerns and as the effects of climate change intensify (SOW-2 p.116 b.6); ALSO PA-2 & PA-4 & PA-10 & PA-11 & PA-12 & PA-14

- In order to underpin such funding strategies[3], increased efforts are needed to raise awareness among policy makers and the general public of the value of PGRFA, the interdependence of nations and the importance of supporting increased international collaboration (SOW-2 p.161 b.2); ALSO PA-15 & PA-16

- In spite of the enormous contribution by PGFRA to global food security and sustainable agriculture, its role is not widely recognized or understood. Greater efforts are needed to estimate the full value of PGRFA, to assess the impact of its use and to bring this information to the attention of policy makers and the general public so as to help generate the resources needed to strengthen programmes for its conservation and use (SOW-2 p.200 b.6)

319. **Capacity:** Genetic resources programmes should have as appropriate, a focal point for public awareness. Genetic resources workers, however, should develop the capacity to articulate the importance of programme goals and activities in the broader context of sustainable agriculture and development. They should be able to communicate this to all stakeholders using tools provided by public awareness specialists.

320. Plant genetic resources programmes should consider enlisting the help of well-known and influential people to increase access to the media and attract added attention.

321. National genetic resources programmes should draw on public awareness tools and technologies generated at the regional and international level for use in their own information efforts. These tools – and the messages they convey – may have to be adapted to reflect national priorities and circumstances. However, it is likely that many of the regional and global messages will prove useful in supporting national public awareness strategies and activities. This will substantially reduce costs to the national programme.

322. Awareness of the value of plant genetic resources for food and agriculture, and of the role of scientists, plant breeders, farmers and communities in maintaining and improving them, should be promoted in schools at all levels, as well as in specialized agricultural research institutions.

- In the effort to mobilize additional resources for *ex situ* conservation, greater efforts are needed in raising awareness among policy makers and the general public, of the importance of PGRFA and the need to safeguard it (SOW-2 p.87 b.9). ALSO PA-4 & PA-5 & PA-6 & PA-7 & PA-8

- Efforts to raise additional resources to support work on PGRFA require new and innovative approaches, better coordination in fundraising among the different institutions and sectors, and greater efforts to increase awareness among policy makers, donors, and the private sector as to the actual and potential value of PGRFA (SOW-2 p.137 b.9); ALSO PA-8 & PA-15

[3] It refers to the previous paragraph "Although several new networks have been formed, many others have suffered from a lack of funds. At least one has ceased to function. New and innovative funding strategies and mechanisms are needed" SOW-2 p.161 b.1

323. **Research/technology:** Research into, or consideration of, the information needs of targeted audiences should be made before launching major public awareness initiatives. At the international level, research into the use of the new information technologies to meet public awareness needs should be undertaken.

- Specific research needs relating to on farm management or *in situ* conservation of PGRFA include (SOW-2 p.44 b.10):

  • Further research to provide information to underpin the development of appropriate policies for the conservation and use of genetic diversity, including the economic valuation of PGRFA. ALSO PA-2 & PA-4 & PA-5 & PA-8 & PA-11 & PA-12 & PA-15

324. **Coordination/administration:** A certain degree of coordination and facilitation is needed at the international level to rationalize and bring cost efficiencies to public awareness work. National programmes and others can take advantage of materials developed at the international level, for example through public awareness officers in FAO, UNEP, the CGIAR system, and NGOs, including the private sector. Linkages between international organizations and NGOs will facilitate the sharing of messages and the identification of opportunities for collaborative activities.

- Greater collaboration is also needed among policy and funding bodies at the international level, and a greater awareness of the need for long-term financial support (SOW-2 p.162 b.3); ALSO PA-15

325. **This activity is closely linked with:**

- All other activities