



GFAR

GLOBAL FORUM ON AGRICULTURAL RESEARCH
FORUM MONDIAL DE LA RECHERCHE AGRICOLE
FORO GLOBAL DE INVESTIGACION AGROPECUARIA

Regional Priorities and Emerging Global Programmes: A Preliminary Report on a Stakeholder Dialogue

Note: This document will continue to evolve in the near future as a consequence of the ongoing dialogue among stakeholders. The regional priorities that are presented in Annex 1 of this document are under discussion with the respective Regional/Sub-regional Fora, and their presentation will be improved in subsequent versions of this document.

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Chapter 1 - Inter-Regional Cooperation in the Context of GFAR

1. Background

The Global Forum for Agricultural Research (GFAR) is a joint undertaking by all stakeholders of ARD to mobilise the global scientific community in order to address the three major challenges of rural poverty alleviation, achieving food security and assuring a sustainable management of the environment. In the development and strengthening of a *Global Agricultural Research System (GARS)* all stakeholders participate very actively in this process at the national, regional and global levels (NARS, IARCs, NGOs, ARIs, farmers' organisations, the private sector and donors). Within this context, global activities are being carried out through an increasingly diversified range of research partnerships, in which three modes of collaboration play a key role: (a) international centres with a global mandate, (b) inter-regional cooperation between National Agricultural Research Systems (NARS) and other stakeholders of agricultural research for development (ARD) through various forms of research partnerships, and (c) global programmes and networks that emerge in specific areas of research. The first mode of collaboration is basically constituted by the research centres of the CGIAR and a few more cases of international centres that also have a global mandate. International centres have played an important role in the process of building a GARS through the quality research they have produced since they were established. But in the globalised world of today the other two modes of collaboration are playing an increasingly important role as part of the process of the globalisation of science. One of the objectives of GFAR is to facilitate the participation of NARS and of other stakeholders in inter-regional research partnerships through their respective Regional Fora (second mode), and in promoting the emergence of global programmes in key strategic areas of agricultural research (third mode).

The basic mechanism for the mobilisation of stakeholders of agricultural research for development at the regional level has been the Regional/Sub-regional Fora (RF/SRF) that have been established throughout the nineties: AARINENA for West Asia and North Africa, APAARI for the Asia/Pacific region, the CAC Forum for Central Asia and the Caucasus, FARA for Sub-Saharan Africa, and FORAGRO for Latin America and the Caribbean. Over the last couple of years, all regional/sub-regional fora have been actively engaged in regional priority-setting and in formulating regional and sub-regional strategies in agricultural research and development. This has led to the emergence of regional networks and of other forms of regional/sub-regional cooperation. At the same time, as part of its reform process the CGIAR has decided to set its own global agenda on the basis of regional/sub-regional priorities in order to respond to the needs of developing countries. Given this convergence of interest, in October 2000 all regional fora agreed to revisit, update and refine their regional priorities in making a special effort to involve all categories of stakeholders in this process, in order to assure a more participatory approach and to integrate civil society's concerns and priorities. This reflects the increasingly diversified institutional infrastructure of agricultural research and the new role being played by the NGOs, the private sector and farmers' organisations, who are joining the NARS, IARCs and ARIs in this endeavour.

The purpose of this document is to present a status report on two complementary dimensions of GFAR activities. The first one is a preliminary report on the results that are being obtained by the regional priority-setting process that is taking place in the various regions of the developing world. In the last meeting of the GFAR Steering Committee the GFAR Secretariat was requested to circulate this information, so that each region and stakeholder can have a better sense of the type of results that are coming out in other regions. Secondly, this document presents a preliminary report on the emerging ideas for global programmes that are coming out of the cross-cutting research themes that are common to various regions, and in which stakeholders believe that collaboration at the global level can bring an added-value to their own endeavours.

2. The Importance of Inter-regional Interaction

One of the modes of cooperation that is playing an important role in GFAR is that of inter-regional cooperation among NARS and other stakeholders, both in the South/South and in the North/South dimensions. In the South/South dimension RF/SRF are starting to exchange information on research priorities and on research areas that are of mutual interest, as well as information on policy issues that are of interest to them. Interaction in the North/South dimension has been greatly facilitated by the establishment of the European Forum on Agricultural Research (EFARD), in the case of Europe. Working in close interaction with the other Regional Fora, EFARD is playing an important role in promoting collaboration between European research groups and their partners in other regions in the development of the Global Forum (GFAR), and in the insertion of the European research community into the globalised environment of agricultural research. This process has received a new impetus with the decision of the European Commission to organise the New (6th) Framework Programme around the emergence and strengthening of an *European Research Area (ERA)*, and of actively inserting this ERA into the globalised environment that characterises agricultural research in the beginning of this century. In March 2001, EFARD accepted the invitation of Commissioner Busquin to work together with the European Commission, DG-Research, in the preparation of the Agricultural Research for Development (ARD) dimension of the European Research Area (ERA-ARD). Concretely, this implies the preparation of a proposal to integrate an ARD component in the New (6th) Framework Programme which will be discussed in a Ministerial level meeting that will take place in Brussels in November 2001.

In addition to the mobilisation of the European National Fora for this exercise, EFARD also decided to seek inputs from the different Southern Regional Fora on their specific development needs, building on the inter-regional dimension that has been emerging in the context of GFAR. In order to do so, EFARD and the Regional/Sub-regional Fora of developing countries requested the assistance of the GFAR Secretariat to collect and consolidate in a single position paper the contributions of the different regional fora. A shorter version of this report is being presented to EFARD as the input that all Regional/Sub-regional Fora are providing to this strategic planning process in Europe. This is a very interesting case of inter-regional interaction facilitated by GFAR.

It is noteworthy to point out that *new collaborative arrangements* are appearing at the inter-regional level, that typifies the dynamic nature of global science. Three instances of this process that are of particular interest are: (a) the emergence of the "*Mediterranean agricultural research area*" at the confluence between Europe and the AARINENA region; (b) the emergence of *PROCINORTE* that brings together Canada, the US and México with other partners from Latin America and the Caribbean; and (c) the emergence of collaborative research partnerships in the context of *APEC* that brings together the Pacific rim countries. These arrangements cut across regions, as traditionally defined, even in the North/South dimension.

3. Regional Priorities and Stakeholder Involvement

Chapter 2 and Annex 1 of this report present the preliminary regional priorities that have been identified by the different Regional/Sub-regional Fora, as well as their proposals for collaborative research programmes to be carried out with researchers from other regions. Annex 1 is made up by sections on each of the Regional Fora: AARINENA, APAARI, CAC, FARA and FORAGRO. In turn, each of these sections integrate inputs that were prepared by the Sub-regional Fora within each region. It should be emphasised that the regional priorities are still based on preliminary results that will continue to evolve in the near future as part of the ongoing consultation process with stakeholders in each region. For each region there are three aspects that are covered: a brief statement of the main challenges agricultural production presently faces; an outline of the regional research priorities that have so far been identified; and a set of research areas or programmes each region is interested to carry out in collaboration with other regions and/or stakeholders.

Besides the regional priorities and regional proposals that are presented in the various sections of Annex 1, a comparative analysis of these regional priorities has been made in order to develop more structured research themes that can make them more comparable from region to region, and to identify common research concerns that cut across regions. This comparative analysis thus makes it possible to establish relative importance of research topics when one takes an inter-regional or global perspective. The results of this comparative analysis are presented in a Summary Table in Annex 2 of this report.

It is interesting to point out that in the ongoing process of regional priority-setting there is an important learning process that is taking place, in response to the weaknesses that this process clearly had at the beginning. Four important issues are being addressed:

- a) A better distinction between *development priorities* and objectives, on the one hand, and *research priorities*, which should be expressed as researchable issues, on the other.
- b) A more focused analysis of research priorities and a better understanding of the various *analytical units* available for their determination (i.e. ecosystems, NRM constraints, technological constraints, biodiversity management issues, socio-economic concerns, commodity-chains, the role of the new areas of science, etc.).
- c) How to *effectively integrate the various stakeholders involved* and how to develop an inter-stakeholder dialogue on research priorities. This is different from individual consultations with specific persons in a corporate planning process, which has always taken place. We are only now starting to understand the difference between the two.
- d) Fourthly, there is a growing awareness that regional priority-setting, if closely linked to major development efforts and investment processes in each region, can greatly contribute to placing agricultural research in the national and regional agendas. Thus it can clearly play a role in advocacy, and in placing agriculture and ARD at the heart of strategic development concerns in the region. But this requires a strategic approach to this endeavour.

One of the most innovative aspects that are emerging in this process is that of how to assure the effective participation of all stakeholders. Consultation with individual farmers or with specific NGOs has taken place for many years, both in the case of National Agricultural Research Institutes (NARIs) as well as in the case of International Centres (IARCs). But what is now emerging is a *new form of consultation based on inter-stakeholder dialogue*, where stakeholders have the opportunity of taping the opinions and development needs of their own constituencies, and of making an input into priority-setting and into programme-design, as stakeholders. As pointed out above, this is different from individual consultations with specific persons, which has been the traditional way of

conducting this process. What is being addressed here is a new approach to stakeholder dialogue, based on exploring new and innovative ways of effective stakeholder participation.

The objectives that are being pursued through this approach are three. The first one is to identify research priorities that reflect the real needs of stakeholders. The second objective is to seek to mobilise and commit/involve stakeholders around the common objectives that are being jointly defined. The implementation of these priorities is not only the “business” of a given stakeholder, but it becomes “*the business of all*”. The third objective is related to the advocacy role for agricultural research, that has clearly been identified as a very important function in order to place agriculture research back into the national, regional and global agendas. The best way to achieve this objective is to have proactive stakeholders committed to this goal. Proactive stakeholder commitment and action is the most effective way for reaching policy-makers, and for placing agricultural research back into the regional and global agendas. This is one of the most important contributions that GFAR can make to this process.

4. Emerging Global Programmes

From the analysis of research priorities and action proposals across regions it is possible to identify major research and development concerns that are shared by a broad range of developing countries and that mobilise the interest of many stakeholders. These cross-cutting research themes are potential topics for *Global Programmes*. The subject of how to identify and formulate global programmes is an issue that received significant attention at the GFAR-2000 Conference held in Dresden, Germany (May 21-23, 2000). Both at this conference and in the year that has gone by since then, special attention has been paid to what has been learned from the various cases of developing such programmes, and how can this process be facilitated. The learning process this generated led to the preparation of general guidelines on this topic that were prepared by the GFAR Secretariat, and that were discussed and adopted by the GFAR Steering Committee at its recent meeting in Durban in May 2001 (see “*Towards the Formulation and Implementation of Global Programmes*”; Rome, GFAR Secretariat, 2001). The GFAR concept of “*Global Programmes*” is strongly based on two essential characteristics: in the first place, they are based on the regional priorities determined by each region; and secondly, they are based on the conception that in these programmes the national institutions of the participating countries should play a central role (*stakeholder-driven*), in strategic alliance with the main actors of technological development at the global level.

From the comparative analysis of the regional priorities presented by all Regional Fora there are seven major topics that have the potential of evolving towards Global Programmes, that are presented in Chapter 3 of this report: (a) access to information and information management; (b) agrobiodiversity and research issues related to the Global Plan of Action for the conservation and sustainable utilisation of plant genetic resources for food and agriculture; (c) NRM issues related to tropical agriculture; (d) under-utilised and orphan species and commodities; and (e) commodity-chains of interest to two or more regions that may be tackled through global programmes among the interested stakeholders; (f) animal health and production for human food security and food safety; and (g) linking farmers to markets through post-harvest, rural innovation systems and rural SMEs. A brief explanation of each one is given in Chapter 3. It should be pointed out that at this early stage these proposals are not yet fully formulated programmes. Furthermore, the degree to which in certain cases a fully structured programme can emerge, will probably vary from topic to topic. In certain cases it may be sufficient to develop a “*common framework for action*”, within which stakeholders engage in collaborative efforts and strategic alliances among themselves for more specific purposes within each thematic area. This idea is further elaborated in Chapter 3.

Chapter 2 - Regional Priorities and Regional Proposals for Collaboration in ARD

In the last year Regional/Sub-regional Fora have been engaged in a process of formulation of regional priorities in agricultural research as a key tool for the orientation of their regional collaborative efforts, reflecting the needs of the countries in each region. The recent decision of the CGIAR to adopt a regional approach to research planning, priority-setting and implementation has given an additional dimension to the importance of regional priorities. Given the interest of this topic to all stakeholders, the GFAR Secretariat was requested to facilitate the exchange of information among Regional/Sub-regional Fora and among stakeholders on the results that are emerging from these exercises in the different regions. This exchange of information is useful in providing to stakeholders a better understanding of how these issues/questions are being addressed by their colleagues in other Regional/Sub-regional Fora., and a first perception of the main emerging topics that are coming up in each region. The exchange of this information among stakeholders also facilitates a more open and dynamic stakeholder dialogue. In order not to lengthen this report, the preliminary results that are emerging from the regional priority-setting process in each region are presented in Annex 1. For each region, Annex 1 covers three aspects: (a) challenges facing agricultural production in the region;¹ (b) research and development priorities; and (c) proposals for collaborative research projects.

It is important to point out that an increasing distinction is now being made between “*development priorities and objectives*”, and “*research priorities*” in agricultural research. While the former refers more to the development problems and challenges that have to be addressed in order to improve the well-being of people (with a strong people-orientation), the second one refers to researchable issues in which the generation and utilisation of knowledge can contribute to solve the problems that are being faced, through research endeavours. These two dimensions are closely linked, since the correct choice of research priorities can greatly contribute to attaining the development objectives that are being pursued. But at the same time these two dimensions have their own specificity. Although research and the technology and knowledge it generates can greatly contribute to achieving the development objectives, the latter also depend on other factors that go beyond research, and that have to do with other policy and institutional considerations that impinge upon the effective utilisation of knowledge and its impact.

An interesting result of the analysis of all the regional inputs is that in terms of “development priorities/objectives” there is a great consensus among all regions involved. Basically in all cases the following four general development priorities have been identified: (a) addressing rural poverty alleviation and improving the well-being of people; (b) increasing productivity and enhancing competitiveness in order to generate a sustainable economic growth; (c) sustainable management of the environment and enhancing the capacity of the natural resource base; and (d) assuring food security. These four major development priorities define the framework within which the more specific research priorities have been determined by all regional/sub-regional fora. Since they are common to all regions they will not be repeated in each section. See Annex 1 for the detailed information for each region.

¹ **It should be pointed out that the coverage of forestry and fisheries by the Regional Fora is a question that is gradually emerging, but that still has to be improved. In this chapter forestry and fisheries appear in the regional priorities, but only in a limited way. A dialogue with RF/SRF is taking place to see how this can be improved.**

Chapter 3 - Emerging Global Programme Ideas

As pointed out in chapter 1, from the analysis of research priorities and action proposals across regions it is possible to identify major research and development concerns that are shared by a broad range of developing countries and that mobilise the interest of many stakeholders. These cross-cutting research themes are potential topics for *Global Programmes*. The purpose of this chapter is to identify those research areas that emerge from the comparative analysis of regional priorities as being potential topics for global programmes, and to present a brief outline of each emerging theme or research area. In identifying and developing these proposals, the criteria and guidelines defined in the methodological document recently approved by the GFAR Steering Committee have been followed (see “*Towards the Formulation and Implementation of Global Programmes*”; Rome, GFAR Secretariat, 2001).

The concept of global programmes (GPs) allows the articulation of national and regional research efforts into *concerted research endeavours* with partners in different parts of the world and from different stakeholders. They allow to relate the local with the global; the immediacy of community action with the generation of knowledge that is applicable to the solution of development constraints that confront sustainable development efforts anywhere in the world. In some cases, these challenges are equally valid for developed and developing countries (i.e. biodiversity management, food safety, etc.). In other cases the “globality of the issue” comes not from the problem that is being confronted, but from the fact that the impact of that issue will have a widespread effect for all at the global level (i.e. rural poverty, acute environmental deterioration, etc.). Whatever the *nature of the globality*, the magnitude of the problem does require concerted action among the various stakeholders.

From a preliminary comparative analysis of the regional priorities presented in the previous chapter, there are seven major topics that emerge as potential themes for global programmes. A very brief analysis of each one is presented in this chapter. Since regional priorities are still evolving in the different regions, this analysis should be taken as a preliminary one. Other possible themes for global programmes will most likely emerge from a more detailed analysis. Given their magnitude and complexity, in the development of these global programmes all stakeholders will have an important role to play.

It should be pointed out that the concept of “*programme*” may take different forms and shapes in going from case to case. In some cases a “*fully structured programme*” may be feasible, constituted by a formal set of specific projects and activities that are jointly designed and that are funded by an integrated budget. This is the concept of programme that is used at the corporate level (i.e. in a NARI or an IARC). In other cases what may really be required is simply a “*common framework for action*” within which stakeholders share information, develop synergisms and carry out complementary activities, either alone or in partnership with other stakeholders. Thus the degree of *programmatic structuring* may widely differ from case to case.

Another important characteristic of the global programmes that are being promoted in GFAR is that of the *direct stakeholder involvement in the identification and formulation of these programmes*, through a bottom-up participatory approach. One of the challenges that is being confronted here is that of how to effectively integrate stakeholders in the identification and formulation of global programmes (see the analysis of stakeholder involvement in chapter 1). The seven GP proposals that are presented in this chapter are generating an important *learning process* on how to do so.

1. Access to information and information management

1.1. Background

The Global Forum on Agricultural Research (GFAR) was established in 1996 as a neutral and transparent platform involving all stakeholders of Agricultural Research for Development (ARD). Through GFAR, these stakeholders have expressed their willingness to (a) share information and communicate in more effective ways, (b) discuss global and often controversial issues, acknowledging that possible differences of opinions do not preclude the enormous potential for co-operation; (c) launch and build research partnerships that could lead to the design and implementation of global programmes; and (d) provide institutional support to the different stakeholders, in particular the developing country NARS and their regional and sub-regional fora. This, in turn, generates the challenge of how to effectively use the new information and communication technologies to respond to the increased needs for the exchange of information, the sharing of experiences and knowledge, and the facilitation of debates on global topics.

1.2. EGFAR, a global programme that complements the RAIS

EGFAR, the Electronic Global Forum on Agricultural Research, is being developed as the electronic information and communication system of the GFAR stakeholders, allowing them to reach their objectives. The recently completed *First GFAR External Review* clearly emphasised the importance and the urgency of addressing the communication and information dimension of GFAR and strongly recommended the strengthening of the GFAR Secretariat to deal specifically with this issue.

Three main objectives are being pursued through the establishment of EGFAR. The first objective is to develop and manage, in a neutral and transparent way, an interactive communication system between the various stakeholders of agricultural research in the perspective of developing a global research system. Global partnerships are needed to address problems transcending national frontiers, such as poverty alleviation, drought and climate change and research issues related to conservation and sustainable use of plant genetic resources. The building up of global and even regional programmes require a neutral, transparent and effective communication platform between the various stakeholders.

The capacity to access information and share it is of paramount importance for the development of a stakeholder-led initiative such as GFAR. Thus, the second main objective of EGFAR is to identify information resources relevant to agricultural research for development and enhance access to them by the GFAR stakeholders through a gateway function. EGFAR intends to be a portal for ARD allowing the end-user to know very quickly, through a user-friendly interface, who is doing what and where, and what are the main results and achievements. The NDIL database, presently hosted by EGFAR and related to institutional information on stakeholders, is a first step to achieve this goal, but it will obviously have to be improved through a more decentralised and participatory approach involving the *Regional Agricultural Information Systems (RAIS)*, that play a key role in facilitating access to decentralised information sources in both developing and developed countries. A *webring* involving all the GFAR stakeholders is being developed as part of this process.

A third objective of EGFAR is to selectively build pools of knowledge in a few high priority areas identified by the GFAR stakeholders in any of the lines of action of GFAR which are: genetic resources management and biotechnology, natural resources management and agroecology, commodity chains and under-utilised commodities, and policy management and institutional development. To achieve these three main goals the central website of EGFAR will be developed in collaboration with interested stakeholders, while at the same time support will be provided to

strengthening the capacity of the weaker stakeholders to access information and to participate in debates on topics of their interest in the increasingly globalised world of today. These activities are being developed in close collaboration with the WAICENT outreach group in FAO. It should be pointed out that EGFAR will not create centralised databases, but will rather play a gateway function to databases and information sources at the national level, through a multihost database search engine.

1.3. Key Principles

Internet-based communication tools (e.g. e-mail conferences, electronic discussion fora, Intranet developments, in house applications, etc.) allow stakeholders to generate information in a totally decentralised manner, thus facilitating local initiatives and a bottom-up approach. This principle of *decentralisation* is being followed in all EGFAR activities, which places emphasis on linking the local with the global level, through the mediating role of the Regional Agricultural Information Systems (RAIS). A second key principle is that of *subsidiarity*: by developing information and communication products for the local level information and information services are kept as close as possible to the end-users. Regional and global information systems seek to add value to the local ones, through such tools as regional directories of researchers and of ongoing research projects, and sign posting services or gateway services.

1.4. Complementarity between regional and global activities

The concept of a multi-stakeholder led platform for communication and exchange of information is now widely shared and will become a key tool in the construction of EGFAR. In the regional priority setting exercise carried out by all the Regional/Sub-regional Fora, *Information and Communication Management (ICM)* has been identified as being of high priority for developing countries. In building up their ICM capacity, RF/SRF are presently establishing and developing Regional Agricultural Information Systems (RAIS) in each region: INFOTEC in the case of Latin America and the Caribbean; APARIS for the Asia/Pacific region; the AARINENA-RAIS in the case of the WANA region; and EIARD-InfoSys in the case of Europe. In Sub-Sahara Africa, the European Union is supporting two sub-regional information projects, in CORAF/WECARD and ASARECA. The following table summarises the status of development of these various initiatives:

FORUM	AARINENA	APAARI	EFARD	FARA /CORAF	FARA /ASARECA	FORAGRO	GFAR
ICM recognition as a priority by the forum	YES	YES	YES	YES	YES	YES	YES
Name of the information system	AARINENA-RAIS	APARIS	INFOSYS		RAIN	INFOTEC	EGFAR
Project already formulated	NO	YES	YES: in phase 2	Under process	YES	YES	YES
Funding available	NO	NO	YES (EU)	YES (EU)	YES (EU)	NO	NO
Personal dedicated to ICM	NO	YES	YES Zadi is leading (Germany)	YES	To be recruited	YES	YES
Availability of a website	NO	NO	YES, well developed	YES	NO	YES	YES, to be improved

2. Agrobiodiversity and research issues related to conservation and sustainable utilisation of plant genetic resources for food and agriculture²

2.1. Background

At the meeting of GFAR in Dresden in 2000, the participants, representing national agricultural research systems, regional and sub-regional organisations, universities, advanced research institutions, non-governmental organisations, the private sector, farmer's organisations, multilateral and donor agencies, and international agricultural research centres, recognised the important contribution of plant genetic resources for food and agriculture towards food security, poverty alleviation and environmental sustainability, which was expressed in the '**Dresden Declaration on Plant Genetic Resources for Food and Agriculture**'.

The GFAR meeting participants call in this declaration in particular for more political and financial support for the implementation of the '**Global Plan of Action (GPA) for the Conservation and Sustainable Utilisation of Plant Genetic Resources for Food and Agriculture**', which was officially adopted by 150 countries in 1996 in Leipzig at the fourth FAO International Technical Conference on Plant Genetic Resources. This Plan contains twenty priority activity areas for action that are based on the needs, gaps and constraints identified in the first State of the World's Plant Genetic Resources, presented at the Conference, building on detailed analyses carried out by national institutions, together with the FAO and IPGRI, including 159 Country Reports, 12 regional and sub-regional meetings involving 143 countries, a number of specialised workshops and symposia, and active electronic conferences. The **International Undertaking (IU) on Plant Genetic Resources**, as revised through intergovernmental negotiations in the FAO Commission on Genetic Resources for Food and Agriculture, is expected to be approved by the November 2001 FAO Conference as a legally binding international agreement. Article 15 provides that Contracting Parties should promote the effective implementation of the GPA, including through national activities and, as appropriate, international cooperation, to provide a coherent framework, *inter alia*, for capacity-building, technology transfer and exchange of information. Regional/Sub-regional Fora are particularly interested in seeing these three last aspects being addressed through this emerging global programme, given the strategic importance they have. Although for operational reasons this emerging proposal refers to *plant genetic resources*, in GFAR-2000 stakeholders highlighted the need to develop a parallel and complementary effort in *animal genetic resources*, that should be coordinated with the World Strategy in this field.

2.2. Agrobiodiversity and the GPA

Amongst others the GPA breaks new ground in that it calls attention to and recognises the importance of on-farm management of agrobiodiversity, and calls for participatory research approaches involving scientists, genebanks and farming communities. The GPA places great emphasis on the importance of making collections more accessible and useful for breeders and rural communities by characterisation and evaluation of *ex situ* collections using improved information systems. It further calls for a rational, economically efficient and sustainable global system of genebanks and collections able to safeguard as much existing unique and valuable diversity as possible to foster international collaboration both at the political and the technical/scientific level, recognising that states have sovereign rights over their plant genetic resources for food and agriculture and contributing therefore to **conservation-for-development**.

² This section has been prepared with IPGRI and with FAO, on the basis of the inputs received from all the RF/SRFs.

2.3. Global framework

From the regional research priority setting as carried out by the Regional Fora for Agricultural Research and NGOs/Civil Society (CS) in the developing countries (see Annex 2 for full overview of regional priorities related to Agrobiodiversity), as well as in Europe, it becomes clear that Agrobiodiversity in general and the issues related to the implementation of the GPA are a priority for all regions. The overview below combines the twenty priority activity areas of the GPA with the research priority setting carried out by the Regional Fora and CS/NGO's, and illustrates the strong concurrence and synergy with some typical examples for all GPA activity areas. Therefore a **global programme approach**, involving all developing regions and EU partners, and linking effectively with NGO's and with international (research) institutions and networks such as the CGIAR, in particular IPGRI and the FAO, will contribute significantly to the implementation of the GPA as has been called for in the GFAR Dresden declaration, and to the ultimate goal of sustainable conservation and use of Agrobiodiversity for the future of the world.

2.4. Illustrative links between the GPA and Regional and CS priority setting

The twenty priority activity areas of the GPA are grouped in four clusters: *in situ* conservation and development, *ex situ* conservation, use of plant genetic resources and institutions and capacity building. On the basis of the regional priorities identified by RF/SRF in this area (see Annex 3), the following links with the four main clusters of the GPA can be highlighted:

- GPA activity areas 1-4: *In situ* conservation and development
 - 3.2³ - Collection and documentation of indigenous knowledge on conservation and use of plant genetic resources (All regions & CS)
 - 4.1 - *In situ* conservation strategies and the sustainable use of native at risk species, recovering local knowledge (All regions & CS)
 - 5.3 - Developing and evaluating truly participatory farmer-led research methodologies (APAARI, FARA, FORAGRO & CS)
- GPA activity areas 5-8: *Ex situ* conservation (see also footnote1)
 - 3.1 - Eco-regional survey, exploration and collection of endemic, endangered, neglected and traditional cultivars (All regions & CS)
 - 4.4 - Bioinformatics and management of germplasm banks (All regions)
 - 4.5 - Strengthening regional networks of genetic resources (All regions)
- GPA activity areas 9-14: Use of Plant Genetic Resources
 - 5.1 - Sustainable use and conservation of biodiversity and agrobiodiversity (All regions & CS)
 - 1.5 - Utilisation of underutilised crops (All regions)
 - 4.3 - Identification, isolation and characterisation and use of genes of interest (i.e. disease or stress resistance) for breeding programmes (All regions)
- GPA activity areas 15-20: Institutions and Capacity Building
 - 1.10 - Policy advocacy on IPR/IPP and sharing of genetic resources and of their benefits (All regions & CS)
 - 4.8 - Implementation of Biosafety regulations and risk assessment for decision making (All regions)
 - 1.14 - Human Resource Development and capacity-building efforts (All regions & CS)

³ Annex 3 presents a matrix table that identifies the concrete priorities and proposals identified by each region related to genetic resources. The number that appears in this list corresponds to the row number in the table in Annex 3.

2.5 *Research Agenda for a Global Partnership on Agrobiodiversity*

The priorities identified by the Regional Fora and Civil Society underline both the importance of a global approach to *ex situ* and *in situ* conservation and the need for sustainable utilisation of agrobiodiversity, that can reflect the needs and requirements of developing countries. As far as *in situ* conservation is concerned, a global approach is needed for conserving and using biodiversity in productive agro-ecosystems, compliant with CBD regulations and with the recent agreements reached in the negotiation of the IU. This requires the development of sustainable conservation and utilisation strategies that empower communities to make better decisions about the management of biodiversity in their agroecosystem, allowing it to be productive, resilient, flexible and protected, but not isolated (i.e. open for influences from outside, but protected against invasive and destructive species and cultivation practices). For *ex situ* conservation the development of a blue print for a rational, economically efficient and sustainable global system of genebanks and collections, able to safeguard as much existing unique and valuable diversity as possible, has a high priority, recognising the sovereign rights of States over their genetic resources and the need to assure an equitable distribution of benefits by operationalizing the principle of Farmers' Rights. This global system should be based on networking among the national genebanks, complemented with the collections of the international centres. Here the regional/sub-regional genetic resources networks play a key role, as an important component of the global system.

It is also important to highlight the need to establish and/or strengthen the professional and institutional capabilities of developing countries in these plant genetic resources activities and to ensure a significant improvement in the capacity of developing countries for the production and distribution of improved crops varieties, as required to support major increases in their agricultural production. This will require international collaboration and agreement, under the leadership of the FAO Commission on Plant Genetic Resources for Food and Agriculture. An important step would be to develop criteria for a global conservation system and to put in place the elements of that system, including an information infrastructure and financial mechanism to ensure its long-term sustainability. Research will also be needed to upgrade in a sustainable manner global and national conservation facilities, and to promote the rationalised use of genetic resources collections through existing regional alliances.⁴ In this context, this emerging global programme proposal should particularly be oriented towards complementing the efforts aimed at conservation strategies that are already underway (i.e. the Global Conservation Trust mentioned in footnote 4), with a clear effort to mobilise resources and concerted efforts among stakeholders for the other components of the GPA and the IU: capacity-building in developing countries, technology transfer and facilitating access to information.

3. NRM, Agro-Ecology and Tropical Ecosystems

3.1. *Rationale*

One thrust in developing research partnerships for development is to link local and global knowledge in agro-ecology and natural resource management (AE/NRM) by pulling together and transforming decentralised initiatives into global initiatives using a bottom-up approach". This aim flows directly from two GFAR guiding principles: subsidiarity and additionality.

⁴ **At present the feasibility of a *Global Conservation Trust* is being investigated by the Consultative Group on International Agricultural Research (CGIAR) under the aegis of the FAO, to ensure long term support from public and private donors for the development and operation of such a rational global system of genebanks and *ex situ* collections.**

To achieve the aim of a Global Program, the central question of how to use a bottom up approach to pull together and transform numerous decentralised initiatives into a coherent global program will have to be addressed. In the GFAR-2000 Conference, several proposals in the area of AE/NRM have been received and discussed by various stakeholders. NGOs and farmers' associations are playing a very important role in developing these proposals and seeking links with research and development organisations in the South and North and with international research centres. At the same time, the international agricultural research centres have their respective programmes in AE/NRM which builds on their various systemwide initiatives.

Thus, there is a high potential for collaboration and complementarity between these various initiatives and the importance of assuring possible synergisms that can mutually enrich them.

3.2. *Emerging nature of global programmes on NRM and Agro-ecology*

On the basis of indicative results coming out of the on-going regional research priority setting exercise being carried out by various Regional Fora for Agricultural Research, high priority is being accorded to the sustainable use, management and conservation of the natural resource base.

From the emerging proposals put forward by various stakeholders, two general types of global programmes are emerging. The first type includes those proposals focusing on **processes**, with a special emphasis on local innovation and stakeholder participation (e.g. farmer-to-farmer, participatory technology development, etc) in improving NRM and improving productivity using technologies developed by farmers themselves. This is the type being put forward by the civil society.

This process-oriented approach does not necessarily have a geographic focus, i.e., it can be in any region, in any country and is site specific. Neither does it have a very specific NRM thematic focus. It rather concentrates on local innovations in any NRM issue (e.g. on IPM, livestock development, postharvest, water management, etc.). It aims at systematising local knowledge (wisdom) so it can be codified and made transferable to other interested stakeholders, providing "alternative" methodologies and technologies which can complement the results of scientific research.

The second type places a greater emphasis on improving the management of natural resources and increase the sustainability of agricultural production, using appropriate technologies for specific ecosystems (i.e. the humid and semi-humid tropics). This second type has a stronger research component, but it is also clearly based on a multi-stakeholder participation that integrates the farmers and NGOs. Proposals of this type are being put forward jointly by NARS, farmers and NGOs (e.g. FORAGRO's Tropical Ecosystem Technologies proposal), and by a collaboration among ARIs-NARS-IARCs-NGOs (e.g. Direct Sowing, Mulch-based and Conservation Tillage - DMC).

Unlike the approach that takes as a point of departure the analysis of local innovations, this second approach is thematic-based (tropical ecosystems, conservation tillage) and also has a geographic or ecoregional focus. It provides a thematic context in which the "alternative" methodologies and technologies identified can be developed, tested and applied.

In the identification and development of these proposals a very intensive process of interaction among NARS, ARIs, IARCs, farmers and NGOs is taking place. This is already moving

in the direction of implementing the Durban agreement of developing a closer interaction among these stakeholders in the area of NRM and agro-ecology.

4. Under-utilised and orphan species and commodities

4.1. *Background*

Although only about 30 crops provide the bulk of human nutrition and just over a hundred species of plants contribute 90 percent of the supply of food crops by weight, calories, protein and fat for most of the countries of the world, this gives a false impression and a distorted view of the global contribution made by plant diversity to human activities. Thousands of species are utilised worldwide, not just for nutrition but to supply energy, fibres, medicines and other needs. In fact, about 7000 plant species have been recorded in cultivation and many of these are what are variously described as **underutilised, underdeveloped, neglected, minor, promising, orphan or relict crops or species and life support species**. Since all these terms are ambiguous, they are referred to here, along with the commodities derived from them, as **UOCs**. Similar situations can be found for animal and fish species.

UOCs often play a major role in the daily lives of hundreds of millions of ordinary rural and urban householders. They do not replace but complement staple foods in traditional agricultural systems such as home gardens and make a much greater contribution to the livelihoods of households in subsistence agricultural systems, in marginal as well as in urban areas than is generally acknowledged. The number of species involved runs into thousands and they highly contribute to the maintenance of biodiversity. It is estimated that about 60% of the world's agriculture consists of traditional subsistence farming systems in which there is both a high diversity of crops and species grown and in the ways in which they are cultivated.

4.2. *The Challenge*

The main barrier to development of UOCs is the non-attraction of investments by private enterprises because their production volume and their economic exploitation potential today are low or unknown. Since they occupy a narrow niche, the seed industry companies also usually find them unattractive investments. They can then be considered as underdeveloped in the sense of not much effort being put into developing their production, harvest and post-harvest technologies or their markets. UOCs are not, however, considered underutilised by the people who traditionally use them for their daily subsistence or as a source of income, in particular the poor small farmers in the marginal areas and the fragile ecosystems.

The challenge is therefore to create sufficient awareness to promote research and development programmes on UOCs, to provide a favourable policy environment, to encourage their development and use, and also to attract development funding from different sources including the private sector. The national, regional and international public agricultural research and development institutions have a key role to play, as the identification of UOCs with a good development potential will critically depend on the knowledge gathered and exchanged on these species.

UOCs plants are a very diverse group and cover the following classes, although there are no clear separations between them and some species belong to more than one class:

- Species that are wild harvested and often 'managed' in forests and other ecosystems
- Species that are partially domesticated and grown in traditional agricultural systems

- Species that are already cultivated on small scale and for which there is a potential for more extensive or more productive cultivation (so-called underutilised or neglected)
- Tolerated weeds – weedy species that colonise cultivated fields or that have co-evolved with the crops and are tolerated because of the important contribution they make to diet, for example as leafy vegetables
- New crops that can be derived from any of the above wild species that are not currently cultivated or are only partially domesticated (note: they can be new to cultivation globally or in particular countries or areas).

4.3. *Priorities*

In spite of huge differences in UOCs, common needs can be identified in terms of policy, information and research and development.

a) *Policy needs*

Action on UOCs is undertaken by a very wide diversity of agencies and groups and is mainly uncoordinated. UOCs are also rarely considered as priorities in agricultural research agendas. The following is needed:

- Inclusion by each country in their appropriate national policies of a section dealing specifically with the exploitation and/or introduction, development and commercialisation of UOCs. Special consideration will be given to sub-regional and regional harmonisation of these policies.
- Recognition of the importance of UOCs by development agencies and, as a consequence, their active support for inclusion of UOCs in national agricultural research priorities. Collaborative research efforts at the sub-regional and regional levels will have to be promoted.
- Clear statements of policy by International Development and Aid agencies and Donor Countries on the importance of UOCs in agriculture.

b) *Information needs*

The literature on UOCs is extensive and scattered, raising the need for the establishment of an **information system** and **clearing house mechanism**. Public awareness of the value and significance of these crops also needs to be addressed.

c) *Research and development needs*

- National inventories of the different kinds of UOCs and surveys of their diversity and distribution
- Priority determining mechanisms and identification of groups of species of UOCs at national and regional levels
- A review of holdings of UOCs in gene bank collections and the adequacy of the accessions and related passport data
- Greater efforts are needed to characterise these species, their distribution (both wild and cultivated), agroecological niches, economic characteristics and cultivation requirements
- More work is needed on their role in nutrition, diet and household sufficiency
- The causes of the neglect or underdevelopment need to be determined
- Farming systems research should be reoriented so as to give a clearer picture of the economic significance of UOCs and their potential in niche markets
- Surveys by resource managers of the needs for *in situ* and on-farm conservation of UOCs that have not been domesticated or are under domestication
- Mechanisms for storage and exchange of genetic resources at the farmer level

- Technologies for crop improvement, post-harvest processing, storage life under varying conditions and marketing mechanisms
- Mechanisms for establishing networking/partnerships

4.4. *The approach taken*

These policy, information and research and development requirements suggest the need for a **Global Facilitating Mechanism** that would coordinate and facilitate the work that is undertaken on these different aspects of UOCs by agencies and organisations world-wide. It would cover the identification, assessment, improvement, development, sustainable use and marketing of these species and the commodities derived from them, for the benefit of local farmers and users. It would encourage the development of common tools and approaches that can be applied to different contexts and situations. It would provide a common forum for discussion and suggestions for action.

In view of their mission and mandate, the Food and Agriculture Organisation of the United Nations (FAO), the International Fund for Agricultural Development (IFAD), the International Plant Genetic Resources Institute (IPGRI) and the International Centre for Underutilised Crops (ICUC) have agreed to join forces, within the Global Forum on Agricultural Research (GFAR) framework, for steering the process of promoting research and development for UOCs and for encouraging all national, regional and international institutions to join them in developing and launching activities along the lines mentioned above.

In July 2001 Germany, through BMZ, its Ministry of Cooperation, agreed to financially support and to host the GFAR Global Facilitating Unit for UOCs. Activities will soon be launched by the different regional fora with the assistance of this new unit in order to identify the regional priorities, strategies and plans of action on UOCs.

5. Commodity-chains of interest to two or more regions

5.1. *Background*

All regions have identified in their priorities the development or the strengthening of international cooperation on some major commodity crops or export crops such as citrus, cocoa, coconut, coffee, cotton, oil palm, pineapple, rubber, sugar cane, etc., which form the backbone of the economies of many developing countries, especially the Least Developed Countries. Most of the major commodity crops are export-oriented and remain an important pillar of overall growth and rural development for many countries in the South. They play a major role to achieve integration in international exchanges, and contribute to poverty alleviation as being the basis of their income generation. Contrary to a commonly held idea, many of the major commodity crops are, to a large extent, cultivated as small holder crops produced in mixed farming systems and not as plantation crops by agro-industries. In many countries, as a consequence of liberalisation, support for small holders growing these crops as part of mixed economies disappeared, since the State Companies responsible for this were privatised.

Research on such crops is, to some extent, carried out by NARS, either in specialised institutes or at universities, but usually with only limited resources (human, financial and equipment). A few crops are, traditionally speaking, under-researched but today, many crops experience problems in raising funds for research in a context of long lasting low prices for most of the commodities.

Donor support to commodity research has generally been limited, as the main emphasis for most donors has been on food crops contributing directly to food security rather than commercial agriculture. Many donor agencies consider that research for these crops must be financed by the industrial sectors that make use of their products. But generally, the private sector only contributes funding for specific projects closely linked to the competitiveness of their industry and many producers' concerns remain neglected or even ignored.

The sustainability of agricultural performance of commodity crops is crucial for many countries in the South, particularly the least developed. But a regular supply of most of these commodities is also vital for many industries, in the North and in the South, with increasing quality requirements. Producers and the industry will become more and more dependent upon each other to achieve their goals: sustainable supply at a price satisfactory for both, to provide quality products that fit consumers' demand.

Many commodity crops have developed cooperation mechanisms, at local, regional and global levels, which can play an important role. But these mechanisms are very often limited, either geographically or in terms of partnerships, which reduces their efficiency to address problems or challenges at global level. New models/mechanisms for action are obviously required which should be developed in the context of the Global Forum. The aim would be to build on and coordinate already existing private and public sector activities in order to produce more "public goods", complying with the GFAR principles of equity and subsidiarity.

Strategies to provide support for research and development on these crops aim at operationalizing the concept of global programmes that can be built using a "commodity chain" approach. Given the nature of commodity chains, partnerships involve research groups from different stakeholders, including the private sector that plays an important role in many of them, NGOs and farmers' associations.

The added value proposed by GFAR is to contribute to strengthen partnership among all the stakeholders in the various commodity sectors. The objective is to implement global programmes, using a commodity chain approach, to address problems or challenges that are of global concern, and could not be correctly tackled at local or regional levels.

The **concept of Commodity Chain** means that for a given crop, the approach is not restricted to the conventional agricultural components related to increases in productivity, but rather that the crop is considered "as a whole" in all aspects of a chain (or a system), from its production through to its consumption or use by the consumers. This approach adds new dimensions to the traditional agricultural research agenda and it implies the involvement of a full range of new partners, who are not usually involved in agricultural research.

GFAR therefore suggested to assist its stakeholders in developing global programmes and to begin on a small number of commodity chains jointly identified, based on the priorities expressed by the commodity communities and NARS Regional Fora.

5.2. *The approach taken*

IPGRI and CIRAD have established a small facilitation unit in Montpellier, to evaluate the feasibility of developing such global programmes for the major commodity chains (citrus, cocoa, coconut, coffee, cotton, oil palm, pineapple, rubber and sugarcane).

It began to assemble information on ongoing collaborations in the area of research and development for the major commodity chains. Then, the major stakeholders of a selected number of commodity chains were contacted to investigate possibilities for, and interest in, the development of a global programme.

The first contacts showed that, for two commodities, coconut and cocoa, initiatives had already been taken at an international level, and work on possible cooperation mechanisms was ongoing. The possible commitment of the different partners was discussed, in full consultation with all interested stakeholders, and lead organisations were identified.

The Montpellier Unit keeps on giving assistance to the projects, which are at various stages of development according to the commodities. For coconut, the content of the programme has been adopted and details of its implementation are being finalised. For cocoa, a decision to start a global programme has been taken and discussions focus on its possible content.

For the other commodities – cotton, coffee, citrus, natural rubber, sugarcane, etc. -, possibilities of Global Programmes are not yet clearly identified and contacts will continue to encourage the emergence of new initiatives among the various stakeholders of these commodities. Several stakeholders have also expressed an interest in launching a Global Cassava Strategy, a proposal that is presently under discussion.

6. Animal Health and Production for Human Food Security and Food Safety

6.1. *Rationale*

In the fighting of poverty alleviation, one of the topics of particular attention to which the world scientific community is devoted is that of the "food security" for poor people. Food security, in terms of quantity, has now evolved to include the concept of "food safety", in terms of quality. Secure, safe food for human populations means education in the hygiene of animal husbandry and in the use of their products. Food safety implies, therefore, reduction of diseases transmitted from animals to humans (zoonotic diseases) and consequently of human mortality. From the consumer perspective, it also means rational use of drugs for no residuals in the animal products (milk, cheese, yoghurt, eggs, etc.), with consequent improvement of animal and human welfare.

6.2. *Emerging nature of the problem*

Livestock farming provides food and nutrients for people. It is a source of cash, income and income security. It often is the main source of livelihood of the poor, enabling them to exploit common resources, particularly land and water. The contribution of livestock farming to rural income is increasing more rapidly than those of agriculture, especially for the poorest farmers who have limited access to land, capital and services.

Population growth, urbanisation, and rising incomes in developing countries are fuelling a massive increase in request for food and nutrients of animal origin. The growing demand for animal products could become a driving force in the development of cereals production and in this way offer a good opportunity for agricultural development. As such, livestock can be considered as the driving force of the «next food revolution». These changes have the potentiality to significantly improve the well being of many rural poor, if an appropriate policy environment is put in place.

At the environmental level, attention must be deserved to the expected increase in herds, their massive movements and the intensification of livestock farming. New policy strategies need to be created for sustainable rural development and prevent waste, pollution of land and water, potential increase of zoonotic disease diffusion and eventually decrease of animal welfare.

In the livestock sector, GIS applications are used to integrate ground collected information on livestock (e.g. distribution and density, disease prevalence, etc.) with agricultural, human, climatic and other environmental data in view to create comprehensive database which will be subject to spatial data management and analysis. This process aims to generate predictive models for e.g. animal health and production, mixed farming systems and land use, which are used as decision support tools in planning development programmes. From these integrated studies emerges the need of development of *disease control strategies* for improved productivity and for human health. Those diseases transmitted from animals to humans should be of particular attention to the scientific community.

For example, Trypanosomosis is a major constraint to livestock productivity on the three continents of the developing world. In sub-Saharan Africa, the main pathogenic trypanosomes in ruminants are *Trypanosoma congolense* and *T. vivax*, which are generally transmitted by tsetse flies. They cause an acute or a chronic disease, characterised by anaemia and immunosuppression, resulting in decreased productivity and economic losses that are estimated to \$1.3 billion annually. In addition, non-tsetse biting insects may transmit *T. vivax* to African cattle and *T. evansi* to camels. In South East Asia and China, *T. evansi* affects cattle and water buffalo, with a socio-economic impact that has not been fully measured but appears to be of increasing concern. In tropical areas of South America, where biting insects transmit *T. vivax* and *T. evansi* to livestock, outbreaks of trypanosomosis are becoming more and more a major threat, particularly for dairy farming.

The current measures – vector control and chemotherapy in the host – are not sufficient for an effective and sustainable control of livestock trypanosomosis. Tsetse control through combined use of sterile male release and insecticides has proved very effective, but the cost of these techniques and the difficulty in preventing re-invasion of tsetse free areas are a limit to their large-scale application over the African continent. Moreover they have little effect over non-tsetse biting insects.

Only a few trypanocidal drugs are available that have been extensively used on the African continent over the past fifty years. The occurrence of drug-resistant trypanosomes (resistance to melarsoprol for humans) has been reported in various parts of West and East Africa. The potential of African indigenous taurine breeds, that have undergone natural selection under high tsetse challenge over thousands of years, has been recognised for a long time but under-utilised.

Similar problems have emerged also for other parasitic diseases such as the *Helminthosis* (gastro-intestinal parasites). Many farmers have experienced that the drugs they are using to deworm their sheep and goats do not work as well as expected. Resistance of parasites to all broad spectrum anthelmintics has in fact become an increasingly widespread problem in recent years and multiple drug resistance strains have been reported from many parts of the world.

Due to the resistance phenomenon and of growing pressure from consumer groups concerning residues in food, there is an increasing need to identify and develop alternative methods and strategies for the control of gastrointestinal parasites. Several different possibilities are under development and investigation such as grazing management systems, selection of genetic resistant animals, vaccines, strategic nutritional intervention and biological control in order to combine their

effects in an integrated parasites control programme and to minimise the selection pressure for resistant parasite. These are only a few examples of interaction between animal and human health, while several other diseases could be mentioned as animal and human life constraints.

In conclusion, there is an obvious need for a better understanding of animal diseases and their impact on productivity, in order to develop alternative control options that may complement current methods. The proposed global programme will create a synergy between groups involved in the various aspects of basic and applied research on animal and human health, towards achievement of food security and safety for human population.

6.3. *The approach taken*

This global programme is evolving as a broader approach from an original proposal on “A Global Initiative to exploit biotechnology and animal genetic resources for the improvement of livestock productivity through control of trypanosomosis”, which resulted from an informal meeting that took place in January 2000 in Montpellier, France. This meeting was attended by representatives of CIRAD, FAO, Concerted Action ICPTV ILRI, OIE and University of Montpellier and the GFAR Secretariat.

- The main added values of the proposed broader programme have been identified as follows:
- a) Link the experiences of scientists involved in studies on animal and human diseases to develop predictive models;
 - b) Promote the establishment of networks created *ad hoc* to support the work of International Organisms (FAO, WHO, etc.);
 - c) With particular attention to Trypanosomosis:
 - Link the experience and research agendas of scientists and institutions that have historically focused on trypanosomosis as an **African** problem with the needs, resources and agendas of **Asia** (Surra), and **Latin America** (*T. vivax* and *T. evansi* infections), where the disease is an increasing problem.
 - Integrate research on the parasite species of economic importance *Trypanosoma congolense*, *T. vivax*, *T. brucei* and *T. evansi* in the livestock species (cattle, buffalo, goats, horses, camels) of greatest economic importance for each region.
 - Integrate research products on diagnoses, epidemiology, chemotherapy, immunology, vaccines and exploitation of the genetic resources of disease resistant livestock.

7. Linking Farmers to the Market: Post-Harvest, Rural Innovation Systems and Rural SMEs

7.1. *Background:*

There is a growing awareness of the need to complement the traditional approach to agricultural research and development with a new approach based on the concept of “*rural innovation*” and on the need to promote “*rural innovation systems*,” if we want to effectively achieve the objectives of poverty reduction and sustainable development. The reasons for the emergence of this new approach are related to several important changes that are taking place in the present context of agricultural research and production. The first one refers to the limitations that are being confronted in the effective impact of agricultural research and the *loss of “technological dynamism”* in the region, mentioned in the section on regional challenges above. Secondly, trade liberalisation is leading to a market situation where the local farmer has to compete with cheap food imports. He is thus faced with an increasing requirement to be competitive, even in the local market.

Recent studies on this issue clearly show that “competitiveness” is not only related to yields and productivity, but also to a series of factors that are related to the structural characteristics of production chains that may promote or inhibit technical change (“*innovation*”), and thus the capacity to be competitive. Competitiveness is increasingly based on *innovation networks* and *innovation clusters*, rather than on innovative farmers working on their own. Thirdly, the demand structure for agricultural products is rapidly changing for many reasons, evolving in the direction of processed foods of one type or another. This is leading to the increasing importance of the post-harvest phase and of agroindustries. Post-production operations account for more than 55% of the economic value of the agricultural sector in developing countries, and they represent up to 80% in developed countries. Agroindustries of different types are becoming the basis of socio-economic development in rural areas, and they play a critical role in meeting the objectives of food security and poverty eradication, through the generation of employment and income in the rural sector. Other changes that are taking place are related to such aspects as the shift in emphasis from a predominantly quantitative concern, to a more qualitative approach, where the characteristics of the products, and thus quality control, is becoming very important; and to the increasing trade in specialised categories of high value agricultural products that require processing (i.e. cut flowers, organic products and medicinal plants).

7.2. *Key concepts:*

In developing a new approach to the interaction between research, extension (technology transfer) and production, based on *incentivating innovation* and on the development of *innovation systems*, the following key concepts play an important role:

- 1. Importance of agroindustries and challenge confronted in orienting them towards effective rural development:** As a result of the factors mentioned in the previous section, the importance of post-harvest technologies and of the development of small and medium-sized rural enterprises (rural SMEs) is clearly becoming apparent. Agroindustries of different types are becoming an important component of socio-economic development in rural areas, and they are playing a critical role in meeting the objectives of food security and poverty eradication, through the generation of employment and income in the rural sector. But this requires promoting an *agroindustrial development pattern* where the benefit that is generated also involves the farmer in the rural sector. In many cases the agroindustrial development pattern that has prevailed in recent years has generated income and benefit largely for the urban sector, with very marginal beneficial effects for the rural sector as such. This implies the need to question critically the pattern that has tended to prevail in the agroindustrial development process in many countries, and to see what can we learn from these experiences in terms of how to increase the benefits for the rural sector, and specially for the rural poor.
- 2. Rural Innovation:** A *rural innovation approach* takes as a point of departure not research programs and how to transfer the technology produced by them, but rather the needs of the producer and how he/she is using knowledge at the farm level or at the enterprise level. This concept requires an integrated view of the different factors that intervene in the farmers’ decision to innovate. An *innovation* is conceived as an increase in productivity or competitiveness of a given product, as a consequence of an improvement (or change) in either production or marketing technologies or know-how. Such an innovation may lead to a new agricultural product being introduced into the market, or to an increased competitiveness of an existing product in order to succeed in having access to new markets. The “*innovation*” involved may refer to any of the different factors that intervene in determining the productivity or the competitiveness of agricultural production, such as: an innovation in agricultural technology (increasing productivity or introducing a new product); an innovation in the management of the ecosystem and of the natural resources (NRM) that are used in the production process; an innovation in post harvest technology, related to conservation and storage, to packaging, to

transportation, etc.; an innovation by generating a “new application” or use for an existing agricultural product; an innovation in marketing and in the presentation of the product in the market that makes it attractive to new segments of it; an innovation in the quality of the product, including its nutritional value; or an innovation in the management of the whole process and on the capacity of the agricultural producer to relate to the other actors in the respective “commodity chain”.

3. **Rural enterprises and rural SMEs:** The third critical concept is related to the importance of making the shift from thinking only on the “*Farm*”, or on “*production systems*”, as the main production units in the agricultural sector, to thinking on agricultural production as something that requires the emergence of “*rural enterprises*”, with an agri-business perspective. This is true not only for large commercial agriculture, but also for the small agricultural producer. Here the development of “*small and medium-sized rural enterprises*”, or *rural SMEs*, can play a critical role. They can make a major contribution to employment and income generation, and thus to food security and to poverty eradication. The concept of food security also includes the concept of having at least a minimal income in order to be able to have access to food. The development of an entrepreneurial capacity among farmers plays here a critical role.
4. **Commodity-Chain Approach:** The fourth main concept is that of the need to address the previous two issues (i.e. rural innovation and the promotion of rural SMEs) in the context of a “*commodity chain (or filière) approach*”. A “commodity chain” perspective implies that, for a given crop, the approach is not restricted to the conventional agricultural components related to increases in productivity, but rather that the crop is considered “as a whole” in all aspects of a chain (or a system), that goes from production through to its consumption or use by the consumers.
5. **Empowering the community to involve small producers in the development of SMEs.** Given the objective of developing SMEs among small producers in poor communities, the importance of the *social dimension* has clearly been identified. In order to develop an agro-industrial development pattern that integrates the family farm and the small producer, the *social organisation of production* plays a key role in this process.

These five concepts are being combined in developing a practical conceptual framework that may help to operationalize this “*innovation systems*” approach.

7.3. Approach that is emerging

On the basis of the various initiatives that some Regional/Sub-regional Fora are taking in order to respond to these changing circumstances, there is a growing interest in developing a global initiative aimed at facilitating the exchange of experiences, developing a learning process and promoting collaborative research efforts among interested stakeholders with the purpose of:

- ◆ Carry out case studies of rural innovation and of successful rural SME development in order to better understand the factors that intervene in this process in the rural sector.
- ◆ Document successful cases that can help to identify “*best practice*”, and facilitate access to this information through EGFAR (see section 1 of this chapter).
- ◆ Support the development of pilot projects aimed at facilitating the establishment of *innovation networks* or *innovation clusters* in specific sub-regions of the developing world.
- ◆ Facilitate the development of a *knowledge pool* on these topics (i.e. on what works and what doesn’t), through the establishment of a global network among the institutions/groups that are working on these issues, or that are developing practical action-research projects.
- ◆ Identify institutions that could provide training on key skills related to the development of an “innovation capacity” in developing countries (i.e. quality control and food safety, development of entrepreneurial skills among agricultural producers, market information, social organisation at the community level for cooperative SME development, etc.).

- ◆ Identification of the links between innovation, rural enterprise development, value-added, income generation and economic growth. This type of analysis can contribute to the advocacy role for the importance of ARD, and thus for investment in it.

From recent dialogue among stakeholders on this topic, many NARS (through their respective Regional/Sub-regional Fora) have expressed interest in developing this initiative at both the regional/sub-regional and the global levels, in partnership with ARIs, with IARCs, with NGOs, with farmers' organisations and with the private sector. Among IARCs, it should be pointed out that ISNAR has started to develop an interesting program line on rural innovation. The involvement of farmers, of NGOs and of the private sector is essential in this type of project.

Annex 1 – Summary of Regional Priorities by Region

1. AARINENA: The West Asia and North Africa Region

1.1. Challenges Facing Agricultural Production in the Region

The Near East and North Africa Region is food deficit and for many years, it has been the largest net food importer among developing countries. As some 60% or more of the population of the region live in the rural areas and depend on agriculture for their livelihood, the decreasing agricultural production is therefore not only affecting food security in general but also hampering poverty alleviation efforts.

The Region is physically a vast area with aridity as the prevailing feature making it the poorest region in the world in terms of water resources. It is rich in indigenous plant genetic resources, but most of its diversity is threatened by erosion. The Region also has a great wealth of livestock, representing, for example, 74%, 26% and 21% of the world total for camels, sheep and goats, respectively. The contributions of animal production to the national agricultural gross product differ greatly from one country to another and ranges from 16% to 81%.

In spite of the greatly improved incentives introduced through domestic policies and higher international prices, the region has only achieved limited success in the production of strategic crops, the diversification of the agricultural base and the enhancing of productivity of land and labour in the agricultural sector. While several factors have contributed to this state of agriculture, much of the onus falls on the agricultural research systems and technology transfer agents to halt, if not reverse, this situation. On the other hand, strengthening information exchange and communication among AARINENA's members and between them and the outside world envisages the need for improving information exchange and communication through maximum use of internet-based services.

AARINENA's main goal is to strengthen national and regional agricultural research capacities through regional cooperation, in order to reverse the downward trends in agricultural productivity and the deterioration of the natural resources base. Its aim is to promote greater interaction among the countries of the Region and with the international research and development community. The development objectives of this cooperation is to achieve a greater degree of self-reliance in food and agriculture and to improve the nutritional well-being and overall welfare of the people of the Region, while at the same time sustaining and further improving the productive capacity of the natural resources base.

Section 1.2 presents the regional priorities for collaboration in agricultural research that have been identified as part of the strategic planning process. Section 1.3 has a brief description of collaborative research projects that have been identified by the NARS of the region, either to be addressed through regional networks/projects, or to be carried out in collaboration with researchers from other regions (both in the North and in the South). These are classified under five major themes: Genetic Resource Management (GRM), Natural Resource Management and Ecology (NRM), Commodity Chain, Policy Management and Institutional Development, and Information Management for Agricultural Research Development.

1.2. Research and Development Priorities

In order to elaborate its “Strategy for the future”, AARINENA examined the status of priority setting in the region building on national priorities and on the exchange of views among the NARS of the region. A regional view of agricultural research priorities has emerged which served to update and complement the common wisdom prevailing in the region in terms of needs of both the sub-regions and the region as a whole.

AARINENA classified its main priorities under two major categories, namely technical and institutional research priorities. However, no priority ranking was attempted at that time, considering that should be best left to each of the AARINENA sub-regional groupings.

Technical Research Priorities, both factor and commodity related, which are generally well recognised and where a fair amount of work remains to be done on many of them. This set of priorities includes:

- ◆ Water management and increasing water use efficiency
- ◆ Land degradation and measures for its control, including soil conservation
- ◆ Rangeland rehabilitation and management
- ◆ Crop improvement for wide adaptability and/or tolerance to biotic and non-biotic stresses
- ◆ Four main crops have been identified as of high priority for the region: datepalm, olives, citrus and cotton
- ◆ Animal breeding and management
- ◆ Livestock nutrition
- ◆ Management and sustainable use of salt-affected soils
- ◆ Use of saline and poor quality water for crop production
- ◆ Sustainable use and management of dryland areas
- ◆ Minimising the inputs of chemical fertilisers and pesticides
- ◆ Farming system research
- ◆ Agroforestry research
- ◆ Aquaculture research
- ◆ Natural resource management
- ◆ Biotechnology

Institutional Research Priorities are mainly policy- and management-related priorities. AARINENA should continue to bring these priorities to the attention of its member countries. The institutional research priorities include:

- ◆ Formulating agricultural research strategies at national and sub-regional levels
- ◆ Improving all components of research management
- ◆ Enhancing information systems at all levels
- ◆ Mapping of poverty to help focus attention on poverty eradication
- ◆ Strengthening collaboration among research institutions
- ◆ Establishing formal mechanisms for linking research institutions with extension agencies and end users.

It should be pointed out that AARINENA and ICARDA are presently carrying out a survey among NARS leaders in order to formulate these regional priorities in terms of more clearly defined researchable issues. The results of this survey should be ready by early 2002.

1.3. Proposals for Collaborative Research Projects

1.3.1. Genetic Resource Management (GRM)

a) Genetic Engineering for Stress Tolerance in Agronomic Plants in the Arabian Peninsula Sub-Region / Improving Abiotic Stress Resistance in Mediterranean Food Crops and Vegetables

Rationale: The Gulf States lie in the hot arid region of the Arabian Peninsula that is characterised by long hot summers, scarce fresh water and sandy salty soils. Food and feed production is highly restricted leading to total reliance on importation. Under such harsh conditions, traditional crop management practices and breeding methods are inadequate to sufficiently enhance local food and feed production. Much could be achieved by introducing modern techniques of genetic engineering and tissue culture and if they would be applied to agronomic crops capable of growing under arid climatic conditions. The second project that is being presently developed is aimed at developing collaboration among the research groups that work in improving abiotic stress resistance in Mediterranean crops and vegetables.

b) Development of Biotechnological Research in the Maghreb States.

Rationale: In the North Africa region per capita food production has declined, the region is a net importer of food and food security is stated as policy objective in many countries. The need for more and better crop improvement strategies is apparent from the predictions of food shortages in the year 2020 in the Maghreb region. Molecular biology and tissue culture offer a range of techniques that can help to increase the efficiency of crop production systems when integrated in crop improvement schemes. The project will support the establishment of biotechnology laboratories in Maghreb countries, as well as with the transfer of biotechnological techniques to these countries. The project strategy encompasses five essential mechanisms for the successful transfer and establishment of a technology to the national programs. These aspects are difficult to cover in an individual country approach.

c) Development of Wheat Cultivars for Durable Resistance to Leaf and Stem Rusts in the Nile Valley and Red Sea Region

Rationale: Leaf and stem rust diseases represent the major biotic stresses affecting wheat in the Nile valley and Red Sea Region. They are considered the main factor limiting wheat production and longevity of high-yielding varieties. Yield losses due to leaf and stem rusts in Egypt are 11% and 23%, respectively. In Yemen, yield losses due to leaf rust are 15-20%, and to stem rust 20-30%. Therefore, it is essential to control these diseases in order to increase wheat productivity and stabilise production in the countries of the region. Breeding for disease resistant in general and for wheat rusts in particular is almost the only practical way to control rust diseases, since chemical control is not economical, particularly for resource-poor wheat farmers, besides its detrimental effect on the ecosystem and the environment. Therefore, developing new cultivars resistant to leaf and stem rusts to be grown by farmers is the main objective of many wheat programmes.

d) Development of Wheat Cultivars with Durable Resistance to Yellow Rust and the Identification of Wheat Yellow Rust Pathways in the Near East and North Africa.

Rationale: Yellow rust caused by the pathogen *Puccinia graminis* fsp. *tritici* is one of the most devastating diseases of wheat in the Near East and North Africa region, causing serious yield losses over wide areas. For instance, an average annual crop loss of 10 to 50% in Yemen and up to

60% in Egypt has been recorded in recent years. A wide range of virulent pathotypes is evolving in the region causing the breakdown of widely utilised sources of resistance in wheat. The dynamics of yellow rust in the region are not well understood and the pathways through which the pathogen is spreading are unknown. The knowledge of the yellow rust pathways is essential for the proper exploitation and management of available sources of resistance. This project aims at improving the exploitation and management of available sources of resistance to wheat yellow rust in the Near East and North African countries.

e) Dairy Sheep Breeding for Small Flocks Based on Simple Recording

Rationale: The main objective of this activity is to design cost effective breeding schemes for improvement in dairy sheep and goat production in marginal areas. Participatory farm recording will be used to identify management constraints, which would be corrected through peer group comparisons and provision of extension advice. Single visit milk records and dairy advised selection criteria (conformation, temperament, udder shape, fat, protein, etc.) to identify superior stock whose breeding value will be estimated through established computer programme.

1.3.2. Natural Resource Management and Ecology (NRM)

f) Water Management and Increasing Water Use Efficiency for Sustainable Agricultural System.

Rationale: Water is a scarce resource of great strategic importance for most countries of West Asia and North Africa (WANA). At present agriculture accounts for some 80% of total water consumption, but with increased industrialisation and urbanisation and growth in population, water is increasingly allocated away from agriculture. The scarcity of water has in some countries reached the point where supplies of fresh water are mainly for domestic and industrial use with agriculture pushed more and more towards using brackish and saline water. This situation prevails already in the Gulf States and it will not be too long before other countries find themselves in similar predicament. Averting the threat of water shortage to the region's agriculture will depend on greater efficiency in the use of available irrigation water as well as finding new less conventional sources and supplies of water. What in fact is needed is a long-term research programme to deal with the various aspects of irrigation water shortages to generate new and innovative technologies. Two concrete projects that have been prepared on this topic are: (a) the use of GIS and modelling techniques for hydrological research and management of water resources; and (b) sustainable use of water for agriculture in West Asia and North Africa.

g) Integrated Feed/Livestock Production Systems using Non-Conventional Feed Resources in the Al-Mashreq Region

Rationale: Livestock production, and especially the production of small ruminants, represents an important economic activity throughout the sub-region, contributing to rural incomes and national economies. Three main production systems can be distinguished within the livestock sector: traditional extensive production system in the low rainfall areas; semi-intensive production of dairy cattle, dairy goats and sheep; and lamb fattening and intensive production enterprises involving higher inputs and outputs. Despite the fact that the production of barley has increased the region has been unable to satisfy feed demands; the "feed gap" is increasingly being met by imported feeds. There is ample evidence of the availability of alternative, non-conventional, feed resources in the region, including crop residues and agro-industrial by-products. This project is aimed at improving both the availability of animal feed and its quality, since this is a major constraint to production.

h) Integrated Pest Management in Cereal and Food Legume Based Cropping Systems in the Maghreb Countries and in West Asia and North Africa

Rationale: Diseases, insects and weeds are major limiting factors of cereal and legume production in the Maghreb countries, as well as in West Asia and North Africa, where they cause at least 30% yield loss. The demand for agricultural products has grown rapidly over the past two decades and, given an annual demand increase of 4%, these countries will be importing 40% of their needs by the year 2010. The control of these pests would be greatly enhanced by an integrated pest management system that includes host plant resistance, cultural practices, safe chemicals and biological control. Two projects have been prepared on this topic. The first one is a project aimed at enhancing the productivity of cereal and legume farming systems in the Maghreb countries by the development of sustainable and ecologically sound integrated pest and weed management packages that reduce crop losses caused by major pests in the different agroecological zones and cropping systems of the region. The second project has a similar objective, but covers West Asia and North Africa.

1.3.3. Commodity Chains

i) Regional Network for Date-Palm in the Near East and North Africa

Rationale: The establishment of a post-harvest and market-oriented Regional Network for Date Palm in the Near East and North Africa, that complements the ACSAD network that presently exists. The establishment of such a network comes as a direct response to the growing felt need for increasing communication and exchange of experiences among date producing countries. The participants in an expert consultation to examine this matter held in Teheran in October 1999 further confirmed the need for such network. Indeed, most of the dates producing countries are looking forward to this initiative. This new network will basically carry out the following activities: (a) collection and dissemination of information on production, marketing and processing technologies; (b) collection, conservation, evaluation and utilisation of germplasm; (c) study the socio-economic aspects in the date-palm regions and its impact on ecological conservation; and (d) assist NARS in date palm production and marketing policies and the formulation of national networks to increase collaboration among national institutions.

1.3.4. Policy Management and Institutional Development

j) NARS Reform: Regionalizing Agricultural Research within Countries in the Maghreb Region

Rationale: There are several factors which favour the regionalization of agricultural research. Many countries are trying to increase the democratic content of their governments by decentralising public structures to the regional level within each country. In addition, agricultural research is reacting to concerns over natural resource management (NRM) by placing more emphasis on these issues, which are best-undertaken in a local/regional perspective. In spite of common constraints and common objectives the process of regionalization in the Maghreb countries is leading toward different organisational, structural and institutional models as well as to different operational mechanisms. For these countries it will therefore be highly beneficial to pool their recent experiences, to analyse them in greater depth and to develop more effective, efficient and sustainable models for regionalization of agricultural research.

k) Strengthening National Seed Policy and Production Systems

Rationale: Few countries in the Region could claim well-developed formal seed supply systems complete with seed laws and operating certification and evaluation systems. At the other end of the spectrum there are several countries with virtually no formal seed supply system and where only a very small amount of seed of the most important crops is produced without hardly any seed quality control. The remaining countries are at varying in-between stages of development. Like in most developing countries, formal seed enterprises in the AARINENA Region will supply only a small portion of the total required seed of major cereal crops, with the remaining requirement coming from farmer seed retention or exchange among neighbouring farmers. In collaboration with national and international organisations, ICARDA has developed the WANA Seed Network that is currently the main hub of a number of national and regional activities. The objective of this proposal is to complement this network with a Near East and North Africa Seed Consultative Forum (NENA-SCF), with the objective of improving collaboration among the countries of the region and to strengthen the capacity to formulate policies and strategies for seed production and distribution.

1.3.5. Information Management for Agricultural Research Development

l) Development of an Agricultural Information System for West Asia and North Africa (AARINENA-RAIS)

Rationale: Agricultural production is becoming increasingly knowledge-based and science intensive. AARINENA, like other regional fora, has recognised that “Access to information requires appropriate information and communication infrastructure, equipment, instruments and networks. Adequate capacities will be needed at national and regional levels to effectively link up with the global knowledge system. But considerably more effort is needed in this vital area”. As a result of discussions between AARINENA, FAO and the GFAR Secretariat, AARINENA decided to develop a WANA Agricultural Information Strategy and a project proposal to establish a Regional Agricultural R&D Information System (RAIS). Collaboration with EIARD/InfoSys and with the RAIS of other Regional Fora, as well as with FAO-WAICENT, is considered essential. Other concrete projects are being developed within the information area, such as the VERCON project that is aimed at improving research-extension linkages.

2. APAARI: The Asia/Pacific Region

2.1. Challenges Facing Agricultural Production in the Region

In the region where 50 per cent of the world’s population resides and where 70 per cent of the world’s farming households live on less than 30 per cent of the global agricultural land, the main challenge besetting Asia-Pacific agriculture is evidently how to ensure that there is enough food on every table for every family while, at the same time, maintaining the integrity of the natural resource base.

The task is enormous and poverty continues to be a major challenge despite the positive social and economic gains achieved by the region in the past 25 years. Despite the decline of poverty incidence in East and South Asia in the period 1985-95, these subregions still account for about 75 per cent of the poor in all developing countries. While population growth in the region appears to be

low (roughly 1.5 percent annually from 1995-99)⁵, population distribution across countries is uneven. China, India and Indonesia alone accounts for 70 per cent of the region's population. Thus, the challenge of addressing food needs of these countries appears to be of regional and global importance.

The growing population and consumption pattern of food and feed, and the need for more food will have to be met by increasing agricultural production. Availability and accessibility of food, therefore, becomes of paramount importance in the region. However, agriculture in the region is multi-faceted. For one, agricultural landscape varies from highlands and semi-arid tropics to humid coastal plains with climates varying from temperate to tropical. The nature of agriculture also varies in the Asia-Pacific region: from small island developing states like Fiji Islands and Samoa to archipelagic countries like Indonesia and the Philippines to large countries like Australia, China and India. While biologically and genetically rich, capacity to harness diversity is uneven given the varying level of scientific and technological "advancement" as well as of economic standing of the countries in the region.

With these diversities notwithstanding, the agriculture sector in the Asia-Pacific region is characterised as consisting of small farms and farmers; unfavourable land/farmer ratio; deteriorating soil, water and forest resources, flora and fauna and the atmosphere due to pollution; vast areas facing risk of droughts, floods and cyclones; diverse farming systems; decreasing farm lands due to conversion of agricultural land to non-agricultural uses; fragmentation of farm holdings due to population increase and consequent division of family; limiting farming capital; and limiting agricultural support services such as credit, marketing, research, extension and post-harvest facilities.

Despite successes achieved through green revolution in the '60s and '70s, agricultural production in the region is constrained by water shortage, low soil fertility and lack of integrated approach, among others.

Water management is crucial to the future of agriculture. The region faces water scarcity problem (60% of the irrigated water lies in Asia, and 40% of this is in India and China). Rainfall harvesting and management need to be enhanced, hence, the need for water-based strategy at different levels (e.g., river basin, watershed; community; and farm level). There is also the challenge of arresting soil degradation and desertification which warrants utilisation of improved soil conservation strategies using available technologies (e.g., zero-tillage, reduced tillage, seeding, bed-planting, etc), and an integrated nutrient and pest management strategy. Climate change also impacts on agriculture in the region. Agriculture in developing countries like India, Bangladesh and Pakistan are very much susceptible to climatic changes like drought, floods and cyclones. Small island developing states are also vulnerable to climatic change, hence, the need for improved adaptation technologies.

In addition to the above, major changes in the Asia Pacific region have taken place in the last two decades: growth of agro-industries and rural industrialisation, increasing role of private sector in agriculture; diversification of family farming activities such as livestock and aquaculture; diversification of consumption demands towards livestock and aquaculture products, sugar, edible oils, fruits and vegetables; growth of peri-urban agriculture, and a wave of financial and macroeconomic instability in East Asia, with the latter drastically affecting agricultural exports, consumer demand, market for farm produce and farmers' income. Globalisation involving opening

⁵ World Bank Development Data, 2001.

up of commodities, goods, labour, capital, and service markets to world trade is another challenge which the region has to grapple with.

There are diverging views on the prospects for future growth in food supplies in the region⁶. On the one hand, there can be a marked slowdown in cereal production growth due to rapid deterioration of the region's natural resource base. Traditional sources of growth (e.g., modern varieties and hybrids, fertilisers in irrigated areas through commodity approach) have little further potential to dramatically raise productivity, particularly in vast rainfed areas. On the other hand, technological improvement and trade can facilitate meeting food demand, thus, no food supply difficulties is predicted in the foreseeable future. The issue, however, is that food entitlement among countries in the region is not quite the same. Even within a country, food supply availability (and stability) does not guarantee food in every household in the region across population groups and across geographic areas. In either case, it implies that new sources of agricultural productivity will have to be knowledge intensive, harness system interactions, address biotic and abiotic stresses, conserve biodiversity, and take account of new economic environment generated by global conventions and agreements.

2.2. Research and Development Priorities

With these challenges in the region, the Asia-Pacific Association of Agricultural Research Institutions (APAARI) formulated its Vision 2025 in the following terms:

“Agricultural Research for Development (ARD) in the Asia-Pacific region is effectively promoted and facilitated through novel partnerships among NARS and other related organisations so that it contributes to sustainable improvements in the productivity of agricultural systems and to the quality of the natural resource base that underpins agriculture, thereby enhancing food and nutrition security, economic and social well-being of communities and the integrity of the environment and services it provides.”

APAARI will endeavour to fulfil this vision by building and strengthening NARS contribution to sustainable agricultural development, strengthening regional cooperation and coordination of ARD. APAARI's specific objectives are to promote the exchange of scientific and technical information, encourage and facilitate cooperative research and training programmes, and assist in strengthening research organisational capacity of member institutions. It functions as a neutral platform for discussion on major research policies and issues.

In the various APAARI strategic planning and experts consultation meeting, several thematic research priorities were identified. These research priorities are expected to contribute in realising the vision for agricultural research for development in the region:

1. Research and development aimed at increasing productivity with special focus on livestock (e.g., livestock genetics and genomics), fisheries, horticulture and agro-forestry. Productivity enhancement in crops, commodities and other species will also be pursued through utilisation of underutilised species, germplasm enhancement, biotechnology, and other appropriate technologies (and ensuring biosafety measures).

⁶ APAARI Vision 2025, October 2000.

2. Research and development aimed at improving post-harvest technologies (processing, product development, etc) to ensure value addition. Special attention will also be given to agribusiness management and trade.
3. Research and development aimed at ensuring the sustainable use and conservation of life-support systems (such as soil, water, flora, fauna, and the atmosphere) and integrated approach to agro-ecosystems/natural resource management. This includes, but is not limited to, a systems approach to pest management including integration with fish-rice system, promotion of resource conservation technologies (RCT) such as zero tillage techniques and rice-wheat system, water management technologies/strategies for agricultural and forestry-linked agro-ecosystems, and organic recycling, waste and by-product utilisation.
4. Research and development aimed at agrobiodiversity management. This includes, among others, the development and implementation of national action plan for agrobiodiversity conservation. R&D which will improve and strengthen *in-situ* and *ex-situ* conservation techniques and other mechanisms for the sustainable conservation and utilisation of crops and commodities will be pursued, including germplasm collection, conservation, characterisation, evaluation and documentation. This responds to the acute degradation of natural resources the region is confronting.
5. Research and development aimed at addressing global climate change such as rangeland conservation, management and rehabilitation, as well as carbon sequestration by forests and rangelands.
6. *Mapping of poverty* is considered of very high importance given the role it can play in focusing research efforts on poverty-eradication objectives. Two other priorities mentioned in points 3 and 4 above (adoption of a systems research approach and the need for diversifying agricultural production), are also linked to the poverty eradication objective.

However, to ensure the effective implementation of these R&D priorities, there is a recognition in the region that these be undertaken in an interdisciplinary manner. Participatory approach will be employed in carrying out specific programmes under each of these R&D themes and that active involvement of diverse partners (when and where feasible) from scientists to farmers, from NGOs and farmers organisations to private sector and public sector will be ensured. Research planning and prioritisation, therefore, will be a bottom up initiative so that these efforts will be responsive to the needs of the farmers and will be contributing to improving rural welfare.

In addition, there are several other cross-cutting concerns that need to be addressed in the region such as **policy advocacy**. There is a need to sensitise policy and decision-makers at the country level on the need to increase agricultural R&D investment and on issues such as intellectual property rights and sharing of genetic resources.

Public awareness is also identified as a priority activity at the national, sub-regional and regional level. APAARI is expected to facilitate capacity building of NARS by developing materials and formulating strategies to increase public awareness on agriculture and NRM issues. **Socio-economic research** for policy planning is also deemed important, particularly in the light of international trade regime.

There is also a need to develop adequate **infrastructure and core human resource** for strengthening NARS, promoting coordination and cooperation among NARS through networks, and helping them in strategic planning and prioritisation. The Asia-Pacific region is home to 15 crop and

five (5) regional Plant Genetic Resources (PGR) networks that are being promoted by the Asia Pacific Office of the International Plant Genetic Resources Institute (IPGRI). Several agricultural research networks on specific crop/commodity groups such as those for rice (i.e., International Network on Genetic Resources, INGER; and the Council for Collaborative Rice Research in Asia and the Pacific, CORRA), cereals/legumes (i.e., Cereals and Legumes Asian Network, CLAN), and maize (i.e., Tropical Asian Maize Network, TAMNET) are being facilitated by APAARI. Thus, strengthening these networks under the APAARI umbrella is deemed important.

Finally, to facilitate interaction and knowledge sharing among NARS in the region and with their counterpart in other parts of the globe, improving the information and communication technology capacity of the region needs to be addressed.

2.3. Proposals for Collaborative Research Projects

The APAARI region has a very strong dynamics of regional cooperation. As such, collaborative research projects are usually undertaken through and by the *regional research networks* mentioned above. Cooperation with other regions can also be channelled through these regional research networks. In addition to the APAARI networks, it is important to highlight the work being done by Asia Pacific Association of Forestry Research Institutes (APAFRI), Animal Production and Health Commission for Asia and the Pacific (APHTA), Network of Aquaculture Centres in Asia-Pacific (NACA), and Group on Fisheries and Aquaculture Research (GOFAR) in the fields of forestry, animal production and health and fisheries.

Besides these main areas of regional concern, APAARI Vision 2025 articulates the following critical areas where concerted research efforts are deemed critical: information technology (where a region-wide ICT proposal is underway and is further discussed below); geographic information system (GIS) and remote sensing application; crops and systems modelling; biotechnology; intellectual property rights; sustainable natural resource management (e.g. Integrated Pest and Nutrient Management approaches); post-harvest technology and management; agri-business; upgrading scientific and technological skills of NARS researchers and scientists through technology exchanges; and technology impact assessment and evaluation, among others.

More specific proposals along the topics mentioned above are yet to be finalised. Nevertheless APAARI already has a set of collaborative research proposals that are considered to be of high priority for the region, that were presented at the GFAR-2000 Conference in Dresden (May 21-23, 2000), and were subsequently elaborated in the Chiang Rai meeting of APAARI in November 2000 (in the case of the APARIS project). A brief description follows of each one.

2.3.1 Asia-Pacific Agricultural Research Information System (APARIS)

The *Asia-Pacific Agricultural Research Information System (APARIS)* is being designed to be an information resource and gateway to agriculture R&D in the region which will involve the active participation of APAARI members. CABI, FAO-WAICENT and the GFAR Secretariat have been providing support for its development.

The most important role of APARIS is to add value by putting together and interrelating region-specific information resources. Recognising the existence of numerous databases at national, regional and global levels, APARIS will link with these existing regional databases held by regional organisations such as APAFRI, NACA, APHCA, IARCs and other like minded organisations.

Building on what already exists, APARIS will adopt a meta-system rather than primary system approach. Management of databases will remain decentralised and, thus, operative at national level.

A few databases will be established at the regional level, mainly for the purpose of monitoring agricultural research activities and sharing information on major scientific and technological events in the region. In developing these databases highest priority lies with institutional information (on NARS) and dissemination of “success stories” in ARD; information on training opportunities and conferences; and meta databases on regional/sub-regional R&D networks and scientists.

2.3.2 Techniques and Approaches for Conservation and Utilisation of taro genetic resources in the Pacific

This will involve collection of genetic diversity and the assessment/evaluation of germplasm (screening for disease resistance/to taro leaf blight, other promising traits). It will also include conservation of available germplasm in Field Gene Banks, *in vitro* collection and *in situ*/on-farm, following complementary conservation techniques/strategies, multiplication of material and dissemination of improved cultivars to rural/farming communities, establishment of database on taro for the Pacific region, and promotion of network TAROGEN with effective role of stakeholders through working group meetings/workshops

2.3.3 Health in Ecological Agriculture Learning (HEAL)

The proposal aims to increase the capability of farmer groups in Asia to conduct local studies which will lead to a better understanding of the health effects of pesticide use. The project will build on the success of the pilot activities organised in Indonesia, Cambodia and Vietnam which were conducted under the FAO Programme for Community IPM in Asia. These activities involved community health studies carried out by groups of farmers who had graduated from IPM Field Schools. Activities will include: (1) *scaling-down* by creating a capability among farmer groups who have participated in pilot activities to carry out studies of the health effects of pesticide use on a sustained basis as part of community IPM programmes; (2) *scaling-out* by organising HEAL pilot activities in new countries using approaches which have already been tested in other parts of Asia; and (3) *scaling-up* of HEAL activities in countries which have already undertaking pilot activities.

2.3.4 Strengthening Ecological Agriculture for Students and Teachers in Asia (EAST)

The proposed project seeks to strengthen the capability among Government and NGO agencies in South and South-East Asia for expanded and sustained implementation of educational activities in the school sector which will bring about greater appreciation of ecology and its application in agriculture.

It will support catalytic activities in participating countries, including programme development, training of teachers, planning meetings, and in-country exchanges. It will also fund some pilot field schools. Regional activities will include Programme development meetings and regional workshops to exchange experience on the curriculum development, assessment procedures, student follow-up activities etc; exchanges of training expertise; electronic networking; specialised technical support; raising international awareness; and support for resource mobilisation.

2.3.5 A multi-country stakeholder participatory approach to identify policies for smallholder dairy development in the Hindu Kush - Himalyas (HKH)

ILRI and ICIMOD (International Centre for Integrated Mountain Development) identified, through GIS-based mapping, that smallholder dairy is increasing in importance in the HKH region. Informal discussions with NARS, NGOs and Dairy Cooperatives in Nepal, Bhutan, Uttar Pradesh and Himachal Pradesh of India indicated that there is lack of a conducive institutional and policy environment, and appropriate technology to support dairy development in these countries/regions.

The project is expected to contribute in improving smallholder dairy systems, including dairy productivity in the sub-region by developing technology and policy options that can be immediately implemented in the sub-region. It also aims to identify knowledge gaps in smallholder dairy development in the Hindu Kush - Himalyas (HKH) as well as contribute in building the capacity of the NARS in the subregion increase their capacity to undertake rapid policy assessment.

2.3.6 Transfer of Knowledge and Experience about Scaling-up of People Managed Micro-Credit – An Action Research

The proposed action-research is meant to assist the evolution and scaling up of “People Managed Micro-Credit” and forge partnership among farmers’ organisations, NGO and Research networks in different Asian Countries for scaling up micro-credit programs. It will also involve documentation and analysis of country experiences in the region, organising exchange and transfer of knowledge across nation boundaries and dissemination of accumulated knowledge on world-wide, with specific focus on Asia.

The result will comprise techno-economic design of micro-credit and organisation management design package. The adoption of new design would raise the effectiveness of large number of micro-credit programs, whose joint membership exceeds a million.

3. CAC Forum on Agricultural Research: The Central Asia and Caucasus Region

3.1. Challenges Facing Agricultural Production in the Region

Agriculture is of paramount importance in the region as a whole. On average, it is the source of employment for a third of the labour force and its percentage contribution to GDP has increased since the republics gained their independence, but this is due to a decline in other sectors rather than an increase in agricultural production. In spite of vast resources and agricultural potential of the region, both yields and production of crops and livestock are variable between years and generally below those of other regions of the world with similar agroecologies.

The region can be divided into four basic agroecological zones: lowland rainfed, lowland irrigated, lowland semi-arid rangeland, and mountains. Each zone faces specific challenges:

In rainfed areas, inputs are low and problems are developing in maintaining soil fertility under the predominant cereal-based systems in the absence of fertilisers. The emerging small farmers need assistance with enterprise development and the introduction of new crops and rotations.

Considerable potential exists for developing mixed farming based on the integration of crop and livestock production.

In irrigated areas, salinization and waterlogging are major problems due to either the lack of drainage systems or poor maintenance of existing drainage systems and rising water tables. Management of former state-operated large-scale irrigation systems is collapsing. Opportunities exist for intensifying irrigated agriculture, but only if appropriate water management systems are applied for delivery of water to private holdings and appropriate irrigation practices are employed to maximise the productivity of water.

The vast areas of semi-arid non-arable steppe lands provide rangeland for livestock. Previously controlled by the state agricultural enterprises, the redistribution of these common lands is leading to problems of open access and overgrazing and degradation in some areas. Cutting of trees and removal of woody species for fuel is exacerbating the problem. The traditional arrangements that controlled access and grazing prior to collectivisation have long since disappeared. Opportunities exist for improving the fertility and productivity of rangelands, but only if suitable access and grazing systems are implemented.

In mountain areas, foothills and upland valleys support dryland farming. Productivity is low and the farming communities are among the poorest in the region. Harsh conditions promote out-migration and land abandonment. Subsistence is obtained from drought resistant crops, such as barley, and transhumant flocks of small ruminants that move to the mountain pastures in the summer. Much of agriculture is conducted on sloping land and soil erosion by water run-off is a localised but major problem. More productive, but resource conserving, modes of land use are needed.

Other problems cut across these major agroecological zones. With the collapse of trade within the former Soviet Union, the governments of CAC are giving priority in agricultural production to securing the domestic supply of basic food commodities, but average yields are far below those achieved in agroecologically similar regions of the world, reflecting the decline in inputs. Furthermore, because of a few varieties were distributed and are widely grown, crops are highly vulnerable to the outbreak of new diseases. All countries of the region also face similar problems in seed supply and no system has been put in place to ensure the diffusion and adoption of new varieties that may flow from research. Since independence, livestock numbers have been reduced drastically in all countries. Agrarian reform and attention to socio-economic problem have progressed at different rates in different countries. Decollectivization and privatisation of land are encountering problems arising from the fragmentation of land, particularly in the management of large-scale irrigation schemes. The shift from large-scale state and collective farm systems of production to privatisation also raised issues of land tenure, access and use rights and agriculture employment. Finally, no extension or farmer advisory services, credit facilities, or marketing arrangements have yet been put in place.

3.2. Research and Development Priorities

Through different consultations which were initiated by the CGIAR in 1996, the following research priorities were identified:

- Institutional development, organisation and management of national research systems
- Cropping systems improvement, including germplasm conservation and enhancement and the introduction of new rotations for agricultural diversification
- Soil and water management, including soil fertility, management of large scale irrigated systems under decollectivized systems, rehabilitation and management of areas suffering from

salinization and waterlogging, efficient irrigation methods to optimise the productivity of water, and, in mountain areas, soil conservation measures to combat soil erosion by water

- Livestock production systems, including the improvement and integration of feed crop production and livestock management
- Rehabilitation and management of rangelands
- Research to develop policy options to support agrarian reform and the emergence of small farmers in transition to a market economy especially in the rural communities and mountainous areas.

In January 2000, when formally establishing the CAC Forum, the NARS leaders of the eight countries held a brainstorming session with the primary objective to identify research priorities to be carried out at the regional level which were either outside the CGIAR mandate or which could complement and add value to the CGIAR-CAC Programme of work. The following table is the result of this exercise and should be read in keeping in mind the limitations and reserves mentioned above.

<p>1. Genetic Resources Management (GRM) & Biotechnology</p> <ul style="list-style-type: none"> • <i>Indigenous livestock breeds</i> (<u>Note</u>: All countries recognise the efforts made in GRM by the CGIAR, especially for crops but consider that more attention should be paid to the genetic conservation of indigenous breeds of livestock) 		
<p>2. Natural Resources Management (NRM) & Agro-ecology</p> <ul style="list-style-type: none"> • <i>Aral Sea integrated conservation and management</i> • <i>Mountain cropping systems</i> • <i>Soil salinity and reclamation</i> (<u>Note</u>: more support to on-going efforts needed) • <i>Salinity and water management</i> (<u>Note</u>: more support to on-going efforts needed) • <i>Forestry management</i> • <i>Reclamation of sandy soils</i> 		
<p>3. Global Networks along the principle of Commodity Chain (<u>Note</u>: Two or more countries have expressed an interest in developing regional and global cooperation)</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;"> <ul style="list-style-type: none"> • <i>Cotton</i> • <i>Horticulture</i> • <i>Fruits</i> • <i>Oilseeds</i> • <i>Rice</i> (<u>Note</u>: IRRI is not yet part of the CGIAR Consortium) </td> <td style="width: 50%; vertical-align: top;"> <ul style="list-style-type: none"> • <i>Grape</i> • <i>Tea</i> • <i>Sugar Beat</i> • <i>Tobacco</i> </td> </tr> </table>	<ul style="list-style-type: none"> • <i>Cotton</i> • <i>Horticulture</i> • <i>Fruits</i> • <i>Oilseeds</i> • <i>Rice</i> (<u>Note</u>: IRRI is not yet part of the CGIAR Consortium) 	<ul style="list-style-type: none"> • <i>Grape</i> • <i>Tea</i> • <i>Sugar Beat</i> • <i>Tobacco</i>
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<p>4. Policy Management & Institutional Strengthening</p> <ul style="list-style-type: none"> • <i>Development of a unified agrarian market for CAC countries</i> • <i>Socio-economic research on the reforming process</i> • <i>Food Security research</i> • <i>Information Management Systems</i> (<u>Note</u>: Development of a regional agricultural information system, the CGIAR program is focusing more on national systems) • <i>Human capacity-building</i> (<u>Note</u>: Top priority - much more has to be done) 		

3.3. Proposals for Collaborative Research Projects

A CGIAR Collaborative Research Program for Sustainable Agricultural Research in CAC has been launched in 1998 and, since then several research projects have been implemented in collaboration with the CGIAR research centres in the fields of :

- Productivity of agricultural systems
 - Germplasm enhancement
 - Livestock production systems and integrated feed/livestock management
 - Range rehabilitation and feed improvement
- Conservation and evaluation of genetic resources
- Natural resource conservation and management
- National research organisation and management

In addition to the on-going collaborative research projects with the CGIAR, the CAC Forum would like to develop new collaborative projects in the following fields:

- Improvement of cotton production
- Soil and water protection in the Aral Sea region
- Development of salt and drought tolerant varieties
- Establishment of a Central & West Asia Yellow Rust regional network
- Conservation of animal genetic resources in danger of extinction
- Programme of rehabilitation of viticulture and winemaking in the Caucasus
- Information and Communication Technologies and Management (ICT & ICM)

4. FARA: The Sub-Saharan African Region

In the case of the Sub-Saharan African Region, FARA has developed a “Vision of African Agricultural Research and Development” which has been endorsed by its members in April 2001. At the same meeting, the establishment of a permanent FARA Secretariat led by an Executive Secretary and hosted by FAO in its regional office in Accra, Ghana was also approved. Within the context of the FARA Vision research priorities have been identified for the three sub-regions (see section 4.2). Furthermore, FARA and the CGIAR are also closely collaborating in the development of a CGIAR Strategy for Africa.

4.1. Challenges Facing Agricultural Production in Sub-Saharan Africa

Reduced to its essentials, the challenge for African agriculture is to reach a 6 percent annual growth in a generation. The goal can be achieved by expanding and accelerating innovation of the last decade.

In order for agriculture to play its proper role in the economic development of the continent, it must (i) increase efficiency and competitiveness along the food chain (at the local, national, regional, continental and international levels); (ii) organise, capture and consolidate agricultural market niches; (iii) increase farm-level productivity and increase market access through improved quality enhancement and diversification of products developed; (iv) formulate and implement policies that address land use, trade, energy utilisation, labour use efficiency and other agricultural inputs; and (v) enhance the scope and quality of soil and water use and management.

A concerted effort is needed to address the distortions in agricultural markets, enhance the production-consumption continuum, improve access to basic infrastructure and protect the natural resource base. The full potential of African agriculture must be captured by:

- completing the large unfinished policy agenda, including anti-export biases in trade regimes, remnants of marketing boards and parastatals in some countries (e.g. Tanzania and Ghana).
- breaking through demand barriers: enhance private agribusiness environment and skills, foster (sub)regional economic and trade integration; access to OECD agricultural and food markets;
- sharply improving access to public infrastructure and services;
- promoting agriculture-led industrialisation through value-added activities. Domestic improvements in business practices remain critical in an era of global competition, as does improved access to sub-regional and OECD markets for processed goods.
- improving input markets and use: promote sub-regional seed, fertiliser markets; improve access to fertiliser by eliminating remaining policy distortions and monopolies; and
- bringing the best and most appropriate science to bear through the development, adaptation and dissemination of new technologies.

Agricultural development hinges on the availability of technology to increase productivity in a sustainable manner that does not deplete or degenerate the natural resource base. The development of the agricultural sector in Africa has been severely hindered by the slow rate of technology generation, transfer and adoption by farmers. The continent has the capacity, in one generation, to develop and adopt improved and new farming technologies to reverse the trend. Key to these developments will be technological innovations--adapted to local situations--and higher rates of technology diffusion and adoption. Such a breakthrough depends critically on a dynamic, creative and strong African agricultural research system.

A broader view of both the role of agriculture and the factors which contribute to agricultural growth is necessary. A beneficial interplay between technological change and the larger environment offers hope for agriculture to provide the impetus for economic growth. Generally speaking, social development (education and health), environmental concerns, physical infrastructure development as well as political development are all vital to the development of agriculture. Agricultural development contributes to progress in each of these areas, by creating wealth--broadly distributed throughout the population--necessary to maintain social progress, finance preservation of the environment, and enable people to divert more energy from mere survival to a thriving existence. Agricultural development therefore has implications that reach far beyond the agriculture sector. And, similarly, some of the most important actions contributing to agricultural growth lie actually outside agriculture. The transformation of the agricultural sector cannot be isolated from the broader political and economic systems.

The current situation in sub-Saharan Africa calls for a new approach and a renewed commitment built on local experiences. The emerging consensus on the role of the civil society and community leadership, and the proactive measures intended to correct gender bias can serve as a tangible basis for changing the rules of the game in the rural sector. Also needed are implementable actions and partnerships designed to accelerate the transition to a more productive future. The key strategic interventions proposed build upon the strengths and achievements of African countries in their efforts to build effective and cohesive sub-regional and national agricultural research and development institutions.

In developing a regional strategy, it is important to avoid two opposing extremes: promoting ideals which are difficult to achieve; or relying on the notion that everything should be left to

indigenous skill and cultural strengths, which would be insufficient in a rapidly changing environment. A correct balance is likely to be somewhere in the middle. Some underlying factors common to success in Africa include (i) a recognition of, and pride in, indigenous and traditional strengths; (ii) an engagement of local expertise and corresponding ownership; (iii) political commitment by the leadership, signalling the importance of agriculture in African economies; (iv) a decentralisation of responsibility and accountability to primary stakeholders; (v) stakeholder participation in choices and actions that affect them; and (vi) better coordinated, less fragmented donor support.

4.2. Research and Development Priorities

FARA has been conceived as a facilitating and coordination mechanism and, since the origin, it was decided that regional research and development priorities will be based on the priorities defined at the sub-regional level by the three Sub-Regional Organisations: ASARECA, CORAF/WECARD and SACCAR. The three SROs will also have the overall responsibility to implement the regional collaborative projects. As a consequence, the research and development priorities are presented by sub-region.

4.2.1. Research and Development Priorities in the ASARECA Region

Regional priorities in the ASARECA region have been defined in terms of broad research areas. Five broad high priority research areas have been identified:

1. Research directed at increasing the productivity of farmers in the region, either through improving the genetic material (higher yielding or stress tolerant varieties) or production systems (land and labour productivity, agronomy, plant nutrients, mechanisation) for the following crops: cereal grains (maize, sorghum & millet, rice and wheat); pulses (beans, groundnuts); roots and tubers (cassava, potatoes, bananas), cash crops (cotton, coffee), tree crops (cashew, coconut, macadamia, citrus),
2. Research directed at increasing the productivity of the livestock production systems within the region (beef, dairy, small ruminants, control of diseases, non-ruminants).
3. Research directed at adding value to the agricultural produce – post-harvest processing, storage, food quality, etc.
4. Research directed at natural resource management and utilisation – i.e., soil fertility, soil & water conservation, agro-climatology, water harvesting, biodiversity, plant and animal genetic resource conservation, and irrigation.
5. Research directed at enhancing effectiveness and efficiency of the institutions and organisations which support the agricultural production systems: from institutions and organisations responsible for input supplies, land tenure, agricultural marketing, technology development and transfer, agricultural processing, etc.
6. Research directed towards strengthening information and communication systems.

4.2.2. Research and Development Priorities in the CORAF/WECARD Region

a) Promotion of Agricultural Policy

Rationale: Inappropriate policies constrain farmers' access to input and output markets, stifle productivity growth and development of the agricultural sector in the sub-region. In addition, incomplete or missing credit and insurance markets inhibit farmers' adoption of new technologies and prevent them from fully exploiting market opportunities. Research is needed to address policy issues, guide decision takers on appropriate policies to implement and provide the necessary economic incentives to producers to improve technology adoption, increase output and productivity.

b) Improving Cash crops production, and competitiveness

Rationale: The cash and perennial crops of priority to the sub-region are cotton, coffee, oil palm, cocoa, and para-rubber. These crops represent important economic activities in the sub-region, contributing to both rural and national economies. Cotton is adapted to the drier conditions in the guinea savanna and Sahel, whereas coffee, oil palm, cocoa, and para-rubber are adapted to humid conditions in the coastal zone. However, profitable production of these crops is fraught with a number of constraints that also reduce their competitiveness. Among the factors contributing to the poor performance are very close parental lines with little genetic diversity.

c) Strengthening peri-urban agricultural systems

Rationale: Fast growing urban populations give rise to increased food needs; urban perimeters are also increasingly encroaching on otherwise rural areas. It is expected that the increasing urban markets which will be closer to production areas would provide the required incentives to intensify production. In the three zones of the sub-region (Sahel, Coastal and Central), urban-rural linkages are expected to be stronger thus strengthening competitiveness of production, and ensuring income for producers. Similarly, biodegradable organic wastes from urban centres are available for incorporation as organic fertilisers by farmers in peri-urban areas. However, the competition between agricultural land use and urban land use makes peri-urban agricultural activities precarious, and subject to quick changes. Intensification of agricultural systems in urban and peri-urban centres jeopardises long-term sustainability of the city environment. Therefore, peri-urban agriculture is a major research stake in relation with the booming urban development, creating new challenges for providing food for the burgeoning urban population, employment generation, and preservation of the city environment.

d) Grain legumes improvement programme

Rationale: Groundnut and cowpea are the two most important sources of dietary protein and oil for human and livestock consumption in the sub-region. These two crops are capable of producing significantly in marginal environments, with low soil fertility and under soil drying conditions. In spite of the significance of these crops in food security in the sub-region production is still by small-holders. As in many other sectors, the crops' production constraints include inadequate production inputs, inappropriate risk management in the legumes-cereal association, or rotation, unavailability of good quality seeds, and the inappropriate use of technology. Commercialisation and popularisation of industrially transformed products of groundnut, for example, can stimulate increased research and their production.

e) Development of a sustainable irrigated agriculture in the Sahel

Rationale: The present weak contribution of irrigation to food security needs to be strengthened with a determination to increase the total area irrigated from the present 3% (i.e. 1,300,000 hectares) in humid tropics, and 3.5% (or 600,000 hectares) in the Sahel, of the cultivated surface. In the humid tropics irrigation represents only 4% of cereal production, and 14% of cereal production in the Sahel. This marginal contribution of irrigation to food production is even currently on the decline, largely as a result of inadequate policies, poor prioritisation/lack of necessary skills for the management of irrigation schemes by the farmers' organisations, lack of private sector participation, and rising costs of required materials and services.

f) Banana/Plantain production for food and income

Rationale: Despite their increasing importance as food and cash crops, biophysical and socio-economic baseline information on plantain and banana is not available in the sub-region. Improved varieties resistant to major pests and diseases need to be introduced to improve yields, and economic value. Although fruits are produced throughout the year, the major banana/plantain harvest comes in the dry season when most other starchy staples are either unavailable or difficult to harvest. The main constraints of production include the narrow genetic base of the cultivars, low yielding varieties, and high susceptibility to diseases. Up to 10% to 35% post harvest losses are observed during handling and transportation of the produce. These also constitute great constraint to production, and cause significant economic loss.

g) Root /Tuber Crops for food security and poverty alleviation

Rationale: Cassava, yams, and sweet potato constitute important sources of food, and income in the sub-region. Cassava is the single largest source of calories produced throughout tropical Africa. West and Central Africa account for about one-third of cassava production in Africa. Cassava is more tolerant of poor soils. Production requires relatively little labour compared to yams, which are also very important. As population pressure leads to increasing use of marginal lands, the area planted to cassava is expanding. The cassava crop, once established, is known to withstand drought. A major source of expansion of areas planted with sweet potato has been inland valley.

h) Management of natural resources and production systems

Rationale: The West and Central African sub-region has a diverse agro-system ranging from the oasis system of the Sahara through the various levels of the Sahel Savannah to the equatorial forests of the humid zones. These natural resources base need to be sustainably managed to ensure continued productivity. However, population pressures are increasing leading to reclamation of more land from forests, and uncontrolled exploitation of natural resources. Climatic changes, especially changes in the pattern and quantity of rainfall, have further increased the tempo of natural resources degradation, and limited their productivity. These have resulted in loss of soil fertility, distortion of production, accelerated disappearance of vegetation, desertification, prolonged and sometimes unexpected drought, significant degradation of the ecosystem, and thus a food insecurity situation. The main research challenges faced in this area are the following ones:

- Conservation and management of water resources is the highest priority
- Development of draught resistant varieties
- Soil fertility conservation, enhancement, and sustainable use
- Management of forest resources, and agro-forestry systems

- Intensification of production systems
- Socio-economic and socio-institutional aspects in natural resource use

i) Conservation and Sustainable Utilisation of Plant and Animal Genetic Resources

Rationale: Western and Central Africa are home to a rich and diverse flora and fauna. A number of plant and animal species are endemic to the sub-region. Such endemic species have specific genetic constitutions that confers on them resistance to diseases and pests, ability to produce in marginal environments, and resistance to some environmental hazards such as drought. These species are also consumption preferences (culinary and organoleptic qualities) of the population, and they probably hold the key to food security and sustainable development in the sub-region. The genetic base of these species are, however, being seriously eroded. Forest ecosystems of the sub-region, especially those of Central Africa, contain about 70% of African tropical rain forests. Apart from arid areas, coastal reefs and marine islets, these forests harbour several types of biotopes. The continued erosion of the genetic resource base of the indigenous species is as a result of lack of awareness of the significance of plant genetic resource by the decision takers, poor development of national genetic resource programs, lack or inappropriate conservation facilities, climate change and human activity.

j) Integrated cereal production systems for increased food security

Rationale: Rapidly increasing populations lead to increased demand for food and fodder. The sub-regional cereals par excellence (maize, millet, rice and sorghum) constitute major sources of calories intake by urban and rural communities, and the stover forms a critical input into livestock production. The constraints facing production of these crops include: soil fertility, water management (including drought), pests and disease, and lack of improved cultivars for different agro-ecological zones. Other constraints include inadequate exchange of genetic materials, grain quality (storability), processing and utilisation (food and feed), and poor marketing systems.

k) Livestock research for improved food security and income generation

Rationale: Livestock production is central to the livelihoods of most farming communities in West and Central Africa, accounting for not less than 17% of the gross domestic product in many countries. In addition, the demand for foods of animal origin is increasing, and likely to continue for reasons already stated in other areas. Livestock production occurs on a continuum from extensive, pastoral systems in drier areas, through mixed crop-livestock systems to intense production often associated with urban centres. It is apparent that these systems are evolving and that mixed crop-livestock farming in particular is increasing. Apart from providing immediate cash income for the farmer, the integration of livestock with crop production offers great opportunities in promoting system sustainability, through the production of manure for improved soil fertility and reduction of degradation under traditional grazing management practices. This research area also refers to mixed production systems, such as:

- Agro-pastoral/crop-livestock systems
- Fisheries and aquaculture
- Biodiversity management

l) Strengthening Information and Communication Systems

Rationale: The complete transformation of the sub-regional research system and consequently, food availability can be achieved much more rapidly if modern information and communication technologies are available and accessible to the stakeholders. However, access to, and dissemination of information within, and amongst the countries of the sub-region, sub-Saharan African, and between the sub-region and international community are fraught with difficulties. The constraints include absence of qualified personnel for information collection, collation and management, weak access to the internet and to international networks on information, lack of the necessary information and communication facilities. These lead to isolation of scientists away from their peers, inability to publish and use research results, and inability to determine the next steps. Eventually new technologies do not get to the desiring users. There is, therefore, an urgent need to develop a system of information and communication which would be essentially NARS-based, with CORAF/WECARD playing the facilitating and co-ordinating roles. Such a system is expected to encourage exchange of information and communication, sharing of experiences and resources (human and material) between, scientists, research institutions, and development agencies. It would also constitute a framework and a facilitating co-operation tool between CORAF/WECARD and other sub-Saharan African research co-operation organisations (ASARECA, SACCAR & FARA), and international organisations. This would also create a greater visibility of the scientific capabilities of the sub-region, and highlight the comparative advantage of each NARS of the sub-region.

4.2.3. Research and Development Priorities in the SACCAR Region

SACCAR has identified four “strategic thrusts” as the main pillars of its Five-Year Strategic Plan 2000 – 2004, namely:

- ◆ Improvement of the regional research and training coordination and integration
- ◆ Promotion of partnerships in the area of agricultural research and training
- ◆ Improvement of the information and communication system in support of research and training coordination and scientific and technical partnerships
- ◆ Review of SACCAR’s institutional framework

SACCAR is mainly operating through coordination of regional programmes / projects / networks:

- ◆ Land & Water Management Research Programme
- ◆ Sorghum & Millet Improvement Programme
- ◆ Grain Legume Improvement Programme a) Bean; b) Groundnut
- ◆ Training in Research Management
- ◆ Agroforestry Research Programme
- ◆ SADC Plant Genetic Resources Centre (SPGRC)
- ◆ Maize & Wheat Improvement Network
- ◆ Strengthening Faculties of Agriculture, Forestry & Veterinary Medicine
- ◆ Regional Vegetable Research & Development Network
- ◆ Southern African Root and Tubers Crops Research Network
- ◆ Biosystematics Network for Southern Africa (SAFRINET)
- ◆ SADC/USAID/UF Heart Water Project
- ◆ SADC Animal Agriculture Research Network

4.3 Proposals for Collaborative Research Projects in the FARA Region

As for the presentation of the research and development priorities, the proposals for collaborative research projects are presented at the sub-regional level. The only proposal which is currently discussed at the FARA level is related to the field of “Information and Communication Management”. The three SROs have formulated a project proposal entitled: “*Building a Shared Information Reservoir on the research networks in Sub-Saharan Africa: A First Step Toward a Regional Agricultural Information Strategy*”. They are also finalising a Memorandum of Agreement between them to facilitate the implementation of this project.

4.3.1. Proposals for Collaborative Research Projects in the ASARECA Sub-Region

ASARECA did not identify any concrete proposals for cooperation, other than the regional networks that presently operate in this region. They feel that cooperation with Europe and with other regions should basically be channelled through the existing regional research networks. These networks are presented in Table 1.

Table 1: Regional Agricultural Research Networks (RARNs) under ASARECA

First Generation Networks – Operational (established in the 1980s)	
	Agroforestry Research Network for Africa – Eastern and Central Africa, AFRENA-ECA –changing to TOFNET, w.e.f .2001
	Eastern Africa Rootcrops Research Network, EARRNET
	Eastern and Central Africa Bean Research Network, ECABREN
	Regional Potato and Sweet Potato Improvement Programme in Eastern and Central Africa, PRAPACE
Second Generation Networks – Operational (established in 1990s)	
	Banana Research Network for Eastern and Southern Africa, BARNESA
	Postharvest Processing Network, FOODNET
	ASARECA Animal Agriculture Research Network, A-AARNET
	Eastern and Central Africa Maize and Wheat Research Network, ECAMAW
Projects, Programmes and Initiatives – Operational (established in the 1990s)	
	African Highlands Initiative, AHI
	ASARECA Technology Transfer Project – TTP
	Eastern and Central Africa Programme for Agricultural Policy Analysis, ECAPAPA
	Electronic Communication, AFRICALINK
New Networks under Planning (be established in 2000/01)	
	Eastern, Central and Southern Africa Rice Research Network, ECSARRN
	Eastern Africa Plant Genetic Resources Network, EAPGREN
	Eastern and Central Africa Regional Sorghum and Millet Research Network, ECARSAM
	Soil and Water Conservation Network, SWMNet
	Coffee Research Network, CORNET
	Regional Agricultural Information Network, RAIN
	Strengthening the Capacity of NARS for Managing Regional Programmes

4.3.2. Proposals for Collaborative Research Projects in the CORAF/WECARD Region

CORAF/WECARD has a portfolio of projects in the 12 priority areas identified in section 4.2.2. above. Interested potential partners can contact the CORAF/WECARD Secretariat.

4.3.3. Proposals for Collaborative Research Projects in the SACCAR Sub-Region

SACCAR has a portfolio of projects in the priority areas identified in section 4.2.3. above. Interested potential partners can contact the SACCAR Secretariat.

5. FORAGRO: The Latin American and Caribbean Region

The *Foro de las Américas para la Investigación y Desarrollo Tecnológico Agropecuario (FORAGRO)* was established in 1996 by the national agricultural research institutes of the region, and by representatives from NGOs, farmers' associations, universities and the private sector. The establishment of FORAGRO was formalised and endorsed by a resolution of the Ministers of Agriculture of the Americas, that was approved in the Santiago meeting of the *Junta Interamericana de Agricultura (JIA)* in 1997. The Technical Secretariat of FORAGRO is hosted by IICA in San José, Costa Rica, which began to operate in 1998. In operational terms, most of the FORAGRO activities are implemented through five sub-regional collaborative programmes that cover the different sub-regions: PROCANDINO, PROCISUR, PROCITROPICOS, PROCICARIBE, PROCINORTE and SICTA.

FORAGRO works in close collaboration with a *Regional Fund for Agricultural Technological Development (FONTAGRO)*, that was established by the countries of the region with the support of BID and IICA for the financial support of collaborative multinational research and technological development projects in this sector. In order to orient its funding activities FONTAGRO developed a prioritisation model that consists of two dimensions: a spatial dimension whereby the region is divided into eleven "mega-domains", and a technological dimension whereby eleven "families" of technologies that are of critical importance to the LAC region have been identified: plant-breeding, optimum use of inputs, post-harvest and agroindustry, new uses of agricultural products, improvements in the management of agricultural enterprises, integrated pest-management, use and management of biotic resources, international environment regulations, technologies for small-scale agriculture and policy design and institutional strengthening. This prioritisation model is used to select the projects that are funded.

5.1. Challenges Facing Agricultural Production in the Region

There are five main challenges that agriculture is facing in the Latin American and Caribbean region. The first one is the low rate of increase of the aggregate agricultural production (per capita), as compared with previous periods and as compared with other regions of the world. This is basically due to the fact that per capita production in basic foodstuffs is decreasing, although in total food production per capita production has been slightly increasing. Until recently yields had

been increasing and had greatly contributed to the availability of foods and basic grains. But in recent years the region is facing stagnant yields in basic foods, despite the fact that very significant increases have occurred in certain cash crops that have led to success stories of insertion into world trade. Despite this, the stagnant yields and decreasing per capita production in basic foods have led to the fact the Latin America and the Caribbean is passing from a situation of net exporter of basic foodstuffs, to an increasing net importer of food.

The second major challenge is the emergence of worrisome indicators of the sustainability of agricultural production, both crops and livestock. The growth that is taking place in some of the major agricultural products of the region (i.e. sugar, coffee, oils, fruits) is being done at the expense of the natural resource base. Thus the capacity to maintain the present levels of food production may be jeopardised by the erosion of the natural resource base, leading to a deterioration of the food security of the region. The challenge being generated by the sustainability of agricultural production is being aggravated by the very high rate of deforestation that characterises the region. This clearly highlights the need for a closer interaction between agriculture and forestry research, whose links are presently very weak (this is particularly important in the tropical ecosystems: see section 5.2.1).

Thirdly, high levels of rural poverty have persisted in many countries of the region, where more than 65% of the poor population are rural poor. Furthermore, urban poverty which is an increasing problem in the region is very closely linked to living conditions in the rural sector that are expelling population that end up in the growing metropolitan areas of the region. This is leading to the need to re-think critically many of the *basic institutions* of the agricultural sector, that are showing serious limitations in their capacity to cope with this growing challenge.

A fourth major challenge is that the cumulative impact of these various factors is mainly concentrating on the tropics, where there is a double challenge being faced of little technology being developed for its products (i.e. tropical fruits), while at the same time the vulnerability of its ecosystems are not being properly addressed aggravating the problem of sustainability. In the case of fruits, particularly tropical fruits, the growth in production has been basically due to a growth in the cultivated area, with very little contribution coming from increased yields. This has allowed the region to increase its share of international trade in fruits, despite very little availability of technology (and of research efforts). Thus agricultural (crops and livestock) production in the tropics is facing a very serious challenge, with little technology being generated to cope with it. Total agricultural production in the region started recovering in 1993, but basically due to the success of certain crops in the Southern Cone. If one analyses the situation being confronted by the tropical part of the region the situation has tended to deteriorate throughout the nineties. This will be further analysed in section 5.2.1 below.

As a consequence of the previous factors there is a limited technology capacity to respond to the changes in the structure of agricultural production that are taking place in the region. Behind this *slowing down of "technological dynamism"* in the region we can identify the following factors, which represent the fifth challenge. The first factor is a significant reduction in public sector investment in agricultural research in the region. If one compares 1985 with 1995 one can see that funding for public sector research in the LAC region decreased around 10% (in 1985 dollars), according to IICA figures. Secondly, the scientific productivity of agricultural research centres has tended to diminish as measured by number of varieties released annually and by other indicators of technology flows. Thirdly, NARS are facing an important challenge of how to integrate the new stakeholders of agricultural research more clearly into the picture and how to increase the effectiveness of the national research system. This is leading many countries of the region to try out different approaches to the question of *NARS integration* that places more emphasis on *innovation*, rather than on *research*, and to the establishment of *national fora* to develop consensus around major

development objectives and research endeavours. As part of this picture, it should be pointed out that the private sector has not played the active role they play in developed countries in investing in ARD. These and other similar factors point out to a very important issue: how to re-position agriculture in the national and regional agenda.

5.2. Research and Development Priorities

In this section a summary is presented of the regional priorities that have emerged from the recent effort carried out by FORAGRO and the sub-regional organisations (PROCI and SICTA). In the first semester of this year a pilot project was developed for Central America (“Meso-America”), in which a more in-depth effort will be carried out with three additional objectives in mind. The first one will be to focus better the research priorities in the case of Meso-America given the higher level of rural poverty this sub-region is confronting. Secondly, carry out a pilot project to develop a more proactive participation by NGOs, farmers and the private sector in the determination of regional priorities and in the design of regional R&D programmes with a strong stakeholder involvement, precisely to develop a “*strategic alliance*” around them. This is being envisaged as a *learning process* of how to do so. Thirdly, this project will be done in close collaboration with the international centres of the CG, in order to identify the most relevant regional priorities that are also relevant for the CGIAR, in order to provide an input into the development of the CGIAR agenda. A project proposal has been presented to the consideration of donors.⁷ This section presents the wider picture of regional priorities in the LAC region.

5.2.1. Technologies for Tropical Ecosystems:

Rationale: Tropical ecosystems are suffering the consequences of an accelerated deterioration in its ecological capital. Most of the agriculture production systems show high degrees of environmental degradation, as indicated by declines in soil fertility, vegetation cover, biodiversity loss and increases in soil erosion. These processes contribute to a reduction in ecosystem stability, productivity and overall sustainability. One of the major reasons for this is the use of technologies developed under temperate conditions which were not properly validated or applied under tropical conditions, and were based on an intensive use of inputs without considering socio-economic, environmental and production factors of tropical agriculture systems. On the other hand, monoculture and disciplinary research approaches to solving problems without a previous systems analysis has resulted in low adoption rates and lack of social and economic impact in many countries of the tropics. Despite being the most common systems in the tropics, integrated crop systems (rotation or intercropping) or mixed production systems (crop-livestock) have received less attention for technological development.

The new vision of tropical agriculture recognises the complexity, specificities and peculiarities of the tropical ecosystems, including biodiversity (genes, species and ecosystems), structure, functions and dynamics, and their implication on the development of new knowledge and technology. Therefore, tropical agriculture is something more than tropical crops and livestock. Development of sustainable and competitive agriculture tropical production systems implies the revision of the contributions of different sciences and disciplines to the understanding and comprehension of bio-physical, socio-economic and environmental components of agricultural systems and their interactions in specific regions and niches. Furthermore it should be pointed out that the Latin American and Caribbean Region has huge forest areas (rain forest, principally) and at the same time very high rates of deforestation. The tension between both realities gives a great

⁷ See “*Pilot Project for the Study of Agricultural Research Priorities in Meso-America and to Consolidate Strategic Alliances Around Them*”; San José, FORAGRO, May 2001.

priority to forest topics because of its relationship with the quality of life of people, through impacts on soil and water availability, on biodiversity and on climate change. In addition to its environmental services and benefits, sustainable use of natural and planted forests is a great alternative to generate employment and progress in a region where a large share of the population is facing critical levels of poverty. Some strategic topics are mentioned below:

a) Natural Resources Management and Sustainability

- ◆ The complexity and the interactions among the different components of tropical agriculture systems require a holistic research approach, addressing above issues.
- ◆ Development of integrated soil and water management practices to improve the sustainability of tropical production systems
- ◆ Sustainable grazing (grasses and legumes) feeding systems and development of strategies to recover degraded pastures in tropical ecosystems
- ◆ Establishment of multi-strata and agroforestry pilot production systems in tropical fragile ecosystems
- ◆ Development of technological components for intercropping and rotational cropping system
- ◆ Development of policies to incorporate environmental services as a component of tropical agriculture (benefits)

b) Plant and animal protection and clean production technologies

- ◆ Epidemiology and control of bovine trypanosomosis in the tropics
- ◆ Adaptation mechanisms of tropical native species to stress (biotic and abiotic)
- ◆ Integrated Pest Management programs under intercropping and rotational cropping systems in the tropics

c) Biodiversity

- ◆ In situ conservation strategies and sustainable use of native at risk species (recovering local knowledge)
- ◆ Molecular marker assisted plant breeding programs for tropical species (animal and crops)
- ◆ Forestry resources and their effective conservation and sustainable utilisation

5.2.2. Genetic Resources Management and Biotechnology

- ◆ Identification, isolation, characterisation and use of genes of interest (i.e. disease or stress resistant) for breeding programs
- ◆ Bioinformatics and management of germplasm banks
- ◆ Strengthening of regional networks of genetic resources
- ◆ Issues related to genetic resources policies; IPR and licensing of derived materials or products
- ◆ Participatory breeding programs with local communities
- ◆ Seed policy and seed distribution systems
- ◆ Improving the implementation of the biosafety regulations that have been enacted in the region

5.2.3. Linking the farmer to the market: Rural Innovation, Post-Harvest and Agroindustrial Development

- ◆ Increase productivity and competitiveness of farmers through increased rural innovation and through innovation networks in key commodities of the various sub-regions (PROCISUR, PROCICARIBE, PROCIANDINO, PROCINORTE, SICTA).
- ◆ Promote the development of small and medium-sized enterprises (SMEs) in order to scale-up innovative products for agriculture (i.e. biofertilisers, biopesticides)
- ◆ Development of post-harvest technologies to add value to non-traditional products and promotion of small agroindustrial enterprises to improve access of the small producer to the market
- ◆ Quality control, control of origin and monitoring systems to assure food safety

5.2.4. The integrated development of key commodity chains

- ◆ Improving production, increasing added-value and facilitating access to market for tropical fruits
- ◆ Getting more value out of underutilised crops (i.e. cassava, nuts, etc)
- ◆ Aquaculture and fisheries and their interaction with agricultural production systems

5.2.5. Policy and institutional aspects related to agricultural development from the perspective of technological development

- ◆ Integration of NARS and NARS strengthening (reform): changing nature of public research institutions, and active involvement of end-users and of stakeholders
- ◆ New forms of technological agricultural policies and institutional arrangements that are emerging in the LAC countries
- ◆ Mapping of poverty as a tool for focusing R&D efforts on poverty eradication
- ◆ Impact of trade policy and trade agreements on agricultural production and NRM
- ◆ Changing nature of rural society ("*Nueva Ruralidad*"). Second generation institutional reforms in the agricultural sector to respond to obsolete institutional arrangements

5.2.6. Access to information and strengthening the regional capacity of knowledge management

- ◆ Strengthening the Regional Agricultural R&D Information System: INFOTEC
- ◆ Integration of local knowledge and indigenous knowledge
- ◆ Improving the access to internet by agricultural research and extension institutions

5.3. Proposals for Collaborative Research Projects

This section presents brief project profiles of a few strategic projects that can convert the above mentioned regional priorities into concrete collaborative research activities. It should be pointed out that in all of these proposals four objectives are being addressed: contributing to poverty-eradication by using poverty mapping and other tools (see 5.2.5 above) to help focus research endeavours on this objective; increasing the competitiveness of agricultural production in the region; food security, in a region that is increasingly facing the need for food imports; and the sustainable management of natural resources through the emphasis that is being placed on agroecological approaches and a greater systems approach to agricultural research. Another

important characteristics of these proposals is that they are based on stakeholder-driven processes, that integrate the farmer (the *campesino*) as a key partner in agricultural research.

5.3.1. Technologies for Tropical Ecosystems:

In response to the high priority that is being given to this topic, an integrated programme of research is being discussed among different countries of the region, in which collaborative research with European researchers, as well as researchers from IARCs and from other regions, would be greatly welcomed. There is a package of research and training activities that is being designed, among which three complementary projects could be mentioned (the first two are research projects and the third one is related to graduate training):

- a) **Development of Feeding Systems for Meat and Milk Production in the Tropics:** The objective is to develop a feeding system that can be used to optimise management of pastures and nutrition of grazing animals (dual purpose cattle) under tropical conditions.
- b) **Evaluation of Agrosilvopastoral Systems in the Tropical Savannas of South America:** One promising approach to reduce current degradation processes of the tropical savannas of South América is the development of integrated agrosilvopastoral systems in which the agricultural and silvopastoral components directly and indirectly contribute to the help of the agroecosystem, to increase production and income. The objectives are: Development of technological alternatives that can reverse the process of pastureland degradation; improvement of the productivity and sustainability of beef and dual-purpose cattle systems, whilst enhancing the conservation of the natural resource base; development of analytical tools to determine optimal rotation and production systems and integration of this models into a GIS framework.
- c) **Virtual Centre of Excellence in Tropical Agriculture:** This *Virtual Centre* is conceived as a centre of excellence that can be constructed by linking through internet groups of researchers located in different institutions (NARS, IARCs, ARIs, NGOs, Universities), for purposes of collaborative research and mainly for the development of a *graduate training programme* through the collective effort of a group of participating institutions. None of them have the necessary *critical mass* to tackle this undertaking alone. But using web-based technologies and long-distance education techniques, it is possible to develop such a programme. Existing approaches and methodologies that have been developed for other areas could be adapted to this particular area of research. The complexity of tropical ecosystems and the challenge to generate new knowledge and appropriate technology for developing competitive and sustainable agriculture production systems in the tropics, along with the need to prepare highly trained human resources that can develop and use this type of approach, are the driving forces for the implementation of a “Centre of Excellence” (“*Escuela de Pensamiento*”) on tropical agriculture. This initiative will take an integrated approach to problem-solving in tropical agriculture, developing new strategic research activities and innovative training programs based on the existing capacities and agendas of the group of participating institutions, and taking advantage of the different tropical ecosystems as natural laboratories (high and low tropical ecosystems, and low humid and dry), as well as the new communication and information technologies and platforms to facilitate access to different research groups and stakeholders.
- d) **Agroforestry Research in Tropical Ecosystems:** In order to address the need mentioned in section 5.2.1 of bringing closer together forestry research and agricultural research, the Directors of Latin American and Caribbean forestry research organisations recently established a permanent *Regional Forum of Forestry Research Organisations* that will operate as a specialised forum within FORAGRO at the regional (LAC) level, and within the context of the International Union of Forestry Research Organisations (IUFRO) and of GFAR at the global level. Working in close interaction with FORAGRO and with NARS, it will seek to strengthen agroforestry research that responds to the challenges of the tropical ecosystems mentioned above.

5.3.2. Food Safety and Quality Control of Agri-food Chains

The various sub-regional organisations in the FORAGRO region, but specially PROCISUR, have been working in the development of a collaborative programme aimed at addressing the issue of quality control, control of origin and food safety from the research perspective, where collaboration with Europe and other regions can play an important role. This proposal includes aspects such as:

- a. Harmonisation (technological and methodological adjustment/management) and articulation of the different models of quality safety.
- b. Developments to guarantee levels of specific quality.
- c. Development of technical bases to implement tracing and identity preservation. Improvement of the tracing systems and IP based on biological and chemical technologies of the highest scientific standards.

5.3.3. Cooperation in Genetic Resources Management and in Biotechnology

There are *sub-regional genetic resources networks* (related to the PROCIS) that have research and technical assistance programs. Through their work, the LAC countries are interested in collaborative research on the following topics:

- a. Adaptation or development of techniques to assist traditional plant breeding, such as: use of molecular markers, techniques to speed genetic progress, production of duplohaploids, rescue of embryos in interspecific crossing, detection of DNA incorporation.
- b. Assistance in genetic resources conservation such as *in situ* and *ex situ*, with development of alternative conservation protocols (criopreservation) either for seed reproductions species or for embryos, and for those with special problems (recalcitrant). Assistance in vegetal quarantine.
- c. Characterisation and organisation of genetic resources (native and exotic) following the concept of contrasting characters bank.
- d. Search, identification and characterisation of genes, sequences, markers and useful genotypes (resistance to insects, stress, etc.) that are available in the native genetic resources, with emphasis in the functional analyses on complete genome sequences.
- e. Obtaining biotechnological products derivative of vegetable, animal and microbiological genetic materials; new breeds, cultivars, transgenics, biofactories (biopesticides based on normally existing organisms in the region, vaccines, medicines, etc.)
- f. Support to the development of experiences in risk evaluation taking into account the production in small and large-scale, and testing of the transgenic plants, specially considering their relation to the origin centres of the regional genetic resources.

5.3.4. INFOTEC: Strengthening of the Regional Agricultural R&D Information System

The *LAC Regional Agricultural R&D Information System (RAIS)* is presently under construction, under the name of INFOTEC. INFOTEC is being built as a regional information system that is the joint effort of the various organisations that are related to agricultural research and development in the Latin American and Caribbean countries, at both the national level and the regional/sub-regional level. In the latter the role of IICA, CATIE and CARDI should be particularly highlighted. This system seeks to link, in an integrated and coherent regional system, the various information facilities and services that have emerged in the countries of the region in this area. It builds upon the information systems and networks that have been established by the agricultural research institutions in the region, and by the NGOs and producers' associations interested in accessing knowledge and technology in order to increase the effectiveness of production and the welfare of the rural population. By integrating and linking these information facilities, and by

sharing a common information strategy and a normative framework (i.e. compatible protocols and database designs), knowledge flows among stakeholders of agricultural research will be facilitated. Collaboration with EIARD/InfoSys and with the RAIS of other developing regions, is considered of great importance.

5.3.5. Sustainable Development and Global Climate Change

- a. Excessive use of agro-chemicals in the intensive production systems and field crop rotations.
- b. Loss of biological and economical efficiency in the intensive production systems.
- c. Environmental impact of the waste of agricultural systems, intensive forestry and agroindustry.
- d. Agriculture contribution to mitigate the emission of gases that produce greenhouse effect.
- e. Environmental management at eco-region level. Development of a regional information system on the agri-environment to monitor the most sensible border eco-regions of the Southern Cone.
- f. Environmental management at farm level. Development of methodologies at farm scale that allow the establishment of an agroecological certification system of the productive processes to characterise enterprises by environmental management capacity.

5.3.6. Promoting Agricultural Technological Innovation

Low agricultural development and competitiveness in the LAC region is due to reduced productivity in agricultural and agroforestry systems, to the use of technologies with negative impacts on the environment, to the scarcity of managerial capabilities in small-scale rural agriculture, and to poor production support services. In addition, there is often a lack of socio-economic, technological, and environmental policies for developing competitive advantages, as well as shortcomings in the current institutional structure that does not provide a clear support to innovation processes in the rural sector.

This situation is leading many NARS in the region to develop a new approach to agricultural research and development, based on the concept of “*rural innovation*” and on the need to promote “*rural innovation systems*.” Instead of taking as a point of departure the perspective of agricultural research programmes and of how to transfer the technology produced by them, which follows a “supply approach”, the new perspective they are seeking to develop is strongly based on the analysis of the needs of the producer and on how he/she is using knowledge at the farm level or at the enterprise level in order to cope with their needs.

Several NARS from the region and IICA are putting together a programme aimed at:

- a) To document at the field level successful cases of technological innovation in fostering the competitiveness of specific agricultural (or agro-industrial) production systems, in order to determine the factors that lead to a successful innovation and how these innovations dynamized a given micro-region or a particular agri-food chain. The objective here is to determine “*best practice*” and to identify the factors that facilitated the innovation process and led to a competitive production chain.
- b) To identify implicit or explicit innovation systems or innovation networks that have developed in the LAC region, including “innovation clusters”, to see what can be learned from these cases in terms of the innovation environment that has to be created at the regional or chain (network) level. Both PROCISUR and PROCIANDINO are promoting these type of networks that bring together research centres/groups with farmers’ associations and enterprises. The

same effort is being carried out in some of the crop networks, such as PROMECAFE, MUSALAC, and REDCAHOR, among others.

- c) To disseminate and debate at the regional level the findings of the case studies, as well as of the “best practice” that has been determined, in order to generate a learning process on these topics. The objective here will be to generate recommendations on the type of policy and institutional environment that is conducive to innovation, as well as how to articulate in the practice “innovation networks” and innovation clusters.

In carrying out this programme, the LAC NARS are interested to participate in the global network on “Innovation and Rural SMEs” that GFAR is supporting, in cooperation with NARS in the other regions of the developing world and with ARIs in Europe that are working on this topic.⁸ As part of this emerging programme, a regional consultation is being made on the present status of post-harvest technologies and of rural small and medium-sized enterprises (SMEs) in the Latin American and Caribbean countries, which is part of a broader initiative that GFAR and FAO/AGSI are supporting in various regions of the developing world.⁹ Similarly, this programme will seek to involve the participation of ISNAR and of GTZ, who are working in the development of this approach to ARD.

⁸ See: *“Final Report: Conclusions of the International Seminar on Agroindustrial Chains for the Development of Peasant Economies”*; GFAR/IAO, Firenze, October 12-13, 2000.

⁹ See: *“La Post-Producción de Alimentos: Términos de Referencia para las Consultarías Subregionales”*; IICA/PRODAR, June 2001.

Annex 2 – Main Research Priorities and Regional Distribution: A Summary Table

Regions	APAARI	AARINENA	FARA	FORAGRO	CAC	CS
1.0. Genetic Resources Management and Biosafety/Biosecurity						
1.1 Agrobiodiversity/biodiversity management and conservation (and integration of indigenous knowledge)	X	X	X	X	X	X
1.2 Strengthening seed (policy) system	X	X	X	X		
1.3 Genetic resources policies, IPR and licensing of derived materials or products	X	X	X	X		X
1.4 Collection and documentation of indigenous knowledge on conservation and use of plant and animal genetic resources.	X	X	X	X	X	X
1.5 Germplasm collection, characterisation, conservation, improvement, and use for food and agriculture (including the development of tools and techniques)	X	X	X	X	X	X
1.6 Characterisation (including molecular and phenotypic characterisation), conservation and improvement of poultry and ruminant genetic resources and evaluation local and exotic breeds	X	X	X	X	X	
1.7 Eco-regional survey, exploration and collection of endemic, endangered, neglected and traditional cultivars,	X	X	X	X		X
1.8 In situ conservation strategies and sustainable use of native at risk species (recovering local knowledge)	X	X	X	X	X	X
1.9 Implementation of Biosafety/Biosecurity regulations and risk assessment for decision-making; Awareness raising and risk management of GMOs	X	X	X	X		X
1.10 Bioinformatics and management of germplasm banks (including gene banks development at the sub-regional level)	X	X	X	X		
1.11 Participatory breeding programs with local communities	X		X	X		X
2.0 Biotechnology application in crop and animal improvement/protection						
2.1 Germplasm improvement/enrichment programme including development of new genetic material of high variability (crops and livestock)	X	X	X	X	X	
2.2 Crop improvement (including characterisation and selection for tolerance to drought, resistance to prevalent diseases and pests)	X	X	X	X	X	
2.3 Grain legumes improvement programme		X	X			
2.4 Identification, isolation, characterisation and use of genes of interest (i.e. disease or stress resistant) for breeding programs	X	X	X	X	X	
2.5 Transfer of technologies for mass multiplication and clean seed production of tropical species (plantain, cassava, etc) and development of productive projects with local communities	X		X	X		X
2.6 Animal health and epidemiological research			X	X		

Regions:	APAARI	AARINENA	FARA	FORAGRO	CAC	CS
3.0 NRM and Agro-ecology						
3.1 Development of integrated soil and water management practices to improve the sustainability of tropical production systems (e.g. moisture conservation in farming systems; sustainable irrigated agriculture and cropping systems)	X	X	X	X	X	X
3.2 Soil management (including reversal of soil degradation, soil fertility management and soil fertility in urban and periurban areas, agroforestry, and use of urban organic wastes)	X	X	X	X		X
3.3 Land management (including land use, land use rights, etc)	X	X	X		X	X
3.4 Sustainable agriculture integrated with NRM (e.g. IPM, low-external-input agriculture)	X	X	X	X	X	X
3.5 Sustainable grazing (grasses and legumes) feeding systems and development of strategies to recover degraded pastures in tropical ecosystems; rangeland management		X	X	X	X	
3.6 Crop-Livestock Integration (including assessment of benefits and evaluation of nutrient recycling options)		X	X	X	X	
3.7 Sustaining livelihood given limited arable land (e.g. dryland areas)	X	X	X	X		X
3.8 Developing and evaluating truly participatory farmer-led research methodologies	X		X	X		X
3.9 Promotion and management of indigenous knowledge			X	X		X
4.0 Forestry Research						
4.1 Forest and watershed management	X		X	X		X
4.2 Development and application of appropriate water management technologies/strategies for agriculture- and forestry-linked agroecosystems	X	X	X	X		X
4.3 Agro-silvo pastoral systems				X		
4.4 Climate change (e.g. carbon sequestration, sink, etc)	X	X	X			
5.0 Fisheries and aquatic research*						
5.1 Studies on the management (and biology) of shared, straddling and highly migratory fish stocks	X		X			
5.2 Management of water bodies under stress, including ecosystems dynamics of reservoirs for fish culture	X		X			
5.3 Identification of techniques and sustainable management strategies for water resources, by riverine communities/fishing communities including the social and economic implications.	X		X			X
5.4 Data exchanges for conservation and sustainable management of shared resources, including an effective fisheries database and information systems	X					
5.5 Readdressing stock assessment models, including development of production models for floating netcages, pens, ponds, etc.	X					
5.6 Development of legal, regulatory and control framework for resources management, including an effective and cost-efficient monitoring, control and surveillance systems	X					
5.7 Integrated fish farming in peri-urban irrigated schemes (including development of specific breeding techniques for fish farming).	X		X			

Regions	APAARI	AARINENA	FARA	FORAGRO	CAC	CS
6.0 Linking the farmer to the market: Commodity chains, post-harvest and rural SMEs						
6.1 Increased productivity and competitiveness of farmers through improved rural innovation and through innovation networks that may help to link the farmer to the market	X		X	X		X
6.2 Utilisation of "underutilised and orphan crops" (e.g., establishment of pilot projects on post-harvest processes of fruits and vegetables for export markets)	X	X	X	X	X	X
6.3 Support to the development of market commodity chains (e.g. datepalm, coconut, cocoa, cotton)		X	X	X	X	
6.4 Integrated cereal, roots and tubers production systems for increased food security		X	X		X	
6.5 Rural innovation and SMEs						
6.6 Marketing and risk sharing	X	X	X	X		X
6.7 Development of post-harvest technologies to add value to non-traditional products and promotion of small agroindustrial enterprises to improve access of products to local markets	X	X	X	X		X
7.0 HRD, Capacity building and agricultural policy research and advocacy						
7.1 Capacity building/Human Resources Development (e.g., gender, Experts Consultation Workshop/training for NARS managers, policymakers on IPR and related matters, GIS and modelling techniques, etc.)	X	X	X	X	X	X
7.2 Strengthening regional networks	X	X	X	X		
7.3 Capacity building on genetic resources management	X	X	X	X		
7.4 Public awareness and information dissemination on conservation and sustainable use of genetic resources	X	X	X	X		X
7.5 Research-extension-farmer linkages/Action research	X	X	X	X		X
7.6 Elaborating and implementing national agricultural extension policy linked to research	X	X	X	X	X	X
7.7 Enhancing effectiveness and efficiency of the institutions and organisations which support the agricultural production systems (land tenure, agricultural marketing, etc.)	X	X	X	X	X	X
7.8 Socio-economic and socio-institutional aspects in rural settings (including socio-cultural involvement/implications in natural resource use)			X	X	X	X
7.9 Impact of trade and other policies on small-holder farmers and researchers	X		X	X	X	X
7.10 Mapping of poverty as an important tool to focus research on poverty-eradication objectives	X	X	X	X	X	X
8.0 Information and Communications Technology	X	X	X	X	X	

* Based on 1999 ICLARM Conference on Regional Cooperation on Fisheries

** Based on the NGO document "An Introduction to the Goings-On about International Agricultural Research from the NGO Perspective," and the Report of the "Easter and Southern African NGO/SFO Meeting on Agricultural Research for Development," held on 20 May 2001, Durban, South Africa.

Annex 3 – Regional Priorities Related to Genetic Resources and the GLPOA

Regions	APAARI	AARINENA	FARA	FORAGRO	CS
1.0 APAARI					
1.1 Agrobiodiversity/biodiversity management	X	X	X	X	X
1.2. Strengthening NRM techniques	X	X	X	X	X
1.3. Development of conservation strategies for diverse crops	X		X	X	
1.4. Development and application of appropriate water management technologies/strategies for agriculture- and forestry-linked agroecosystems.	X	X	X	X	X
1.5. Utilisation of "underutilised crops"	X	X	X	X	
1.6. Use of appropriate cutting edge and biotechnology in agriculture	X	X		X	
1.7. Systems diversification	X			X	
1.8. Strengthening seed system	X	X	X	X	
1.9. Strengthening regional networks	X	X	X	X	
1.10. Policy advocacy on IPR/IPP and sharing of genetic resources	X	X	X	X	X
1.11. Increase biosafety	X			X	X
1.12. Impact of climate change in agriculture (research to mitigate environmental degradation)	X	X	X		
1.13. Promoting public awareness on NRM, including agrobiodiversity	X			X	X
1.14. Human Resource Development (e.g. Experts Consultation Workshop/training for NARS managers, policymakers on IPR and related matters)	X	X	X	X	X
1.15. Globalisation					X
2.0 AARINENA					
2.1 Application of Genetic Engineering in crop improvement		X		X	
2.2 Development of Commodity Chain Network (e.g. Datepalm)		X	X	X	
2.3 Strengthening seed policy and production systems	X	X	X	X	
3.0 CORAF/WECARD					
3.1. Eco-regional survey, exploration and collection of endemic, endangered, neglected and traditional cultivars,	X	X	X	X	X
3.2 Collection and documentation of indigenous knowledge on conservation and use of plant genetic resources.	X	X	X	X	X
3.3 Germplasm collection, characterisation, conservation, improvement, and use for food and agriculture (including the development of tools and techniques)	X	X	X	X	

3.4 Germplasm/crop improvement/enrichment (including characterisation and selection for tolerance to drought, resistance to prevalent diseases and pests, etc.)	X	X	X	X	
3.5 Gene bank development/ Support to and/or establishment of regional networks	X	X	X	X	
3.6 Integrated Pest Management	X	X	X	X	
3.7 Action research/Research-extension-farmer linkages (e.g. participatory plant breeding)	X		X	X	X
3.8 Capacity building on genetic resources management	X	X	X	X	
3.9 Public awareness and information dissemination on conservation and sustainable use of genetic resources	X	X	X	X	X
4.0 FORAGRO					
4.1 In situ conservation strategies and sustainable use of native at risk species (recovering local knowledge)	X	X	X	X	X
4.2 Molecular marker assisted plant breeding programs for tropical species (animal and crops)			X	X	
4.3 Identification, isolation, characterisation and use of genes of interest (i.e. disease or stress resistant) for breeding programs	X	X	X	X	
4.4 Bioinformatics and management of germplasm banks	X	X	X	X	
4.5 Strengthening of regional networks of genetic resources	X	X	X	X	
4.6 Genetic resources policies, IPR and licensing of derived materials or products	X		X	X	
4.7 Participatory breeding programs with local communities	X			X	X
4.8 Implementation of Biosafety regulations and risk-assessment for decision-making	X	X	X	X	X
4.9 Strengthening sub-regional genetic resources networks	X	X	X	X	
5.0 CIVIL SOCIETY (GLOBAL)*					
5.1 Sustainable use and conservation of biodiversity and agrobiodiversity	X	X	X	X	X
5.2 Indigenous knowledge			X	X	X
5.3 Developing and evaluating truly participatory farmer-led research methodologies	X		X	X	X
5.4 Shifting research from on-station to on-farm					X
5.5 Sustainable agriculture integrated with NRM (e.g. Low-external-input agriculture)	X	X	X	X	X
5.6 Impact of trade and other policies on small-holder farmers and researchers	X		X	X	X

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