PROJECT PROPOSAL

ORGANIC RESEARCH CENTRES ALLIANCE

(ORCA)

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EXECUTIVE SUMMARY

Context. Organic agriculture is a production system that relies on ecosystem management rather than the flow of external agricultural inputs. It considers potential environmental and social impacts by eliminating the use of synthetic inputs and replacing them with site-specific management practices that maintain and increase long-term soil fertility, employment opportunities and mitigation and adaptation to climate change. Organic agriculture is practiced worldwide by 1.2 million producers in 141 countries, with production of organically grown food continuing to steadily increase by 15 percent per year. While most of the organic markets are in developed countries, developing countries are becoming important suppliers as organic practices are particularly suited for the conditions of their farmers, especially smallholders living in rainfed areas. Farmers in resource-constrained countries traditionally use few external inputs but many of the environmental, social and economic benefits of organic management, which translate into ecological intensification, are hampered by a lack of appropriate agro-ecological knowledge.

Rationale. Given the future scenarios challenging the agricultural sector such as crippling food demand, climate shock and water scarcity, additional research capacity is needed in order to realize the full benefits of organic agriculture and respond to the needs of farmers and consumers. Though there is evidence of a movement toward international collaboration in organic research, such as initiation of transnational research projects and exercises to identify research priorities for organic agriculture, efforts are struggling due to a lack of resources. Thus, the proposed alliance of research centres would enhance organic research for and in developing countries. The ultimate objective of the proposed Alliance is to ensure that the environmental, economic, and social benefits accruing from organic research are shared worldwide and beyond the organic community, as a contribution to sustainable agriculture and poverty alleviation. The ORCA concept is designed following a research paradigm that heavily draws on traditional knowledge, improves it with scientific investigation and shares it widely. Research centres may be physical laboratories or "institutions without walls", formed through alliances between producers and scientists, as well as partnerships between institutions in developing and developed countries. The proposed alliance therefore intends to internationally network and strengthen existing institutions with scientific credentials and empower them to become centres of excellence in transdisciplinary and participatory organic agriculture research.

Management Structure. ORCA will consist of eleven research centres joined together by a shared concern for organic agriculture and cooperating in order to increase the critical mass of researchers, institutions, with direct farmers engagement, complementary research programmes and funding. Each of the research centres will be charged with pursuing a specific focus area; five of the eleven centres will focus on a specific major agro-ecosystem and the remaining six will focus on a component of the organic system that merits special attention. These research centres will not be comprised of a single institution, but a consortium of research institutions working together. Each ORCA Excellence Centre is a network composed of: core organic research institutions (at least 2); collaborating organic research institutions; non-organic research institutions that undertakes relevant research on low-input systems and ecology; and farmers' organizations and grassroot organic movements that guide agenda setting and technology development. Each research centre will have a core research entity in a developing country and a partner research entity in a developed country, its "twin", in order to strengthen the entity in the developing country through research collaboration and support. Each of the research centres will also take the lead in researching two main subjects, or 'resource concentrations' within its specific focus area. For each subject, the designated centre will become the ORCA focal point by collecting and sharing research materials with other centres and the public at large and facilitating communication and collaboration between centres in that subject. In addition, each research centre will undertake research

programmes relevant to soil, which is believed to most differentiate organic from conventional production. A small Secretariat based in FAO will be responsible for overseeing centres' collaboration, raising funds and administering the overall ORCA system and knowledge sharing. The Secretariat tasks will be overseen and guided by a Facilitation Board, composed of a variety of stakeholders, in order to ensure a decision-making role to farmers and other food chain actors in the governance of the Alliance.

Budget. All centres will receive funding to initiate ORCA activities. Annual disbursement of funding will be provided by the Secretariat to maintain the resource libraries and minimum staff support. Any additional funding for each Centre must be solicited from the Secretariat and is based on an internal competitive process. It is also expected that Centres will seek funding from non-ORCA sources. In order to ensure that the impact of ORCA is not limited to the host institution of each Centre, there will be an obligation to spend a certain ratio on competitive calls which will enable other institutions to benefit from the support. It is expected that the total budget of ORCA will be approximately USD 25 million/year, including USD 2 million/year for each established Centre and Secretariat and system-wide activities. The growth of the ORCA system is expected to be incremental, starting with the establishment of one or more Centres with core activities and developing as funds become available.

Duration. ORCA will have a phased approach to implementation through 2025. FAO started implementation in 2009 through the establishment of an ORCA Portal, as well as the development of the operational procedures, in consultation with stakeholders. ORCA is designed to be a lasting network of organic agriculture centres of excellence. The concept is based on catalyzing existing research entities and partnerships, rather than subsidizing research activities. It is expected that participating institutions become centres of excellence that can generate their own resources in the global network.

Expected Outcomes and Outputs. ORCA's vision is that organic research will be mainstream, robust, and valued by farmers and policy-makers worldwide by 2025. It aims to achieve its vision by producing a network of research centres collaborating to produce high quality research in organic agricultural systems relevant to the needs of farmers and processors in developing countries. The expected outputs are consistent with those of all high quality research institutes and universities. They are quantifiable and enable measurement of the organization's performance. ORCA is expected to publish papers in peer-reviewed journals; present research results at significant congresses; pioneer innovative approaches to research and development processes; educate constituencies through publication in practitioner-oriented literature and websites; train and mentor young scientists; and compete successfully for external funding. Ultimately, ORCA seeks to implement an alternative research paradigm based on horizontal and vertical collaboration and synergies that can better serve our highly challenged society and Planet.

Partnerships and Country Contributions. The ORCA concept has developed over a year through a number of consultative processes, including electronic public comments, expert meetings and conversations with development partners. This document is the product of a partnership between FAO and two important research institutions, FiBL and ICROFS, with vocation to assist developing countries with organic research. Several developed countries have started focusing on developing national organic research agendas and expanding their research base, also into developing countries. Several of these countries have also formed regional programs such as the EU Technology Platform on Organic Agriculture. However, developing countries often lack the resources to promote and implement their own research agenda. ORCA will provide seed funding and expertise to existing research institutions with dedicated personnel and experimentation fields (including farmers' fields) to organic research. Thus, recipient countries' contribution will be in-kind, as well as active participation of its organic farmers and movements. ORCA will be an alliance that pool together, catalyzes and structures national programmes and international cooperation in organic agriculture for developing countries.

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LIST OF ACRONYMS

AAO	Associaçáo de Agricultura Orgânica
ACAO	Cuban Association of Organic Agriculture
ACTAF	Cuban Association of Agricultural and Forest Technicians
AIAB	Associazione Italiana per l'Agricoltura Biologica
AKST	Agricultural knowledge, science, and technology
AREC	Agricultural Research and Education Centre
ARGOS	Agriculture Research Group on Sustainability
ARNOA	Asian Research Network of Organic Agriculture
ARU	Aquaculture and Aquatic Resource Management Research Unit
ASARECA	Association for Strengthening Agricultural Research in Eastern, Central, and Southern Africa
ATTRA	National Sustainable Agriculture Information Service
AVRDC	The World Vegetable Center
BOKU	University of Natural Resources and Applied Life Sciences, Vienna
BOL	German Federal Organic Farming Scheme
BRAD	Biodynamic Research Association Denmark
CETDEM	Centre for Environment, Technology and Development, Malaysia
CGIAR	Consultative Group on International Agricultural Research
CIRAD	Centre de Coopération Internationale en Recherche Agronomique pour le Développement
CIFOR	Center for International Forestry Research
CLOA	Central Laboratory of Organic Agriculture
CORE-Organic	Coordination of European Transnational Research in Organic Food and Farming
CREAR	Centro Regional de Estudios de Alternative Rurales
CREE	The Centres for the Reproduction of Entomophages and Entomopathogens
CREI	Citrus Research and Extension Institute
CSK	Chaudhary Sarwan Kumar
DARCOF	Danish Research Centre for Organic Farming
DEFRA	Department of Environment, Food and Rural Affairs
DITSL	German Institute for Tropical and Subtropical Agriculture
EMBRAPA	Brazilian Agricultural Research Corporation
EPOPA	Export Promotion of Organic Products of Africa
ERA	European Research Area
ERS	USDA Economic Research Service
EU	European Union
FAO	The Food and Agriculture Organization of the United Nations
FiBL	Research Institute of Organic Agriculture
FQH	Organic Food Quality and Health Association
GAO	Grupo de Agricultura Organica
GFAR	Global Forum for Agricultural Research
IAASTD	International Assessment of Agricultural Knowledge, Science and Technology for Development
IAO	IFOAM Africa Office
IBDF	Institute for Biodynamic Research

IBERS	Institute of Biological, Environmental and Rural Sciences
ICAR	Indian Council of Agricultural Research
ICARDA	International Centre for Agricultural Research in the Dry Areas
ICCOA	International Competence Centre for Organic Agriculture
ICROFS	International Centre for Research in Organic Food Systems
IFAD	International Fund for Agricultural Development
IFOAM	International Federation of Organic Agriculture Movements
IITA	International Institute of Tropical Agriculture
INCA	Instituto Nacional de Ciencias Agrícolas
INIBAP	International Network for the Improvement of Banana and Plantain
INORA	Institute of Natural Organic Agriculture
INRA	French National Institute for Agricultural Research
IOL	Institute of Organic Agriculture
IRRI	International Rice Research Institute
ISD	Institute for Sustainable Development
ISOFAR	International Society of Organic Agriculture Research
ITAB	Institut Technique de L'Agriculture Biologique
ITMS	Institute of Traditional Medicine Services
IUFRO	International Union of Forestry Research Organisations
KIOF	Kenya Institute of Organic Farming
KOAN	Kenya Organic Agriculture Network
LIHREC	Long Island Horticultural Research & Extension Cente
MDG	Millennium Development Goal
MSC	Marine Stewardship Council
NEFG	Nafferton Ecological Farming Group
NIHORT	National Horticultural Research Institute
NOGAMU	National Organic Agriculture Movement of Uganda
OAC	Organic Agriculture Consortium
OACC	Organic Agriculture Centre of Canada
OCA	Organic Consumers Association
OECD	Organization for Economic Co-operation and Development
OFA	Organic Federation of Australia
ORCA	Organic Research Centres Alliance
QLIF	QualityLowInputFood
RIRDC	Rural Industries Research and Development Corporation
SAFO	Sustaining Animal Health and Food Safety in Organic Farming
SCOAR	Scientific Congress on Organic Agriculture Research
SIDS	Small Island Developing States
SINCITA	National System of Agricultural Science and Technological Innovation
SPC	Secretariat of the Pacific Community
TOAM	Tanzania Organic Agriculture Movement
UNAAB	University of Agriculture, Abeokuta
UNCTAD	United Nations Conference on Trade and Development
UNEP	United Nations Environment Programme
USDA	United States Department of Agriculture
VEERU	Veterinary Epidemiology and Economics Research Unit
vTI	Johann Heinrich von Thünen Institute
WHO	The World Health Organization

1. BACKGROUND

According to the Codex Alimentarius Commission, "Organic agriculture is a holistic production management system which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles, and soil biological activity. It emphasizes the use of management practices in preference to the use of off-farm inputs, taking into account that regional conditions require locally adapted systems. This is accomplished by using, where possible, agronomic, biological, and mechanical methods, as opposed to using synthetic materials, to fulfill any specific function within the system.[1]"

Therefore, organic agriculture is a system that relies on ecosystem management rather than flow of external agricultural inputs. It is a system that begins to consider potential environmental and social impacts by eliminating the use of synthetic inputs, such as fertilizers and pesticides, veterinary drugs, genetically modified seeds and breeds, preservatives, additives and irradiation. These are replaced with site-specific management practices that maintain and increase long-term soil fertility and prevent pest and diseases.

Organic agriculture systems and products may be certified, a verification process required in many developed countries. Those systems and products that are organically produced but are not certified also represent a significant portion of production and are referred to as "non-certified organic agriculture or products." But agriculture systems that have as their primary characteristic that they do not use synthetic inputs are not organic by default, as such systems may lack the required soil building practices and degrade land.

There is evidence of a movement toward international collaboration in organic research. However, many of these efforts are struggling for lack of resources and a system that ensures synergies. Resource-constrained countries must direct limited national resources on ensuring local adaptability of research findings and subsequently translating findings to farmers. In order to enhance organic research for, and within, developing countries, there is need to carefully link the research agenda with national development priorities, increase coordination, interaction, inter-linkages, partnerships, and networks and secure innovative financing and resourcing mechanisms. A consistent focus on poverty is essential and would serve to orient all research on global, eco-regional, and sectoral topics.

The ultimate outcome of the proposed organic research system is to ensure that environmental, economic, and social benefits accruing from the organic sector are shared worldwide. To launch this system, an internationally devised, donor supported strategy is needed. The aim is to strengthen existing organic research centres that are currently poised to implement comprehensive research programmes and to transform them into centres of excellence. Centres would function as nodes in a larger network so that the breadth of research and analysis demanded by the organic sector would be achieved through a division of labour, with individual centres specializing in high priority research areas and sharing research results across the alliance.

1.1 General Context

[1] Codex Alimentarius. 1999. Guidelines for the Production, Processing, Labelling and Marketing of Organically Produced Foods (GL-32).

Production and sale of organically grown food and fibre continue to increase rapidly. The 2007 tally from 141 countries reporting organic production data finds 32.2 million hectares (mha) under organic management by 1.2 million producers, with an additional 31 mha under wild cultivation[2]. Global sales have increased USD 5 billion annually since 2000, with the 2007 market estimated at USD 46.1 billion[3].

Organic agriculture is practiced worldwide, with all continents reporting increases in production. Two-thirds of the agricultural land under organic production is in permanent grasslands and one-third is in cropland. Of this agricultural land, two-thirds is in the developed world. Organic wild areas, in contrast, are largely found in developing countries. For example, while Africa had only 900 000 ha of cropland under organic management, it has 9.6 million ha of organic wild harvest areas.

Region	Area under organic management (million ha)	Number of organic producers	Number of countries with organic regulations
Africa	0.9 (croplands) 9.6 (wild areas)	529 986	3 countries 7 in process of drafting East African Organic Products Standard
Asia	2.9	234 147	11 countries 7 in process of drafting
Europe	7.8	213 297	27 countries (EC Reg.) plus 11 countries 3 in process of drafting
Latin America	6.4	222 599	15 countries 4 in process of drafting
North America	2.2	12 275	USA and Canada
Oceania	12.1	7 222	Australia and New Zealand Pacific Organic Standards

Source: The World of Organic Agriculture 2009. Data from 2007 FiBL/IFOAM Survey

While lagging behind, developing countries are nevertheless benefiting from organic agriculture. Most obviously, consumer demand in Europe, North America and certain parts of Asia has outpaced supply, creating lucrative export opportunities for developing countries. More significantly, organic production is well suited to the southern hemisphere. Resource-constrained countries, whose farmers traditionally use few external inputs, find organic agriculture suitable for maintaining and building soil fertility. As well, the labour-intensiveness of organic production can lead to gainful employment in rural areas, though supplying a healthy workforce is a serious challenge in communities devastated by the HIV/AIDS epidemic. Adoption of organic management is also hindered by a serious lack of agro-ecological knowledge appropriate to various

[2] Willer, H. and Klicker, L. (Eds.) 2009. *The World of Organic Agriculture. Statistics and Emerging Trends 2009*. IFOAM, Bonn; FiBL, Frick; ITC, Genf.

[3] Organic Monitor. 2009. Research News. [Available at http://www.organicmonitor.com/r3001.htm]

regions, a shortfall which is particularly acute in developing countries.

All indicators suggest that organic agriculture is thriving and increasingly important in all areas across the globe. The International Federation of Organic Agriculture Movements (IFOAM), which has an official liaison status with FAO for organic agriculture, has 750 member organizations in 108 countries. At least 70 countries have an organic regulation and many more are proceeding to enact organic standards and laws. A concerted effort is needed in order to boost and harmonize organic agriculture research to ensure equitable access to the knowledge it generates.

1.2 Sectoral Context

1.2.1 Development Priorities, World Food Summit Objectives and MDGs

The International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD) (http://www.agassessment.org) was organized around answering a pressing and fundamental question: "How can agricultural knowledge, science and technology be used to reduce hunger and poverty, to improve rural livelihoods and to facilitate equitable, environmentally, socially and economically sustainable development?[4]". While the agricultural research enterprise has fulfilled its promise to improve productivity, significantly improving the livelihoods of millions of people, it has been less attentive to the unintended social and environmental consequences of research achievements. It is therefore critical that the proposed organic research centre alliance be evaluated for its potential to contribute to achieving the Millennium Development Goals (MDGs) (http://www.un.org/millenniumgoals).

Organic Contributions to Sustainable Development

Organic agriculture contributes to sustainable development through a combination of many features, most notably by:

- Increasing yields in low-potential areas (e.g. dry lands) and market-marginalized areas;
- Conserving bio-diversity and nature resources on the farm and in the surrounding environment;
- Increasing income and/or reducing production costs;
- Producing safe and diversified food;
- Creating sustainable food supply chains;
- Being environmentally, socially and economically sustainable in the long term.

The first MDG is the eradication of extreme poverty and hunger. Organic agriculture as a production method is well suited for resource-poor and subsistence farmers as well as those who are commercially successful. Organic agriculture relies on fossil-fuel independent and locally-available production assets. Farmers work with natural processes and thus increase cost-effectiveness and resilience of agro-ecosystems to climatic stress. By managing biodiversity in time (rotation) and space (mixed cropping), organic farmers use their labour and environmental services to intensify production. Organic agriculture also breaks the vicious cycle of indebtedness for agricultural inputs and reduces the improper use of chemicals that sometimes contaminate the environment and compromise public health. The challenge therefore, is to provide the research and development necessary to aid poor farmers in adopting organic management systems and hence, optimizing the

[4] IAASTD. 2005. [Available at: http://www.agassessment.org/index.cfm?Page=Overview&ItemID=3]

productive use of local natural resources and human and social capital. In particular, capitalizing on available labour, knowledge and institutions is a promising strategy for poverty alleviation in rural areas.

Consumer demand in North America and Europe has created wealth-generating market opportunities for some, but certainly not all, farmers in the developing world. According to The Science Council of the Consultative Group on International Agricultural Research (CGIAR), diversification of smallholder production systems through incorporation of high value crops and livestock is an important strategy for improving rural livelihoods, particularly in the absence of a major redistribution of land and capital. But achieving this will require a reorientation of traditional research systems such that scientists develop technology and knowledge systems that would enable small-scale producers to access dynamic markets[5]. As detailed in Section 4, the proposed organic research centre alliance is designed, from inception, to retain close contact with practitioners and includes, among other things, on-farm research, network analyses and expert dialogues. This design significantly lowers the costs of research and aids the rapid absorption of new findings into agricultural practice.

The second and third MDGs relate to women, and organic agriculture indirectly contributes to the realization of these goals. The second MDG is to achieve universal primary education. In cases where farmers have experienced higher yields and higher incomes (from lower production costs and organic premiums), the extra household income is often invested in the schooling of girls[6]. The education of girls, in turn, improves the agricultural system; according to the International Fund for Agricultural Development (IFAD), farm yields rise around 22% when women receive the same education as men[7]. The third MDG is to promote gender equality and empower women. When farms are managed organically, less capital is required to purchase inputs and more diversification is required, meaning that women are often taking on a variety of tasks that empowers them within the household and also lifts their skill level and contribution to family income and nutrition.

The fourth, fifth and sixth MDGs (to reduce child mortality, to improve maternal health, and to combat HIV/AIDS, malaria and other diseases) all relate to human health. Organic agriculture contributes in several ways. First, it does not contaminate water, allowing for more access to safe drinking water, a critical need in the developing world. Organic production does not rely on dangerous pesticides, which is a serious cause of concern (e.g. 20 000 deaths from pesticide poisoning annually). The diversification of organic systems can contribute to a more diversified diet, significant for the attainment of essential nutrients that maintain health and combat disease. Finally, research is emerging to suggest that organically grown food may have favourable health qualities compared to conventionally grown food, for example, increased levels of plant secondary metabolites, polyphenols and carotenes.

The seventh MDG is to ensure environmental sustainability. Many of the regions facing the greatest challenges in achieving the MDGs are the very same regions facing the greatest problems of ecosystem degradation. Although socioeconomic factors will play a primary role, achievement of the MDGs is unlikely without improvements in ecosystem management. Organic agriculture is a

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5 CGIAR. 2005. System Priorities for CGIAR Research 2005-2015.

6 Jiménez, J. 2006. Organic Agriculture and the Millennium Development Goals. IFOAM.

7 IFAD 2001. Rural Poverty Report: The Challenge of Ending Rural Poverty.

promising approach. Soil health and fertility is improved[8,9], biodiversity enhanced[10, 11, 12,] external energy consumption decreased[13] and climate mitigation and adaptation is optimal[14] through organic management.

The challenge is to design ecologically sound organic production systems so that they provide increased yields commensurate with conventional agriculture over the long term. At the FAO International Conference on Organic Agriculture and Food Security, scientists raised the question: can organic agriculture feed the world? Among the papers presented was an econometric model that found organic agriculture could produce enough food on a global per capita basis for the current world population[15]. This study generated controversy, as expected, since it was one of the very first attempts at evaluating the potential of widespread adoption of organic agriculture. Multiple assessments and additional research is needed to ultimately determine the suitability of organic production for all regions of the world. Long-term comparison trials are necessary to evaluate and improve organic agriculture for yield enhancements, a function central to the design of the organic research centre system.

The eighth MDG – developing global partnerships with the aim of reducing poverty and hunger, improving education and health and protecting the world's natural resources – is extremely relevant to the proposed organic research centre alliance. Building an agriculture research for development system in Africa requires, according to one analysis, carefully linking the research agenda with national development priorities, increasing coordination, interaction, interlinkages, partnerships, and networks and securing innovative financing and resourcing mechanisms[16]. By identifying research and development priorities and collaborating with northern research institutes, the organic research centre alliance provides a framework within which these kinds of relationships can be built. Rather than a series of small and scattered research communities, fragmented both geographically and institutionally, the proposed alliance of centres will facilitate the gathering of dispersed expertise and thereby increase the competitive quality and relevance of the research.

1.2.2 Sectoral Policy and Legislation

In a context of persistent and even increasing poverty and hunger, it has become obvious that high

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8 Reganold, J.P., Elliott, L.F., Unger, Y.L. 1987. Long-term effects of organic and conventional farming on soil erosion. *Nature*. 330: 370-372.

9 Mäder, P, Flieback, A., Dubois, D., Gunst, L., Fried, P., Niggli, U. 2002. Soil fertility and biodiversity in organic farming. *Science*. 296: 1694-1697.

10 Hole, D.G., Perkins, A.J., Wilson, J.D., Alexander, I.H., Grice, P.V., Evans, A.D. 2005. Does organic farming benefit biodiversity? *Biol. Conserv.* 122: 113-130.

11 Bengtsson, J., Ahnström, J. Weibull, A.C. 2005. The effects of organic agriculture on biodiversity and abundance: a meta-analysis. *J. Appl. Ecol.* 42: 261-269.

12 Kotschi, J. 2006. Coping with climate change and the role of agrobiodiversity. Conference of International Agriculture Research for Development. October 11-13, 2006.

13 Pimentel, D. 2006. Impacts of organic farming on the efficiency of energy use in agriculture. Organic Centre State of Science Review.

14 FAO, 2009. Low Green House Gas Agriculture: Mitigation and Adaptation Potential of Sustainable Farming Systems

15 Badgley, C., Moghtader, J., Quintero, E., Zakem, E., Chappell, M.J., Avilés-Vázquez, K., Samulon, A., Perfecto, I. 2007. Organic agriculture and the global food supply. *Renew. Agric. Food Syst.* 22: 86-108.

16 Mbabu, A. and Ochieng, C. 2006. Toward building an agricultural research for development system in Africa. IFPRI-SNAR discussion paper, No 10.

input technologies and credit provision cannot meet the needs of the poor. The combination of rising input costs (costs of Nitrogen fertilizers increased 160% in 2008), decreased availability of natural resources (especially water) and climate variability are already squeezing most farmers, but especially smallholders with little to invest. Evidence exists on opportunities for improving agricultural productivity at lower costs with organic agricultural practices, and where markets are available, certified organic products offer valuable export earning opportunities and the commercialization of small farmers.

Policies designed to improve the environmental performance of agriculture includes bans on a number of pesticides, financial incentives to revegetate, penalties for water pollution and funding on damage abatement technologies. These policy tools are applied in an *ad hoc* way and lack a supportive milieu for the adoption of holistic management that prevents problems to arise. Organic agriculture policies simultaneously address a range of economic, social, political and environmental problems facing rural communities.

Organic agriculture combines and integrates solutions to natural resources conservation, profitability of farming and health of land, ecosystems and people. However, if farmers lack access to resources such as land and if farming is unreasonably taxed, there is not much relief to convert to organic management. More importantly, in applying organic agriculture methods and approaches, farmers require credible science and critical evaluation for improving productivity and environmental impacts. Government support to research and development remain limited on adapting production to different ecosystems and cultural traditions.

The objectives of organic agriculture policies vary from income generation through exports (e.g. Chile) to import substitution on domestic markets (e.g. Malaysia), environmental protection (e.g. Denmark), rural development (e.g. South Africa), strengthening the competitiveness of small holders (e.g. India), promoting quality over quantity as a market strategy (e.g. small island states) or a combination of these.

The organic food supply chain in 70 countries is governed by organic regulations in various stages of implementation, including requirements on production, processing, certification, labeling and marketing. Organic agriculture is perhaps the most regulated sector, as governments in developing countries believe that an organic legislation, including production and certification standards, is the entry point to lucrative markets in Northern countries. With very few exceptions, organic legislations do not provide for measures that can enhance farmers' adoption or agro-ecosystem productivity, such as research and extension.

Generally, organic policies and legislations are not integrated within agricultural policies. Following an overall policy direction with clear objectives, the establishment and implementation of an organic action plan is a logical step, including aspects of: standards and regulations; market development; production issues; and capacity building and research. Existing action plans, mostly in the EU, include income support through agri-environmental and rural development programmes; processing, certification and marketing support; producer information initiatives (research, training and advice); and consumer education and infrastructure support. Very few contain measures to ameliorate potential conflicts between different policy measures. In the EU, the regulation for organic marketing also forms the foundation for directed support to organic farmers under the agri-environmental programmes of the Common Agriculture Policy.

Important policy measures for organic agriculture entail the removal obstacles and biases against organic agriculture. Proactive actions include integrating organic agriculture in general education and extension services, targeted interventions for technology development and the promotion of organic seed breeding and testing. Dedicated organic research funds and programmes are needed to support innovation in production techniques, food processing, food marketing and retailing, in collaboration with farmers and building on traditional knowledge.

2. RATIONALE

If we are to realize the full potential of organic agriculture in contributing to food security and poverty alleviation while protecting natural resources, additional research capacity is needed. This is especially true given that all future scenarios depict crippling food demand, climate shock, and water scarcity, all which challenge the very foundations of the agricultural sector and require new strategies and major adaptations. To account for this, several efforts are underway to identify high priority research for organic agriculture.

Several efforts are now underway to share and coordinate scientific expertise and compare country experiences in organic agriculture. While many of these efforts are struggling for lack of resources, they indicate a strong desire for international collaboration in organic research. In many cases, these efforts have included exercises to identify and build consensus on research priorities for organic agriculture, while others have initiated transnational research projects. These various research agendas provide strong evidence that investment in organic agriculture is necessary.

2.1 Problems/Issues to be Addressed

There remain major barriers to the goal of ensuring that the benefits of organic agriculture are shared equitably among developed and developing countries. This is evidenced by the disparity between organic research activities among developed and developing countries, which is consistent with significant geopolitical concentration of science spending. Ten countries now account for over 80 percent of worldwide science spending. This has created a large and growing divide between the scientific capabilities of countries, with developing nations maintaining weak and sometimes almost non-existent infrastructure. Investments in agricultural research and development in sub-Saharan Africa, for example, failed to grow by more than one percent per year for the whole of the 1990s and, for the 27 African countries for which national estimates are available, about half spent less on agricultural research and development in 2000 than was spent in 1991[17].
Attempts to overcome this barrier have only chipped away at the problem. Most efforts have only been bilateral rather than truly global in nature, as discussed below. This limits the ability to innovate and communicate transdisciplinary research over time and space. There has thus been little investment in organic research in the developing world, which constrains the success of organic agriculture as part of development strategies to reduce poverty and hunger. Without a systematic and targeted financial support, developing countries are unlikely to build-up the expertise necessary to fully develop regional and site-appropriate organic production methods. Experts from developed countries can assist in leapfrogging scientific and technological experiences to assist developing countries in building their organic expertise. For long-term goals to be achieved, indigenous knowledge and problem-solving approaches found in developing countries

[17] Pardey, P.G., Beintema, N., Dehmer, S., Wood, S. 2006. Agricultural Research: a growing global divide? IFPRI Food Policy Report No 17,

need to be valorized and enriched. Ultimately, knowledge can flourish and be applied by local communities only when research agenda are defined locally.

Capabilities for science, technology and innovation in organic agriculture require committed local institutions and individuals in developing countries and partner institutions in developed countries. ORCA proposes a new agenda, to work within such a framework to create a sustainable, transnational network of centres of excellence in organic agriculture research.

2.1.1 Responding to the International Assessment for Agriculture Science and Technology Development (IAASTD)

This new agenda is consistent with the findings of IAASTD. The IAASTD (http://www.agassessment.org) was a three-year international collaborative effort (2005-2007) to evaluate the "relevance, quality and effectiveness of agricultural knowledge, science, and technology (AKST) and effectiveness of public and private sector policies as well as institutional arrangements in relation to AKST." It assessed current research institutions and structures for meeting the goals of reducing hunger and poverty; improving nutrition, health and rural livelihoods; and facilitating social and environmental sustainability

Before brainstorming our own ideas for promotion of organic research, we carefully studied the IAASTD report. Our goal was to learn from past experience and build upon the IAASTD analysis by incorporating IAASTD recommendations directly into the design of whatever institutional arrangement we developed.

Consistent with this proposal, IAASTD recommended increasing the investment in research to improve low impact practices such as organic agriculture, as well as providing incentives for the sustainable management of natural resources. As we developed our vision, we were mindful of these specific recommendations derived from the IAASTD report:

- Expand focus from ensuring food production to include environmental, social and economic functions such as mitigating climate change and preserving biodiversity;
- Harness local and traditional knowledge as well as formal science and technology information to increase equitable access to technologies;
- Develop incentives in research organizations to foster different kinds of partnerships;
- Create systems of incentives and rewards for multi-functionality and ecosystem services;
- Improve community-level scientific literacy by decentralizing technological opportunities;
- Integrate farmer concerns in research priority setting and the design of farmer services; and
- Encourage public-private partnerships for improved commercialization.

IAASTD describes a new research paradigm for agriculture that should enable voices that are ignored to be heard, including farmers' knowledge and empirical evidence not yet considered by the dominant research system. Our vision includes promoting a twin-track approach whereby both mainstream science and field innovations are pursued, even when aspects are not yet considered very "scientific". Extending the research methodology to meet the different needs of organic and biodynamic communities in particular, and the overall public quest for sustainability, will be part of the approach utilized by ORCA centres.

In addition, the IAASTD report notes that research would better advance sustainable agriculture if it

was designed to address certain objectives from the inception of the work. While there are multiple objectives embedded in the IAASTD report, the list includes the following, all of which are addressed in the design of the proposed alliance in this paper:

- Deploy suitable cultivars adaptable to site-specific conditions;
- Improve soil, water and nutrient management and conservation;
- Increase small-scale farm diversification;
- Increase the full range of agricultural exports and imports, including organic and fair trade products;
- Reduce transaction costs for small-scale producers; and
- Strengthen local markets and food safety nets.

2.1.2 Relation to the Consultative Group for International Agricultural Research (CGIAR)

The CGIAR, established in 1971, is a strategic alliance of members, partners and international agricultural centres producing science and engaging in development activities to benefit the poor. Members include 21 developing and 26 industrialized countries, four co-sponsors and 13 other international organizations. CGIAR's 8 000 staff members include approximately 1 000 scientists and the organization is active in over 100 countries. The annual expenditure for the CGIAR system was USD506 million in 2007.

It is reasonable to ask why an alliance of centres for organic agriculture research is necessary, given the research capacity of CGIAR. Can an inter-disciplinary system perspective (and location-specific information) such as organic agriculture be accommodated within the CGIAR mandate and mode of operation? Organic agriculture research falls within the broader CGIAR mandate of research on sustainable agriculture for poverty reduction. Inter-centre research programmes and centre research projects do not focus on organic agriculture but several of the centres are involved in research related to the principles of organic agriculture and/or are occasionally involved with an organic project. For example, the International Rice Research Institute (IRRI) has published a primer on organic-based rice farming; the International Network for the Improvement of Banana and Plantain (INIBAP) network has published a report on organic banana production; the International Centre for Agricultural Research in the Dry Areas (ICARDA) has been investigating organic seed production; and the International Institute of Tropical Agriculture (IITA) is involved in a research project to assess the market potential of organic vegetables in West Africa. Organic can and does fit into the CGIAR system. Prior to commencing our effort to develop a proposal for an organic research centre alliance, we sought to catalogue the organic research carried out by CGIAR centres to better understand how the CGIAR can be harnessed for the advancement of organic agriculture knowledge.

The CGIAR Challenge Programme was in fact considered as one potential model for the proposed structure. There are many similarities in that the Challenge Programme creates 'centres without walls' by operating through existing institutions and creating opportunities for collaboration. However, the vision for this project does not fit the Challenge Programme model for a number of reasons. First, the Challenge Programme exists to facilitate research for discrete periods of time. The research that grows from an alliance of organic centres requires a sustained, long-term approach that would not be met by a discrete project through CGIAR. Second, one of the explicit aims to accomplish under our proposed structure is capacity building in the developing world, which is not an articulated goal of the Challenge Programme (although in some cases, its activities

have contributed to this). Third, the "problem" of organic research is not specific enough to fit within the Challenge Programme mandate as we envision a structure that encompasses a breadth of research needs, across disciplines, sectors and geographic borders.

Our analysis and communication with CGIAR leadership suggests that while the CGIAR system does not have the capacity to lead and undertake the substantial new agenda proposed in this paper, there are clearly important synergies between the CGIAR centres and the organic research centres alliance proposed herein. These synergies must be exploited to ensure wise use of resources and to bring together the best of scientific thinking. In some ways, the newly proposed structure is loosely modelled on CGIAR, but it is not envisioned as an organic replica. Instead, the proposed structure is a virtual system of centres that will work in tandem with CGIAR, together creating communities of practice to advance organic agriculture. These virtual centres are really meant to function as nodes, albeit major ones, within a larger network of organic research efforts. This larger network includes the existing organic work that occurs within CGIAR as well as through other research institutions (e.g. FiBL) and resources (e.g. Organic Eprints); our vision is that the virtual centres be nested within this larger network to specifically facilitate and strengthen organic research relevant in the developing world.

2.1.3 Needs Unique to Organic Agriculture

Is it necessary to design a research system specifically for organic agriculture or can existing conventional agriculture research entities take on the research agenda envisioned in this paper? We anticipate that some will ask what, if anything, is inherently so different about organic agricultural research that requires a dedicated enterprise?

A dedicated enterprise focused solely on organic systems is necessary, one reason being the holistic approach of the organic food systems and the use of and further development of advanced agro-ecological methods for soil fertility and pest management. An obvious example would be organic post-harvest handling, in which severe limits on pest control agents and ionizing radiation make it necessary for organic processors to develop novel systems to meet organic standards; thus organic post harvest handling is quite different from conventional post-harvest handling. Seeds and breeds provide another striking example. The attributes desired for plants and animals maintained under an organic system differ significantly from the desired attributes for agricultural biodiversity under conventional management as the organic varieties need to be more adapted to local environmental conditions to better withstand, for example, pest and diseases attacks. Wild collection has been overlooked entirely by most research entities, and yet is hugely significant in the organic market. For climate change adaptation, the organic approach focuses more on building agro-ecosystem resilience to drought and floods rather than counting on single crop drought tolerance. The list of examples could go on and on. Yet we do recognize that there may be other topics, within our proposed scheme, that seem to be less organic-specific. Agritourism may be an example of this, with various kinds of small farms seeking to diversify their enterprises to strengthen their financial position. That said, the vast majority of agritourism farms at this period in time are organic farms and this seems to match consumer' demand. So even here, it would seem that an organic approach is appropriate.

Just as with CGIAR, we expect synergies and cross-learning between organic research centres and other sorts of research entities. Increasingly conventional farmers and processors will face new

production constraints as a result of environmental degradation and stemming from environmental laws and regulations. In addition, experiences within individual countries (eg. USDA in the USA, EMBRAPA in Brazil) demonstrate that while organic research is increasing being conducted within these organizations, it often exists as defined research subject in much the same way as crop species or disciplines. Organic agriculture research requires a holistic approach that considers location-specific trade-offs within and between natural and human communities.

While it is not expect that all farmers and processors will adopt a fully organic orientation, the research pioneered by organic farmers and led by the organic research centres proposed in this paper will significantly aid in the transition to more environmentally sound farming. A good example of this is drawn from the USA where organic farmers had, for years, worked on perfecting rotational grazing systems. With research documenting the value of rotational grazing, many conventional farmers then adapted their systems to embrace this strategy.

2.2 Stakeholders and Target Beneficiaries

The various networks and organizations of scientists identified in Appendix 2 will be among the participants in ORCA. Farmer networks will be engaged early on as described in previous sections. Partner organizations will also include universities, aid organizations, civil society groups, international organizations (e.g., UN bodies, global think tanks), private industry, and government ministries.

Target beneficiaries are farmers and processors, particularly those in developing countries who face serious resource constraints. That said, the knowledge generated by ORCA is expected to benefit most food producers, regardless of their chosen mode of production. For example, new knowledge on soil fertility may benefit farmers choosing to produce under conventional systems as well as those who maintain organic practices. This has been the case in many practices pioneered by organic farmers – once viewed as an organic alternative – now widely practiced by a variety of farm types.

Other beneficiaries include researchers who will strengthen their work through connections with networking with other scientists. Through its research results, ORCA is expected to assist extension agents in expanding education and training programmes to include organic agriculture as well as aid certifiers and accreditors in informing the development of organic standards. Consumers will also benefit from ORCA as organic research is conducted on market development and supply chain dynamics to provide access to organic foods and products.

2.3 Project Justification

2.3.1 Existing efforts

There are many efforts underway that focus on developing organic research agendas and expanding the research base within developed countries. In this section, we first present five examples (i.e. USA, Canada, Australia, Denmark, and Switzerland) as evidence that countries are individually coming to the realization that it is necessary to formulate research agendas and develop new frameworks to carry out high priority organic research. We also note efforts in European institutions and among selected universities to pursue organic research agendas involving

developing countries. These transnational efforts generally lack the resources necessary to promote global organic agriculture research priorities.

In the United States, the Department of Agriculture provided a grant of over USD1.5 million to establish The Organic Agriculture Consortium (OAC) in 2000, the purpose of which was to network university scientists to better assist farmers through integrated multidisciplinary research, education, and outreach programmes. At the same time, the Scientific Congress on Organic Agriculture Research (SCOAR) was launched to facilitate collaboration between scientists nationwide on organic research and information-exchange. In 2007, SCOAR published a National Organic Research Agenda (http://www.ofrf.org) which was largely adopted by the advisory board to the USA Secretary of Agriculture on research in 2008 (http://www.ree.usda.gov/nareeeab/reports030708/organicag0308.pdf). Later that same year, the US Congress approved, as part of the farm bill legislation, a historic USD66.4 million for competitive research grants for organic agriculture research through the year 2012.

The Organic Agriculture Centre of Canada (OACC) was established in 2001 and conducts research and education on numerous topics, oftentimes in concert with Canadian universities. The research agenda for OACC is driven by an Expert Committee on Organic Agriculture through which priorities are developed annually within eight organic research areas: animals, plants, soils, ecological systems, health and food quality, marketing, policy and sustainable agriculture and rural communities. The Canadian government has supported OACC's work by approving a grant for USD604 000 through their Advancing Canadian Agriculture and Agri-Food Program. As part of this grant, OACC will develop an Organic Research Needs Database and distribution network to support joint organic research between farmers, processors, extension specialists and academics. OACC's completion of an assessment for organic cereals in 2009 is a step toward the development of this database and network. Through this assessment, they identified the top 20 research needs within each of the OACC research areas; the top rated needs for organic cereals included soil fertility and crop rotations, ecological interactions in rotations, soil quality and quality and nutrition of organic field crops. Since 2004, the government agency Agriculture and Agri-Food Canada has provided USD6.4 million to support 74 organic projects, primarily for development of locally-based markets.

In Australia, the Rural Industries Research and Development Corporation (RIRDC) of the Australian government has been the major investor in organic research and development. One of the 2009-2010 RIRDC research priorities for organic is to develop an Australian Organic Hub through which gaps in organic research topics can be identified and collaborated upon among research institutions and partners. The RIRDC has also produced three five-year plans for organic research and development. In producing these plans, the latest of which covers the years 2006-2011, input is solicited from conventional and organic agriculture, organic supply chain participants, researchers and food and agriculture investors. The current plan (http://www.rirdc.gov.au/programs/established-rural-industries/organic-systems/r&d-plan/r&d-plan_home.cfm), which is implemented in partnership with the Organic Federation of Australia (OFA) calls for investment in farming systems, supply chain issues, and the agro-ecological performance of organic farming systems, with high priority research needs cited in grains, dairy, horticulture, and meat production. A key feature of the 2006-2011 plan is that it seeks co-investment in its programme from the commodity and food sectors.

In Denmark, the Ministry of Food, Agriculture and Fisheries has established ICROFS. The centre

was established in 1996 as DARCOF and in 2008, it was given an international board and a mandate to operate and collaborate at international level. It has been established as a 'centre without walls' to initiate and coordinate strategic and user-oriented research in organic farming and food systems to promote organic farming and promote the sustainable development of the farming and food system as a whole, including environment, climate, nature, rural development and animal welfare. The research programmes have focused on: 1996-2000: Production and Environment; and Research Development and Communication; 2001-2005: Effective production; inherent and organic qualities of organic foods; 2006-2010: International research cooperation and organic integrity.

The current ICROFS programme has a total budget of USD33.5 million and includes 15 national research projects involving 18 institutions (180 researchers). ICROFS coordinated the EU funded European Research Area (ERA)-Net CORE Organic (described below) which launched 8 transnational organic research projects (2007-2010) and is heading the preparations for a CORE Organic II. With its new international mandate, ICROFS will be looking more into research collaboration addressing research issues related to organic food systems in developing countries.

Since 1973, FiBL has served as the main European research centre in organic agriculture. It employs 125 staff and "research laboratories" in more than 300 farms in Switzerland and has created service hubs in Germany and Austria in 2001 and 2004, respectively. FiBL has co-founded research institutes in the Czech Republic and Luxembourg and has numerous projects in Eastern Europe, India, Latin America and India, which promote the development of organic research services as well as advisory services. Recently, FiBL has started investigating the feasibility of organic agriculture in Kenya, India and Bolivia through the establishment of long-term trials. Over USD4.4 million was spent in 2006 on research projects and over USD2.6 million on international cooperation. In 2008, FiBL was involved in 17 EU projects where it continues to play an important role, such as the QualityLowInputFood (QLIF) project.

Federal and university commitment to organic agriculture has increased significantly in many countries in recent years, as the market share for organic products has increased. In most cases, this has been realized within the existing research structure. For example, the Brazilian Agricultural Research Corporation, EMBRAPA, now has scientists at 27 research centres working on a common project entitled "Scientific and technological basis for the development of organic agriculture in Brazil" with an investment of more than USD900 000". In France, the French National Institute for Agricultural Research (INRA) includes research efforts on many aspects of production and processing issues in organic systems. Likewise, the Trenthorst Institute (Germany, within the Federal Agricultural Research Centre) includes systems-level comparisons and also a substantial effort in organic livestock and dairy production. In the USA, grant funding from the United States Department of Agriculture (USDA) Integrated Organic Programme (directed primarily to universities and other stakeholders in organic agriculture) increased more than four-fold from 2008 to 2009, to more than USD17 million. This is in addition to an increasing number of research projects conducted by the USDA Agricultural Research Service. A number of land-grant universities (Iowa State University and North Carolina State University are examples) have also developed faculty positions and on-going research programmes in organic systems.

2.3.2 Biodynamic Research

When dealing with organic agriculture support systems such as research, another management approach should be considered: biodynamic agriculture. While, for policy and support purposes,

biodynamic products have to fulfill organic standards, biodynamic agriculture has a distinct paradigm and thus, specific research requirements.

Biodynamic agriculture considers both the material and spiritual context of food production and works with terrestrial as well as cosmic influences. The influence of planetary rhythms on the growth of plants and animals, in terms of the ripening power of light and warmth, is managed by guiding cultivation times with an astronomical calendar. All organic principles apply to biodynamic farming, gardening and forestry. A specific feature of biodynamic agriculture, inspired by Rudolf Steiner (1861-1925) is the regeneration of the forces that work through the soil to the plant by using compost and spray preparations from naturally fermented organic substances in minute doses to soils and crops. The aim is to harvest crops which not only have substances but also vitality. The use of biodynamic preparations has been shown to have substantial restoration power on exhausted soils and biodynamic animals seem to have better resistance to infection.

Biodynamic agriculture research focuses on two main features: the biological character of fertilization; and the dynamic effects of natural forces. From the late 1920s in Germany and India, and the 1940s in the UK and USA, biodynamic agriculture pioneered soil fertility research, as a pre-condition for healthy plant, animals and humans. The promulgation of the European Regulation for organic farming and related subsidies and incentives have shifted efforts, especially in academia and research institutions, to organic agriculture, leaving behind the biodynamic paradigm that views the farm as a “living organism”.

A salient feature of biodynamic research is soil health and the vitality of farm products. Current (though decades-long) initiatives in biodynamic research include long-term experiments comparing conventional, organic and biodynamic fertilization, mainly in temperate agro-ecosystems. The evaluation of the effect of biodynamic preparations on productivity, and experimentation of new preparations, are presently undertaken with regards impact on compost, soil micro-organisms, root growth and plant health. A unique aspect of biodynamic research is its attention to formative forces that determine seed germination, plant formation, storage duration, food inner quality and ultimately, health. The relatively novel concept of “vitality” is measured (and eventually mainstreamed) through copper-chloride cristallization methods. Besides developing new methods such as picture formation methods (or bio-cristallization), biodynamic research investigates new concepts, such as “vital quality” and “warmth”, derived from growth and differentiation of life processes.

Innovations and perspectives brought by biodynamic research, based on seeking balance and integration between nutrients, soils, plants and animals, and ultimately the intimate connection between growing methods, nutrient values and health, are likely to lead towards an effective application of the holistic approaches necessary for the “renewal of agriculture”.

The proposed research system ought to include a space for a different approach to reality and even the scientific approach. The recent debate within the scientific community on quantum mechanics is unlocking a new vision on the non-locality of the physical world, which may require abandoning fundamental convictions.

Main Biodynamic Research Institutions

- ✓ Agricultural Section at Goetheanum, Switzerland: http://www.sektion-landwirtschaft.org/560.html?&L=1
- ✓ Institute for Biodynamic Research (IBDF), Darmstadt, Germany: http://forschungsring.de/index.php?id=root_ibdf_en
- ✓ University of Kassel/Department of Biodynamic Agriculture, Germany: http://www.agrar.uni-kassel.de/bdl/?language=en&c=1
- ✓ Biodynamic Research Association Denmark (BRAD), Denmark: http://www.organicfqhresearch.org/research_projects/research_brad.html
- ✓ Louis Bolk Institute/Department of Healthcare and Nutrition, Netherlands: http://www.organicfqhresearch.org/research_projects/research_louis_bolk.html
- ✓ Biodynamic Research Institute, Sweden: http://www.jdb.se/sbfi/default.asp?page=55
- ✓ Michael Fields Agricultural Institute, USA: http://www.michaelfieldsaginst.org/
- ✓ Biodynamic Farming and Gardening Association, USA: http://www.biodynamics.com/
- ✓ Biodynamic-research.net: http://www.biodynamic-research.net/
- ✓ Food Quality and Health Association (FQH), 14 European members: http://www.organicfqhresearch.org/index.html
- ✓ Biodynamic Association of India: http://www.biodynamics.in/

2.3.3 Need for Developing Country Organic Research Coordination

No large-scale efforts to devise an organic research agenda and implementation strategy, such as described in the previous section, have been undertaken by developing countries. However, there are nascent and rapidly developing efforts in Africa, Asia, and Central and South America.

Efforts have been undertaken either by individual countries or in collaboration with institutions and organizations in developed countries. There are also a small number of collaborations between developed and developing countries, most of which are bilateral in nature, established between a single organization in each country rather than the development of a network. The Swedish International Development Assistance, through Grolink, has established collaborative efforts on exportation of organic products via the Export Promotion of Organic Products from Africa (EPOPA) project that operated for 10 years in Tanzania and Uganda. These and other local initiatives led to the establishment of the National Organic Agriculture Movement of Uganda (NOGAMU), the Tanzania Organic Agriculture Movement (TOAM), and the Kenya Organic Agriculture Network (KOAN), each providing technical and marketing assistance in their respective countries, as well as the basis to establishing research and networking services.

Despite the paucity of funding for organic research, several G77 research institutes and dozens of scientists have persevered, organizing credible, scientifically significant programmes in the developing world. For example, the Kenya Institute of Organic Farming (KIOF) facilitates adoption of organic agriculture in sub-humid areas. KIOF (http://www.kiof.org) established in

1986, facilitates adoption of organic agriculture in sub-humid areas. KIOF maintains five regional demonstration centres and has published several books on smallholder organic farming practices. In 2007, KIOF initiated, along with several other research institutes, a long-term farming experiment in which conventional and organic production of maize and vegetables are compared.

As another example, Cuba is a country in which nearly all of the agricultural research is oriented to organic agriculture, including 220 reproduction centres producing lines of bio-pesticides. As well, the country has contributed greatly to the understanding of organic citrus production. The crisis in the late 1980's led Cuba towards structural changes in order to find an alternative to fossil-fuel based agricultural inputs and promote ecological agriculture as a necessary path towards food self reliance. Towards the end of the 1990's, Cuba could count on a well developed research capacity and scientific skills in organic (or semi-organic) agriculture, with 221 research and development centres and 46 centres of higher education that employ over 60 000 workers. While prior to 1990, agricultural research was highly disciplinary, with institutes specializing in particular crops and commodities, a process of institutional consolidation was started in 1995. The aims, objectives and strategies of the 19 research institutes of the Ministry of Agriculture were revised to establish a model network: the National System of Agricultural Science and Technological Innovation (SINCITA). In 1994, the Cuban Association of Organic Agriculture (ACAO) was founded, largely by a group of applied researchers. ACAO now has local offices in most provinces and each member is active in his or her own area of work. In 1999, ACAO achieved formal recognition by the Cuban Government and became the Grupo de Agricultura Orgánica (GAO). In 1998, the Government has launched a national programme for biological pest control. The Centres for the Reproduction of Entomophages and Entomopathogens (CREE) produces beneficial insects and biopesticides, as well as bio-preparation plants; in 1998, there were 222 CREEs situated on farms or in higher education establishments. The Soils Institute and its Basic Units of Worm Culture provides ecological soil fertility inputs.

Organic agriculture is a rapidly growing sector in India. In 2003, India had only 73 000 ha of cultivated certified organic land; by 2007, this figure grew to 311 000 ha, with an additional 217000 ha of land under conversion to organic management. Neighbouring countries like Sri Lanka, Thailand, Nepal, and Bhutan have started organic programmes. While these efforts are now focused on standard setting and market facilitation, in the future it is hoped that developing countries will augment their programmes to encompass research. Since 2003, the Indian Council of Agricultural Research (ICAR) is implementing a network programme on "Development of Technology Package for Organic Farming" to develop production packages, conducting applied and strategic research and documenting know-how in organic agriculture. Many institutes established by ICAR and its 26 agricultural universities conduct research on various aspects of organic horticultural crops. The National Centre of Organic Farming was created in 2004 by the Ministry of Agriculture as a service provider for organic farmers. This Centre has six regional centres of about 100 staff each with the mandate of providing technical training and facilitating organic certification. The federal Horticulture Mission scheme provides funds to State Horticulture Departments which in turn reach-out to farmers with regards subsidies, credit, planting material and know-how, including subsidies for organic agriculture. Organic subsidies were provided on a pilot basis (~USD9 per hectare) till 2007 and credit schemes for organic agriculture are now being explored through the National Agricultural Bank for Rural Development. Until 2006-07, the total support to organic agriculture was USD80 000 per year in order to: develop infrastructure for conversion to organic management, compensate for potential losses, conduct feasibility studies and prepare guidelines on organic practices.

2.4 Past and Related Work

Existing organizations and institutes continue to actively pursue organic research and through which it will be critical for FAO to coordinate with to successfully establish an organic research network; examples of such institutes are provided to highlight the depth and breadth of existing efforts to pursue organic research agendas. In 2003, the International Society of Organic Agriculture Research (ISOFAR) (http://www.ISOFAR.org) was organized by Institute of Organic Agriculture (IOL) in Germany and the Research Institute of Organic Agriculture (FiBL) in Switzerland. The goals of ISOFAR are to promote research in organic agriculture by facilitating global cooperation in research and education and knowledge exchange. The 400 individual scientist members of ISOFAR are from all parts of the globe, although the majority resides in Europe where ISOFAR is based. Together with IFOAM (http://www.IFOAM.org), ISOFAR facilitated a discussion among scientists from European countries to envision an organic research agenda for the next 20 years, which was published in 2008[18]. At this time, ISOFAR may be the most significant international organic research network in existence in that, despite a predominately European membership, the design and purpose of the organization is to be a global network. It is to be noted that while ISOFAR is a network of organic scientists, it is not undertaking research as such.

Cultivating the Future
Modena, Italy June 2008

The 16th IFOAM Organic World Congress, the 2nd ISOFAR Conference, and the 4th QLIF workshop were held concurrently with 1,700 people from 108 countries in attendance.
Over 400 scientific papers were submitted to ISOFAR in preparation for the conference. A two volume set of these papers, all of which are 4 pages long, consistently formatted, and organized by topic is available for purchase (http://www.fibl.org).

The Organic Food Quality and Health (FQH) association was launched by four European Research Institutes in 2003 to encourage, coordinate, and disseminate research in the field of organic food and health (http://www.organicfqhresearch.org). The research institutions within FQH work on research concepts and on collective or bilateral research projects. In 2008, FQH published a research agenda for 2008-2011, available on the website, that describes high priority organic research needs in the area of organic food quality and health.

The European Council has, on several occasions, recognised that organic agriculture improves Common Agricultural Policy. In 2004, "Coordination of European Transnational Research in Organic Food and Farming" (CORE Organic) was launched by the European Commission as part of the ERA-Net scheme to improve coordination between national research activities. The overall objective of CORE Organic has been to enhance the quality, relevance and utilisation of resources in European research in organic food and farming by gathering a critical mass and establishing a joint research programme. Over 36 months, 13 national partners in 11 countries participated in transnational research in eight high priority areas supported by a budget of close to USD1.6 million (http://www.coreorganic.org). In October 2007, CORE Organic partners met and developed an

[18] Niggli, U., A. Slabe, O. Schmid, N. Halberg and M. Schluter, 2008. Technology Platform "Organics", Vision for an Organic Food and Farming Research Agenda to 2025, Organic Knowledge for the Future. IFOAM/EU, ISOFAR.

agenda for future joint activities, identifying high priority research to improve coherence and coordination across European research entities. Preparations for a CORE Organic II are presently on-going.

An open access database on organic research, Organic Eprints (http://www.orgprints.org), was established in 2002 by the then DARCOF (Danish Research Centre for Organic Farming), now ICROFS (International Centre for Research in Organic Food Systems). Organic Eprints is now jointly being developed and maintained by ICROFS (Denmark), FiBL (Switzerland) and BOL (the German Federal Organic Farming Scheme). The database is designed as a global service; currently, it counts 10 000 registered users and 100 000 visitors each months. Presently, the majority of the 8 000 papers in the database are of European origin or relevance and researchers worldwide are encouraged to submit papers to the database. There are plans to expand the database and establish a facility in Spanish in addition to the English and German facilities.

While these transnational efforts to determine global research priorities have been primarily organized in Europe, other parts of the world are beginning to undertake similar activities. In 2001, the Asian Research Network of Organic Agriculture (ARNOA) was established and for many years it has held an international conference to discuss regional concerns (e.g., 2004 International Conference on Organic Rice, Korea). In 2004, IFOAM established the IFOAM Africa Office (IAO) to help facilitate growth in organic agriculture on that continent. Among other things, IAO facilitates the exchange of information on the different experiences with organic production across African nations and a database of these experiences is under development. The Association for Strengthening Agricultural Research in Eastern, Central, and Southern Africa (ASARECA), while not focused on organic agriculture, is nevertheless an important effort to unify and strengthen the research enterprise in Africa. A Research Network for Organic Agriculture in Africa has been established in May 2009, and sponsors are expected to strengthen collaborative efforts in the region.

2.5 FAO's Comparative Advantage

The long-term objective of the FAO Organic Agriculture Programme is to enhance food security, rural development, sustainable livelihoods and environmental integrity by building capacity in member countries in organic production, processing, certification and marketing. The FAO website (http://www.fao.org/organicag) documents the evolution of FAO work in this area and provides access to essential documents. Typically, FAO work consists of development projects that focus on a country or region. FAO is well poised to work in concert with the proposed organic research centre alliance (as it now does with the CGIAR system) along with other UN development agencies (e.g., UNEP, IFAD, UNCTAD) and international and national partners. This kind of partnership allows the proposed centres to focus on research and shift the main burden of development work onto FAO and other development agency partners.

In April 2009, the FAO Committee on Agriculture "stressed that an ecosystem approach be adopted in agricultural management in order to achieve sustainable agriculture, including integrated pest management, organic agriculture and other traditional and indigenous coping strategies that promote agro-ecosystem diversification and soil carbon sequestration... Several Committee members noted the need for capacity building in new approaches and incentives to producers. The Committee endorsed the proposal that public and private investments be made in agro-ecological

research, at both national and international levels[19].”

FAO hosts the Secretariat of the Science Council of the Consultative Group for International Agricultural Research (CGIAR) and the Secretariat of the Global Forum for Agricultural Research (GFAR) and has the mandate to assist advancing agricultural research under all aspects.

Through its 10 years of consecutive work with the global organic community, including NGOs and farmers' organizations and its mandate to work with governments on agricultural policies and capacity building, FAO is in an ideal position to host the ORCA alliance and link organic and non-organic research institutions, as well as northern and southern partners, in order to advance organic agriculture in developing countries.

3. PROJECT FRAMEWORK

3.2 Impact

ORCA's intended impact can be summed up by its vision statement:

Organic research:
mainstream, robust, and valued by
farmers and policy-makers worldwide
by 2025.

The ORCA vision is one of a future in which organic agricultural research is pervasive, rigorous, and meaningful. Strategic planners suggest that prospective organizations, from the start, develop a clear and compelling vision with a long-term year goal and a clear finish line. Well known examples of such visions from the corporate world include: Nokia “Connecting 5 billion people by 2015” and Microsoft “A personal computer in every home, running Microsoft software”. In 2000, the CGIAR System adopted a new vision “A food secure world for all”.

We see a future in which organic management systems prevent many of the vexing problems we face today. Through organic agriculture, a sustainable foundation for long-term gains in productivity will be achieved. Leading scientific journals of all sorts will regularly publish articles on organic agricultural systems. Universities will support training and research in organic agriculture and promotion systems will be recalibrated to value transdisciplinary work. Research produced within developing countries will be of a high quality and on par with that produced by developed countries. Vibrant research networks, supported by cutting edge communication technology, will stimulate novel collaborations. Farmers and food processors in all regions of the world will benefit from the research and improve their production systems and livelihoods.

As documented in Section 2.3, funding for organic agricultural research is very low, and funding and research are geographically concentrated in developed countries. Most peer reviewed journals and universities are just beginning to include organic agriculture in their work. Therefore, it is fair to characterize organic agricultural research as a small, albeit emerging, alternative within the conventional scientific enterprise. This is the context within which the vision for the Organic Research Centre Alliance (ORCA) was developed.

[19] Committee on Agriculture. 21st Session. 2009 Report.

3.2 Outcome and Outputs

3.2.1 Outcome

To achieve its vision, ORCA is designed to produce the following outcome:

A network of research centres collaborating
to produce high quality research in organic agricultural systems
relevant to the needs of farmers and processors
in developing countries.

The above outcome captures the central purpose of ORCA. It is the means by which we achieve our vision. While this statement is somewhat general in nature, it conveys some important organizational principles:

- First, the organization is a network. A single research centre producing high quality research does not accomplish the mission. The organization is designed to promote high quality research through collaborative arrangements between research centres formally within ORCA as well as through partnerships with research institutes and networks outside of the system.
- Second, the focus is on developing countries. This does not exclude the participation of scientists and research centres in OECD countries. In several ways, their involvement is integral to the construction of the organization. But the focus is on building the scientific capacity in the developing world to undertake research on problems confronted by farmers and food processors in those regions, most of them challenged by significant resource constraints.
- Third, the research must be relevant to the needs of farmers and food processors. From inception, all research projects will be evaluated and chosen for their applicability to the problems faced by food producers. This requires scientists to co-create research agenda with practitioners to ensure the relevance of the research enterprise and to articulate the justification for their work. This does not prevent scientists within the organization from competing for external funding to support very basic research, but it is not the primary function of the centres and must not dominate the work of the organization.
- Finally, the needs of food processors as well as farmers are considered. Organic processors confront issues of food safety, quality, materials, processing, and storage, among other things, that require scientific investigation and support.

The research of the organization is structured around major problems of international significance. ORCA, acting as one entity, albeit with many parts, will:

- Identify organic agriculture research priorities and provide a framework within which research collaborations can be built;
- Undertake high priority organic systems research, including on-farm participatory, whole systems, and multi-farm studies;
- Utilize transdisciplinary research methodologies, when possible, to facilitate collaboration among scientists and organic farmers, processors, civil society and private enterprise;
- Promote scientific exchange and cooperation between industrialized and developing countries and between centres within the system;
- Create a shared understanding of organic agriculture as an ecological and socially-just approach for managing agricultural and food systems;
- Pursue knowledge to understand better the complex interactions and long-term effects of organic practices on agro-ecosystems and communities; and

- Engage in the analysis of research findings across centres and regions to develop a comprehensive understanding of the impact of broad-scale adoption of organic agriculture and identify more sustainable pathways in the face of rapid change.

3.2.2 Outputs

ORCA is a scientific organization, and as such, the output expectations are consistent with those of all high quality research institutes and universities. These outputs are quantifiable and enable measurement of the organization's performance.

ORCA is expected to advance knowledge in organic agriculture by:
- Publishing papers in peer-reviewed journals;
- Presenting research results at significant congresses;
- Educating constituencies through publication in 'grey'(practitioner-oriented) literature and websites and responding to media inquiries;
- Training and mentoring young scientists; and
- Competing successfully for external funding.

The outputs, by organizational objective, that ORCA is expected to achieve are the following:.

Output 1: Operational procedures are developed for the ORCA system and for Centres of Excellence
This will be achieved through the following activities:
1.1. Develop the operational procedures for the application of research consortia for ORCA's support;
1.2. Develop a process for selection of ORCA host institutions and partner institutions;
1.3. Develop a monitoring scheme for ORCA centres;
1.4. Develop the ORCA funding policy;
1.5 Develop the terms of reference and mandate of the Secretariat and Facilitation Board.

Output 2: The ORCA Secretariat established, managed and administrated efficiently
This will be achieved through the following activities:
2.1. Establish the ORCA Secretariat and Facilitation Board;
2.2. Select, coordinate and monitor the ORCA host institutions and partners;
2.3. Raise funds and develop project proposals tailored to specific ORCA donors and centres;
2.4. Support ORCA centres in preparing competitive research calls;
2.5. Prepare regular ORCA system-wide progress reports and report to donors, as required.

Output 3: A support system (a virtual laboratory) has been created for the exchange of organic research results and for facilitation of networking among research and development institutions involved in organic development relevant to developing countries
This will be achieved through the following activities:
3.1. Establish and maintain interactive ORCA website(s);
3.2. Establish and maintain chat rooms/online discussions platforms;
3.3. Establish and maintain web-based file sharing facility;
3.4. Establish a news and result sharing web-facility;

3.5. Establish a call centre for guidance on organic research, training and development resources.

Output 4: Collaboration and coordination is strengthened among stakeholders in organic research and a common organic research agenda for developing countries is established and revised regularly

This will be achieved through the following activities:

4.1. Convene biannual conferences of ORCA centres;
4.2. Develop and implement a process for establishing and updating a global organic research agenda;
4.3. Revisit organic research epistemology, according to formal and informal research experiences;
4.4. Develop and implement a strategy for participatory farmer-based quality assurance of research agenda and research programmes;
4.5. Develop and implement a strategy for developing and strengthening the networking among organic research stakeholders in developing countries, in collaboration with ISOFAR and IFOAM.

Output 5: ORCA Centres of Excellence for research in organic and biodynamic production systems established and active research programmes developed and implemented

This will be achieved through the following activities:

5.1. Establish a management and administration system for each Centre according to the project document and research contract, as developed by the ORCA Secretariat in consultation with stakeholders;
5.2. Develop and implement detailed research programmes according to project document and research contract;
5.3. Develop and maintain a virtual library on the Centre' relevant resource concentration(s);
5.4. Undertake competitive research calls and develop and implement a support system for monitoring and disseminating research from awarded projects;
5.5. Disseminate research results through the ORCA systems and engage actively in networking and exchange of knowledge among ORCA centres and other stakeholders.

3.3 Sustainability

ORCA is designed to be a lasting network of organic agriculture centres of excellence. Institutional responsibility and individual commitment of the ORCA partners lies at the heart of this project. The ORCA principles for centres' selection and support are based on criteria seeking a high degree of system' sustainability, as participating institutions become centres of excellence that can generate their own resources in the global network. Furthermore, the ORCA concept is based on catalyzing existing cooperation and partnerships, rather than "subsidizing" research activities. Also, the administrative capacity of the project is partly provided through the FAO regular programme for organic agriculture. At all levels, co-financing of ORCA services are provided in-kind by capitalizing on existing work force and related infrastructure.

3.4 Risks and Assumptions

Output level

Climate change and environmental degradation is a fact, and on the top of the global development agenda. However, research and development have foremost been focused on aspect of sustainable energy use and less on agricultural-related research particularly relevant for the associated problems in developing countries.

Competition for funds is strong and it will be a challenge to convince donors to prioritize the need for research in long-term sustainable agricultural production systems that hold large potentials for smallholder farmers in developing countries. There are, however, several donor countries in the industrialized countries that are very supportive of organic farming principles in general – in the industrialized production systems as well as in low-input systems. Furthermore several reports from the UN system have been published with statements on how organic agriculture can improve the livelihoods of farmers in developing countries and its overall contribution to a green economy.

Another risk that has to be considered is the limited experience in the institutions becoming centres of excellence in planning and implementing organic research programmes, including competitive calls. This risk will however, be overcome by the twinning approach as well as by support functions of the ORCA Secretariat.

Outcome level

Organic agriculture has in the past been criticized for its low yield potential and decreasing productivity, as compared to conventional agricultural with widespread use of chemical pesticides and chemical fertilizers. While this may be true in intensive agricultural areas as in many industrialized countries, the situation is different in areas where the majority of farmers are resource-poor smallholders, as it is the case in most developing countries. With the agro-ecological methods introduced by organic farming, the soil capacity (e.g. soil fertility and water-holding capacity) and the biodiversity for natural protection of crops, livestock and environment can be improved with time and the performance of organic systems has demonstrated to be more resilient to climate change and variability.

Presently, there is varied support from governments to developing countries. However, with the recent International Assessment of AKST for development, it is expected that more and more attention and interest will be given to organic agriculture for its agro-ecosystem approach and multi-functionality and principles, as mirrored in AKST, including issues such as:

- Degradation of ecosystems limits or reverses productivity gains;
- A fundamental shift in AKST is required to successfully meeting development and sustainability goals;
- Recognition and increased importance to the multifunctionality of agriculture is necessary;
- Accounting for the complexity of agricultural systems within the diverse social and ecological contexts;
- Success requires increased public and private investment in Agricultural Knowledge Science and Technology;
- An interdisciplinary and agro-ecosystems approach to knowledge production and sharing will be important;

With an increasing interest in the potentials of organic systems, it is also to be expected that the risk of not being able to attract high capacity scientific staff is minor and will be decreasing over the next few years. The need for organic research capacity building will be overcome by the twinning

(or triangulation) and the networking approach of ORCA.

Impact level

Financial interest of private companies involved in producing and selling chemical inputs for the agricultural sector may feel threatened by the spreading of organic agriculture. The tradition of governments and extension systems may conflict with the organic farming principles and will have to be overcome by dialogue and open sharing of research results from the ORCA Centres and other organic research initiatives. However, with the growing global environmental concern exacerbated by the climate change and need for mitigation and adaptation as well as the need to create green jobs, there is a growing demand for agro-ecological production methods from more and more political decision-makers, as well as from citizens as a whole. It is assumed that this risk will not be critical, but should be monitored together with other assumptions.

4. IMPLEMENTATION AND MANAGEMENT ARRANGEMENTS

4.1 Institutional Framework and Coordination

ORCA consists of eleven research excellence centres held together by shared concern for organic agriculture, administrative processes, cross-cutting research programmes and funding.

4.1.1 ORCA Focus Areas

Each centre will pursue a research programme in at least one of the eleven focus areas that have been chosen for ORCA inclusion. Five of the 11 focus areas are comprised of the major agro-ecosystems which require radically different farming systems from one to the next, and for which place-based research is appropriate and necessary. The remaining six focus areas are components of the organic system that merit special attention: for example, the concurrent growth in urban and organic agriculture makes this sector attractive for investment.

The 11 Focus Areas of ORCA

Agro-ecosystem

1. Coastal and small islands agro-ecosystems
2. Hilly and mountainous agro-ecosystems
3. Arid and semi-arid agro-ecosystems
4. Humid and sub-humid agro-ecosystems
5. Temperate and irrigated agro-ecosystems

Specialty

6. Seeds and breeds
7. Post-harvest and safety
8. Economics, markets and trade
9. Nutrition, quality, and health
10. Urban and peri-urban systems
11. Climate change

The first five centres represent major agro-ecosystems. We expect that these centres will undertake research of all sorts relevant to that agro-ecosystem within the region described. For example, the Centre on Arid and Semi-Arid Agro-Ecosystems will be based in and conduct research on a variety of organic cropping and livestock systems suitable and relevant to farmers living in arid and semi-arid lands.

The remaining six specialty centres represent major areas where research related to organic systems is needed. There is no constraint on the climatic location of these centres (although we seek to establish at least one in a developing country), as the work could be undertaken in many parts of the world. It is expected that each of the Specialty Centres will conduct research in collaboration with

the centres that are regionally based. For example, the Centre on Nutrition, Quality and Health will need to network and develop research in conjunction with centres in each agro-ecosystem to account for geographical differences in diet diversity and food availability.

4.1.2 Soil Research

All 11 centres will undertake research programmes relevant to soil, an essential topic in organic production and which is largely believed to most differentiate organic from conventional production.

Each of the five regionally-based agro-ecosystem centres will undertake soil research relevant to their region. Specialty centres will also undertake soil research. For example:

- the Centre on Economics, Markets and Trade could explore the economics of sequestering carbon through organic production;
- the Centre on Seeds and Breeds could undertake breeding for salinity and drought tolerance;
- the Centre on Urban and Peri-Urban Agriculture could explore mediation strategies to negate the contamination of soil by ambient air pollutants; and
- the Centre on Nutrition Quality and Health could explore the relationship between soil fertility and crop nutrition.
- Climate Change could explore the contribution of organic management to climate change mitigation by developing adequate methodologies for soil carbon sequestration and developing no-tillage without synthetic inputs.

Although the graphic below suggests that the soil agenda within each centre will be of equal proportion, this is not our intent. In some centres, we foresee soil work consuming a significant portion of the research portfolio. In other centres, it may play a minor role. The extent to which soil research is undertaken by each centre within ORCA will depend on the applicability to an individual centre's role in the network. Despite varying levels of importance placed on soils research within each Centre, we nevertheless expect that the cross-network research on soils will unite ORCA, providing a common ground for collaboration and systematic analysis. Furthermore, we expect that the multidisciplinary and multi-regional perspectives gained from universal involvement in the study of soils will benefit the science of organic agriculture and sustainable agriculture as a whole.

4.1.3 Resource Concentrations

Each of the ORCA Centres is expected to take the lead, within its focus area, in two subjects or 'Resource Concentrations'. For each subject, the designated centre will become the ORCA focal point by:

- collecting and sharing research materials, databases, and models in that subject area with other centres and the public at large (e.g., through a web portal); and
- facilitating communication and collaboration between all ORCA centres in that subject.

11 Centres	22 Resource Concentrations	
Coastal and Small Island	Capture Fisheries	Aquaculture
Hilly and Mountainous	Forests	Agroforestry
Arid and Semi-Arid	Pastures	Livestock

Humid and Sub-Humid	Rice Systems	Fruit and Vegetables
Temperate and Irrigated	Comparative Studies	Cropland Yield
Seeds and Breeds	Protected Areas	Agritourism
Post Harvest and Safety	Pest/Disease Management	Fibres
Economics, Markets, Trade	Commodity Intelligence	Consumers
Nutrition, Quality, Health	Under-Utilized Varieties	Aromatic and Medicinal Plants
Urban and Peri-Urban	Landscaping	Compost and Waste
Climate Change	Agro-energy	Energy Flows

The 22 Resource Concentrations have been placed within ORCA centres most likely to have research interests that encompass, or at least overlap, these areas. For example, the Centre on Coastal and Small Island Agro-ecosystems may be a natural home for a resource library on organic fisheries and aquaculture. As discussed, these subjects are multidisciplinary and can apply to many geographic regions and their placement among Centres is presented as one way to organize these subjects; other configurations are possible

4.1.4 ORCA Centres Functions

Each ORCA Centre has three main functions:
- manage its network of institutions;
- undertake research in its Focus area, including soils and two main subjects; and
- organize and deliver information for 2 Resource Concentrations.

It is to be mentioned that despite a Centre specialization in selected subjects, a holistic approach to research is maintained.

Because ORCA is built upon existing research entities, it is expected that these entities will modify their agendas to accommodate the needs of ORCA and facilitate collaboration with their twin, but this effort will not constitute the entire portfolio of the institute's work. For example, the twining organization(s) working with the regionally-based Centre of Arid and Semi-arid Agro-ecosystem research will maintain some aspects of their current work. In this way, participation in ORCA does not subsume all organic research now underway, nor prevent the development of comprehensive research agenda.

4.1.5 Organizational Design

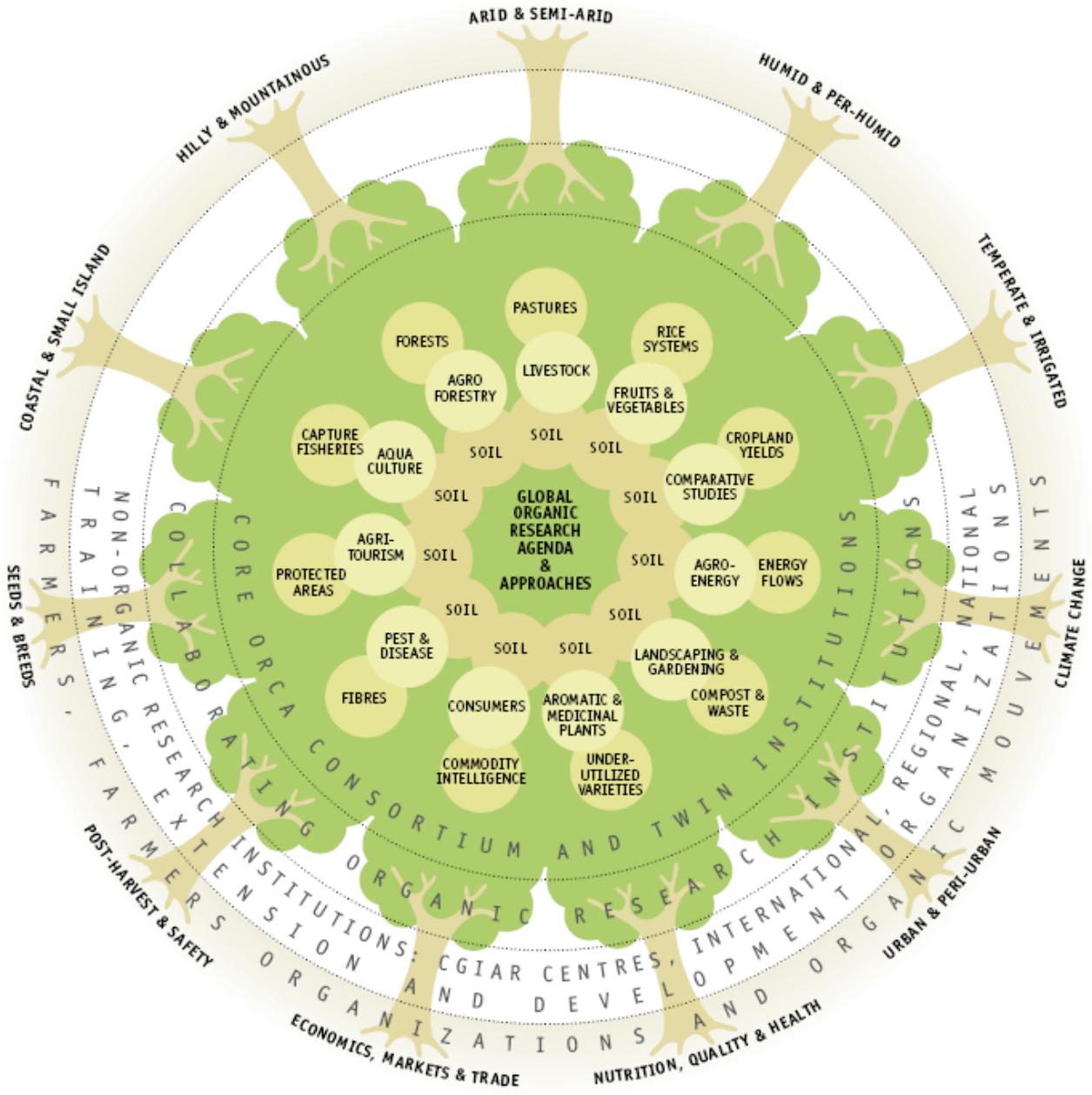
The ORCA system will ultimately comprises eleven centres that undertake holistic research according to their Focus areas (i.e. agro-ecosystem type of specialty subject), as well as being the Excellence Centres of the ORCA system on two main topics (i.e. Resource Concentrations). As described below, soil research is fundamental to all centres. The development of the ORCA global agenda and research approaches will emerge from the collective efforts of all centres. The system-wide work, including tackling of new issues, will be coordinated and orchestrated by the ORCA Secretariat. The graphic below depicts what ORCA could ideally be in 2025.

Each ORCA centre is a network of different types of institutions collaborating in different ways,

and hence having different levels of support and commitment to the system. An ORCA centre has a tree structure whereby: solid roots (i.e. farmers and farmer organizations) and grassroot growth (i.e. organic movements) guide the research agenda and its development; the stem (i.e. non-organic scientific institutions such as CGIAR centres and other international, regional and national bodies) contribute state-of-art science on low-input agriculture and ecology; and the crown (i.e. the core organic institutions and collaborating organic research institutions) generates new science or ORCA fruits (i.e. the two Resource Concentrations, soil research and other research outcomes).

Farmers are essential partners for on-farm research. The organic movements are valuable contributors to farmers research needs. Non-organic research institutions have expertise relevant to organic practices, such as low external input systems and integrated ecosystem management. Training and development institutions, although not part of the ORCA system support, are key to delivering research and building-up fertility.

VISION OF ORCA IN 2025



4.1.6 Networking and Twinning

In the case of the five geographical focus areas (e.g., arid and semi-arid agro-ecosystem), a regionally-based agro-ecosystems research entity in a developing country is designated and joined together with one or several research entities – a 'twin' – most likely from the industrialized world and not necessarily from that same agro-ecosystem – or a consortium of research entities. The purpose of this twinning or consortium establishment is to strengthen the regionally-based entity in the developing country through research collaboration and support.

As shown in the graphic above, each ORCA centre is a pole of cooperating institutions within a larger network of networks. While each network will have its own structures and dynamics, the global system is supported and coordinated by the Secretariat. It is important to point out that the graphic illustrates the diversity of topics and focus areas in need of research; however, the diagram should not be perceived as a fixed structure in terms of division of research but rather as a vision of how research topics could be organized.

ORCA Excellence Centres are composed of a consortium of at least two research entities working on a given focus area and/or two institutions that are twinned to facilitate collaboration and concentrate resources. At least one of the cooperating entities will be based in a developing country.

The twinning of entities to address these main focus areas does not imply that collaboration with other organizations is not encouraged or expected. Triangular partnerships and potentially other types of North-South and South-South collaborations are also foreseen.

To ensure that the impact of ORCA is not limited to the host institutions of centres there should be a clear obligation to spend a certain ratio (e.g. 50 percent) of the ORCA funds allocated to one centre, on competitive calls which will enable other institutions in the South to benefit from the support. The evaluation of competitive calls should be undertaken by a board with members from 2-5 institutions.

4.1.7 Flexibility in Design

Centres may articulate other resource concentrations than described as we expect research needs to evolve over time. It is also critical to note that the organization and activities of ORCA do not supplant current research, development, and training activities in organic agriculture. As discussed previously in this document, there are a growing number of efforts in organic agriculture research and outreach, in both developing and industrialized countries. Some of these efforts are national (or even regional). Others are transnational, most often bilateral efforts between countries focusing on a specific aspect of organic agriculture. The explicit functions of ORCA as proposed are to connect these efforts and build-upon these in a coordinated and target oriented-manner.

4.1.8 Secretariat and Facilitation Board

The ORCA Secretariat will have a small central administration office based in FAO's headquarters in Rome, Italy. The Secretariat is responsible for overseeing centres collaboration; budgets and annual disbursement of funds; public communications; Facilitation Board services; and donor solicitations. The staff is small and consists of one professional staff member responsible for overall

administration and programming, one professional staff member responsible for fund raising, proposal development and financial planning; and one person responsible for administrative support.

Facilitation Board Membership	
5	Scientists (at least one of whom is a soil scientist)
3	Farmers (involved in crop, livestock and fish farming)
2	Processors
1	Organic certifiers
2	Agribusiness representatives (retail, marketing, trade, input suppliers or machinery dealers)
2	Representatives of civil society organizations (at least one of whom is focused on issues of development and poverty alleviation)

The Facilitation Board will be convened virtually several times a year. The Board is required to:

- Determine research priorities for ORCA and assist the Secretariat in soliciting contributions to support the priorities;
- Review and advise the Secretariat on ORCA publications, websites, and other communications to ensure that such materials are consistent in design, integrated across centres, widely disseminated, and useful for various constituencies;
- Annually review Centre budgets and work plans and provide advice, particularly with regard to potential collaborations across centres and with other contributing organizations.
- Every five years, publish a formal public evaluation of ORCA, including detailed reviews of the individual centres;
- Select Centre projects for receipt of the Soil Science Challenge Fund annual awards;
- Assist the Secretariat in other functions, as requested.

Members of the Board are appointed by the FAO and serve five-year staggered non-renewable terms. The Board has 15 members from 15 different countries, at least 7 of whom from developing countries. Board appointments are made to ensure geographic diversity, as well as a range of expertise and perspective. Categories of appointment are specified. Members of the Board are prohibited from having a financial relationship with any of the individual centres that form ORCA (e.g., staff member, consultant).

Each of the centres will designate a liaison from that network to the Facilitation Board, to participate, as invited, as a non-voting advisor.

The Facilitation Board serves to elevate partnerships with non-governmental and civil society organizations, as recommended by the FAO Policy and Strategy for Cooperation and stressed by member governments in the World Food Summit Plan of Action.

The Secretariat will be responsible for convening a biannual forum of ORCA Centres to facilitate:

- integration of the activities of the various Centres;
- adoption of strategies that will allow the enterprise as a whole to progress in concert;
- cultivate emerging leaders within ORCA to transition to leadership positions (and replace "founders" when appropriate);
- interaction with organic research leaders throughout the various networks within which

ORCA operates to ensure cohesion and to invite their full participation and ownership of ORCA; and (5) review and devise alternative research approaches.

4.2 Strategy/Method

4.2.1 Transdisciplinary and Participatory Research

The preferred method for ORCA programmes is transdisciplinary research, defined as participatory research that, from inception, is conceived of and undertaken by extremely diverse teams, including non-scientists, who tackle complex problems with the goal of finding practical solutions. Such research is structured to accommodate and integrate different kinds of knowledge produced from various sectors such as laboratory scientists, field researchers, farmers, food processors and others.

Transdisciplinary research methods are favoured for several reasons:

- First, the best ideas are often produced by diverse teams. Farmer engagement in organic agricultural research is particularly desirable, since traditional and indigenous knowledge is scarcely documented yet crucial for ecological evaluations (e.g., genotype, phenotype, site, climate and management interactions of plants and animals).
- Second, keeping analyses at a realistic level, engaging in expert dialogues, and utilizing on-farm and field research, ensures that research results are feasible for adoption.
- Third, research is not, in itself, sufficient to catalyse wide-scale adoption. Engaging various stakeholders in the research programme will accelerate implementation of results by promoting joint learning and ownership.
- Finally, participatory research can contribute to capacity building for research collaborators, from small community-based organizations to national government research institutes and universities.

It would be a mistake to assume that transdisciplinary work is synonymous with that of development. The mission of ORCA is to produce high quality research. If this distinction is not maintained, it is possible that ORCA-based scientists would pursue development work because of attractive funding opportunities. Development work is necessary, of course, but it must not distract from the central mission of the organization. The development community, including the staff of inter-governmental agencies such as FAO, UNEP, UNCTAD, IFAD, UNDP, WHO and others should be kept informed of ORCA work so to enable them to undertake corresponding development work. We include this precautionary statement because recent critiques of the CGIAR system have found that insufficient funding created an incentive for scientists to take on the dual role of development practioners, leading to an erosion of the core research programme.

In addition, while there is a great need for extension and training specific to organic agriculture, this is not a role that ORCA will play explicitly. Rather, ORCA will work collaboratively with other networks and institutions that have a specific mission to carry out these activities and extend production knowledge. This is a critical connection that must be pursued to ensure that the research results realized through ORCA move from the "laboratory" into the field and are adopted and tested across a variety of geographic areas and production systems. For example, through an online networking site and other possible information technologies, key research findings from ORCA could be passed onto organizations in a format usable for their existing training of farmers or trainers programmes or for field trials. We expect training institutions to partner with ORCA

centres in order to develop curriculum and extension work that uses and disseminates research results. This networking approach is the mechanism by which research from ORCA will reach and be applied in the field and throughout the supply chain.

4.2.2 Farmer-Scientists

Farmers are capable of undertaking research on their farms and some ORCA projects may be entirely farmer-led. Under our vision, farmers are expected to be co-producers of knowledge. This may be done through their own work or through a partnership with technically-trained scientists who are carrying out ORCA-sponsored research. Many progressive farmers are experienced in research design, as success has come from their efforts to learn and adjust production methodologies over time in a series of informal experiments. This concept of farmer-scientist has been taken up across the world. In Bolivia, for example, potato farmers have been trained to design and manage experiments and carry out basic statistical interpretation of results; on the other side of the world, potato growers in the Netherlands formed an association to monitor nematode infestations and experiment with alternative control methods. In Germany, a network of biodynamic farmers has undertaken systematic on-farm plant breeding to develop high quality varieties that perform well in organic systems; success has been so great that many of these varieties are now registered with the European Union and available to farmers worldwide.

These efforts, and many more like them, are well documented and validate the concept of farmers as scientists. This practice needs strengthening and expansion. In addition, existing indigenous knowledge is an under-utilized resource and should be cultivated as an element of organic research at ORCA Centres. Centres should find ways to compensate farmers for participating in ORCA research, a tacit acknowledgement of their role as research partners. In addition, we expect that food processors may take on a similar role as farmer-scientists by undertaking research related to processing, waste and spoilage, and supply chain dynamics alongside Centres.

4.2.3 Virtual Laboratories

Launching and maintaining an active alliance of Centres and an extended network of scientists and stakeholders will require support systems that allow sharing of information and ideas in real time. To facilitate this, ORCA will acquire appropriately tailored Internet and web-based systems to allow participants to communicate and organize. Interactive websites, chat rooms, on-line discussion facilities, file sharing, and voice-over-internet and teleconferencing options will support the 'ORCA virtual laboratory.'

Specifically, an online networking site or virtual community of practice will be established where ORCA Centres will share their research and connect with others through workgroups organized around either focus area or resource concentration. Workgroups will be able to collaborate on documents, post to forums and connect with users from other ORCA Centres through the ORCA webportal. Similar to the benefits of many social networking sites, the ORCA online community will allow research results to be shared quickly and facilitate the generation of new research ideas and projects. A protocol will be developed for the recognition of the authors of innovations in order to facilitate early and safe sharing of new ideas. In developing this online community, existing technology will be used to complement our network; for example, Organic.Edunet (http://www.organic-edunet.eu/organic/index.html), an online resource that provides content (e.g.,

news, events, recent projects) on organic agriculture and agro-ecology, is driven by a consortium of European institutions, all of which can provide useful input into the start-up of ORCA's virtual communication.

4.2.4 Research Topics

Focus areas selected for ORCA are described in Appendix 2. These general descriptions are intended to provide potential applicants an understanding of what is meant by the designation so to determine if their centre is suitable to undertake work in that focus area. Herein, we have listed the Resource Concentrations found on the diagram and linked to particular sectors as "proposed." As previously stated, we connected Resource Concentrations to focus areas anticipating overlapping research pursuits and expertise. However, this may not always be the case and ORCA applicants can propose realignments of the resource concentrations.

Each Centre will offer specialized expertise within the overall ORCA system. Research is no longer undertaken in isolation but within communities and throughout the food chain.

4.3 Criteria and Process for Centre Selection

4.3.1 Criteria for Centre Selection

Centres seeking inclusion in ORCA will be evaluated and selected using the 16 criteria listed herein.

Ability to produce high quality research
ORCA is designed to facilitate the production of high quality, relevant research. The likely ability to succeed in producing high quality research will be the most heavily weighted criterion in proposal evaluation.

Demonstrated expertise in organic agriculture systems
It is essential for proposed centres to have expertise in organic agriculture. This expertise may be in different forms but it must indicate potential for the proposed centre to take a leadership role in organic agriculture research. Expertise may be demonstrated across several fields of knowledge (e.g. a centre that has been involved in both organic livestock and crop production) or it may be focused within an area that matches the proposed area of resource concentration (e.g., expertise in organic seed propagation for the Seeds and Breeds centre). It is not necessary for centres to be solely focused on organic research. It is possible, for example, for a research institute specializing in vegetable production and exploring multiple production methodologies, including organic, to be suitable for ORCA inclusion. Many centres have credible, and in some cases exemplary programmes in organic agriculture complemented by non-organic research. That said, we expect that upon application, institutes vying for centre designation will already have in place organic agriculture programming that is central to the work of their institute. Proposals in which organic agriculture is clearly a proposed new endeavour will not be ranked highly.

Institutional commitment
Proposed centres must demonstrate a commitment to organic agriculture through their research and development work, and centre leaders must be able to articulate a vision for and commitment to

organic agriculture. ORCA investment is aimed at strengthening the overall capacity for organic research; its ability to financially support research may ebb and flow given donor interest. Thus is it essential that ORCA resources be dedicated to centres that will do everything possible to maintain organic research programmes even during times when ORCA resources may be constrained.

Location
The five regionally-based Centres must have at least one of the twinned institutes located in that agro-ecosystem. All 11 Centres of ORCA will be comprised of twinned institutes, at least one of which must be located in a developing country.

Articulation of Centre research agenda
This paper lays out, in a brief manner, expectations of Centre work; the request for proposals will provide significant elaboration. The ability of applicants to describe convincingly how they intend to carry out the described work and furthermore, to articulate a clear agenda for the Centre will be an important factor in the evaluation.

Likelihood of assisting developing countries
The relevance of proposed scope of work to the needs of developing countries will be assessed.

Dedication of resources to support the Centre
Proposed centres are expected to contribute resources to ORCA. Resource contributions may take many forms. Financial support for staff and research programmes is one important way a centre can support ORCA work. Support may also take the form of dedicated infrastructure, land, and equipment for ORCA-related research.

Correspondence with ORCA needs
As envisioned, ORCA will efficiently allocate leadership responsibility for various research topics across many centres, thereby concentrating expertise and reducing overlapping and duplicative efforts. A proposed centre, therefore, will be evaluated based on its likelihood to augment ORCA research and expand the Alliance's capacity to meet a broad array of research needs, needs which may shift over time in response to emerging scientific knowledge.

Proposed Resource Concentration
Centres will be responsible for two Resource Concentrations, as described in this paper. While we have connected resource concentrations to specific Centres, we recognize that there are other, equally valid ways of organising these multiple resource needs. Applicants will be asked to propose two resource concentrations for inclusion in their Centre. These concentration proposals will be evaluated based on the ability of the applicant to carry out the work.

Proposed twinning of institutes
Integrated proposals submitted jointly by collaborating institutes suggesting themselves as twins, or a consortium of two or more institutions, will be highly favoured.

Publication record
Centres are responsible for producing scientific information and for disseminating information in their respective areas of resource expertise. Centres with proven records in placing research results in peer reviewed journals, as well as in literature designed to advance farmer and processor adoption of organic agricultural systems will be favourably considered.

Participation of farmer-scientists
The design of farmer and processor integration into research structures and programmes and the degree to which they will participate in carrying out the work will be evaluated.

Track record in external funding
The centres of ORCA will be expected to seek external funding to complement the funds received through ORCA participation. Proposed centres with demonstrated ability to secure external funding will be favourably considered.

Ability to develop and maintain viable networks
Each Centre is expected to interact with existing research institutions, including the CGIAR Centres and other regional or national non-organic institutions undertaking research of relevance to their subjects, especially research on ecology and low-input systems. Centres are also expected to network farmers, processors and other stakeholders in the organic community. The purpose of this networking is to assist in research priority setting, obtain expertise, facilitate research collaborations, avoid duplication of efforts, and disseminate information. The degree to which an applicant has existing networks and the potential to build networks will be considered. Proposed centres with proven records in outreach to and partnering with other organizations will be favourably considered, particularly if those efforts have extended between the northern and southern hemispheres.

Participation of stakeholders in centre design
Evidence of participation of stakeholders, such as private industry and civil society organizations, as well as farmer and processors will be considered. While letters of endorsement of such organizations and individuals will be considered, preference will be given to proposals that demonstrate active involvement of such stakeholders in the proposed Centre operations.

Language and technological capabilities
Communication between the centres within ORCA, and between each individual centre and the various constituencies seeking information related to its Resource Concentrations, will necessitate strong language and technology skills. Proposed centres with some staff capacity to converse and write in English and that have staff able to creatively use the kinds of technology that ORCA will rely upon, including various web-based tools, will be favourably considered.

4.3.2 Process for Selection

It is not known, at this writing, when and in what amounts, money will become available to proceed with ORCA implementation. While it is possible and would be ideal to receive support for full-scale implementation at the onset, we rather anticipate that donations will require staggered implementation. Donors may also have strong interests in sponsoring research endeavours in certain areas of the world and as a result will place additional restrictions on their investments. However, to the extent possible, the vision for ORCA centre selection is that it will be donor driven, FAO facilitated and peer-reviewed.

A call for Centre proposals will be issued by FAO upon receipt of sufficient funding to designate at

least one Centre within ORCA. Depending on donor interest, the request for proposals may be specific to a particular centre(s) and/or resource concentration(s) (e.g. solicitation of proposals for the Centre on Arid and Semi-Arid Agro-ecosystems) or it may be open-ended (e.g., solicitation of proposals for any Centre as described in this proposal).

The request for proposals will be posted on the FAO organic website, distributed to the directory of people and organizations contributing to development of this proposal, and sent to networks and organizations with likely interest (e.g. ISOFAR). The call for proposals (issued in English, French, Spanish, Arabic, and Chinese) will fully elaborate the paperwork requirements for proposal submission. There will be a time period of no less than four months between the call for proposals and the deadline for proposal submission.

Preference will be given to proposals that are jointly submitted as a consortium of institutes or as twinned institutes vying together for Centre designation. We anticipate, however, that some applicants may require assistance in establishing such twinning relationships. To the extent possible, before and after the deadline for Centre proposals, FAO staff will assist in partnering organizations who demonstrate strong interest and potential affinity.

Once proposals are received, FAO will convene the Facilitation Board to evaluate and rank them. In this way, the initiating process reflects the shared decision-making of diverse constituencies that is expected to be endemic to Centre work.

Applicants for proposed centres will be asked for a one paragraph description of their centre for posting on the FAO website. This posting will allow parties interested in ORCA to understand the community of potential centres and facilitate connections that might facilitate future proposal development.

Awards of centre designation will be announced through the same procedures described above for release of the request for proposals. All unsuccessful applicants will receive feedback on their proposal so that they may learn ways in which they could, if they so choose, strengthen their proposal for resubmission upon a subsequent request for proposals.

4.3.3 Funding Structure

Funding schemes are organized to promote collaboration among the centres within ORCA, to value private sector engagement in the research programme, and stimulate the production of competitive and innovative science.

Start-up Funding
All centres will receive funding to initiate ORCA activities. This one time infusion of funds is to support: purchase and coordination of appropriate, state-of-the art communication tools to facilitate centre interaction; and accumulation of materials for the Centre's two Resource Concentration areas.

Base Annual Funding
Each centre will receive, upon approval of the Facilitation Board, an annual disbursement of funding to maintain the resource libraries in the Concentration Areas and minimum staff support for

the administrative and management work of the Centre. Additional funding for research of the Centre must be solicited from the Secretariat and is based on an internal competition for funds. The CGIAR experience is that developing countries contribute only 4% of the total organizational budget. It is unreasonable to expect that twined institutes based in developed countries require the same level of support as those in developing countries. For this reason, basic annual funding is provided based on specific needs.

Soil Funding
ORCA places high priority on funding for soil science and this is a major area for Secretariat-driven fund solicitation. Each year, the available budget for soils will be divided. One-half of the funding will be shared equally by the 11 Centres to support their ongoing work in soil science. An annual internal competition will be held for the remaining half of the soil funding (i.e., Soil Challenge Fund), with the awards determined by the Facilitation Board. Preference will be given to proposals that include more than one centre.

Competitive Funding
Research funding obtained by ORCA, in addition to funding for soil programming and base Centre support, will be distributed via an internal competitive process. The Secretariat, with assistance from the Facilitation Board and *ad hoc* peer review panels, will determine grant awards.

External Competitive Funding
It is expected that Centres will seek funding from non-ORCA sources. The Secretariat has a staff person to help with development of competitive proposals and to facilitate collaboration among the various centres within ORCA.

Valuing Collaboration
When funding is limited, people tend to invest most of their energy in maintaining their own research and teams, rather than engaging in collaborative work. For this reason, research partnerships, both within and outside of ORCA, will be calculated in the assessment of internal grant proposals. ORCA funding will be almost equally split between core institutions and collaborating institutions, formal and informal (i.e. farmers). Teams involving researchers from the countries of study as equal partners are likely to produce better research and more quickly lead to institutional change. Contributions from the private sector, in cash, time, or materials, to facilitate the research of the Centre are highly valued. Such contributions may be considered by the Secretariat and the Facilitation Board in the awarding of competitive funds.

Funding Prohibition
ORCA does not fund construction of buildings and large infrastructure. The centres are "centres without walls", albeit hosted by an institution and it is our goal to strengthen and network institutions that already exist. It is expected that the infrastructure at these existing research entities and field stations will suffice for ORCA work.

4.4 Donor Inputs

FAO staff will work to solicit funds for ORCA. As we learn more about donor demands, needs, and expectations with regard to ORCA, specific project documents will be developed, tailored to donor's needs and target beneficiaries.

The ORCA Secretariat will raise and channel funds to establish and support the ORCA system. As ORCA does not aim to centralize funding but add value to existing efforts, donors' contributions to ORCA also foresee the continuation of bilateral assistance from a donor to a specific beneficiary in a developing country, but through a coordinated process where central ORCA resources and bilateral resources pursue a common objective. For this purpose, the ORCA Secretariat will organize donor's round tables to share information and build synergies among respective programmes.

While multi-lateral collaboration is at the centre of ORCA, the system provides also for a multitude of bilateral cooperations. For example, some donors may retain their direct support with their beneficiaries but prefer to operate within a wider coordinated system such as ORCA. The same applies for philanthropic organizations seeking to assist civil society organizations and smallholder groups working within a broader network such as ORCA. Similarly, universities may wish to allocate grants to their students seeking oversees experience to a target-oriented system such as ORCA. Contributions to ORCA can take different forms, as long as the different efforts seek the common objective of sharing and advancing organic agriculture knowledge.

ORCA's main vocation is research but linkages with training and development institutions will be deployed, from local NGOs, through national education/extension, to international UN organizations. For this purpose, coordinated efforts will also be maintained with donors seeking to support NGOs for disseminating ORCA's knowledge outputs, as well as development organizations with capacity-building mandate.

At a minimum, our expectation is that the ORCA vision will inspire donors to increase their commitment to organic research, with particular regard to developing country needs. If, for whatever reason, donors choose not to place funds within the ORCA framework but rather allocate additional funding to organic research in different ways, spurred on by the argumentation in this paper, we will welcome and applaud those inputs.

A project proposl for a prototype ORCA centre will be prepared with detailed costs and specific terms of reference. Roughly, it is estimated that one centre would require a budget of about USD 2 million annually.

4.5 Technical Support/Linkages

In developing the ORCA concept and basic information services, FAO is drawing on the technical expertise of its Inter-Departmental Working Group on Organic Agriculture and its worldwide network of partners. FAO will continue providing the services of a Senior Officer to ORCA, on a part-time base, as well as its general staff expertise, when requested. During implementation, FAO will provide liaison services with the Science Council of the CGIAR system and the Global Forum for Agricultural Research (GFAR), both of which having a Secretariat in FAO, as well as national research institutions with whom it normally collaborates.

In 2008, FAO has developed an ORCA Webpage, E-Forum and Directory. In early 2009, an extensive ORCA-List was created, as well as an ORCA Portal that maps organic research and other relevant research worldwide. This platform will evolve to become the hub of the virtual libraries of all ORCA Centres.

The FiBL and ICROFS partners have a key role in implementing research cooperations and twinning arrangements with developing countries' research institutions. ORCA is in line with their mandates and shared desire to create such an Alliance.

More recently, the International Society for Organic Agriculture Research (ISOFAR) and the International Federation of Organic Agriculture Movements (IFOAM) joined the Alliance, as well as a number of national research institutions (i.e. Agro Eco Louis Bolk Institute, BOKU University, and vTI) with an international mandate. They brought their insights in finalizing the ORCA concept and will respectively prompt their countries to support ORCA.

The shared concerns of these partners create a critical mass of institutions willing to pool resources and expertise for international assistance in organic research.

4.6 Management and Operational Support Arrangements

Management arrangements and operational support costs will follow the standard FAO procedures, including recruitment of Secretariat staff and implementation of information services.

5. OVERSIGHT, MONITORING, MANAGEMENT INFORMATION AND REPORTING

The logical framework presented in Annex 1 will form the basis around which monitoring, evaluation, and reporting will take place.

5.1 Oversight and Reviews

Every five years, the Facilitation Board, in collaboration with donors, will undertake a comprehensive evaluation of ORCA and make those evaluations available to the public. A 'final' evaluation will be performed in 2025 to inform a new ten to fifteen years strategic plan.

Among other things, the evaluations will include:

- Solicitation of input from those outside of ORCA, including representatives from farming, handling, academia, civil society and private industry. These reviewers will be asked to evaluate ORCA contributions. This input will be summarized and available to the public along with Facilitation Board views and conclusions;
- Solicitation of input from ORCA centres of excellence on the strengths and weaknesses of the network;
- Statistics on publications;
- Statistics on media imprints and web traffic;
- Examples of real world application of ORCA research results;
- Evidence of ORCA research contributing to livelihood improvement, poverty reduction and environmental and biodiversity conservation.

Solicitation of input from ORCA stakeholders and beneficiaries is an attempt to incorporate participatory monitoring into the network.

Impact indicators will include number of articles published in peer-reviewed and practitioner journals based on ORCA-funded research, level of media exposure of these studies, adoption of

methods related to ORCA research, and contribution of these methods to the MDGs.

Outcome and output indicators will include numbers of ORCA centres designated, number of farmers actively participating in the research, studies funded, long-term field trials established and standard research methodologies developed.

5.2 Monitoring and Knowledge Sharing

Routine monitoring of ORCA implementation will be conducted by:

- the Secretariat, in terms of funds disbursed and public communications. Periodic monitoring will be conducted by the Secretariat through the Facilitation Board's intra-annual virtual meetings and annual review of centre budgets and work plans.
- each Excellence Centre, in terms of progress on ORCA-funded research and dissemination of results.

ORCA is designed to facilitate knowledge sharing among centres, farmer-scientists, and other stakeholders. While this idea is infused throughout the network design, the primary mechanism for knowledge sharing is the proposed virtual laboratory system (see Section 4.2.3).

5.3 Communication and Visibility

An ORCA website was created in 2008. The ORCA draft concept paper was made available electronically for public comments, from 17 November 2008 to 15 December 2008. To enter the E-Forum, responders were required to login and provide some basic information including the name and location of their institution and the major agro-ecological area and research topics with which their institution is engaged. The electronic consultation resulted in comments from 211 people in 57 countries. The comments provided on the draft ORCA concept are summarized into a document Reflections on the Discussion Forum available online at http://www.fao.org/organicag/oa-portal/discussion-forum/en/.

This respondent information was compiled by FAO into a "Directory", available on that same webpage. FAO used this Directory to create an ORCA-List that will be a primary route for distribution of announcements relative to ORCA, including calls for centre proposals. The mailing list will also be used as a tool to connect potential centre applicants with one another and facilitate twinning and other collaborative arrangements for the advancement of organic research.

FiBL has taken leadership in compiling worldwide data on many topics related to organic agriculture. Currently, FiBL is in the process of constructing profiles for each country and these profiles will include information on scientists and institutes engaged in organic research within each country. The FiBL effort is extensive and the ORCA web will feature the FiBL country profiles.

The ORCA website will continue to be a vehicle for communicating progress and lessons leant from the Alliance research programme. As Centres are established and developed, the ORCA Portal will evolve to become the meta database of the 11 ORCA Virtual Libraries. Evaluations, publications, and announcements will be made available and updated regularly by the Secretariat. In addition, the website will maintain a database of training and development institutions that might be prepared to pass-on ORCA research findings to the field.

5.4 Reporting Schedule

As part of the annual disbursement of funds, Centres will report on their progress and submit budgets and workplans to the Facilitation Board. The format of the annual progress report is flexible but should include the following:

- An analysis of project performance over the reporting period, including outputs produced and, where possible, information on the status of the outcome;
- The major constraints experienced in the progress towards results and the reasons for these;
- Lessons learned;
- Clear recommendations for future orientation in addressing key problems in lack of progress.

The Secretariat will report on progress every three years to the ORCA donors. It is possible that individual donors will have additional reporting requirements. When such funding is targeted at specific Centres, these Centres will be responsible for meeting the reporting requirements. However, if such funding is disbursed to a number of Centres, the Secretariat will be responsible for reporting.

APPENDIX 1: ORCA Logical Framework

Impact: Organic research: mainstream, robust, and valued by farmers and policy-makers worldwide by 2025

Outcome: A network of research centers collaborating to produce high quality research in organic agricultural systems relevant to the needs of farmers and processors in developing countries

Output 1: Operational procedures are developed for the ORCA system and for Centers of Excellence

Activities

1.1. Develop the operational procedures for the application of research consortia for ORCA's support
1.2. Develop a process for selection of ORCA host institutions and partner institutions
1.3. Develop a monitoring scheme for ORCA centers
1.4. Develop the ORCA funding policy
1.5. Develop the terms of reference and mandate of the Secretariat and Facilitation Board

Output 2: The ORCA Secretariat established, managed and administrated efficiently

Activities

2.1. Establish the ORCA Secretariat and Facilitation Board
2.2. Select, coordinate and monitor the ORCA host institutions and partners
2.3. Raise funds and develop project proposals tailored to specific ORCA donors and centers
2.4. Support ORCA centers in preparing competitive research calls
2.5. Prepare annual ORCA progress reports and report to donors, as required

Output 3: A support system (a virtual laboratory) has been created for the exchange of organic research results and for facilitation of networking among research and development institutions involved in organic development relevant to developing countries

Activities

3.1. Establish and maintain interactive ORCA website(s)
3.2. Establish and maintain chat rooms/online discussions platforms
3.3. Establish and maintain web-based file sharing facility
3.4. Establish a news and result sharing web-facility
3.5. Establish a call centre for guidance on organic research, training and development resources

Output 4: Collaboration and coordination is strengthened among stakeholders in organic research and a common organic research agenda for developing countries is established and revised regularly

Activities

4.1. Convene biannual conferences of ORCA centres
4.2. Develop and implement a process for establishing and updating a global organic research agenda
4.3. Revisit organic research epistemology, according to formal and informal research experiences
4.4. Develop and implement a strategy for participatory farmer-based quality assurance of research agenda and research programmes
4.5. Develop and implement a strategy for developing and strengthening the networking among organic research stakeholders in developing countries, in collaboration with ISOFAR and IFOAM

Output 5: ORCA Centres of Excellence for research in organic and biodynamic production systems established and active research programmes developed and implemented

Activities

5.1. Establish a management and administration system for each Centre according to the project document and research contract, as developed by the ORCA Secretariat in consultation of stakeholders
5.2. Develop and implement detailed research programmes according to project document and research contract
5.3. Develop and maintain a virtual library on the Centre' relevant resource concentration(s)
5.4. Undertake competitive research calls and develop and implement a support system for monitoring and disseminating research from awarded projects
5.5. Disseminate research results through the ORCA systems and engage actively in networking and exchange of knowledge among ORCA centres and other stakeholders

APPENDIX 1: ORCA Logical Framework (cont.)

Impact	Indicators/targets	Data Sources	Assumptions
Organic research: mainstream, robust, and valued by farmers and policy-makers worldwide by 2025.	Research results on organic production systems sought after widely and results often highlighted in acknowledged scientific and non-scientific publications.	Non-ORCA information sources.	Political support to organic agriculture will not be corrupted by external factors and/or non-scientific based national or regional agendas.
Outcome			
A network of research centres collaborating to produce high quality research in organic agricultural systems relevant to the needs of farmers and processors in developing countries.	New knowledge and techniques for organic production systems from ORCA centres being developed and information on what, how, and when are available through open information sources.	ORCA established information sources.	The research of the ORCA centres is acknowledged and supported locally and regionally and can attract high capacity scientific staff also from organic and non-organic disciplines.
Outputs			
1: Operational procedures are developed for the ORCA system and for Centres of Excellence.	Between 1 and 11 Regional and specialty ORCA centres established and an operational framework developed.	Research Programmes from ORCA centres.	Donors acknowledge the potentials of organic agriculture and allocate sufficient resource for a range of different ORCA centres.
2: The ORCA Secretariat established, managed and administrated efficiently.	Administrative and management procedures established and followed.	Procedures manual of Secretariat and Facilitation Board.	FAO hosting the ORCA Secretariat
3: A support system (a Virtual Laboratory) has been created for the exchange of organic research results and for facilitation of networking among research and development institutions involved in organic development relevant to developing countries.	Web-features available and being used by a 'virtual' community of researchers and other stakeholders.	Communication data from web-facilities.	Web platform hosted by FAO and technical solutions and access to the necessary equipment to support a virtual system is widely available.
4: Collaboration and coordination is strengthened among stakeholders in organic research and a common organic research agenda for developing countries is established and revised regularly.	Research agenda formulation process undertaken and agenda revised every second year through a consultative process. A number of new research collaborations established between research institutions.	Research agenda – document available on ORCA website. Process described at ORCA web-site. Research databases.	Sufficient interest in developing a global research agenda for organic agriculture and be mobilized among researchers and other stakeholders.
5: ORCA Centres of Excellence for research in organic and biodynamic production systems established and active research programmes developed and implemented.	Number of organic research projects per Centre being implemented by own researchers and number, as well as collaboration with other institutions.	Monitoring and progress reports.	Sufficient interest from research institutions in developing countries and from twin partners to become engaged in ORCA as a Centre of Excellence.

Activities	Preconditions/inputs
1.1. Develop the operational procedures for the application of research consortia for ORCA's support 1.2. Develop a process for selection of ORCA host institutions and partner institutions 1.3. Develop a monitoring scheme for ORCA centres 1.4. Develop the ORCA funding policy 1.5. Develop the terms of reference and mandate of the Secretariat and Facilitation Board	• Interest among experienced researchers, networkers, project managers with interest and/or experience from the organic sector to become members of the Facilitation Board. • Experienced and skilled staff recruited for the Secretariat • Sufficient funds for support and monitoring activities of the Secretariat and expert resources when required.
2.1. Establish the ORCA Secretariat and Facilitation Board 2.2. Select, coordinate and monitor the ORCA host institutions and partners 2.3. Raise funds and develop project proposals tailored to specific ORCA donors and centres 2.4. Support ORCA centres in preparing competitive research calls 2.5. Prepare annual ORCA progress reports and report to donors, as required	• Financial support for a Secretariat and a Facilitation Board • FAO support to host Secretariat Experienced and skilled staff recruited for the Secretariat • Sufficient funds for support and monitoring activities of the Secretariat and expert resources when required.
3.1. Establish and maintain interactive ORCA website(s) 3.2. Establish and maintain chat rooms/online discussions platforms 3.3. Establish and maintain web-based file sharing facility 3.4. Establish a news and result sharing web-facility 3.5. Establish a call centre for guidance on organic research, training and development resources	• Sufficient funds • Adequate technology
4.1. Convene biannual conferences of ORCA centres 4.2. Develop and implement a process for establishing and updating a global organic research agenda 4.3. Revisit organic research epistemology, according to formal and informal research experiences 4.4. Develop and implement a strategy for participatory farmer-based quality assurance of research agenda and research programmes 4.5. Develop and implement a strategy for developing and strengthening the networking among organic research stakeholders in developing countries, in collaboration with ISOFAR and IFOAM	• Interest among researchers and other stakeholders from the organic as well as the non-organic sector to impact on and develop a common organic research agenda with particular focus on the needs of developing countries • Sufficient funds for engaging stakeholders in a participatory process for development of a common research agenda • Sufficient funds for meetings and other network activities
5.1. Establish a management and administration system for each Centre according to the project document and research contract, as developed by the ORCA Secretariat in consultation of stakeholders 5.2. Develop and implement detailed research programmes according to project document and research contract 5.3. Develop and maintain a virtual library on the Centre' relevant resource concentration(s) 5.4. Undertake competitive research calls and develop and implement a support system for monitoring and disseminating research from awarded projects 5.5. Disseminate research results through the ORCA systems and engage actively in networking and exchange of knowledge among ORCA centres and other stakeholders	**Separate logframes and project documents will be developed for each centre including risk analysis and budgets**

APPENDIX 2: ORCA RESEARCH TOPICS

Centre on Coastal and Small Island Agro-ecosystems
Proposed Resource Concentrations: Capture Fisheries & Aquaculture

The core work of this Centre is to conduct research relevant to food production in coastal and small island agro-ecosystems. Such systems are found at the interface between land and sea, including marine, estuary and coastal wetland areas and large inland lakes. Highly productive agricultural areas are located in river deltas and coastal plains. Coastal areas frequently contain critical terrestrial and aquatic habitats and support rich biological diversity. Examples of such habitats are estuarine areas, coral reefs, coastal mangrove forests and other wetlands, tidal flats and sea grass beds, which also provide essential nursery and feeding areas for many coastal and oceanic aquatic species. Countries known collectively as Small Island Developing States (SIDS) have in common their smallness and insularity which often also indicates their vulnerability. These small island and low-lying coastal countries are subject to structural vulnerability that affects their productivity, development and cooperation policies. Organic agriculture is a strategy to improve the resilience of food production in highly pressured ecosystems. The major challenges of converting to organic production in these regions include vulnerability to contamination from shared watershed, sea-level rise and salinization of soils and improving performance of lesser-known but traditionally produced crops.

The resource concentrations are suggested because 90% of the world's fish are, at some time in their life cycle, dependent on coastal areas and fish farming is often undertaken in coastal waters.

Organic Resources

- Secretariat of the Pacific Community (SPC)
- Instituto Nacional de Ciencias Agrícolas (INCA)
- Cuban Association of Agricultural and Forest Technicians (ACTAF)
- Centro Regional de Estudios de Alternative Rurales (CREAR)

Centre on Hilly and Mountainous Agro-ecosystems
Proposed Resource Concentrations: Forests & Agroforestry

The core work of this Centre is to conduct research relevant to hilly and mountainous areas often characterized by extreme weather conditions, inaccessibility, poor quality and steep soils subject to erosion, low population density, poor infrastructure and lack of training facilities. Technology transfer is particularly problematic due to lack of roads and transportation infrastructure between villages. Access to agricultural inputs is difficult because of challenging topography and poor roads. Such areas also have favourable conditions such as pristine environments with low incidence of pests and diseases. Organic management is often by default, non-certified, and based mainly on inputs available on the farm. The major challenges of converting farms to organic agriculture in this agro-ecosystem are the costs of extension services, the need for improved household food security, and the distance from farms to the market. Research relevant to farming systems based in hilly and mountainous agro-ecosystems is occurring all over the world. Few research institutions are currently dedicated solely to the study of organic agriculture in these ecosystems, but scientists in many countries are conducting research with applicability to organic hill and mountain farmers.

The resource concentrations are proposed because of the often densely forestation in hilly and mountainous areas and the considerable opportunities for agroforestry in these regions.

Organic Resources
- Chaudhary Sarwan Kumar (CSK) Himachal Pradesh Agricultural University
- Institute of Biological, Environmental and Rural Sciences (IBERS), Aberystwyth University
- Institute of Traditional Medicine Services (ITMS) (no website available)

Centre on Arid and Semi-Arid Agro-ecosystems
Proposed Resource Concentrations: Pastures & Livestock

The core work of this Centre is to conduct research relevant to farming systems based in arid and semi-arid areas. Eighty percent of the world's poor live in areas characterized as rainfed, livestock-oriented, and largely subsistence based. Intensification of agriculture and livestock production often pushes beyond the capacity of the ecosystem, resulting in overgrazing and severe environmental degradation such as soil compaction, erosion, and desertification. As climate change progresses, more areas could become arid and semi-arid and current areas could become further degraded. Since livestock is a vital and integral part of the production system, well managed pastures and adequate stocking rates are necessary to optimize the feed production potential of the ecosystem. Agricultural inputs in these ecosystems are often too expensive for small holder farmers and also difficult to purchase. Moreover, lack of knowledge often results in incorrect application methodologies by small farmers. Organic farming methods, which are more resilient to drought conditions, could be the solution against poverty and hunger, reducing overgrazing and improving soil fertility. The main challenge of converting to organic agriculture in this agro-ecosystem is dealing with the scarcity and the disrupted dynamics of biomass decomposition during the long dry season(s) which result in a very slow build-up of soil organic matter. Research on best practices for animal husbandry to raise livestock with high productivity within an arid and semi-arid organic system is another need.

The resource concentrations are suggested due the preponderance of pastured livestock systems within this agro-ecosystem. Research on pasture will directly benefit those involved in livestock research and possibly *vice versa*.

Organic Resources
- Agro Eco Louis Bolk Institute
- Auroville
- Central Laboratory of Organic Agriculture (CLOA)
- High Plains Ag Lab (HPAL), University of Nebraska-Lincoln
- Institute for Sustainable Development (ISD)
- International Competence Centre for Organic Agriculture (ICCOA)
- KAITE Company
- Kenya Institute of Organic Farming (KIOF)
- Manor House Agricultural Centre (MHAC)
- National Organic Agricultural Movement of Uganda (NOGAMU)
- SEKEM
- Tanzania Organic Agriculture Movement

- University of Agriculture, Abeokuta (UNAAB)

Centre for Humid and Sub-Humid Agro-ecosystems
Proposed Resource Concentrations: Rice Systems & Fruits and Vegetables

The core work of this Centre is to conduct research relevant to farming systems based in humid and sub-humid areas dominated by flooded cropping systems or tropical forest systems. These areas are often characterized by poor and acidic soils due to abundant rainfall and fast decomposition/high mineralization rates of biomass and organic matter – the latter being the most important reservoir for nutrients. Pest and disease pressure is usually high because of year-round favourable temperatures and high relative humidity. Agricultural inputs are generally available, but not always affordable for small farmers living in these areas. Conversion to organic agriculture in humid and sub-humid areas implies less intensive and more integrated production, using resistant and often local cultivars that are often lower yielding. Increased crop rotations and diversification, agro-forestry and the integration of livestock, aquaculture and bee-keeping typical of organic production provides opportunities to diversify the system and increases the security and stability of income and total farm output. The major challenges in converting to organic agriculture in this agro-ecosystem are pest and disease pressure.

The resource concentrations are suggested because rice farming systems are predominately found in this agro-ecosystem and because there is possibility of growing fruit and vegetables year-round in most locations.

Organic Resources
- Associaçáo de Agricultura Orgânica (AAO)
- Citrus Research and Extension Institute (CREI)
- Garden Organic
- Centre for Environment, Technology and Development, Malaysia (CETDEM)

Centre on Temperate and Irrigated Agro-ecosystems
Proposed Resource Concentrations: Comparative Studies & Cropland Yields

The core work of this Centre is to conduct research relevant to farming systems in temperate and irrigated areas that are generally characterized by favourable soils, high levels of mechanization and functioning markets for farm supplies. In these areas, high external inputs make it possible to obtain high production levels but productivity may be pushed beyond the actual ecosystem capacity. Soils receive high levels of synthetically produced fertilizers and crop genetic resources are often hybrids designed to perform well under ideal conditions (such as receiving regular and abundant water and nutrients) and with high levels of pesticides and herbicides. Organic agriculture meets consumers demand for food free of pesticide residues and meets stringent environmental regulations that exist in certain areas. The major challenges in converting farms to organic agriculture in this agro-ecosystem are maintaining the financial health of farms during organic transition and full rotations, labour demand, and raising yields to be comparable to conventional systems.

The resource concentrations are suggested because these high-yielding areas are difficult to match with organic management without yield decrease. Significant work in comparative research trials and yield enhancement efforts, through functional ecological intensification, are

already underway in these agro-ecosystems.

Organic Resources
- Faculty of Agricultural Sciences, University of Hohenheim
- Faculty of Organic Agricultural Sciences, University of Kassel
- German Institute for Tropical and Subtropical Agriculture (DITSL)
- Institute of Organic Agriculture, University of Bonn
- Institute of Organic Farming, German Federal Research Institute for Rural Areas, Forestry and Fisheries (vTI)
- Institute of Organic Farming and Farm Animal Biodiversity, Agricultural Research and Education Centre (AREC)
- Organic Agriculture Centre of Canada (OACC)
- Research Institute for Organic Agriculture (FiBL)
- Rodale Institute

Centre on Climate Change
Proposed Resource Concentrations: Agro-Energy & Energy Flows

The core work of this Centre is to research the impacts of climate change on organic systems and the potential for organic agriculture to mitigate and adapt to climate change. This will include conducting global assessments and developing appropriate methodological tools to assess carbon sequestration levels in organic production. The impacts of increasing global surface temperature, and both the amount and distribution of precipitation are expected to disproportionately impact people in developing countries. There is ample evidence that organic systems are more resilient to abiotic stresses associated with these changes and have lesser contributions to overall greenhouse gas emissions than systems that rely heavily on purchased, synthetic inputs. As the climate changes, diversified organic farms will be more likely than conventional farms to go through natural stages of succession and adaptation and avoid agro-ecosystem collapse. In addition, organic soil management is particularly attractive as a climate change mitigation strategy as it focuses on increasing soil organic matter, which in turn, increases the carbon sequestered in the soil. This Centre can conduct important research on this sequestration potential as well as on other key topics that impact climate change such as the timing and management of manure and use of nitrogen fixing crops.

The resource concentrations are suggested because energy use and climate change are interconnected, and both mitigation and adaptation rely on sustainable use of agricultural resources. Research on energy generated by and used from agricultural sources and how it fits within organic farm management and emission reduction schemes will complement the Centre's mitigation work.

Organic Resources
- Research Institute for Organic Agriculture (FiBL)
- Rodale Institute
- Soil & More

Centre on Seeds and Breeds

Proposed Resource Concentrations: Protected Areas & Agritourism

The core work of this Centre will be production and improvement of plant and animal genetic resources appropriate for organic systems. Currently, many organic farms rely on crop and livestock varieties that have been developed for agrochemical intensive systems. Organic growers and livestock producers require breeding programmes that produce crops and livestock that meet the conditions and challenges of organic farming systems. Breeding crops and livestock under conventional management for use in organic systems fail to meet these needs. Organic crop breeding programmes should focus on optimizing yields while considering such factors as insect and disease resistance, weed competition, and environmental conditions while under low-input conditions. Organic livestock breeding should focus on selecting healthy, adaptable animals that perform well on pasture and that have disease and parasite resistance. Research in the future should be focused on developing crop varieties and livestock breeds that are compatible and complementary in mixed crop-livestock systems.

The resource concentrations are suggested because rich biodiversity is often found in protected areas and plant and animal diversity can be suitable to showcase through agritourism (e.g. opportunities for public education on heritage breeds).

Organic Resources

- Agro Eco Louis Bolk Institute
- Center for Sustaining Agriculture and Natural Resources, Washington State University
- Cornell Organic Working Group, Cornell University
- International Centre for Research in Organic Food Systems (ICROFS)
- Organic Research Centre - Elm Farm
- Organic Seed Alliance
- Organic Seed Program, Bejo Zaden B.V.
- Research Institute of Organic Agriculture (FiBL)
- State Priekuli Plant Breeding Institute

Centre on Post Harvest and Safety
Proposed Resource Concentrations: Pest and Disease Management & Fibres

The core work of this Centre concerns organic processing, transportation, storage, spoilage and waste, and safety of organic products after harvest. Microbial ecology related to organic practices will be undertaken as will the identification and development of appropriate processing materials and inputs. Post-harvest storage and preservation of products and pest and disease control within those systems will be investigated. Major routes for adventitious presence of contaminants in organic foods will be explored and tools to detect the presence, identify the source, and prevent contamination will be developed. Quantitative and qualitative risk assessments for the safety of organically produced foods will be undertaken and models and decision tools for precautionary decision-making will be developed.

The resource concentrations are suggested because many of the most vexing and little studied pest and disease problems occur post-harvest. In addition, the processing of organic fibres into textiles remains a significant challenge because typical toxic processing materials are disallowed and market entry strategies for organic plant and animal textiles is underdeveloped.

Organic Resources

- Agro Eco Louis Bolk Institute
- Nafferton Ecological Farming Group (NEFG) and the School of Agriculture, Food and Rural Development (AFRD), Newcastle University
- Organic Consumers Association (OCA)
- Research Institute of Organic Agriculture (FiBL)

Centre on Economics, Markets and Trade
Proposed Resource Concentrations: Commodity Intelligence & Consumers

The core work of this Centre will be economic and policy analysis. The Centre will measure, forecast, and explain indicators of economic performance, determine costs of production, and assess the financial health of organic farmers and processors. Research on the socio-economic impact of organic production will be undertaken, including its effect on livelihoods of smallholder farmers. Structural characteristics of farms and markets will be evaluated to determine factors underlying the sector's efficiency, returns, and competitiveness. Analysis of the linkages between agricultural and environmental policies and environmental quality will be explored. Trade of organic products will be tracked and international trade agreements will be analyzed for impact on the organic sector. In addition, the distribution of benefits of organic agriculture will be evaluated, with particular concern for price premiums that can make organic inaccessible to many consumers.

The resource concentrations are suggested because analysis of commodity markets, labour inputs and availability, and consumer preference for organic products are all directly related to economic sustainability of this system.

Organic Resources

- Agro Eco Louis Bolk Institute
- Alternative Farming Systems Information Center, USDA National Agricultural Library
- ATTRA - National Sustainable Agriculture Information Service
- Bioforsk Organic Food and Farming Division
- Briefing Room on Organic Agriculture, USDA Economic Research Service (ERS)
- Center for Sustaining Agriculture and Natural Resources, Washington State University
- Cornell Organic Working Group, Cornell University
- Faculty of Agriculture, Ege University
- Faculty of Organic Agricultural Sciences, University of Kassel
- Institute of Biological, Environmental and Rural Sciences (IBERS), Aberystwyth University
- International Centre for Research in Organic Food Systems (ICROFS)
- International Organic Food, Quality and Health Research Association (FQH)
- Nafferton Ecological Farming Group (NEFG) and the School of Agriculture, Food and Rural Development (AFRD), Newcastle University
- Organic Monitor
- QualityLowInputFood (QLIF)
- Research for Development Forum (DEV-Forum), University of Natural Resources and Applied Life Sciences (BOKU)
- Research Institute of Organic Agriculture (FiBL)
- School of Biological Sciences, University of Aberdeen

Centre on Nutrition, Quality and Health
Proposed Resource Concentrations: Aromatics and Medicinal Plants & Underutilized Varieties

The core work of this Centre is to conduct research that will generate knowledge on the health and other benefits of organic production and organic foods. Recently several significant studies have been published that seek to identify food quality differences between organically and non-organically produced food, focused primarily on nutrient density, antioxidant capacity, and pesticide residues. The application of this rapidly emerging research to nutritional diversity and its role in the context of food security around the globe will be an important consideration of the Centre. This Centre will also address the cumulative health and quality factors of organic systems production, including calculating the secondary health impact from water and air. The Centre will conduct animal food studies and epidemiological research; gauge the impact of consumption of organic foods and develop parameters and methods to differentiate between organic and non-organic foods.

The resource concentrations are suggested because of the potential for underutilized varieties (e.g. locally produced landraces) and plant products to be used for improved nutrition and health among a diversity of diets.

Organic Resources

- Agro Eco Louis Bolk Institute
- Bioforsk Organic Food and Farming Division
- Center for Sustaining Agriculture and Natural Resources, Washington State University
- Faculty of Agricultural Sciences, Aarhus University
- Faculty of Human Nutrition and Consumer Sciences, Warsaw University of Life Sciences
- Faculty of Organic Agricultural Sciences, University of Kassel
- International Centre for Research in Organic Food Systems (ICROFS)
- International Organic Food, Quality and Health Research Association (FQH)
- Institut Technique de L'Agriculture Biologique (ITAB)
- Nafferton Ecological Farming Group (NEFG) and the School of Agriculture, Food and Rural Development (AFRD), Newcastle University
- New Evidence Confirms the Nutritional Superiority of Plant-Based Organic Foods
- The Organic Center
- Organic Consumers Association (OCA)
- Organic Food and Nutrition, Soil Association
- QualityLowInputFood
- Research Institute for Organic Agriculture (FiBL)

Centre on Urban and Peri-Urban Systems
Proposed Resource Concentrations: Landscaping & Compost and Waste

The core work of this Centre is to conduct research relevant to farming systems located in urban and peri-urban settings. Urban and peri-urban agriculture is growing, with more than half of the world's population living in urban areas in 2007 and two-thirds of the world's population projected to be living in urban areas in 2005. Agricultural production in these settings is necessary because as pressure for natural resources increases, more efficient uses of land, such as

food production, will be essential. Organic production is desirable because it is relatively environmentally-friendly while fitting the needs of agriculture practiced in close proximity to human settlement. Urban agriculture is characterized by high competition for land, limited space, closeness to markets, and a high degree of product specialization. Such farming systems include, among other things, commercial farms, community gardens, backyard gardens, balconies, decks and rooftops, school gardens, publicly owned land, roadside land, riverbanks, vacant plots, roadway land, and ponds. Use of yard and food waste, grey water for irrigation, and livestock, particularly poultry and egg production is common. There are also many opportunities in urban agriculture to reduce food wastage along the supply chain, from processing to consumption, due to the more contained setting in which production occurs (e.g. community gardens).

The resource concentrations are suggested because organic landscaping, the use of underutilized urban space for food production, is taking root in urban areas. Also, there are opportunities for urban residents, restaurants, and institutions to manage waste that is essentially organic for composting for community needs and beyond.

Organic Resources

- Antonio Núñez Jiménez Foundation for Nature and Humanity
- Central Laboratory of Organic Agriculture (CLOA)
- Instituto Nacional de Ciencias Agrícolas (INCA)
- ProHuerta
- Rede de Agroecologia Ecovida

DESCRIPTION OF RESOURCE CONCENTRATIONS

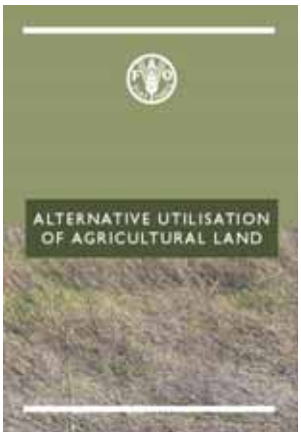
Brief descriptions of the 22 proposed ORCA Resource Concentrations are provided. To give an understanding of why such research concentrations are necessary, we provide some ideas as to essential organic needs for resources in these areas. Our idea is that the Centres should be working in close collaboration with CGIAR centres and affiliated research institutes to avoid duplication of effort. Rather, the work of the Centres is to search out and obtain available expertise, tailor that information so that it is appropriate to the needs of the organic sector, and serve as the focal point for scientists, farmers and processors seeking information on organic agriculture. In some cases, this will take minor effort, in other cases it will require significant research specific to organic production systems.

In many cases, we have also listed an example or more of existing centres and networks that will be likely collaborators for this work. These listing are not meant to be exclusive or to suggest potential awardees of ORCA centre work. Rather these organizations are included to give an idea that work in this area is ongoing and that there are likely research partners with whom to interact.

Agritourism

Agritourism refers to people visiting working farms or other agricultural operations for the purpose of enjoyment, education, or other active involvement. Agritourism encompasses a wide variety of activities and provides a means for farmers to diversify and supplement their income. Such activities may include wildlife study, horseback riding, cannery tours, cooking classes, wine tasting, harvest festivals, barn dances, farm stays, guided tours, and petting zoos. While many

visitors will engage in agritourism for short periods of time, such as an afternoon of berry picking, others remain for days and, in some cases, work on the farm. Diversifying income is an important risk management strategy and organic farmers want to learn more about successful agritourism ventures. They also need better understanding of risks and potential liabilities of having visitors on the farm.



FAO, 2007

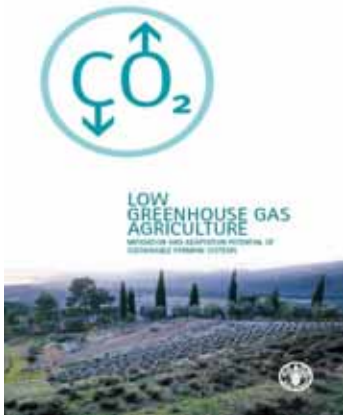
Currently, research in agritourism is virtually non-existent. Most agritourism organizations focus on promoting and encouraging tourism rather than research. Bioecological Agrotourism, a programme of the Italian Association for Organic Agriculture (AIAB) is the most well developed entity focusing on organic agritourism.

Organic Resources

- Associazione Italiana per L'Agricoltura Biologica
- Cooperativa Nuovo Cilento
- Institute of Biological, Environmental and Rural Sciences (IBERS), Aberystwyth University
- Spannocchia Foundation

Agro-energy

The development of agro-energy in recent years has been one of rapid growth in Europe, Asia, and the Americas. However, it may be at the price of unsustainable plantations for bioethanol and biodiesel. Rather than using non-food agricultural products, first generation biofuels are made from crops that otherwise could be used an animal feed or human food. With the growing global population, new methods of obtaining agro-energy that do not cause food shortages and resource degradation must be developed. The second generation of agrofuels will feed on agricultural residues and forest biomass and may have fewer trade-offs. While organic agriculture reduces the need for energy compared with conventional agriculture, energy is still needed for many purposes such as operating machinery and irrigation. Farmers would like to balance their energy production and consumption, and organic agro-energy may allow for a more positive balance since there are few alternatives for fuel besides biofuel. Beyond capturing the environmental savings from use of waste materials and natural resources to generate energy on farms, agro-energy can provide critical access to energy, heat, and cooking fuel for smallholder farmers while providing an income through organic agrofuel production and classic bioenergy (e.g. biogas, gas produced by the anaerobic breakdown of organic matter). The potential of agro-energy within the context of organic systems remains a topic ripe for research and development should opportunities be maximized without risking conflicting use of agricultural biomass (e.g. food, feed, energy, soil amendment). Producers interested in agro-energy are interested in the most energy positive sources of biomass, efficient methods of biogas conversion, and environmental change and stress.



FAO, 2009
http://www.fao.org/organicag/

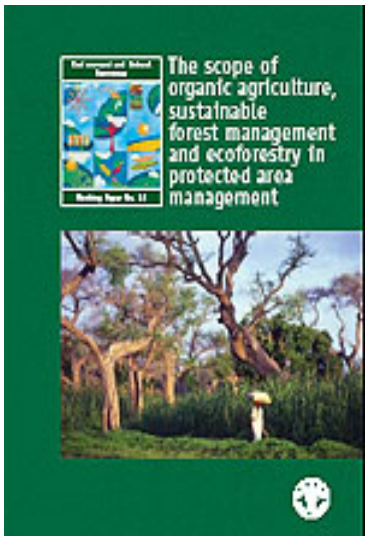
Currently, there has been a lot of interest in researching agro-energy sources; however, much of it is conventional. Organic research in the topic focuses on methods of obtaining large yields of biomass from crops. The main organic research institute involved is the University of Kassel.

Organic Resources

- Faculty of Organic Agricultural Sciences, University of Kassel
- Faculty of Agricultural Sciences, University of Hohenheim

Agroforestry

Agroforestry defines land-use systems and practices that integrate woody perennials with other crops and/or animals. The integration of agroforestry in organic production is uncommon, creating a significant opportunity for research to assist farmers in this underdeveloped strategy. Although use of alley cropping and mixed perennial cropping is increasing in the organic sector, farmers are anxious to understand more about the use of trees, hedges and shrubs as a way to improve soil physical properties, maintain soil organic matter, protect crops and livestock from flying insects and other predators and promote nutrient-cycling. In areas where land-use practices have led to serious degradation, farmers are seeking to make better use of trees in their efforts to reclaim land. Of particular interest is the need to develop the use of and best practices for agroforestry alongside organic agriculture as a strategy to sequester carbon and to complement the existing suite of mitigation approaches for global climate change. This is highly relevant to sustainable development as agroforestry can also be used to improve livelihoods through intercropping and crop diversification as well as potentially enable access to other income generating avenues such as carbon markets.



FAO, 2004
www.fao.org/organicag

Few research institutions are currently engaged in organic agroforestry research. However, non-organic institutions and organizations are engaged in work that will be vital to developing research capacity in organic agroforestry. For example, although not organic institutions, the World Agroforestry Centre maintains extensive libraries of books and journal articles on agroforestry and the International Union of Forestry Research Organisations (IUFRO) is a strong resource for identifying materials and scientific work in the field.

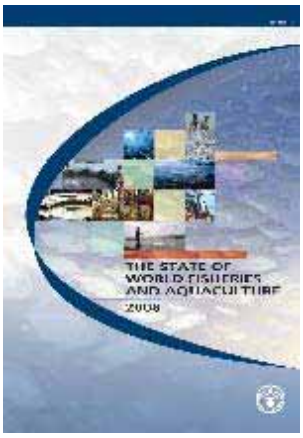
Organic Resources

- International Union for Forest Research Organizations (IUFRO) (non-organic resource)
- Organic Research Centre - Elm Farm
- World Agroforestry Centre (non-organic resource)

Aquaculture

Aquaculture is the fastest growing method of food production. Although aquatic products are among the most widely traded foods, organic aquaculture has lagged behind the agricultural sector in terms of the quantities and diversity of certified organic products. This is due, in part,

because standards for organic fish, crustaceans, and aquaculture production have only recently been established in a limited number of countries. Organic aquaculture producers are seeking knowledge related to nutritional aspects of fish production, including the replacement of fish meal and oil with potential substitutes of plant origin, use of synthetic amino acids and natural antioxidants; construction materials for holding facilities, stocking densities, processing (particularly avoiding microbiological hazards in smoked vacuum packed fish) oxygenation, and management for water quality. Other more broad research topics include allowable feed sources in organic aquaculture, supply chain issues with organic fish sales, and infrastructure for processing fish as organic.



FAO, 2008
http://www.fao.org/fishery/sofia/

Much of the work in organic aquaculture has been in certification rather than research. Therefore, a research void exists in this area. The main organic research work is being done by ICROFS in their ORAQUA project that focuses on feed.

Organic Resources

- Aquaculture and Aquatic Resource Management Research Unit (ARU), Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD)
- Aqua Eco
- Aquaculture Group, IFOAM
- Debio
- International Centre for Research in Organic Food Systems (ICROFS)
- Naturland

Aromatics and Medicinals

FAO, 2004
http://www.fao.org/forestry

Medicinal, aromatic and dye plants (MADPs) can be either cultivated or harvested in the wild under the Organic Standards. These plants have uses ranging from edible herbs and spices to medical and cosmetic applications, as well as uses such as botanical grain protectants. The emergence of the organic cosmetic sector, coupled with the revival of traditional and alternative medicines (US$30 billion annually in the USA alone), has created an enormous demand for plants free of chemical residues, whether cultivated or harvested in the wild. Many of the 700 species commercially used by the herbal industries are harvested under pressure for other uses and are frequently exploited without any particular management strategy. As a result, many species are overexploited and are diminishing if not disappearing. Management methods for these areas and increased cultivation and domestication of some of the species are needed to assure future required supplies of those species. The sustained availability of aromatic and medicinal plants is of high significance to the millions of households and health practitioners, especially in developing nations. However, very few plant species have been sufficiently tested

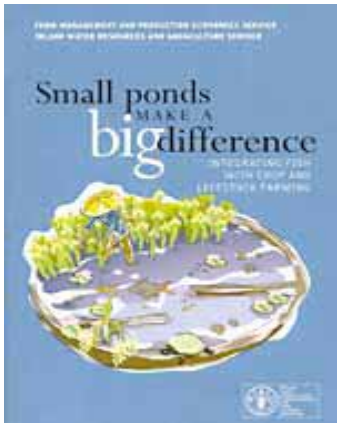
in the laboratory to indicate their usefulness for wider use.

Nonetheless, the research and development sector for MADPs is rapidly expanding around the world. Organizations which focus on phytotherapy, pharmacology, and the aroma and spice trades are particularly active. Located in Bhutan, the Institute of Traditional Medicine Services is a leading institution for research on organic MADPs and a potential resource to organic researchers.

Organic Resources
- Biotechnology Centre (Bio-Centre), Government of Karnataka
- Institute of Ecological Farming, University of Natural Resources and Applied Life Sciences (BOKU)
- Institute of Traditional Medicine Services (ITMS) (no website available)
- KAITE Company

Capture Fisheries

Fish are a significant source of animal protein among the worlds' poor. Beyond its nutritional importance, at least 200 million people derive direct and indirect income from fish. As such, capture fisheries (i.e. fish caught in the wild) are becoming an increasingly important component of the organic food market. Standards for organic capture fisheries still do not exist and there are no signs that they will be developed in the near future. However, the Marine Stewardship Council has established an ecolabel for fish caught in the wild. Research topics range from supply chain issues with organic fish sales and infrastructure for processing fish as organic to a better understanding of consumer demand in buying an organic product that has been source from a wild fishery.

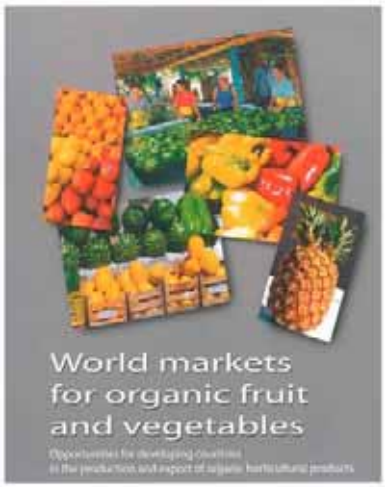


FAO, 2000
http://www.fao.org/organicag

Very little research has been conducted on organic capture fisheries, perhaps resulting from the lack of an international standard for the product. As a result, a sizeable gap still exists in organic fisheries research.

Organic Resources
- Marine Stewardship Council (MSC) (non-organic resource)

Commodity Intelligence



Farmers seek price and sales information to assist in the orderly marketing and distribution of farm commodities. Information is needed on prices, volume, quality, condition, and other market data on farm products in specific domestic and international markets. To constantly improve the efficiency and fairness of the organic market, it is imperative that this information is available to all stakeholders in the supply system.

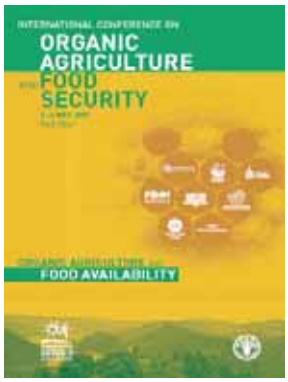
While many institutions are engaged in research on the marketing and trade of organic products, very few are doing work on commodity intelligence, especially in the developing world. Thus far, the most robust research in this area has been carried out by researchers at Aberystwyth University in Wales, where studies have been conducted on organic marketing initiatives with the aim of improving the strategic marketing position of organic products.

Organic Resources

- Institute of Biological, Environmental and Rural Sciences (IBERS), Aberystwyth University
- Briefing Room on Organic Agriculture, USDA Economic Research Service (ERS)
- QualityLowInputFood (QLIF)

Comparative Studies

Long-term comparison trials are necessary to evaluate the benefits of organic agricultural systems. Conversion to organic agriculture can be time-intensive and costly in terms of certification. Before beginning the process, farmers want to be sure of the long-term advantages. They want to understand how organic systems compare with regard to nutrients, energy and in terms of capital and labour requirements. It is expected that the longer land is under organic management, the better crops will perform, due to enhanced nutrient cycling, improved soil quality, and systematic resistance to pests. Long-term studies are needed to document changes that occur over time in maturing organic systems and identify those factors that are most significant over time in maximizing organic productivity.



FAO, 2007
www.fao.org/organicag

The current research in comparison trials focus on cropped based systems. Comparison trials on organic versus conventional livestock systems have not been started. Several civil society organizations have undertaken long-term trials on crops. The USA-based Rodale Institute's long-term trials are in their third decade of comparing organic and conventional production. Recently, FiBL and its partners began developing sites for long-term comparison trials in Kenya, India, and

Bolivia. FiBL, along with Agroscope, also maintains another long-term comparison project called BOK.

Organic Resources

- Agriculture Research Group on Sustainability (ARGOS)
- Agroscope Reckenholz-Tänikon Research Station ART
- Co-ordination for Organic Farming and Consumer Protection, University of Hohenheim
- Faculty of Agricultural Sciences, Aarhus University
- Faculty of Human Nutrition and Consumer Sciences, Warsaw University of Life Sciences
- Institute for Biodynamic Research (IBDF)
- Organic Agriculture Program, Iowa State University
- Organic Agriculture Working Group, Kentucky State University
- Rodale Institute
- Research Institute for Organic Agriculture (FiBL)
- World Vegetable Centre (AVRDC)

Compost & Waste

Compost, vermicomposting, and compost teas are widely used by organic farmers. Composting helps restore soil fertility and raise crop yields particularly for farmers in degraded areas, contributes to soil conservation, and can be used for control and rehabilitation of gullies created by erosion. Some urban centres have begun compost programmes as an environmentally sound way to reduce consumer waste. Organic farmers seek better information on potential pathogens in compost, the impact of turning compost piles, the carbon and nitrogen dynamics within compost piles, and safe methods for making compost teas. Alternative uses (e.g. energy generation) for organic waste materials are an area in need of further research on appropriate technologies, costs and environmental impacts.

FAO, 2003
http://www.fao.org/docrep/007/y5104e/y5104e00.htm

There currently are no research institutes or programs specifically dedicated to researching compost and waste and very little research on organic compost and waste. The Organic Farming Systems and Nutrient Management Program at Washington State University is doing the most research on organic compost and waste.

Organic Resources

- Institute of Natural Organic Agriculture (INORA)
- Long Island Horticultural Research & Extension Center (LIHREC), Cornell University
- Organic Farming Systems and Nutrient Management Program, Washington State University
- Rodale Institute
- Soil & More

Consumers

Knowledge of consumer behaviour including purchasing practices and perceptions of organic goods ranging from commodities to branded food and fibre products is needed within the context of developing countries and the global market. Curiously enough, the financial crisis has not led to a decrease in global retail of organic products. The full potential for organic in the marketplace will not be realized without understanding the interest in demand (e.g. willingness to pay and market studies) and barriers (e.g. challenges in sourcing organic foods locally) to supplying consumers with organic food. In addition t is important to understand how consumers perceive quality attributes of organic foods such as nutritional value, food safety and its adherence to standards that align with their expectations.

FAO, 2008

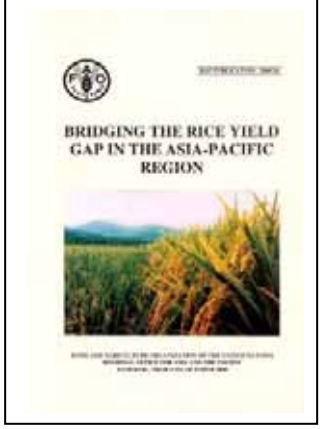
At this time, many different institutions are conducting research on organic consumers. In April 2009, the EU-coordinated QualityLowInputFood (QLIF) integrated project held their final congress. For the past several years, QLIF has provided a platform upon which to expand research in this area, particularly in the developing country context where studies are limited.

Organic Resources

- Agro Eco Louis Bolk Institute
- Bioforsk Organic Food and Farming Division
- Faculty of Organic Agricultural Sciences, University of Kassel
- Nafferton Ecological Farming Group (NEFG) and the School of Agriculture, Food and Rural Development (AFRD), Newcastle University
- International Centre for Research in Organic Food Systems (ICROFS)
- International Organic Food, Quality and Health Research Association (FQH)
- Organic Consumers Association (OCA)
- QualityLowInputFood
- Research Institute of Organic Agriculture (FiBL)
- Soil Association Consumer Guide
- United Kingdom Department of Environment, Food and Rural Affairs (DEFRA)

Cropland Yield

Research is needed to determine the suitability of organic production for various regions of the world particularly with regard to the impact of organic systems on yield and yield security during years of extreme climatic conditions. All agricultural production systems, organic included, must devise strategies to enhance yields to meet increased demand for food. Organic farmers want to understand how to optimize yields in highly diverse, mixed crop and livestock systems. They need information on high-yielding varieties suitable for organic systems. Assessments that better calculate yields in systems with multi-year long-term rotations and that are calibrated to food security needs rather than marketing orders and other artificial dictates of food aesthetics



must be undertaken. Farmers are seeking information about rotation strategies that best boost yields.

Unlike conventional agriculture, research on organic agriculture does not mainly focus on yields. Most of the current research is studying the impacts of high-yield systems on the environment and community. The Institute of Organic Farming within the German Federal Research Institute for Rural Areas, Forestry and Fisheries (VTI) is the main research body focusing on improving organic crop production in respect to high yields.

Organic Resources

- Agroscope Reckenholz-Tänikon Research Station ART
- Center for Sustaining Agriculture and Natural Resources, Washington State University
- Faculty of Organic Agricultural Sciences, University of Kassel
- Institute for Biodynamic Research (IBDF)
- Institute of Organic Farming, German Federal Research Institute for Rural Areas, Forestry and Fisheries (vTI)

Energy Flows

Conversion to organic production reduces farmers' dependence on energy and off-farm inputs and can increase efficiency of energy use. Proper use of manure, green manures, crop rotation and weeding strategies are critical in organic systems and can provide an energy savings by removing the manufacturing, packaging, and shipping costs associated with synthetic pesticides and nitrogen fertilizers. Organic farming also improves soil organic matter by enhancing fertility through increased nitrogen in the soil and reducing water (and energy) demand by increasing storage of rainfall. Forage production also requires less energy than grain production; for example, production of beef protein on good organic pasture has been found to require half as much energy as grain-fed beef. Research to document these energy savings and flows throughout organic systems will help farmers and policy-makers understand the cost savings associated with organic agriculture, both economically and environmentally. Improving efficiency of moving food from farm to fork can also have trickle down effects such as facilitating local access to foods.

Organic research into energy flows is just beginning. There is a gap in research determining the energy savings of organic agriculture. ICROFS, in collaboration with Aarhus University, is conducting the Global Org project, which is currently the main project studying organic energy flows.

Organic Resources

- International Centre for Research in Organic Food Systems (ICROFS)
- Institute of Organic Agriculture, University of Bonn
- Organic Agriculture Program, University of Guelph

Fibres

FAO International Year of Natural Fibres, 2009
http://www.naturalfibres2009.org/

The organic fibre market is growing rapidly; between 2005 and 2008, organic cotton showed an average annual growth rate of 185%. Organic cotton now represents 0.48% of the world's harvested area. Combined, India, Syria and Turkey account for more than 86% of the total production of organic cotton. Other countries with significant organic cotton production include the US, Peru, Uganda, Tanzania, Egypt, Senegal, Israel, Greece, Benin and Brazil. Producing and processing cotton without the use of toxic materials is difficult. Organic farmers are seeking information on pre-plant flaming strategies, beneficial habitat planting, strip and trap planting, field borders, cultivars that mature early, insecticidal soaps, and all aspects of fibre processing and acceptable materials.

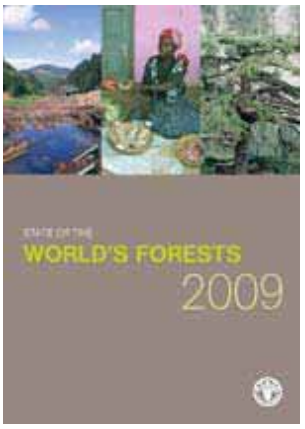
At this time, there are no research institutions dedicated in their entirety to studying organic fibres and textiles. However, several organic non-research partners have done considerable work in the area and could offer valuable expertise to organic researchers. These potential sources of expertise include the Cotton Development Organization in Uganda and Organic Exchange.

Organic Resources

- Cotton Development Organisation
- Global Organic Cotton Community Platform
- Institute of Ecological Farming, University of Natural Resources and Applied Life Sciences (BOKU)
- Max Havelaar Foundation
- Organic Exchange
- Research Institute of Organic Agriculture (FiBL)
- Swiss Association for International Cooperation (Helvetas)

Forestry

Forestry can be a stand-alone occupation for timber production or be done in conjunction with other income generating activities (e.g. alongside agriculture). Organic forestry, a system that functions without the inputs of synthetic pesticides and fertilizers, has tremendous potential to redefine best-practice in forestry. In the Australian state of Tasmania, approximately 1% of the state forest is harvested and regenerated annually without use of chemicals through an organic forestry program. The timber from such programs is often marketed as 'eco-friendly' to consumers and sold at a premium (though consumer demand remains limited). Carbon benefits can also be captured, providing additional income and environmental benefits. It is clear that there is great potential for research on alternatives to chemicals used in traditional silviculture, use of indigenous trees and use of forestry



FAO, 2009
http://www.fao.org/forestry

as a tool for climate change mitigation. Non-timber forest products (NTFPs) collected in forests also serve as a major source of nutrition and income in many parts of the world. However, organic forestry is relatively undeveloped and there is no IFOAM Organic Forestry Standard. Only two certifiers have developed their own Organic Forestry Standards: Debio (Norway) and Naturland (Germany). In the absence of an IFOAM standard, sustainable certification schemes are often pursued by environmentally conscious stakeholders. The Forest Stewardship Council is the international leader for sustainable forestry.

At this time there are no forestry research institutions dedicated in their entirety to this field of organics. This research void has likely persisted due to the absence of an IFOAM Organic Forestry Standard. There are in fact, however, several networks, institutions and organizations that dedicate some portion of their resources to the study of forestry that does not rely on chemical inputs. These relevant non-organic institutions include CIFOR and Forestry Tasmania.

Organic Resources

- Avalon Foundation
- Center for International Forestry Research (CIFOR) (non-organic resource)
- Forestry Tasmania (non-organic resource)
- IFOAM Draft Forestry Standard Proposed in 2002

Fruit & Vegetables

In 2007, 178 000 ha of vegetables were grown organically around the world. In sub-Saharan Africa, organic vegetables are grown in Kenya, Uganda, Madagascar, Malawi, South Africa and Zambia, although this production is almost entirely for export. While much research on organic production of fruit and vegetables is taking place, it encompasses only a handful of crops and is mostly being undertaken in developed countries in temperate and subtropical climates. Organic farmers are seeking information on how to organically manage pests and pathogens. They are asking for expanded information on the potential of botanical pesticides for crop protection, production techniques for low soil fertility conditions, and identification of indigenous varieties that perform well under organic management. There is also a need to understand how to reduce the risks of fruit and vegetable post-harvest losses (which can be as high as 40-60% of yields) due to pest damage and spoilage.

FAO, 2005
http://www.fao.org/organicag

Research on organic vegetable production is conducted at numerous universities and research institutions around the world, but this information has yet to be collated. The World Vegetable Centre (AVRDC) has undertaken organic vegetable research related to plant compounds and yields, which could be of use to organic researchers. In addition, civil society organisations, such as Garden Organic, which seeks to improve techniques in organic horticulture in developing countries, have valuable expertise on the production of organic fruit and vegetables.

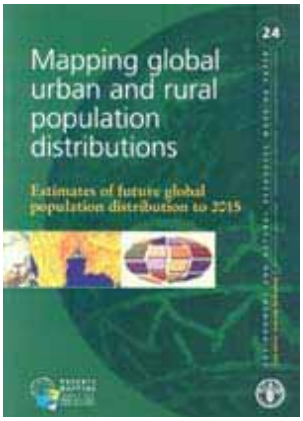
Organic Resources

- African Organic Centre for Excellence, Uganda Martyrs University

- Agricultural Experimental Farm, National Chung-Hsing University
- Agro Eco Louis Bolk Institute
- Co-ordination for Organic Farming and Consumer Protection, University of Hohenheim
- Faculty of Organic Agricultural Sciences, University of Kassel
- Freeville Organic Research Farm, Cornell University
- Institute of Organic Agriculture, University of Bonn
- International Centre for Research in Organic Food Systems (ICROFS)
- National Horticultural Research Institute (NIHORT)
- Organic Agriculture Working Group, Kentucky State University
- Organic Research Centre - Elm Farm
- Organic Training College, Lincoln University
- Organic Vegetable Research Program, Auburn University
- Research Institute for Organic Agriculture (FiBL)
- Rodale Institute
- World Vegetable Centre (AVRDC)

Landscaping

Ornamental and turf agribusinesses, nurseries, cut flower operations, and other landscaping enterprises create systems that are highly dependent on synthetic inputs and often use unsustainable quantities of water. Ecological management of landscapes through organic agriculture is a nascent, but critical pursuit. Organic farmers and residents seeking to beautify their properties need better information on how to create landscapes that are diverse, durable, drought-tolerant, and aesthetically pleasing. Additionally, technical support is needed to allow for the expansion and revision of organic standards in this area. In Canada, efforts are underway to encourage residents to undertake edible landscaping – the incorporation of edible species throughout the landscape. Edible species include a wide diversity of perennial and annual plants. Urban yards use vertical spaces and multi-layered approaches which, on a per square foot basis, may provide more food, wildlife habitat and aesthetic interest than typical annual vegetable gardens. People want to learn more about the use of edible landscaping to assist those who are food insecure and to apply them in various settings such as school yards, businesses, apartment complexes, and public spaces.



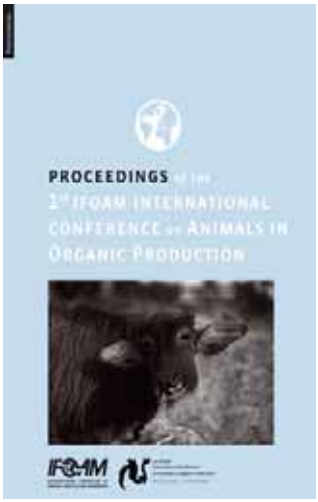
FAO, 2005
http://www.fao.org/nr/

Research into agricultural landscaping is highly limited and very diverse. The few institutions that are currently undertaking research projects on organic landscaping generally have other dominant research foci. Much room remains for the expansion of research in this concentration area.

Organic Resources
- Faculty of Agricultural Sciences, University of Hohenheim

Livestock

More than 50% of the world's poor own livestock and depend on them for food, income, traction, and fertilizer. Across the world, organic livestock (our use of this term includes poultry) systems are far less developed than those for crops. In many aspects, standards are, unfortunately, open to many interpretations and not easily enforceable. For example, the EU Regulation requires that animals be given 'regular exercise' and that 'appropriate breeds' be used, yet there is no clear definition of either of these dictates. However, high priorities for organic livestock are clear. Due to organic prohibitions on certain veterinary drugs, health care protocols must be developed for each species, including research on alternative and complementary methods of disease prevention, effective non-chemical parasiticides, and preventive health care practices. Development of rations and feeding strategies to reduce the incidence of harmful pathogens and breeding programmes for organic animals are needed. Improvements in animal housing, husbandry and better understanding of mixed crop and livestock systems are also important. Especially key in arid and semi-arid areas is the development of feeding strategies that provide adequate nutrition and high livestock productivity given the environmental constraints.



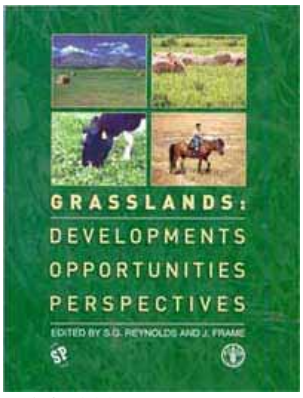
IFOAM, 2006
http://www.ifoam.org

Most of the research on organic livestock is occurring in temperate areas. Though arid areas are largely dependent on livestock, little research is being done on organically raised livestock. The University of Reading's Veterinary Epidemiology and Economics Research Unit is the main institution involved in this work.

Organic Resources

- Center for Sustaining Agriculture and Natural Resources, Washington State University
- Institute of Organic Farming, German Federal Research Institute for Rural Areas, Forestry and Fisheries (vTI)
- International Centre for Research in Organic Food Systems (ICROFS)
- ATTRA - National Sustainable Agricultural Information Service
- Organic Agriculture Centre of Canada (OACC)
- QualityLowInputFood
- Research Institute for Organic Agriculture (FiBL)
- School of Biological Sciences, University of Aberdeen
- Sustaining Animal Health and Food Safety in Organic Farming (SAFO)
- Veterinary Epidemiology and Economics Research Unit (VEERU), University of Reading

Pastures



FAO, 2007
http://www.fao.org/ag/AGP/agpc/doc/climate/aguiar/intro.htm

Approximately two-thirds of organically managed land, roughly 20 million ha, was pasture in 2007. Requirements for animals to be pasture-raised are increasing in organic regulations in developed countries. Furthermore, demands on pasture quality are increasing. For example, the EU Regulation requires that pastures be suitable to natural nutritional and behavioural needs of particular species. These market drivers, along with a burgeoning market for grass-fed meat, has created great interest in the organic sector in pasture improvement strategies. Pastures may also have a large role in mitigating climate change through carbon sequestration. While organic pastures are not typically mono-cultural and include varied species including legumes, organic farmers seek better information on the best plant species and varieties and animal combinations for various regions, and for reaching different soil layers to better absorb soil nutrients. Farmers want to know more about the potential role of early cultivation of pasture crops as an organic weed control strategy; complete protocols for organic pastured beef, hog, and poultry production systems; and biological controls for invasive and harmful weeds.

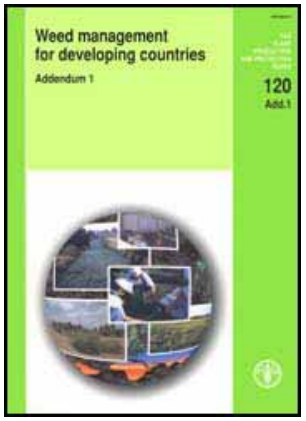
Most of the research in this area is occurring in temperate areas. For example, the Institute of Organic Farming and Farm Animal Biodiversity at the Agricultural Research and Education Centre (AREC), based in Austria, is one institution that studies grassland management. To date, little research is being done on organic pastures in arid areas, although these areas are largely dependent on livestock and pasture.

Organic Resources

- Institute of Organic Farming, German Federal Research Institute for Rural Areas, Forestry and Fisheries (vTI)
- Organic Agriculture Centre of Canada (OACC)
- Agroscope Research Station, Swiss Federal Office for Agriculture
- Institute of Organic Farming and Farm Animal Biodiversity, Agricultural Research and Education Centre (AREC)
- Faculty of Organic Agricultural Sciences, University of Kassel
- International Centre for Research in Organic Food Systems (ICROFS)
- National Sustainable Agricultural Information Service (ATTRA)

Pest and Disease Management

Organic agriculture requires farmers and processors to rely on preventive, cultural, and physical methods of pest and disease management rather than chemical inputs. Botanical pesticides are used but only when biological and cultural practices, such as crop rotations, crop diversification, and beneficial organism releases, fail. Additionally, questions remain on the phytotoxicity and compatibility when mixing these botanical pesticides. Organic farmers and processors continue to ask for development of organic pest management protocols, bioregion organic crop and pest management strategies, and models of weed population dynamics under different cover crop,



FAO, 2003
http://www.fao.org/ag/

tillage, and crop rotation management strategies. They seek better knowledge on pest life cycles and natural hosts, natural enemies, prey and predators, habitats that accommodate beneficial organisms, the potential of breeding for resistance, and the identification of critical periods for weed control.

Several universities and institutions in the north also have robust research in the area. Currently, far fewer institutions are conducting this research in developing countries, but efforts are beginning. For example, scientists in the African Organic Center of Excellence at Uganda Martyrs University and some of the CGIAR network institutions are now conducting research on organic pest and disease management.

Organic Resources

- Agro Eco Louis Bolk Institute
- Center for Sustaining Agriculture and Natural Resources, Washington State University
- Faculty of Agriculture, Uganda Martyrs University
- Faculty of Agricultural Sciences, Aarhus University
- Faculty of Organic Agricultural Sciences, University of Kassel
- International Centre for Research in Organic Food Systems (ICROFS)
- Institute of Organic Agriculture, University of Bonn
- IR-4 Project, Rutgers University
- Nafferton Ecological Farming Group (NEFG) and the School of Agriculture, Food and Rural Development (AFRD), Newcastle University
- Organic Agriculture Program, Iowa State University
- Organic Agriculture Program, University of Guelph
- Organic Research Centre - Elm Farm
- Research Institute of Organic Agriculture (FiBL)
- School of Biological Sciences, University of Aberdeen
- University of Agriculture, Abeokuta (UNAAB)

Protected Areas

Protected areas cover about 10% of the earth. Since few toxic inputs are used in organic agriculture, introducing organic farms in protected areas is believed to be a viable strategy for sustainable conservation and food production as demand for resources increases. However, there is an acute need to find biodiversity-sensitive management strategies for protected areas. There are numerous ways of approaching the conservation of biodiversity and no simple relationship between biodiversity and benefits for the farm. Organic farmers are seeking replicable models of effective conservation and organic production. In particular, they seek strategies for habitat preservation for crop pollinators and for crop pest predators, promotion of *in situ* conservation of wild crop

FAO, 2002
http://www.fao.org/biodiversity/commission-on-genetic-resources/

relatives and wild plants for food production, and approaches for farm layouts that can be used in concert with management practices to increase biodiversity. In addition, research also needs to be done on maintaining and increasing biodiversity in other forms of agriculture such as wetland use strategies, forestry preservation, protocols to monitor potential transmission of wildlife diseases to livestock, and recommendations on equitable and ecologically sustainable limits.

Currently, most organic research focuses on biodiversity in a specific area of agriculture such as livestock or comparative studies. Research gaps remain in better understanding the large-scale benefits and disadvantages of organic farms in protected areas, as well as maintaining biodiversity on a system-wide scale. The University of Guelph's Organic Agriculture Program is the main organic institution studying biodiversity conservation.

Organic Resources

- Research Institute for Organic Agriculture (FiBL)
- Organic Agriculture Program, University of Guelph
- Spannocchia Foundation
- Institute of Organic Farming and Farm Animal Biodiversity, Agricultural Research and Education Centre (AREC)

Rice Systems

FAO, 2004
http://www.fao.org/rice2004

Rice systems are one of the major types of farming systems in the world and rice is the most rapidly growing food source in sub-Saharan Africa. Organic rice systems are much less pesticide intensive than conventional rice systems. However, weed control and soil fertility remain major challenges in growing rice organically. Primary weed control practices include crop rotations (including lengthening typical rotations to include a fallow year), land levelling, seedbed preparation, water management, and rotary hoeing. Because of weed pressure and fallowing, yields tend to be smaller in organic production. Better information on fertilisation strategies from crop rotations, particularly from legumes such as purple vetch, and ways to optimize their use of locally-available nutrients such as rice straw, manure, guano and rock-phosphate is needed. Further research topics could include the potential for organic rice systems to emit less methane than conventional rice systems and rice-crop systems. Rice-fish systems have the potential for providing an extra source of food and income. Although these systems are fairly popular in Asia, they are still in the early stages of establishment in Africa.

Much of the current rice research is being done in Asian countries and a gap exists both in organic rice research and African rice research. Of the conventional research institutes, the International Rice Research Institute (IRRI), which recently published a primer on organic rice farming and has strong rice research connections in Africa, could be a major source of information for organic researchers.

Organic Resources

- International Rice Research Institute (IRRI) (non-organic resource)

- Earth Net Foundation

Underutilized Varieties

Only 150 plant species are used and commercialized on a significant global scale despite the fact that an estimated 7000 species are important to people's livelihoods and have significant potential for commercialization. Many underutilized plant species provide important environmental services, as they are adapted to marginal soil and climate conditions. Organic underutilized varieties are both cultivated and collected in the wild.

A research gap in organic production and collection of underutilized varieties persists and presents substantial opportunity for future research. Bioversity International, which is engaged in research and promotion of underutilized crops and has done some research on organics, does not have a focus on organic production and collection but is nonetheless a valuable resource for information on underutilized varieties.

GFU, 2006
http://www.underutilized-species.org/

Organic Resources

- Bioversity International (non-organic resource)