

TAKING STOCK OF THE MULTIFUNCTIONAL CHARACTER OF AGRICULTURE AND LAND

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Executive Summary

Various analytical approaches have emerged during the past decade that help to capture the complexity and continuing importance of agriculture and assess its relationships with other sectors of the economy and society. In particular, the “Sustainable Agriculture and Rural Development” (SARD) approach aims to foster sustainable development (in the agricultural, fisheries and forestry sectors) that “conserves land, water, plant and animal genetic resources, is environmentally non-degrading, technically appropriate, economically viable and socially acceptable.”

Evolving from SARD, the concept of the Multifunctional Character of Agriculture and Land (MFCAL) encompasses the entire range of environmental, economic and social functions associated with agriculture and related land-use. The concept is based on the assumption that agricultural systems are intrinsically multifunctional, and have always fulfilled more than just their primary aim of producing food, fibre and fuel. Analysis of the multifunctional character contributes to understanding the potential linkages, synergies and trade-offs that can help to achieve sustainability in agriculture and rural development. The MFCAL approach provides a policy-oriented analytical framework for the achievement of SARD goals.

In order to examine the relevance of the concept, a growing body of evidence has been reviewed concerning the multifunctional character of agriculture and land across developing and developed countries and at different scales. The three key sources of information on recent developments generated for the MFCAL conference to be held in September 1999 are:

- The 1999 FAO/Netherlands "Multifunctional Case Studies" (MCS) database, comprising 130 case studies based on questionnaires which covered: geographic location and agro-ecological zone, driving factors, types of agricultural systems, scale, monitoring and sustainability of impacts, replicability of the cases, lessons learned, contact addresses and follow-up material. The MCS database has proved to be a unique information source that has drawn on the wide range of global experiences at various levels, from farm to region, with broad coverage of many technical, social and economic areas.
- The 1999 FAO/Netherlands Electronic Conference, held in early 1999, which involved some 1300 participants from more than 80 countries sharing their experiences and perspectives. Contributions came from farms, universities, the private sector, NGOs, governments and international and other organisations. The majority of participants provided examples from the local and farm levels.
- An assessment of the National Reports to the United Nations Commission on Sustainable Development (CSD). Information at the regional level was obtained through questionnaires, regional studies and literature reviews.

THE CASE STUDIES

The MCS and other case studies have been analysed to explore the principal areas of impact of multifunctional agriculture and the factors that contribute to success. They have been arranged according to three categories of functions: environmental, social and economic. Despite this subdivision, all cases illustrate that the emphasised function exists in conjunction with the others.

The cases that relate more specifically to the environmental function show that:

- farmers can profit from soil and water conservation measures, especially when this involves and enhances their own local knowledge and skills;
- there is an increasing number of proven resource-conserving technologies for pest, nutrient, soil, water and energy management;
- inputs such as pesticides and fertiliser can be more efficiently used with precision farming and delivery techniques, low dose use, resistant varieties and breeds;
- replacing chemical inputs by recycling organic matter can help to maintain levels of production, reduce operating costs, help the land to perform functions other than food production, and provide additional income;
- prevention of harmful effects of agricultural production is usually much more cost-efficient than damage repair.

The cases that relate more specifically to the economic function show that:

- a key to progress in developing countries is the provision of affordable credit to poor families, with micro-finance institutions receiving particular prominence;
- diversification of revenue sources can help vulnerable social groups by opening opportunities to produce a greater range of goods and services, such as eco-tourism and environmental caretaking, as well as contributing to greater food security;
- besides financial capital, accumulation includes capital goods such as equipment, animals and land;
- innovations in farming systems have often had multiple benefits, including significant improvements to rural productivity and welfare, and to the natural resource base.

The cases that relate more specifically to the social function, including questions regarding culture and knowledge, show that:

- human capital is crucial to developing sustainable agriculture; it does so through a range of formal and non-formal processes that encourage people's capacity to learn about and act upon their own environments;
- propositions on innovations are more likely to be adopted when organisational capacity is present, and when local knowledge is sought and incorporated during planning;
- participatory learning is crucial to effective innovation, and imposed solutions are less likely to work;
- farmers are continuous adapters and inventors of technology, and their systems are rarely static from year to year, but effective innovation requires interactive collaboration between professionals, in scientific institutions for example, and farmers;
- recent years have seen an extraordinary expansion in collective management programmes throughout the world, in areas such as watershed and catchment, irrigation, forest, and integrated pest management.

- better community organisation can help to reduce poverty in rural areas and sustain cultural integrity and identity, as well as increasing food security.

THE ELECTRONIC CONFERENCE

The participants in the global Electronic Conference debated the characteristics and implications of MFCAL. The group included a wide representation of various stakeholders and had a broad geographical distribution.

The main findings of the Electronic Conference were that:

- emphasis on non-food functions of agriculture should not distract attention from the demands for food of six billion people;
- emphasis on local stakeholders does not mean that those at higher governmental and other institutional levels have no role to play;
- developing multiple functions in agriculture should help to restore the legitimacy and appeal of agriculture for future generations;
- a major requirement is to raise awareness among stakeholders of options for more sustainable farming systems;
- key factors for success include: effective engagement of all stakeholders, a “champion” to carry the process forward for each case, and the capacity to learn lessons from “disasters” as well as from “successes.”
- impediments to success include: short-term pressures from prevailing market forces, lack of a longer-term investment horizon to preserve land for other future uses, policies that leave farmers with burdens but not benefits from change, and problems with integrating academic and local knowledge.

THE CSD NATIONAL REPORTS

Analysis of National Reports to the CSD revealed evidence of the contribution of multifunctional agriculture and land use to food security, improved policies and institutions, economic development, poverty reduction and equity, social cohesion, and protection, recovery, rehabilitation and enhancement of the environment. Progress towards sustainable agriculture and rural development (SARD) has been uneven, with problems resulting from an imperfect understanding of the links between environmental degradation and poverty. Other problems have included inadequate assessment of the relationship between population growth and migration and the prevalence of insufficient institutional capacity and political commitment. Another problem cited was the cumulative impact of government debt, leading to persistent reliance on natural resource-based exports based on unsustainable practices. The emergence of an effective constituency of consumers concerned with food and the environment was identified as a possible source of support for sustainability in the future.

GENERAL CONCLUSIONS

The case studies and other sources of information illustrate that the MFCAL concept can be used to identify the many potential private and public benefits of multifunctional agriculture and land use to farmers, rural communities and societies as a whole.

The major conclusions of the stock-taking are that:

- active participation and leadership by rural communities is fundamental to achieving sustainable agriculture and rural development;
- the progressive emergence of local and national institutions that mobilise farmers' associations, community groups, NGOs, the private sector and government agencies is a promising means of collectively addressing concerns about agriculture and land use;
- an enabling national policy environment is necessary, but, in many social and economic contexts, developing and implementing effective policies remains a major challenge;
- efficient and transparent flow of information, between all levels, from the individual land user to international bodies and institutions, is essential in order to promote participation in and ownership of innovation;
- there must be a wide availability of applied research results and locally relevant, adaptable scientific and technical information on agriculture and natural resources;
- there must be improvements in economic instruments, including rural credit and savings institutions, tools for valuation of the range of functions of agriculture, and longer-term assessments and perspectives for investment.

The overall challenge is to find new ways to exploit the multiple potential functions of agriculture and land use and understand the synergies and trade-offs between them. This, in turn, could lead to substantial benefits for national economies and peoples throughout the world.

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Chapter 1

Introduction

Agricultural systems are intrinsically multifunctional. Ever since the first crops and animals were domesticated some 10,000 years ago, agricultural systems have fulfilled more than just their primary aim of producing food, fibre and fuel. Agriculture also produces a wide range of non-food goods and services, shapes the natural environment, affects social and cultural systems, and contributes to economic growth. These impacts are often positive, but sometimes negative.

Although well-defined markets exist for food and fibre, agriculture's other non-food functions tend to involve services for which valuation is imperfect, does not exist or has yet to be developed. The issue of the multifunctional character of agriculture and land is not a new one, but the growing attention given to the non-food functions has increased its policy relevance. Multiple outputs are generated by the same activity, so rather than distinguishing between food and non-food 'side-effects,' the multifunctional character of agriculture and land implies the joint and integrated production of all outputs. This concept may be applied at many levels: from farm systems to the agricultural sector as a whole within the global economy.

FAO and other institutions focused attention in the 1970s and 1980s on emerging developments in agriculture that could address concerns about future food security, productivity and sustainability. Thinking was crystallised as an approach to "Sustainable Agriculture and Rural Development (SARD)," with the principal characteristics being that "such sustainable development (in the agricultural, fisheries and forestry sectors) conserves land, water, plant and animal genetic resources, is environmentally non-degrading, technically appropriate, economically viable and socially acceptable." Significant accomplishments have included support to improvements in farm-level information, technology and organization as well as a better understanding of the linkages between rural areas and external institutional and commercial forces.

Evolving from SARD, the concept of the Multifunctional Character of Agriculture and Land (MFCAL) is defined as the entire range of associated environmental, economic and social functions of agriculture. The concept encompasses all the multiple goods and services generated by agriculture and related land-use. Analysis of the multifunctional character contributes to understanding the combination of potential synergies and trade-offs necessary to achieve sustainability in agriculture and rural development.

This paper reviews discusses the contributions that the multifunctional character of agriculture has made during the 1990s to improving the sustainability of agriculture and related land use while maintaining its primary role of providing food security. The concept of multiple functions is employed to better appreciate the important contribution that agriculture can make to sustainability goals. The domain of agriculture here includes forestry and fish farming. This review, the accompanying Issues Paper and six Background Papers constitute the principal inputs to the FAO/Netherlands Conference on the Multifunctional Character of Agriculture and Land at Maastricht in the Netherlands from 12-17

September 1999. The value and implications of the evidence in this paper cannot be appreciated without reference to the Issues Paper.

The overall objective of the Conference is to identify the new practices and the necessary enabling environments that will lead to increased agricultural sustainability. Its particular emphasis is on raising international, national and local awareness of the range, diversity and positive potential of the multiple contributions that agriculture and related land-use can make to improving sustainability in the broad sense.

The principal tasks of the Conference are to:

- review progress, in the context of agriculture and related land-use, towards the principles contained in the Rio Declaration on Environment and Development and Agenda 21: Programme of Action for Sustainable Development;
- identify the main issues to be addressed, taking into consideration the continually evolving nature of agriculture and related land-use.

The first chapter of this paper describes the main sources of information that have been used to examine the MFCAL concept at different levels and scales and the way the information was collected, analysed and assessed. The second chapter presents the results of these information-gathering activities, illustrated by a series of case studies and summaries of progress in groups of countries at different stages of development. The final chapter sets out some conclusions and provides a link to the accompanying Issues Paper, which describes the MFCAL concept, the key issues and the policy implications, sets out an analytical framework and discusses the way forward.

The examples presented in the paper are drawn from a collection of 130 case studies, results of the literature reviews and other sources identified by the principal contributors. The examples do not constitute a representative sample, nor do they attempt to present the full range of possible ways in which the multifunctional character of agriculture and land can contribute to sustainability. The examples are organised to illustrate the three major functional groupings presented in the Issues Paper: the environmental, economic and social functions. The selection covers different geographical, institutional and environmental contexts. Issues of scale and combinations of activities and impacts are addressed, with a balance between the developed and developing world, and between various regions. Each case encapsulates in a few sentences the complexity, the temporal dimensions and the types of transformations characteristic of agriculture at the end of the 20th Century. The examples are useful guides to trends in global agriculture, and did not emerge from formal selection in consultation with each country. The cases, and the key areas identified relative to agriculture and land, do not constitute an analysis of prevailing national conditions.

Together, these papers and six Background Papers provide a broad, integrated and thematically coherent examination of MFCAL issues for the benefit of policy-makers, technicians, practitioners and other interested parties. The analysis seeks to inform and guide but not prescribe national and international policies and actions.

The titles of the Background Papers are as follows:

Sustaining the Multiple Functions of Agricultural Biodiversity. Background Paper 1: Agricultural Biodiversity:

The Multifunctional Character of Agriculture and Land: the energy function. Background Paper 2: Bioenergy.

Drylands and the MFCAL Approach. Background Paper 3: Drylands.

Environment, Trade and SARD: Concepts, Issues and Tools. Background Paper 4: Environment and Trade.

Research and Technology and the Multifunctional Character of Agriculture and Land. Background Paper 5: Research and Technology.

The Contribution of Blue Water and Green Water to the Multifunctional Character of Agriculture and Land. Background Paper 6: Water.

Chapter 2

Sources of Information

Initiatives to develop the MFCAL concept are occurring at a range of scales, with possible applications from farm through community to region, and across a range of sectors. There have been many innovations in process, technology and practice, and these have benefited both agriculture and related land-use and other economic sectors.

This paper draws upon several sources of information to investigate the multifunctional character of agriculture and land across developing and developed countries and at different scales. The process was designed to draw on the experiences of different stakeholder groups – from practitioners to policy makers.

The three key sources of information were:

- The 1999 FAO/Netherlands "Multifunctional" Case Studies (MCS) database;
- The 1999 FAO/Netherlands Electronic Conference;
- Country Reports to the Commission on Sustainable Development (CSD) and other reviews;

2.1 THE MCS DATABASE

The MCS database is now a unique information source that has sampled a wide range of global experiences at various levels, from farm to national and covering a wide range of technical, social and economic areas. It has become a key part of the process of understanding the nature of MFCAL, and a sound foundation for analysis.

In general, more substantive evidence has emerged from the local to regional level, where thousands of farm families and businesses are experimenting with new approaches that illustrate the benefits of MFCAL. But what distinguishes the current material from that of a decade earlier is the spread of some initiatives to much larger scales. Some of these have received significant national policy support. Most, though, could spread much further, delivering considerably more food and non-food benefits, if given greater policy support.

The case-study questionnaires constitute the basis of the database analysis. They were designed both to explore the conditions and processes associated with the multifunctional character of agriculture and land, and to document both food and non-food outcomes. The MCS database incorporates 130 case study questionnaires.

The questionnaires covered: initiating and resources-providing parties, geographic location and agro-ecological zone, types and scale of impact, driving factors influencing the impact, methods used for monitoring multifunctional impacts, factors affecting replicability of the case and sustainability of the impact, lessons learned, contact addresses and follow-up material, and a structured case summary.

The geographic distribution of the case study contributions is shown in Figure 1.

2.2 THE ELECTRONIC CONFERENCE

The Electronic Conference was held in early 1999, and involved some 1300 respondents from more than 80 countries sharing their experiences and perspectives. Contributions came from farms, universities, the private sector, NGOs, governments and international and other organisations. The majority of participants provided examples from local and farm level. Many participants also completed questionnaires for the MCS database, described above. A team from FAO, the Sustainable Agriculture, Natural Resources and Environmental Management (SANREM) Program at the University of Georgia, and the Wageningen University and Research Centre managed and analysed the results.

The purpose of the Electronic Conference was to:

- gather examples of the multifunctional character of agriculture and land, building up an empirical base of information;
- identify key issues for debate to be included in the Taking Stock process, as well as for the main FAO/NL Maastricht Conference;
- catalyse networks, relationships and on-going dialogue on these issues.

The Electronic Conference was conducted in three phases:

Phase I – to create an inventory of examples of the multifunctional character of agriculture and land, and to discuss basic concepts;

Phase II – to analyse the information collected during Phase I, to improve understanding of those functions which are complementary and those which are in conflict;

Phase III – to draw conclusions on the key enabling factors and/or constraints for multiple functions in agriculture and land, and the roles of different stakeholder groups in facilitating different functions.

2.3 NATIONAL REPORTS TO THE CSD

Evidence at the country level relevant to the MFCAL concept has been obtained through National Reports to the United Nations Commission for Sustainable Development (CSD). The majority of countries provided reports on natural resource aspects of sustainable development to a special session of the CSD convened in 1997 to assess progress towards Agenda 21. Two sections of these reports relate

to agriculture and land management. The special session found that the progress to date had not met expectations. The CSD set out to identify ways and means to accelerate progress in the future.

The National Reports were also made in the context of the 1991 Den Bosch Declaration on Sustainable Agriculture and Rural Development (SARD), which called for the attainment of three essential goals:

- food security by ensuring an appropriate and sustainable balance between self-sufficiency and self-reliance;
- employment- and income-generation in rural areas, particularly in order to eradicate poverty;
- natural resource conservation and environmental protection.

These goals were further elaborated as the blueprint for SARD in Chapter 14 of Agenda 21 on 'Promoting Sustainable Agriculture and Rural Development'. The challenge was to satisfy the demands of the growing population by creating the conditions for SARD that will increase food production in a sustainable way and enhance food security. It was recognised that this would require major adjustments in agricultural, environmental and macro-economic policy, at both national and international levels, in developed as well as developing countries. Success would depend largely on the support and participation of rural people, national governments, the private sector, and international co-operation.

As discussed in the Issues Paper, the MFCAL concept is closely related to and grew out of the SARD approach. Since the Country Reports were prepared in the context of SARD, the analysis of these reports by country groupings in the next chapter is in these terms.

In addition to the Country Reports, some regional level information was obtained through questionnaires, regional and literature reviews. The reviews include information on Small Island Developing States and OECD countries.

Chapter 3

Main Findings

3.1 THE MCS DATABASE – GENERAL FINDINGS

The MCS cases have been analysed to explore the principal areas of impact and the factors that contribute to success. Three areas of impact can be distinguished:

- environmental impact (including environmental protection and management of land resources);
- social impact (including social cohesion, poverty reduction and equity, and policies and institutions);
- economic impact (including food security, economic development, and science and technology).

Figure 2 provides an overview of the distribution of responses in terms of types of impact. The most frequently mentioned areas of strong impact related to soils (particularly conservation of soil fertility and productivity, mentioned in 35% of all responses, stakeholder participation (30%), sustainable livelihood contributions (30%), and institution building (29%). At a more general level, impact seemed to be more pronounced in the geographical domain (land resources, technology and environment) and social domains (stakeholder participation, increased public awareness of sustainability issues), than in the economic domain (markets, trade, policies and institutions, which were relatively less affected).

Another dimension of impact relates to scale: the area covered and number of farm households affected. Over 40% of the cases covered areas of more than 100 km² and 50% affected more than 1000 families. At the other extreme, almost 30% covered less than 1000 ha and 16% affected fewer than 100 families. When asked to tick various levels at which their case had an impact (varying from the farm to the global level), 84% mentioned the local and 64% the farm level. The percentages decline gradually towards a mere 8% for the global level. Three-quarters of all cases had impacts at 1, 2 or 3 levels, with only one-quarter claiming impacts at 4 or more levels.

Closely related to impact are the factors promoting or inhibiting success. The MCS distinguished the following categories of factors (called driving forces in the survey) contributing to success:

- historic & social;
- policy & institutional;
- planning & management;
- research & development;
- information, education & communication.

Driving forces in each of these categories were rated using a scaling system ranging from highly positive to highly negative. While none of the categories made a unique contribution to success (each was

mentioned between 50 and 74 times), the results regarding individual driving forces within each category provided a much clearer picture (see Figure 3).

Overall, the most important factor contributing to success (i.e., listed as highly positive many times) appears to be stakeholder involvement and consultation. This is rated as far more important than either science and technology or environmental and natural resources policies. The most important factors inhibiting success include historical and social factors (particularly migration and urbanisation) and policy factors (especially inadequate land tenure policies).

In order to track progress, most projects in the MCS data base used some form of monitoring and evaluation of the multiple functions:

- qualitative field observation (62% of cases);
- quantitative (formal) surveys (58%);
- seminars, workshops, etc. (23%);
- reviewing project literature (18%);
- reviewing secondary literature (7%);
- GIS-type techniques (5%);
- simulation modelling (2%).

The overall degree of monitoring and evaluation was also (subjectively) rated on a scale from 0 (none) to 3 (a great deal). Most projects did a reasonable amount of evaluation, with only 2 projects with no monitoring activities and some 10% doing little in this area. About one-quarter of all case studies involved rather extensive monitoring and evaluation activities.

The widely diverging projects in the MCS allow the distillation of a number of factors that may affect the replicability of the findings. These were grouped into four broad categories:

- socio-political conditions (including such diverse elements as cultural, organisational and institutional aspects, national political interests, land tenure, historical factors and demographic factors) (51% of cases);
- socio-economic conditions (access to markets and resources, level of technological development, government policies, etc.) (51%);
- availability of financial means (financial status of farmers, availability of financial support in the form of credit, etc.) (27%).
- geographical conditions (mainly including local environmental conditions such as climate, soils, etc.) (25%).

Finally, a number of important lessons can be learned from the wealth of project experience represented in the MCS (Table 1).

- involve local farmers, local knowledge and local institutions	70%
- involve private sector	20%
- appropriate policy support	35%
- long term commitment needed	14%
- appropriate human resources	20%
- need for holistic integrated view	29%

The results point towards the overriding importance of the involvement of direct stakeholders (including farmers and local institutions). A favourable policy environment and a holistic, multi-faceted project approach were deemed important by about one-third of the respondents.

3.2 CASE STUDIES

Various sources have been used to present the cases below. The MCS database provided eight, the Electronic Conference one and the others come from different reports and other databases. They are arranged according to three categories of function (environmental, economic and social), but all illustrate these functions in conjunction with others.

3.2.1 MFCAL Cases and the Environmental Function

Natural capital is a vital input to agricultural systems and an outcome of their activities. The cases below illustrate a wide range of ways to exploit the multifunctional character of agriculture and land by making better use of available natural resources and/or intensifying single sub-components of farming systems

Case 1. Soil and water conservation benefits the local economy in Niger

The IFAD-funded soil and water conservation project in the Illéla district is an example of a key sustainable agriculture technology having substantial multiple benefits whilst improving formerly degraded or abandoned lands. Some 5800 ha of abandoned and degraded lands on the farms of some 6000 households in 77 villages have been improved with the adoption of *tassas* (also known as *zai* in Burkina Faso). The usual, large-scale erosion control measures had not been successful in the region.

Tassas are 20-30 cm holes dug in soils that have been sealed by a surface layer hardened by wind and water action. Since this crust prevents infiltration by water, these areas are usually abandoned, devoid of vegetation, scattered with outcroppings of iron crust. They are prime sites for surface erosion. The holes are filled with manure, since soils in this region are normally lacking in organic matter. When it

rains, the holes fill with water and farmers then plant millet or sorghum. *Tassas* are used in conjunction with stone bunds, taking advantage of the stones that farmers remove from fields. These methods of soil and water conservation were learned by the farmers of Illéla on a visit to Yatenga in Burkina Faso where, on the central plateau alone, some 100,000 hectares have been restored – each now producing some 700-1000 kg of cereal per year.

This soil-development activity has allowed the region to attain average millet yields of 480 kg/ha, reaching levels of up to 700 kg/ha if chemical fertiliser is added (an as-yet uncommon practice). Comparatively, fields of similar quality-levels produced only 130 kg/ha. According to IFAD, food availability in participating households rose between 20% and 40%, depending on local rainfall conditions. The average family in Burkina Faso and Niger using these sustainable agriculture technologies have shifted from being in annual cereal deficit amounting to 644 kg (equivalent to 6.5 months of food shortage) to producing a surplus of 153 kg per year. *Tassas* are best suited to landholdings where family labour is available, or where farm hands can be hired. The technique has spawned a network of young day-labourers who have mastered this technique and, rather than migrating, they go from village to village to satisfy farmers' growing demands. There are cases of land being bought back by farmers who recognised early on the profit that can be earned from this land.

Case 2. The multifunctional character of Landcare Groups, Australia

One of the best examples of rural partnerships comes from Australia, where a remarkable national social experiment has been underway since the 1980s. Landcare encourages groups of farmers to work together with government and rural communities to solve a wide range of rural environmental and social problems. By the end of 1998, there were 4500 active local groups, comprising more than a half of all Australian farm families. For a country where individual farmers have long prided themselves on their 'frontier' spirit, and capacity to cope alone with problems, this is an extraordinary society-wide recognition that some problems can best be dealt with by working together.

Landcare groups have emerged to deal with many different local problems that affect the whole community. Groups deal with pest, weed and rabbit problems, tree decline, dune regeneration, conservation farming, soil salinity, wildlife conservation and farm profitability and business management. One example is the Morbinning Catchment group from the wheat belt of Western Australia. The Morbinning Catchment consists of twenty families on 25,000 hectares of farmland. They formed the group in 1989, united by their common problems of increasing soil salinity, poor drainage and the effects of periodic flooding. These problems could be dealt with only by planning and co-operating across farm boundaries. Over eight years, the group has re-vegetated 300 hectares of creeklines, treated 550 hectares of saltland, planted 440,000 trees including 91 km of windbreaks and 90 hectares of fodder trees, erected 249 km of fencing to protect natural bush, planted 460 hectares of alley farming systems and 80 hectares of permanent pastures and installed 145 piezometers to measure regularly the water table depth. The group has also been at the forefront of local farm improvements, including in oil seeds, reduced tillage, alternative fertilisers, soil aeration, floriculture, sandalwood planting, and farm stays and school visit programmes.

But the group has seen more than just environmental and farm benefits. Bob Hall, 1997 president of the group, put it this way: "*Before the group, farms were amalgamating, young people moving away, the community was falling apart. But now we meet 6-8 times per year, with the regular involvement of*

member families. As trust increased, so the opportunities to learn from each other also increased, and this has brought the community together". The Morbinning group won the National Landcare Award for catchment groups in 1995.

Case 3. Conservation farming for sustainable agriculture in Santa Catarina, Brazil

This project which started in the late 1970s, has succeeded in combating soil degradation in an area of 8 million ha in Brazil, benefiting tens of thousand of farm families. The initial objective of erosion control and sustainable land use evolved through a community-driven approach based on micro-catchment areas to a new way of natural resource management. Scientifically proven and economically attractive reduced tillage techniques were further developed on a communal basis into conservation farming systems, involving crop diversification and rotation and alternative uses, such as forests and pastures. Close collaboration developed between farmers, the private sector (input suppliers and manufacturers) and official institutions (FAO, EMBRAPA, etc.).

Measurable benefits have included long term increases in both quantity and quality of water availability (to agricultural and non-agricultural water users), improved soil fertility, and decrease in production risk via diversification. In addition, the project has led to reduced negative environmental impact of agriculture and improved environmental awareness of farmers. Importantly, the forward and backward linkages of increased agricultural production have led to a stimulation of non-agricultural rural activities.

Case 4. Agricultural systems that benefit bird biodiversity in Spain and Scotland

In Spain, *dehesas* are highly integrated systems contributing significantly to both natural and social capital. The term *dehesa* refers to a mix of woodland pastures and open grassland, dominated by holm and cork oak, with cereal crops and livestock - sheep, cattle, pigs and goats - feeding on grass and acorns. These are highly integrated systems, with the trees providing charcoal, firewood, shade, acorns and cork; the cereals providing grain and fodder; and the animals providing livestock products (meat and milk). There are usually 4-20 year rotations for arable practices, so the whole landscape is a mosaic of mixed habitats.

They are very rich in wildlife: up to 60 plant species per square metre, butterflies, birds and animals, including threatened species such as Spanish Imperial Eagle, Egyptian Vulture, Black Stork and Iberian Lynx. *Dehesas* are also important sources of employment for local people when managed properly. For example, one 7000 ha estate in Andalucía produces cork, timber, firewood, livestock (sheep, deer and cattle) and wild plants (herbs and fungi). The arable and grassland systems are low-input, and there is high labour use. This is higher than neighbouring estates not managed in an integrated fashion. But many of these areas are now in decline, with trees removed for more intensive and large-scale agriculture or land given over to reforestation with pines and eucalyptus.

Much the same is true of biodiverse habitats in Scotland. Long-term research on the island of Islay in the Inner Hebrides has revealed again the crucial role of a complex and diverse landscape for bird life.

Islay has ten important bird species: barnacle goose, chough, corncrake, golden eagle, golden plover, hen harrier, merlin, peregrine falcon and white-footed goose. By dividing the island's semi-natural and agricultural systems into eight types, and classifying all 687 one kilometre squares, it was found that different species use different land types at different times of the year. It was the mosaic that was crucial: "*one of the most important features [is] ... how all of the land types are selected at some time in the year. Consequently we concluded that it is the diversity of land types that supports such a large number of bird species*". It is clearly not simply a question of maintaining one or two habitats or remnants amongst intensive farmland. Whole landscapes need to be protected by mixed and sustainable farming practices.

These examples are only two of many similar cases in Europe. These include large semi-natural areas, as in Scotland and many mountain areas, important bird areas throughout the region and areas rich in natural features.

Case 5. Stabilising Hillsides in Central America

Some 45,000 farm families in Honduras and Guatemala have benefited from the adoption of sustainable agriculture, increasing crop yields from 400-600 kg/ha to 2000-2500 kg/ha. Farmers use green manure, cover crops, contour grass strips, in-row tillage, rock bunds and animal manure, which are finely-tuned to local conditions through experimentation. These programmes have regenerated local economies. Land prices and labour rates are higher inside the project areas, and families have moved back from capital cities. There are also benefits to the forests. Farmers say they no longer need to cut the forests, as they have the technologies to farm permanently the same piece of land. These conserved lands also suffered the least during the onslaught of Hurricane Mitch in November 1998, with torrential rains absorbed by conserved soils rather than causing landslides.

Case 6. T'chat (Catha edulis) hedgerow as soil and water conservation technology: the role of local knowledge and practices in sustainable land management in the Eastern Hararghe Highlands of Ethiopia

Most Ethiopian highland areas like eastern Hararghe are known for severe land degradation. The livelihoods of the farming community and population at large are at risk, given downstream impacts on the environment. Attempts were made by the government and donor agencies to combat degradation, though achievements proved small. Previous experiences show that attention should be given to adaptation and improvement of local practices. T'chat (*Catha edulis*) hedgerow-based soil and water conservation practices based on local knowledge have been found to be well adapted to the farming community. The practice has proved its effectiveness, since it integrates land conservation, farm income improvement and associated benefits such as employment generation for the farming community.

Results show that given farmers' resources and existing technology, T'chat hedgerow-based conservation practices are an economically profitable, well adapted practice for conservation and utilisation of marginal and sloping lands in the study area. The multifunctional character of the initiative is enhanced through soil and water conservation, fodder and fuelwood production, and employment generation by off-farm activities like *Catha edulis* trading, particularly by women.

Case 7. Integrated Pest (IP) Programme for Fruit and Vines in the Western Cape, South Africa

In the early 1990s, producers of fruit, grapes and wine in the Western Cape became more aware of the need for environmental protection and human safety. An IP steering committee was formed and out of this an Ag Chem environmental group, made up of all role players in the industry including universities, exporters, co-ops, research institutes, beekeepers, and the agro-chemical industry. Guidelines for pome and stone fruit, grapes and wine production were drawn up and a scoring system for spray programmes was developed to quantify subsequent monitoring. . The Ag Chem group meets a few times a year and reviews the guidelines and related practises and codes for new crop protection agents by consensus. An informal Integrated Pest Management (IPM) group, including representatives of all participating groups, meets every 14 days during the growing season. Trends and topical subjects are discussed, and if necessary, action is taken. Orchard monitoring courses are held for selected farm workers and certificates are issued. The workers are trained to recognise and record the incidence of pests and diseases. This information is used to optimise control measures in order to reduce the impact of cultivation to a minimum and in particular to optimise the use of chemicals applied for pest control, and preserve overseas markets by meeting with standards generally set world-wide.

Case 8. On-farm optimisation of conservation and cash benefits in Fiji

Contour hedges of pineapple (mid-slope areas) and vetiver grass (lower slope areas) were established on sloping degraded lands managed by traditional landowners and tenant farmers in six areas of Fiji. Participatory approaches were followed to identify sites and to establish hedgerows. Planting materials were provided as required. Farming systems being studied include ginger-taro-cassava (in high rainfall areas), and off-season vegetables (in seasonally dry areas). In one case, off-season tomatoes provided a US\$1500 cash return to a single farmer. Equally appreciated and unexpected benefits have been increased food security, family and community collective action, and village wealth, with greater economic development and diversity of production observed.

Hedgerow-based conservation cropping technologies at the village level on marginal sloping lands are being increasingly used for food production. The sustainability of production on these lands had declined due to land degradation. The initiative monitors biophysical, social and economic impacts of this technology, mainly through observation and interviews, and transfers technology to farmers through field and on-farm demonstration. Technology is transferred by NGOs and government agencies in Fiji and other Pacific Island countries through staff and information exchanges in other places. Men and women farmers have participated in design and implementation activities with a high level of ownership in on-farm activities. External support is provided by governments to overcome barriers identified by farmers (for example, by provision of unavailable planting materials and knapsack sprayers) ; and, finally, impact is optimised by balancing economic and conservation benefits.

Activities are being currently undertaken in 6 areas: Waibau, Namulomulo, Serua, Tilivalevu, Nadi/Lautoka, and Labasa. More than 125 on-farm demonstration plots are being monitored. This initiative demonstrates the multifunctional character of agriculture and land through: pineapple and vetiver grass hedgerows introduced on sloping lands with potential to provide short-term cash benefits while minimising soil and nutrient losses through erosion and maximising the use of available soil water and nutrients; improved village and household cash flows through a greater diversity of production,

including off-season vegetables; a high proportion of households (both men and women farmers) involved in participatory planning and evaluation activities; on-farm activities facilitated, rather than controlled, by researchers and extensionists; and increasing interest in the approach as evidenced by an expansion of the area under hedgerows both within the initial, pilot areas and into neighbouring communities.

There is an increasing number of proven and promising resource-conserving technologies for pest, nutrient, soil, water and energy management. These have emerged from many sources: from traditional agricultural systems, experimentation with new techniques and technologies, organic agriculture, and both from developing and developed countries. Many have arisen where steps have already been taken to reduce both costs and adverse environmental effects. These technologies seek to conserve existing farm and land resources, including system nutrients, water, biodiversity and soils. Many of the individual technologies are multifunctional. This implies that their adoption will result in favourable changes in several aspects of the farming and agro-ecological systems simultaneously. Examples include: water harvesting, contour cropping, terraces, minimum tillage, water savings through irrigation management and precision delivery to plants, rotational grazing, mechanised and manual soil recuperation techniques.

Better use of non-renewable inputs and technologies including pesticides and fertilisers are possible with precision farming and delivery techniques, low dose use, use of resistant varieties and breeds, and machinery with lower energy requirements and appropriate scale. The multifunctional character concerns superior impacts on local agro-ecology, sustainable revenues and productivity, and accessibility for producer use.

The above cases demonstrate a number of points:

- It can pay farmers to take soil and water conservation measures, especially when this involves and enhances their own local knowledge and skills. By replacing chemical inputs to some extent by recycling organic matter, not only can levels of production be maintained, but operating costs can be reduced and the land can start to perform its functions other than food production better. This can provide farmers directly or indirectly with the additional income needed for them to be able to continue operating their farms.
- Prevention of harmful effects of agricultural production is usually much more cost-efficient than damage repair.
- Environmental, social and economic functions are not necessarily conflicting, and can be mutually reinforcing.

3.2.2 MFCAL Cases and the Economic Function

An important function of agriculture and land is its contribution to economic development. This comprises the accumulation of financial capital through the returns on sales of produce and services,

through attracting new sources of money (like credits and grants) and an increase in economic activity achieved via a wide range of multiplier effects for the region as a whole.

Case 9. Multiple benefits of livestock development in Uganda

Heifer Project International introduced zero-grazing of dairy production to Uganda. This involves keeping good-quality dairy cows in confinement and cut and carry feeding. The system includes production of forages, grasses and leguminous trees. Much of this is grown on bunds and intercropped with food or cash crops thus conserving soil and moisture. The system also results in greater food security and better family nutrition. Animals are a good source of income and food in the dry season and ruminants can use much of the crop and by-products of food processing. Manure and compost from the zero-grazing unit is used as organic fertiliser and provides for the rapid recycling of limited nutrients within the system. The strengthening of community groups which provide mutual support and training is another significant component.

Dairy heifers are provided as an in-kind loan. Farmers repay the loan by raising a female offspring which is then "passed on" to another farmer in the community. Thus the group has a capital resource which enables the benefits of the programme to spread. The zero-grazing system which was introduced to Uganda by HPI in 1983 has survived despite political and economic problems. It has since been adopted by numerous agencies, including the Ministry of Agriculture and International NGOs.

Over 5,000 families have benefited directly from significant increases in income and nutrition, resulting in dramatic improvements in housing and school attendance. Some 10,000 hectares of land have been improved or stabilised by the development of a sustainable small-holder dairy farming system. More than 50 community-based groups have been strengthened and these are an engine for rural development. The status of women has been enhanced as more than half of the livestock owners are women, many of whom are widows with large families.

Case 10. Olive cultivation contributes to local jobs in Italy

Olive trees have been cultivated for at least two millennia on the Mediterranean coast, contributing to local livelihoods and producing rich and varied habitats for wildlife. But over recent decades, Cilento has suffered from mass emigration, with the young no longer wanting to be olive farmers. Combined with competition from Tunisia, where production costs are lower, pressures on the system are growing.

The CADISPA project co-ordinated by the University of Strathclyde works closely with local groups in a range of countries to support local regeneration. In Cilento, CADISPA-Italy began working with a local olive oil co-operative, Nuovo Cilento, to introduce organic farming and new marketing methods. Now 130 farmers located in the national park of Cilento are fully organic, using a wide range of resource-conserving practices to minimise input use and recycle valuable products, such as using olive husks for fertiliser. They now produce Cilento Verde, an extra-virgin organic oil of high value. Since the successful regeneration of olive production, co-operative businesses have now been set up for wild chestnut flour production, and eco-tourism. These new ventures are largely run by young people, who

are increasingly opting to stay in Cilento and use their abilities and skills to develop high-quality local goods and services.

Case 11. Micro-Finance in Pakistan and India

In the remote Northern Areas of Pakistan, the Aga Khan Rural Support Programme has helped to establish more than 2600 village or women's organisations, which cater for some 53,000 households. Village groups, originally organised to help construct an irrigation channel, road or bridge, then helped members to save small amounts of money regularly and so create collateral for credit provision. Over time, and with local control and responsibility, groups have been able to save substantial sums.

Other notable successes have emerged in southern India, where NGOs such as Myrada, SPEECH and Pradan have again shown the value of small groups. Years of relying on banks and local co-operative societies to supply credit had rarely helped the poor. But when the banks started to work with small independent groups with members feeling they could trust one another, they noticed that not only was the money managed more carefully, there was a far greater commitment and responsibility from the groups towards repaying the amount of money, something that had not unduly bothered them when they were part of the co-operative. What is particularly significant for the programmes is that some 95-98% of loans are repaid in full. This contrasts with just 20-25% for banks making loans under Integrated Rural Development Programmes.

Case 12. Agriculture in Prespa National Park, Greece

The Prespa National Park is close to the borders of Albania and Macedonia. It comprises a montane valley with two lakes and their surrounding floodplain. It is the home to the largest nesting colony of Dalmatian Pelicans (*Pelecanus crispus*) in the world. The area is remote, with the main economic activity being farming of beans, with some livestock and fishing to supplement incomes. The traditional land management system has been important for natural capital, as livestock graze the wet meadows and keep down the reeds, so creating valuable habitats for birds and fish. But adoption of intensive cultivation methods for the beans has led to the conversion of some meadows to arable, and a big increase in fertiliser and pesticide use. Both of these have had a significant impact on the aquatic resources, and the consequent loss of spoonbills and glossy ibis. In 1993, various organisations began to promote organic bean cultivation, diversification of agriculture, and development of the wildlife tourism potential of the park.

Farmers are now getting higher bean yields, as well as premium prices. This is encouraging more to adopt sustainable practices. With the focus on eco-tourism, the annual number of visitors to the park has increased from 5,300 to 13,000. These visits are better spread throughout the year. Young people from the communities have been trained in environmental management, and two tourism centres have been opened. These have helped to change local attitudes to conservation as well as those of visitors. The growth in eco-tourism has prompted the establishment of two guest houses run by local women, and several restaurants and tavernas have benefited from increased spending by visitors. Some 50-60 people are now employed in the eco-tourism sector. The government has also helped by investing in infrastructure for eco-tourism and multiple functions in agriculture.

Case 13. Soybean Cultivation in India

The rapid spread of soybean in Indian farming systems illustrates how the introduction of a single regenerative component into farm systems can have a range of benefits. The change in extent has been from some 0.04 million ha in the mid-1960s, rising to 0.5 m ha in the 1980s (average yield 0.57 t/ha), and now 5.6 million ha (average yield 0.96 t/ha). Each year, some 0.5 m ha are added to cultivation, with extent expected to pass 8 m ha by the year 2000. Soybean exports in 1997 earned India US\$ 518 million (Rs 20 bn).

The multifunctional character of soybean cultivation in India includes:

- oil production – soybean has played an important role in national self-reliance in edible oils;
- foreign exchange;
- on-farm nitrogen fixation and contribution to natural capital;
- rural employment through soya-based agro-industry;
- compatibility as inter-crop with other monsoon (kharif) crops such as pigeon pea, maize, sorghum, finger and pearl millet;
- monetary returns for farmers;
- contribution to soil fertility through organic matter addition – 0.5-2.5 t/ha of crop residues and 45 kg N/ha of fixed nitrogen (equivalent to the free use of 250,000 tonnes of nitrogen fertilisers per year, and the addition of 2.8-14 million tonnes of organic matter);
- rehabilitation of degraded lands – e.g. in Punjab where continuous rice-wheat systems would benefit from introduction of soybean into rotation;
- 95% of seed saved from previous harvest, so farmers not dependent on external seed delivery systems.

Case 14. Fair-trade coffee produces multiple benefits in Mexico

This is an example of an initiative that began at the local level and has received national recognition. Indígenas de la Sierra Madre de Motozintla (ISMAM) is a Maya Indian Organic Coffee group in Chiapas. ISMAM was formed by smallholder coffee growers to meet problems of low productivity, poor marketing conditions and extreme poverty of farm families. By adopting organic techniques and improving quality, the group was able to overcome soil degradation and low yields and move into a privileged speciality market that rewarded their extra efforts towards ecologically sound production. Through sound, participatory management of the organisation and hard work, ISMAM was able to capitalise their enterprise, overcome initial government disinterest and repression to become a major agro-industry with its own processing facilities and direct export markets in the US, Europe and Japan.

The next step was to produce blends and soluble coffee for the national market and diversify agro-production for greater food security. Besides expanding the business, part of ISMAM's profits are returned to regional committees for investment in social works. In 1995 ISMAM received the National Agro-Export prize from the hands of Mexico's President. The group now enjoys a privileged position with respect to credit and government support and has diversified into a number of areas including eco-tourism.

Case 15. Green Enterprises in Willapa Watershed of the Pacific North West, USA

In recent years, the choice between the protection of local jobs and the environment has been a serious source of conflict in the Pacific North West. Bitter disputes have erupted over the spotted owl: after it was declared endangered in 1990, the volume of timber harvested in Oregon and Washington fell by a half. But now, new partnerships between formerly hostile groups have emerged, showing just how much sustainable management of natural resources and agriculture can contribute to local economic growth.

The Willapa watershed comprises 275,000 hectares on the coast of Washington state. It is rich in natural resources, including oysters, clams, crabs, sturgeon, salmon and dense forests. But the four counties that comprise the watershed are extremely poor, and are listed as 'economically distressed' by the state. In addition, natural resources have become diminished: salmon runs have dwindled, sturgeon have almost disappeared, oyster size has fallen, and old growth forests have been replaced by plantations of firs. There is a close connection between the state of resources and local poverty: resources were harvested and shipped out, with few jobs and little income created in the process.

The challenge was to create businesses and products that made sustainable use of natural resources and also added value to them. Ecotrust, an environmental group based in Portland, helped to form a new partnership of farmers, oyster growers, fishermen, small businesses, native American groups and others. This 'Willapa Alliance' commissioned studies on resource use and assets, and developed a joint management plan. It was clear that many business ideas existed, but skills and access to markets and credit were in short supply. Ecotrust then contacted a well established community bank in Chicago, the South Shore Bank, which had invested \$345 million in low-income neighbourhoods for community regeneration since the 1970s. With the support of the Ford Foundation and the South Shore Bank, the Willapa Alliance market-tested development banking for the watershed. Help has now been given to a range of local businesses that add value to natural resources, including:

- Willapa oysters that are now marketed locally rather than shipped out wholesale;
- cranberry growers who now produce a wide range of products - all cranberries used to be transported out;
- mushrooms which are collected from the forests for sale;
- alder which is harvested from secondary forests for high quality wood products;
- fish and crab which is marketed with the NW image of wholesome foods;
- interweaving of *Spartina* grasses with denim to make women's summer shoes (*Spartina* is a weed of shellfish beds, and otherwise would be controlled with herbicides).

Many of these have helped local people to make a new livelihood, including the Shoalwater Bay Tribe, who now have formed an oyster company and harvest from 300 hectares of tidal beds. After several years of increasing success, a new platform has emerged: the Willapa Economic Development Task Force has designed an ambitious regional development plan based on sustainable use of natural resources.

Case 16. Rice-based farming systems result in productivity improvement in Cambodia

The productivity of rice based farming systems in Cambodia has improved tremendously over the past years through the activities of the Cambodia-IRRI-Australia Project (CIAP). Technology released from CIAP has been responsible for a sustainable increase in rice production valued at approximately US\$130 million per annum. Yields have increased from 2.5t/ha to 3.1t/ha in the dry seasons and from 1.3t/ha to 1.6t/ha in the wet season. A range of more efficient rice varieties are regularly released for various ecosystems, cropping systems have been diversified, water resources maximised and farmers have been introduced to IPM practices. Conservation of germ plasm is a major activity and rice varieties lost during the Pol Pot years but stored in a germ plasm centre in the Philippines were returned to the farmers. Innovations include creating a new approach to identifying Cambodian soils, emphasising on-farm experiments, building institution capacity from a fragile base, involving many NGOs and developing a national research approach. These improvements have all improved food quality for the resource-poor farmer without adversely affecting women farmers and the environment.

Results of this initiative have been: fish in the rice field increased; large animals had more feed to eat and numbers increased; crop diversity increased; and farmer's diets were improved. Overall outcomes were: more efficient varieties developed; soil identification systems established as a basis for recommendations on integrated nutrient management; farming systems diversified; fish introduced into the rice ecosystems to reduce the use of pesticides; and land preparation systems improved.

Lessons were also learned: technology can spread in the poorest of conditions; relevant, high quality inputs must be available; variety and adaptability in seed production is very important; sharing responsibilities and involvement of NGOs and other organizations is essential to success..

A number of lessons can be drawn from the cases described above:

- The accumulation of economic capital need not take the form of financial capital. For example, heads of cattle again seem to be becoming a desirable way of measuring wealth in some societies.
- One of the great revolutions to have occurred in developing countries in recent years has been the provision of affordable credit to poor families. People without access to credit are generally poor and so lacking assets. But people without assets cannot get hold of credit. Because they lack collateral, they are too high a risk for banks, and so have to turn to traditional money-lenders, who frequently charge extortionate rates of interest. Micro-finance institutions (MFI) are receiving world-wide prominence, with thousands of groups engaged in savings and loans management in countries such as Bangladesh, China, Fiji, Kenya, Indonesia, Pakistan, and Vietnam. In 1996, the Bank-Poor meeting in Malaysia brought together most of the innovators in this movement to set out how micro-credit could help the poorest and most excluded groups.

The 37 MFI studies for Bank-Poor 1996 were found to have mobilised a total of US \$132 million in savings from some 5.1 million savers.

- Eco-tourism constitutes a much-undervalued source of money for rural households. People value the countryside for a wide range of non-food functions: aesthetic value, wildlife, villages and communities. They like to visit, and when they do visit, they bring with them money to spend. A study in the UK has shown, for instance, that urban people spend £9-14.3 billion in rural areas while on day visits and short-break holidays. As 70% of this leaks out of rural communities, the net contribution to communities and the countryside would be £2.7-4.3 billion. By comparison, direct support from government in the form of subsidies under the Common Agricultural Policy is some £3 billion. People are entitled to enjoy the 'free' public goods of the countryside - the views, the clean air, the tranquillity, the wildlife. But while they are there enjoying themselves, they will spend on accommodation, food, drink, and handicrafts.
- While agriculture is primarily about the production of primary commodities, innovations in farming systems often have multiple benefits and can go a long way towards maintaining rural productivity and welfare.
- Innovative diversification of economic activities within the agricultural sector that also sustain environmental functions can be a promising road towards maintenance of rural communities and preventing the decline of rural areas.
- Credit and diversification of revenue sources improve food security for vulnerable social groups (with the growth of a greater range or new goods and services, such as agro-tourism and other agriculture-related activities, and environmental caretaking).

3.2.3 MFCAL Cases and the Social Function

The following 10 cases illustrate various ways in which the social function of agriculture can be enhanced through the adoption of participatory processes, both at the individual level and at the level where different categories of stakeholders are brought together. The individual dimension refers to human capital, which represents the skills, knowledge and good health of people. The social dimension refers to the development of institutions (social capital) and involves organised group action for making better use of existing resources. Social capital is an important non-food function of agricultural systems. People are aware of social issues that exist within their communities - from local communities to the larger global community. These include a number of different issues, ranging from poverty to gender equity. It can be enhanced through the adoption of participatory processes that lead to organised group action for making better use of existing resources and development of new skills. Such groupings include farmers' research and experimentation groups; resource management and users' groups (*e.g.*, forest protection, fisheries, irrigation, watersheds); credit groups; and horizontal partnerships between external sectoral agencies (*e.g.* government and NGOs; private and public).

Case 17. Federation of Senegalese NGOs (FONGS)

The "Fédération des Organisations Non Gouvernementales du Sénégal (FONGS)" was established in 1978 by autonomous village-based associations seeking solutions to problems faced by small producers. By the beginning of the 1990s, the FONGS had grown to include 24 regionally-based associations made up in turn of 2000 village groups with a membership of 400,000. Some 1.5 million people in all (about

20% of the national population) are positively affected by the federation's grassroots activities in areas like input procurement, collective food production, processing and marketing.

During the 1990s, farmers increasingly voiced concerns over an agricultural model that was resulting in over-exploitation of natural resources and growing dependence on increasingly costly, non-renewable inputs to boost productivity. At the same time, experiments with alternatives for sustainable agriculture were on the increase. FONGS organised a national forum in 1993 which led to the creation of a new platform bringing together all rural associations: the National Council for Rural Dialogue and Co-operation (CNCR). The council has a membership of 3 million. In the past 5 years, CNCR has gained recognition by the government and major donors as the spokesperson for rural peoples' interests in policy and programme negotiations. Along with other initiatives, the CNCR participates in a joint research programme with the Senegalese agricultural research institute and a farmer-controlled mechanism to channel public funds to small-holders' agricultural production projects.

Case 18. Water Users' Associations and Participatory Irrigation Management in Gujarat, India

In July 1995, the government of Gujarat adopted a resolution announcing the participatory irrigation management (PIM) programme. It envisages a complete turnover of operation and maintenance of canals to water user associations (WUA). While the canals remain government property and major repairs continue to be the responsibility of the irrigation department, the responsibility for the day-to-day functioning of the system lies with the WUA. Planning of crops, allocation of water available for irrigation, fixing water rates, collecting water demand forms and water charges from individual members and disciplining defaulters are the other responsibilities of the WUA under the PIM. After carrying out repair and rehabilitation works on the canal network, the management is to be "turned over" to the WUAs.

In the pilot phase of the PIM programme, thirteen projects were selected to experiment with and learn from the new approach. This programme focused on the formation of user co-operatives and the development of links between different actors (participant farmers, NGOs and government). The NGOs mobilise and organise farmers to set up a WUA and guide it during its formation and through subsequent stages. However, technical help, co-operation and guidance from the department remain important. The participating farmers form and manage the Association, they also make a fixed contribution toward the initial expenses of repair and rehabilitation of the system. It is generally understood and appreciated that NGOs have been particularly adept at developing a co-operative spirit among the participants.

The most outstanding results include:

- peoples' participation grew gradually in the WUA, with strong emphasis on "Learning by Doing" (a concept that emerged during the process of implementation of the PIM);
- the higher (than government) water charges levied by the WUA underwent a series of negotiations demonstrating the empowerment of people, but at the same time showing that water pricing was a dynamic and difficult process;

- realisation of the importance of motivation in a participatory programme, and the NGO's role in this;
- phasing strategies for the implementation of the programme provided invaluable lessons for replication;
- realisation of the importance of taking into account the dynamics of caste, class, inter and intra-village differences in society while implementing a programme.

Case 19. Community co-operatives in Japan

Food co-operatives are an important way to get good food to urban groups with no direct access to farms and the countryside. Direct links between consumers and farmers have had spectacular success in Japan, with the rapid growth of the consumer co-operatives, *sanchoku* groups (direct from the place of production) and *teikei* schemes (tie-up or mutual compromise between consumers and producers). This extraordinary movement has been driven by consumers rather than farmers, and mainly by women. There are now some 800-1000 groups in Japan, with a total membership of 11 million people. These consumer-producer groups are based on trust, and put a high value on face-to-face contact. Some of these have had a remarkable effect on farming, as well as on other environmental matters.

The largest and best-known consumer group is the *Seikatsu Club*, a consumer co-operation union. This has a membership of more than 210,000 households organised into 26,000 *hans*, or local branches, all over Japan. It was set up in 1965 by housewives in Tokyo, who wanted to find a way of avoiding the high price of milk. Their idea was to band together and buy milk directly from farmers. Over the next few years, they also began to purchase a range of clothes, cosmetics and pesticide-free foods wholesale. Club members then began to take care of distribution themselves. In the late 1970s, a new headquarters was set up in Setagaya and the first *Seikatsu Club* housewife was elected to local government the following year. Although thirty-seven members have now entered local politics, the Club seeks a much deeper change, aiming to seek to empower each and every member with a voice and role in participatory politics. Historically isolated in the home, this has given strength and new opportunities to women. The turnover of the *Seikatsu Club* alone is now 40 billion yen (US \$320-350 million) and it employs 905 full-time staff.

Case 20. Adult-Education and Integrated Pest Management for Rice, Bangladesh

Farmers in Bangladesh are engaged in extraordinary transformations of their rice systems. The new Integrated Pest Management approach supported by the Department for International Development of the United Kingdom and the Commission of the European Union, both through grant projects executed by CARE International, an international NGO that works with local NGOs, farmers' groups, and local staff of the Ministry of Agriculture of Bangladesh in selected districts. Two well-attended seminars by Bangladeshi field staff members of CARE have been presented in FAO Headquarters over the past year and a half. It involves farmers attending field schools (schools without walls) during a whole rice-growing season. They meet each week to learn a new set of principles, concepts and terms relating to rice, pest and predator management. This is an adult-education approach to increasing food production. Farmers have benefited in several ways: most have reduced or stopped using pesticides with no loss of rice yield, so reducing the costs of production, they raise fish in the rice fields which provide a new source of protein and income, and vegetables are grown on paddy field dikes. As a result, the 150,000 participating households are now food-secure throughout the year.

Case 21. Benefits to children's health and nutrition in Kenya

The Association for Better Land Husbandry (ABLH) promotes low cost methods of conservation-based farming that reduce poverty, improve rural peoples' livelihoods and boost rural economies. The approach is called 'near-nil investment'. The basic principle is that poor rural families do not have the financial resources to invest in farm improvements. What they need are ways to boost productivity and income by making the best use of available human and natural resources. Double-dug beds combined with composting, green and animal manure improve the soil. Good water-holding capacity and higher organic matter content means that these beds are more productive, more diverse and are able to sustain vegetable growth long into the dry season. Once this investment is made, little more is done for the next 2-3 years. Many vegetables and fruits are cultivated, including kale, onions, tomatoes, cabbage, passion fruit, pigeon peas, spinach, peppers, green beans and soybean.

Self-help groups have found that their family food security has improved substantially since adopting conservation farming. Before, they had to use cash when they were short of food in the dry season to pay for maize and vegetables. They had to sell their labour, rely on remittances from family members working elsewhere in the country, or sell cash crops. They would have to do this at a time when food prices were high and labour and cash-crop prices low. Many also relied on collecting wild foods from forests. But now, families have found that by working more on their own farms rather than selling labour to others, they are getting greater returns. They have found that investment in natural capital on their own farms provides better returns in food production. Casual hiring-out of labour has virtually disappeared among group members. Children have been major beneficiaries, as their health has improved through increased vegetable consumption and longer periods of adequate food availability. According to one review of 26 communities in eight Districts, 75% of households are now free from hunger throughout the year, and the proportion of households buying vegetables has fallen from 85% to 11%.

Case 22. Vocational training in rural areas (Rural Training Centres), Solomon Islands, South Pacific region

The Solomon Islands are an archipelago of about 900 islands, many of which have difficult access and with limited services and resources. Rural communities' lifestyle has long been based on subsistence agriculture, artisanal fisheries, forest harvesting and inter-community trade. The expansion of the cash economy and the increased exploitation of natural resources (cash crops, timber, tuna) by non-residential entrepreneurs has enhanced exodus to "urban" areas, development gaps for rural dwellers and social conflicts. The lack of credit facilities, equipment, materials and technical skills has limited the development of smallholders' initiatives and rural businesses. In the early 1990s, based on community, cultural and/or religious relationships, some 30 rural associations, called Rural Training Centres, were spontaneously established. Their main roles were to provide advice, technical assistance, vocational training and access to credit.

The 30 RTCs (more joined the association during the project implementation) supported 10 to 30 initiatives in their area of interest. Some trainees became trainers themselves, finding part-time

employment in the RTCs. New trading facilities and commercial routes were established in the areas of production, creating new job opportunities. New branches of the Development Bank have been established in particularly dynamic provinces. The key impacts include:

- combating poverty through self-employment and entrepreneurship and limiting exodus to urban areas;
- sustainable management of land through support given to the design and implementation of initiatives based on improved traditional knowledge, environmentally sound techniques, use of local resources and the social needs of the communities concerned;
- sustainable agriculture through increased and diversified use of traditional land with better return for local communities: strengthened role of local leadership, added value to local products through direct involvement in commercialisation and processing, and increased social development through new trade and services facilities;
- benefits to women in sustainable development through approval of many applications from women – the most common fields of intervention for women were sewing, food processing and poultry;
- partnerships with NGOs – the RTCs are community-based NGOs and are participating directly in the definition of the roles and activities of their association, and in the decision-making process;
- financing sustainable development – the credit scheme is recording a good rate of success with loan repayment procedures generally in line with the type of investment.

Case 23. The multifunctional character of rice-fish systems benefit health in China

Rice-fish culture offers many benefits to rural households, economies and environments. At present, only 136,000 ha of the total area of 21 million ha of irrigated rice fields in South East Asia are used for aquaculture. Jiangsu province in China has more than 30 million mu (2 m ha) of rice fields, of which one third are suitable for rice-fish culture. The “The Extension Project of Large-scale, High-yielding, High-effective Techniques of Rice/Aquaculture in Jiangsu Province” project was developed by the provincial government in the mid-1990s, with multi-functional aims: to develop rice/aquaculture combined with reforming and ameliorating low-yielding paddies, ponds and waterlogged farmland for the purpose of increasing food production and income, promoting rural economy and enriching farmers.

As a result, the rice/aquaculture area in Jiangsu Province expanded from about 5000 ha in 1994 to reach 68,973 ha in 1997. In addition, the area of rice/crab culture expanded to 36,113 ha and rice/shrimp culture reached 13,867 ha. The economic returns of rice/aquaculture are remarkable. In 1997 the unit profit of rice/aquaculture fields was 2.86 times that of mono-rice cultivation in paddies. Rice/aquaculture systems are low cost, and provide rapid economic returns. They provide an additional source of food and income in rural areas, producing 50 kg of fish per mu.

Rice/aquaculture farming systems also maintain the ecological balance of rice field ecosystems. The rural environment can be improved through the use of non-polluting agriculture – the use of agricultural chemicals is greatly reduced. Rice/fish culture also helps to eliminate mosquito larva harmful to human health. Japanese encephalitis and malaria are transmitted by mosquitoes found in a wide belt of Asia, and their prevention depends on improved environmental manipulation to stop mosquito breeding in rice

fields. Rice/fish systems provide good control of mosquito incidence. In Quanzhou County, the incidence of malaria fell from 11.6/100,000 to 0.1/100,000 which may be partially due to an increase in the area of rice/fish cultivation from zero to 43% over a ten year period.

Case 24. Agricultural and community development in the Appalachia region in West Virginia, USA

This case, while using a community-based approach, illustrates many diverse aspects of multiple functions in agriculture. The Lightstone Foundation was founded in 1986 as a non-profit educational organisation. Its mission is to serve as a regional education and demonstration centre for practising and supporting sustainable family farming, natural resource management and rural community-based development. Its activities are divided among four programmes, *i.e.*, the Future Stewards Program, the Farm Center, the Community Food Systems Program, and a Community Economic Development Program. Lightstone achieves its goals through partnerships with many other organisations at the local, state and national level.

The Future Stewards Program is an experiential training, paid apprenticeship and community stewardship learning programme for high school and college students in the stewardship of natural and human resources. It has three major components: training (intensive four to ten day experiential training workshops at Lightstone Foundation in sustainable agriculture, recycling, natural resources management as well as in leadership and communications skills); paid apprenticeships with farms, small businesses and service agencies in their home communities that are practising stewardship of natural and human resources; community stewardship projects (students continue their apprenticeship by organising and leading community service projects during the school year).

The Farm Center consists of a 562 acre certified organic farm at the headwaters of the Potomac River in Pendleton County, West Virginia, demonstrating sustainable agricultural practices, wetlands restoration, eco- and agro-forestry and community supported agriculture. Lightstone's farm demonstrates the principles of: diversity of crops, pasture, livestock, wetlands and forest; balance of the natural ecosystem and wildlife, livestock and human requirements; succession of native species in wetlands, crops in cultivated areas and livestock in sequential cycles; interdependence of the farm and the larger community; of wild and domestic plants and animals; regeneration of wetlands, highland meadows and forest; and sustainability, through environmentally sound, socially acceptable and economically viable activities. A major goal of Lightstone's Farm Center is to provide experiential education for young people and adults in the areas of watershed preservation and restoration, whole farm systems, value-added food processing and marketing, ecoforestry and agroforestry.

The Community Food Systems Program provides technical and financial support to a co-operative marketing network of diversified farms, creating markets for locally grown food and enhancing access to healthy food. Lightstone provides technical and financial support to a co-operative marketing network of diversified farms. Through its information resources, market development research and on-farm demonstrations, Lightstone identifies potential markets and shows the feasibility of different production models for various speciality crops.

Finally, the Lightstone Community Development Corporation (LCDC) was established in 1994 to create and retain jobs in the Potomac Highlands by providing technical and financial assistance in rural communities having a large portion of their population with low incomes. Micro-loans for sustainable enterprises, supporting area farmers' markets and bolstering local recycling efforts are a few of LCDC's activities.

The examination of the social function of agriculture and land encompasses multiple areas including human organization, mechanisms for collective action, development of human capital, appropriate technology and local knowledge, and collective management. The above cases illustrate these points:

- People who are already well organised, or who are encouraged to form groups, and whose knowledge is sought and incorporated during planning and implementation, are more likely to continue activities after project completion.
- An important and often under-emphasised feature of collective-action institutions is the development of locally-suited practices and technologies. There is a huge diversity of patterns of natural resources, and there are complex linkages between different social groups. Where people spend time and deliberate on their particular contexts, they are more likely to come up with solutions that suit their own conditions. When they are imposed, this is less likely. Participatory learning is, therefore, a central part of the emergence of innovation, and innovation is vital if new solutions are to emerge to deal with future uncertainties.
- Human capital is crucial to developing sustainable agriculture. It does so through a range of processes that encourage people's capacity to learn about and act upon their own environments. These can be non-formal educational activities (such as through farmer field schools) and formal training programmes. The private sector can play a useful role in this process by promoting a more efficient and safe use of crop-protection chemicals. But the production of more food (contributing to nutritional health) and the manipulation of the environment to control disease vectors, can also contribute to a better understanding of people's environments.
- Farmers have always experimented to produce locally-adapted technologies, practices, crops and livestock. They are continuous adapters of technology, and their systems are rarely static from year to year. But the involvement of farmers in adapting technologies to their conditions constitutes a reversal of the normal modes of research and technology generation, as it requires interactive collaboration between professionals and farmers. It is a process in which the knowledge and research capacities of farmers are joined with those of scientific institutions; whilst at the same time strengthening local capacities to experiment and innovate. Farmers are encouraged to develop and evaluate indigenous technologies and choose and adapt external ones on the basis of their own knowledge and value systems. Clearly, researchers and farmers have important and complementary roles, and the greatest benefits arise when effective partnerships can be forged.
- Recent years have seen an extraordinary expansion in collective management programmes throughout the world, described variously as community management, participatory management, joint management, decentralised management, indigenous management, user-participation, and co-management. These advances in social capital creation have been centred on participatory and deliberative learning processes in the context of watershed and catchment management, irrigation management, micro-finance delivery, forest management, and integrated pest management.

- Food security can be greatly improved with greater food production in conjunction with better community organisation, reduced poverty and use of appropriate technologies in rural areas.

3.3 THE ELECTRONIC CONFERENCE

The main findings of the Electronic Conference and the scoping exercise that preceded it were:

- Emphasis on non-food functions of agriculture should not distract attention from the need to feed 6 billion people.
- Emphasis on local stakeholders does not mean that those at higher governmental levels have no role to play.
- As well as helping to move away from policy agendas that are too narrowly growth-oriented, developing multiple functions in agriculture should also give back a legitimacy and appeal to agriculture for future generations.
- Most of the 40 cases presented by the conferees were concerned with raising awareness among stakeholders of the options for more sustainable farming systems. Others showed interesting juxtapositions of agricultural production and various typically 'urban' activities like mining, trade or industry. These included seven cases of (peri-)urban agriculture. The addition of new production lines, like animal husbandry or vegetable production in coconut plantations, was also noted. One case was introduced to show how things can fail, which generated more debate than most other contributions.
- The key factors for success included the engagement of all stakeholders, making use of experience elsewhere, the need for a champion to carry the process forward, and learning the lessons from disasters. Impediments to success included pressures from prevailing market forces and other temptations to revert to old patterns, aiming at the impossible, reserving the land for even better future uses, policies that leave farmers with the burdens but not the added values resulting from changing their approach, and problems with integrating academic and local knowledge systems.
- The idea of buffer zones along rivers generated a lot of support as a way of combining social, economic, environmental and food security functions, as did the idea of fighting environmental damage by productive measures rather than by restrictions.
- There was widespread agreement that a long-term land-care ethic was needed among farmers, governments and other stakeholders and that the notion of the multifunctional character of agriculture and land contributed to making better choices between different possible uses for land.

3.4 REPORTING TO THE CSD

Analysis of Country Reports to CSD revealed evidence of the contribution of multifunctional agriculture and land use to food security, improved policies and institutions; economic development; poverty reduction and equity; social cohesion; and environmental protection, recovery, rehabilitation and enhancement. The primary purpose of the reports was to furnish evidence on progress in sustainable development.

The Country Reports suggest that most *developing countries* have yet to carry out economy-wide and sectoral reviews in line with SARD. Domestic pressure for quality food products is rarely present although external pressures are being exerted through international trade. A few countries are beginning to address environmental problems related to food and agriculture including the preparation of National Environmental Action Plans (NEAPs) with the aid of international agencies. NEAPs focus on the resource base but also include topics such as integrated management of soil, water and plant nutrition, training on Integrated Pest Management (IPM), monitoring and training for sustainable agriculture and agro-environmental protection activities at the field level. Though these NEAPs do not necessarily integrate environmental policies into economic planning, they have contributed to a better understanding of the needs for addressing environmental problems at the national level.

In terms of major issues and identified gaps, the major reasons for the uneven progress in implementing SARD is attributed to:

- an imperfect understanding of the links between the incidence of poverty, the dynamics of population growth and migration, and environmental degradation;
- the absence of a constituency of consumers concerned with food and the environment;
- the burden of government debt that continues to constrain government interventions, including those designed to promote SARD initiatives;
- the need to service debt, leading to continued natural resource-based exports based on unsustainable practices;
- insufficient capacity to review economy-wide and sectoral policies, due to data and institution-related limitations as well as a lack of political commitment.

Many *developing countries* are under pressure from various sources to review agricultural policies, plans and programmes, both economy-wide and sectoral, with respect to their implications for sustainable development and food security. However, they typically possess limited institutional and human resource capacity to assess the implications of developmental plans for sustainable agricultural and rural development. Their limited capacities are further extended by multiple, overlapping and uncoordinated requests for environmental and sustainable development plans and analyses. This often results in top-down, non-participatory actions with too much emphasis on the plan as a document rather than a process that would move agriculture and rural development onto a sustainable path.

A major preoccupation for *countries in transition* towards a market economy has been the need for the radical restructure of agricultural sectors. The introduction and development of market mechanisms has completely altered input-output price relationships. Nevertheless, there have been significant advances in agricultural and environmental policy reform, including the adoption of measures directly related to the rational use of natural resources and environmental issues such as the protection of water and soils. Policies aimed at taking marginal lands out of production are being introduced.

Rather surprisingly, given the disruption to food supplies caused by the collapse of former production and trading patterns, there is little mention in the Country Reports to CSD of agriculture's contribution to food security. Similarly, little is said about improved policies and institutions, poverty reduction and

equity, social cohesion, and science, technology and education. On the other hand, there is considerable attention in several Country Reports to establishing the pre-conditions of agriculture and land use for achieving economic development, for example through the transfer of land to private ownership. In terms of environmental protection/recovery/rehabilitation/enhancement, many countries report strategies in support of SARD. Serious problems of soil contamination and degradation due to past agricultural and industrial practices are common and actions are being taken to remedy the situation. Contributions to land management are also well documented, perhaps because this issue constituted a separate section in the Country Reports.

In addition to the country reports, several regional reviews, also prepared in the context of SARD, covered topics relevant to the multifunctional character of agriculture and land. Two reviews were devoted to Small Island Developing States and OECD countries.

Small Island Developing States (SIDS) have come to realise the extent of the threat of their physical and human isolation, and the relatively recent exposure to exchange of goods and persons, from an ecological and genetic, as well as a socio-cultural perspective. Introduced plants and animal species can create irreversible disturbance to biological and agro-diversity to a far greater degree than in continental regions. There is a growing awareness among SIDS of the fragility of mono-crop agriculture for both economic and ecological reasons. Competition for land, demographic pressure and urbanisation are becoming of growing concern in SIDS, for example in the context of waste disposal. Agriculture, and the quality of foodstuff, can be affected by inappropriate waste management and can itself be a source of pollution. Reductions in the use of agro-chemicals, appropriate treatment and recycling of animal wastes for fertilisation and production of biogas, and recycling of domestic organic wastes for compost and use in agriculture and gardening can all lead to a safer environment.

There is a growing realisation that agriculture, food products and the rural landscape are part of the cultural heritage and constitute attractive assets, together with coastal and marine resources (e.g. spices in Zanzibar, tobacco plantation in Cuba). There is also a growing awareness of the effects of mass tourism on traditional cultural values and consumption patterns, and a realisation that only a multisectoral and integrated approach can help to define the carrying capacity of land resources and related activities. Faced with these pressing issues and with limited human resources and institutional capacity for meeting agreed international targets, SIDS as well as donors have strengthened regional and sub-regional co-operation in areas related to sustainable development, through permanent inter-governmental organisations, for example the South Pacific Forum, the South Pacific Commission (SPC), the Indian Ocean Commission, and CARICOM (Caribbean).

In *OECD countries* that reported to CSD, issues pertaining to food security, economic development, poverty reduction and equity, and science, technology and knowledge were not particularly addressed. The lack of specific reference by any OECD country to food security is probably an indication of their general standard of living, however the growing role of organic food production and the support given to it is mentioned by some countries. There was little reference of contributions to economic development, perhaps because of the relatively small contribution of agriculture to GDP and the limited attention paid to rural development in the Country Reports. Poverty reduction and equity were mentioned by Australia, relating to exceptional circumstances (such as drought), by Austria (for example for special schemes for mountain farmers), as well as in Norway, where equitable representation of women and men in decision-

making within the agricultural sector is being promoted. Science, technology and education issues were addressed to some extent by the governments of Austria, Canada, Germany, New Zealand, the United Kingdom and the United States.

Most OECD countries now claim that sustainable agriculture is the basis for their agricultural policy and have reviewed their policies and legislation in recent years to make them compatible with the aims of Agenda 21. For EU members, this may have been partly driven by EU Directives concerning agro-environmental measures. Several countries support SARD but some make no mention of rural development in their submissions. Social cohesion is addressed in its various aspects, for example through stakeholder participation, environmental education and training, and community participation. Environmental protection/recovery/rehabilitation/enhancement was addressed by a large number of countries. There has also been substantial emphasis on improved management of land resources, with most governments reporting increased activity in this area. However, this may reflect the fact that land management was a distinct section in the reports to CSD.

Conclusions

The MCS case studies and other sources of information clearly illustrate that the concept of the multifunctional character of agriculture and land use can be used to identify many potential private and public benefits to farmers, rural communities and societies as a whole. The major conclusions may be summarised as follows:

- active participation and leadership by rural communities is fundamental to achieving sustainable agriculture and rural development;
- the progressive emergence of local and national institutions that mobilise farmers' associations, community groups, NGOs, the private sector and government agencies are a promising means of collectively addressing concerns about agriculture and land use;
- an enabling national policy environment is necessary, but, in many social and economic contexts, developing and implementing effective policies remains a major challenge;
- efficient and transparent flow of information, between all levels, from the individual, rural land user to international bodies and institutions, is essential in order to promote participation and ownership in innovation;
- there must be wide availability of applied research results and locally relevant, adaptable scientific and technical information on agriculture and natural resources;
- there must be improvements in economic instruments, including rural credit and savings institutions, tools for valuation of the range of functions of agriculture, and longer-term assessments and perspectives for investment.

Other evidence suggests that some farmers have started to apply agricultural and land-management practices with multiple functions that deliver substantial benefits. For example, a recent study of 45 projects in 17 countries of Africa found that 730,000 farm households on some 600-900,000 hectares are practising sustainable agriculture, combining various functions. Yields have increased (95% of examples aiming to increase cereal yield did so by 50-100%), and there have been substantial additional benefits for natural and social capital. Millions of farmers in Africa could adopt agricultural practices that may deliver similar food and non-food benefits, as well as food security through increased access, supply and income. In Indonesia, more than one million rice farmers have attended farmer field schools and have adopted new methods of farming rice, with considerable benefits to themselves and the environment through reduced use of pesticides.

In Europe, innovations in sustainable practices in agriculture are spreading following both increased policy support and demand from consumers. In the cases where farmers have switched to strictly organic farming there is almost always a large cut in productivity, and economic viability is often only maintained through grants and/or receipt of premium prices from consumers. However the limited number of studies carried out suggest that, with a combination of measures, yields increase over time as soil fertility improves and other elements of the system provide valued services to farmers. Combining new technologies and "green" systems remains a major challenge in the most highly industrialised economies, with direct applicability to developing countries.

In the social context, the past decade has seen the emergence of many thousands of local resource management groups world-wide – for irrigation and watershed management, forest protection, integrated pest management, and farmers’ research. Comparisons (e.g. in the Philippines, Kenya, Denmark, Australia, USA) between farmers working in groups and those working individually (with the same set of technologies), suggest that co-operation brings both environmental and social benefits –for farmers and for the public. Systems also become more productive when human capital increases, particularly in the form of farmers’ capacity to innovate and actively manage their farm systems for sustainable outcomes. Lack of information and management skills, however, remains a major barrier to exploration of the potential for new dimensions in agriculture. Less information is available about resource conservation than about the use of external inputs in modern agricultural systems, and less research on resource-conserving technologies is conducted by research institutions.

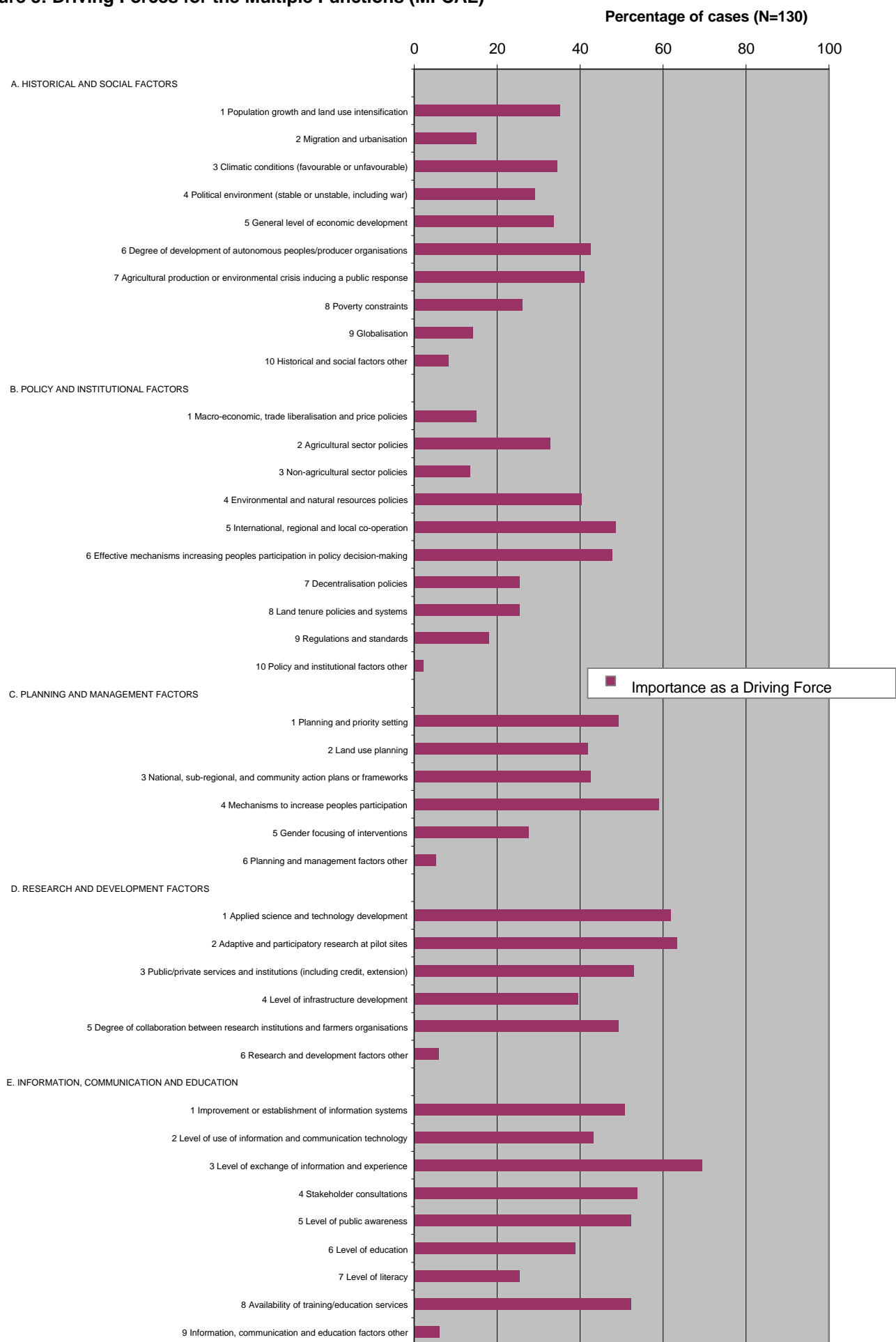
It is clear that the process by which farmers learn about technology alternatives is crucial. If they are enforced or coerced, then they may only use new technologies for a limited period. But if the process is participatory and enhances farmers’ capacity to learn about their farm and its resources, then it appears that the foundation for redesign and continuous innovation is laid. What needs to be made sustainable is the social process of innovation itself.

The challenge is to find new ways to stimulate capitalisation of the multiple, potential functions of agriculture and land use. This, in turn, could lead to substantial benefits for national economies throughout the world. Possible ways forward, in terms of the actions, collaboration and partnerships needed to realise the potential contribution of the MFCAL concept to the achievement of sustainability, are discussed in the accompanying Issues Paper.

Figure 2: Rating factors with positive impacts on the multiple functions (MFCAL)



Figure 3: Driving Forces for the Multiple Functions (MFCAL)



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