Global Farming Systems Study:

Challenges and Priorities to 2030

REGIONAL ANALYSIS
MIDDLE EAST AND NORTH AFRICA

D. Gibbon

The Global Farming Systems Study was conducted by FAO under the overall coordination of S. Funes (Director, Rural Development Division) and the technical leadership of J. Dixon (Senior Officer, Farming Systems, Farm Management and Production Economics Service, Agricultural Support Systems Division) and A. Gulliver (Economist, Investment Centre Division). The Study benefited from the guidance of D. Forbes Watt (Director, Investment Centre Division), J. Monyo (Director, Agricultural Support Systems Division), D. Baker (Chief, Farm Management and Production Economics Service, AGS) and A. MacMillan (Principal Adviser, Project Advisory Unit, TCI) in FAO and of C. Csaki (Senior Advisor/Team Leader-Rural Strategy) and S. Barghouti (Research Advisor) of the Rural Development Department, World Bank.

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Preface

For more than a decade, the proportion of internationally supported public investment directed at agriculture and the rural sector in developing countries has been declining. In the year 2000, World Bank commitments to the rural sector reached their lowest ever levels, measured as a proportion of their total lending portfolio. Moreover, this has occurred at a time when the process of globalisation is bringing about profound changes in patterns of trade and investment, placing agricultural producers and rural communities, more generally, under tremendous pressure to adapt to changing circumstances. Nor is there any evidence of significant progress in reducing the incidence of hunger. In order to reinvigorate its efforts aimed at poverty reduction and sustainable growth among rural populations, the World Bank initiated in 2000 a review of its rural development strategy[1].

As part of this review, the World Bank sought the assistance of the Food and Agriculture Organization of the United Nations (FAO) in evaluating how farming systems might change and adapt over the next thirty years. Amongst other objectives, the World Bank asked FAO to provide guidance on priorities for investment in food security, poverty reduction, and economic growth, and in particular to identify promising approaches and technologies that will contribute to these goals. The identification of future changes affecting farming systems relied heavily on work undertaken in FAO over many years in monitoring trends affecting agricultural production and assessing their likely implications for future output, productivity and nutrition levels.[2]

The global study commenced with the delineation and characterisation of about 70 major farming systems encompassing all developing regions of the world. As existing data systems are based, almost without exception, on national and sub-national administrative areas, while farming systems cross national and even regional boundaries, it was necessary to re-estimate and re-analyse a wide variety of data relating to system characteristics, including physical, social, economic, demographic and environmental parameters. This analysis provided the necessary quantitative underpinning for the central, qualitative, task of developing expert judgements on the future evolution of farming systems and their developmental priorities. In all, the study encompassed the contributions of over 40 specialists in a range of disciplines, both within and outside of FAO, and took into account comments from many others.

Although any specific farming system embraces considerable heterogeneity, the diagnosis of the dynamics, constraints and opportunities of typical farm households contributes to the identification of interventions to improve system performance and sustainability. Therefore, the farming systems presented in this study are considered to provide an effective broad framework for the prioritisation of development actions and investments for accelerating agricultural development, particularly in ways which can reduce rural poverty and hunger.

The results of the study are summarized in a set of seven documents, comprising six regional reports and a global overview. This document, prepared for the Consultation on the draft Middle East and North Africa Rural Development Strategy, summarises the analysis and strategic priorities for the reduction of rural poverty and improvement of food security through farming systems development in the region. This document is supplemented by case study reports of successful development initiatives in the region.

S. Funes,
Director,
Rural Development Division,
Sustainable Development Department,
Food and Agriculture Organization.

[1] "Rural Development: From Vision to Action". World Bank, Washington D.C., 1997.
[2] Most recently in "Agriculture: Towards 2015/30. Technical Interim Report" Global Perspective Studies Unit, FAO, Rome, April, 2000.

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David Gibbon is a Farming Systems Consultant, Sidmouth, Devon, UK.

The Study benefited from discussions at a series of FAO seminars, working sessions and video conferences. In particular, the contributions and editing of C. Batello-Cattaneo and J. Dixon (Agriculture Department), A. Tabet (Technical Cooperation Department), M. Bazza (Regional Office for the Near East) and R. Brinkman, A. Cortas and L. Fe'D'Ostiani (Consultants). The comments of FAO staff of the Agriculture Department (J. Burke, H. Nabhan, J. Poulisse and D. Ward), Sustainable Development Department (S. Baas, J. Bonnal and A. Herrera) and Technical Cooperation Department (A. Carloni, F. Dauphin and S. Gavotti) and the regional rural development strategy update team in the World Bank are gratefully acknowledged – any remaining errors are the responsibility of the Study team.

1 Introduction

CHARACTERISTICS OF THE REGION

Agricultural Population and Resources

The Middle East and North Africa Region (MNA)[3] comprises 16 low and middle income countries stretching from Iran to Morocco. The Region supports a population of 296 million people (5 percent of the global population), of which over 120 million live in rural areas (nearly 4 percent of the global rural population) and about 84 million are farmers, fisherfolk and pastoralists and their families. The region has ancient historical settlements but there is also a long history of immigration from areas North, East and South of the region. Settlement patterns vary depending on historical forces and political changes, but populations are generally increasing in major cities and concentrated in larger villages in many rural areas. The region contains a significant number of pastoralists who move seasonally between low and high altitudes in mountainous regions and from the wetter zones to the steppe in lowland areas.

The region covers an area of 1.1 billion ha and includes a wide diversity of environments, from the wetter coastal regions to high mountain plateaux and drier steppes and desert in the interior. Apart from a narrow strip close to coastlines that receives moderate rainfall, over much of the region rainfall is low and variable. The humid and subhumid areas have a Mediterranean climate, characterised by long, dry summers and mild, wet winters. The long history of human settlement, unequal access to land and urbanisation have led to moderate to severe degradation of land and forest resources in much of the region.

The humid areas account for less than one percent of the land area and over 6 percent of the population, and the arid and semi-arid areas account for 85 percent of the land area and 60 percent of the population. These averaged figures mask the fact that there are centres of population as well as intensively irrigated areas with high population densities in the arid and semi-arid areas. The Middle Eastern part of the region was an important site of early settled agriculture, the centre of origin and diversity of several major cereal and legume crops and of the early domestication of sheep and goats. The region was also a major area of innovation in agriculture between the 4th and 11th Century AD, when many new crops and innovations were introduced in the Region from the East. Crops are either grown with rainfall though the winter period or with irrigation during the summer or year round. The main rainfed crops are wheat, barley, legumes, olives, vines, fruit trees and vegetables. Many subtropical crops are grown with irrigation in the summer months. Livestock, mainly sheep and goats, are now an important feature of many farming systems and provide an important link between and within the different farming systems, from extensive pastoralism to feedlots in peri-urban agriculture.

Poverty in the Region

The growing cities have proved to be a magnet for many young people, but unemployment rates are high and poverty is widespread. Approximately 22 percent of the total population fall below the international poverty line of $ 1 per day and an estimated

[3] MNA comprises 16 countries and includes Yemen Rep., Iran Islamic Rep., Iraq, Jordan, Lebanon, Syrian Arab Rep., West Bank and Gaza, Bahrain, Oman, Saudi Arabia, Israel, Algeria, Egypt Arab Rep., Morocco, Tunisia, and Libya (see World Development Report 2000/2001).

13 percent are undernourished. Poverty in the region is conditioned primarily by the lack of access to the limited soil and water resources and their low productivity. In the rural areas there is significant poverty and poor nutritional status for many people. A high proportion of poor households are farmers or pastoralists who depend on agriculture as a primary food and income source. Poverty is aggravated by highly unpredictable rainfall, relatively few crop and livestock options, poor yields and continuing natural resource degradation. Markets are weak and support policies are geared toward assistance to urban areas and the provision of cheap food. Rural farmers and pastoralists are particularly vulnerable to price subsidies on imported grains and other crops. The low productivity of rainfed agriculture limits the potential for supporting additional people from agriculture in the future without an expansion of reliable and more efficient irrigation. Access to sufficient land to support growing families is a major problem in many countries; land ownership is highly skewed with a small number of farmers owning large areas of the better quality land. Land holdings are often highly fragmented; this can entail some inefficiency in land management practices, but could be addressed, for example, through the collective grouping of land for common management practices. Government policies supporting cheap imports of food and animal fodder to satisfy the demands of growing urban populations have done little to assist poorer farmers and pastoralists.

Role of Agriculture in the Economy

Historically, agriculture played a key role in the early development of many economies of the Middle East and North Africa, initially in the production of cereals and livestock and later in the development of fruits, vegetables and cash crops from irrigated or partially irrigated lands. In 1997 agriculture contributed 13 percent to regional GDP, accounted for 19 percent of exports and 50 percent of employment in the region. However, there are large variations across countries depending on the relative importance of non-agricultural income in the economy. Access to water, both in quantity and quality, remains a key issue, both in agricultural and national economies. However, the relatively low potential for continually increasing output without irrigation over much of the region has meant that many economies have had to rely on alternative engines for economic growth, based on oil production, mining, manufacturing, trading and other commercial activities.

MAJOR FARMING SYSTEMS

Eight major farming systems of the region have been identified and broadly delimited (see Table 1 and Map 1). The classification was based on criteria including natural resources and climate (see Map 2 and Map 4), altitude (see Map 3) and main crops, importance of livestock and access to supplementary or full irrigation (see Map 5). Because of the gradual transition from one farming system to the next, and the intimate linkages between them, the geographic boundaries between the systems are approximate. Large irrigation schemes are indicated on Map 5, but small irrigated areas are distributed across all the rainfed and pastoral farming systems.

Irrigated Farming System. Both large- and small-scale types of Irrigated Farming System are found in the region.

(a) Large-scale irrigation schemes have been linked primarily to perennial surface water resources, but the intensification of traditional karez or quanat systems has also resulted in expansion of irrigated areas. Since the 1960s the rise of drilling and pumping technology has permitted the development of large groundwater-dependent schemes. They are found across all zones and include high-value cash and export cropping and intensive vegetable and fruit cropping. Patterns of water resource use vary greatly, but often water is not used efficiently and significant economic and environmental externalities are produced through excessive drawdown of non-recharged aquifers, and through excessive irrigation resulting in rising groundwater tables, soil salinisation and sodication problems. These large schemes are shown on Map 4.

(b) Small-scale Irrigated Systems occur in many places across the region and although they may not be important individually in term of numbers of people involved or in the amount of food and other crops produced, they are a significant element in the survival of people in dry areas. Such systems develop along small perennial streams and at oases, or are built where flood and spate irrigation is feasible as well as around boreholes. The major crops are mixed cereals and vegetables. These locations (where water is available) always provide a focal point for socio-economic activity but intense local competition for limited water resources between livestock owners and farmers is becoming increasingly evident. Areas with substantial small-scale irrigation are indicated on Map 4 by hatching.

Table 1: Major Farming Systems of the Middle East and North Africa[4]

Farming Systems	Land area (percent of region)	Agric Popn (percent of region)	Principal Livelihood	Incidence of Poverty	Potential for poverty reduction	Potential for agric. growth
Irrigated[5]	2	19	Fruits, vegetables, cash crops	Moderate for small farmers	High	High
Highland Mixed	7	32	Cereals, legumes, sheep	Extensive	Moderate	High
Rainfed Mixed	2	19	Tree crops, cereals, legumes	Moderate for small farmers	High	High
Dryland Mixed	4	15	Cereals, sheep, remittances	Extensive for small farmers	Moderate	Moderate
Pastoral	23	10	Sheep, goats, barley	Extensive for small herders	Moderate	Low
Sparse (arid)	62	5	Camels, sheep	Low	Low	Low
Coastal Artisanal Fishing	negligible	little	Fishing	Moderate	Low	Low
Urban-based	negligible	little	Horticulture, poultry	Low	Low	Low

Priority systems for poverty reduction and/or growth are shaded

Highland Mixed System. There are two systems here, sometimes interlocking. The first is dominated by rainfed cereal and legume cropping, with tree crops, fruits and olives on terraces, together with vines. In Yemen, qat and coffee are traditionally the most important tree crops in mountain regions. The second system is based on livestock (mostly sheep) on communally managed lands in several countries. In some cases, livestock, and the people who control them, are involved in a transhumance system, migrating seasonally between lowland steppe in the more humid winter season and uplands in the dry season. Such systems still exist in Iran and Morocco.

Rainfed Mixed Farming System. The crops in this system are primarily rainfed, although in some areas supplementary irrigation on wheat and full irrigation for summer cash crops are developing rapidly[6]. There is some dry-season grazing of sheep migrating from the steppe areas. The humid area (1000 to 600 mm annual rainfall) has 270 to 365 growing days. There are tree crops (olives and fruit trees), melons and grapes. There is also some protected cropping with supplementary irrigation for potatoes, sugar beet, vegetables and specialist crops and flowers. In the moist subhumid area, with 500 to 300mm rainfall and a growing period of 180 to 269 days, there are fewer trees apart from more drought-resistant ones. Common crops are wheat, barley, chickpeas, lentils, and the fodder crops, vetches and medics. Some supplementary irrigation may be used for vegetable and cut flower production.

Dryland Mixed Farming System. This system is dry subhumid with 120 to 179 days growing period and annual rainfall about 300 to 150 mm. The main rainfed cereals are barley and some wheat with annual or two-year fallow. Sheep and goats interact strongly with the cropping and fodder system. Rainfed barley is grown as a whole crop fodder or in good years, for both grain and fodder. Local barley varieties are particularly well adapted to this system.

[4] Data on farming systems are preliminary estimates, which will be subsequently refined.

[5] Land area and population estimates are for large-scale systems. Area and population for the scattered small-scale irrigated systems are included in the totals for the other farming systems.

[6] Rodriguez, A., H. Salahieh, R. Badwan, H. Khawan. 1999. Groundwater Use and Supplemental Irrigation in Atareb, Northwest Syria. ICARDA SSP 7. 26.p.

Pastoral System. Pastoral systems, mainly involving sheep and goats, are found across large areas of semi-arid steppe lands. They are usually found away from coastal zones and are characterised by a growing season of between 1 and 119 days. Such systems have strong linkages to other farming systems, both in more humid areas and with large feedlots located in urban areas. The animals are involved in seasonal migration, which is dependent on the availability of grass, water and crop residues. These systems are often partially controlled and financed by urban capital.

Sparse (arid) System. This system covers the extensive desert areas of the region. It contains some oasis farming and a number of irrigation schemes, and provides opportunistic grazing for the herds of pastoralists from scattered storms and in good seasons. The boundary between pastoral grazing and sparse agriculture systems is indistinct.

Coastal Artisanal Fishing System. Along the coasts of the Mediterranean and the Atlantic Ocean, small-scale artisanal fishermen have lived for thousands of years. As modern technology and capital have been injected into the offshore fishing industry, the artisanal fishing system has shrunk.

Urban-based Farming System. Throughout the region a small population of urban residents engage in small-scale production of horticultural and livestock products, notably fruit, vegetables and poultry. The contribution of this system to GADP is small, and the system is expected to progressively decline in importance during the coming decades.

Of the eight farming systems, the first five were chosen as principal systems on account of their potentials for poverty reduction or agricultural growth. The Coastal Artisanal Fishing System and the Sparse (arid) System have too few households to warrant in-depth analysis. The Urban-based Farming System involves a greater number of households, but the prospects for poverty reduction and agricultural growth are limited.

2 Region-Wide Trends

HISTORICAL AND PROJECTED TRENDS

Population. During 2000-2030, the population in the region is estimated to more than double from 296 million to 633 million, much faster than the 51 percent growth expected in all developing countries. This could have considerable impact in areas with fragile or vulnerable soils and sloping land, or for water resources everywhere. The areas around major centres of population are particularly likely to suffer from forms of environmental degradation and water shortage.

Nutrition. Currently, the average daily calorie intake in the MNA region is 2 983 kcal, 13 percent higher than the average for all developing countries and the highest among the five regions of this study. The high overall calorie intake reflects high levels of consumption of cereals (20 percent higher than the developing countries average) and meat, reflecting the above-average access to food in oil-rich countries in the region. The high average masks the vulnerable groups within some countries and the differences between the oil-exporting and non-exporting countries. For the period 2000-2030, the expected growth rate of the calorie consumption will be low at 6 percent, but the region will still achieve an average daily intake of 3 170 kcal in 2030, exceeding the developing world average of 3 020 kcal. The increase is expected to derive mainly from the continued growth in consumption of meat (60 percent) and milk and dairy products (23 percent). In many rural areas the quality of nutrition is not good, particularly for poorer people in drier and more remote areas. Although meat and cereals may be reasonably accessible, vegetables and fruits are relatively scarce and expensive.

Arable Land. Since 1961, arable land in the region has expanded by 14 percent. The cropping intensity increased by over 15 percent over the same period. Currently, the arable land in use in MNA is 65 million ha, accounting for 76 percent of the total potential arable land. During 2000-2030, arable land use is expected to expand less than 10 percent, which will push the extent of arable land to 82 percent of the total potential. These figures show that most available arable land is already in use and there is limited scope for further expansion. Particularly for poorer people, access to land will become increasingly difficult over the coming years and the expected increase in cultivation of marginal land will lead to significant environmental degradation.

Water and Irrigation. The hydrological input into the Region accounts for only 1.4 percent of the total annual renewable water resources in the developing world. The aridity of the climate in most of the Region has led to irrigation as the principal means of agriculture intensification and diversification. The hydrological risk traditionally has been managed through the exploitation of shallow groundwater and seepage and small-scale impoundment. The 20th century has seen the construction of large dams in the region to provide storage for large-scale perennial irrigation schemes, but more significantly groundwater has been progressively used as a principal buffer of hydrological risk. This reliance has now turned to dependency in many countries in the region. Currently, more than 20 million ha of land are irrigated. This figure represents 32 percent of the total arable land in use and 60 percent of the land with irrigation potential. The average irrigation efficiency is about 50 percent, somewhat higher than the average 43 percent in all developing countries. Based on irrigated area and efficiency, it is calculated that as much as 58 percent of available water in the

region is currently being used for irrigation. However, by 1995/97, four countries – Jordan, Libya, Saudi Arabia and Yemen – withdrew volumes of water for irrigation that exceeded their annual water resource recharge. This is due to increasing demands for water both from cities and from intensive agricultural systems. Depletion of water resources is likely to become an acute problem in many more places by 2030. During 2000-2030, the irrigated area is forecast to grow by 20 percent. With the expected expansion of the total arable land, it will account for 35 percent of the total arable land, but 77 percent of the land with irrigation potential. During 2000-2030, irrigation water requirements are expected to grow by 14 percent. Irrigation water efficiency is estimated to reach 65 percent in 2030 (compared with 50 percent for all developing countries). Combined with expected expansion of the irrigation area, water use for irrigation will account for 67 percent of the total renewable water resources in the region. These average figures hide the situations noted above where abstraction of groundwater exceeding contemporary recharge is depleting strategic reserves. Economic competition for the limited renewable water resource base of the region is intensifying. Disputes over water use rights and resource allocation between sectors and across international borders are also becoming more evident as limits to economic capture are reached. Under these circumstances, irrigation development is becoming increasingly conditioned by socio-economic and environmental realities to the extent that management of demands for raw water and irrigation services is now an imperative.

Fertilizer. The current fertilizer consumption in the region represents only 7.2 percent of the total in all developing countries. The past decade did not see any increase in the fertilizer consumption in comparison with 3.5 percent annual increase for the developing world. During 2000-2030, total fertilizer consumption in the region is estimated to increase at the rate of 1.1 percent, the same as for all developing countries.

Crop Production. Overall crop production growth to 2030 is projected at 1.7 percent per annum in the region (compared with 1.6 percent per annum in all developing countries). During 1961-1997, crop production increased by 220 percent (same as the average for all developing countries) as a result of both harvested land expansion (29 percent), and yield increase (71 percent). In 1999 the region produced 41 million tons of wheat with an average yield of 2 t/ha, compared with 1 t/ha in 1970. Olive production in 1999 was 2.8 million tons with an average yield of 2 t/ha. During the last decade, the region experienced rapid growth of olive production in terms of both area (2.1 percent per annum) and yield (5.5 percent per annum). For 2000-2030, average crop yield is expected to increase by a further 67 percent, slightly lower than the 69 percent for all developing countries.

Livestock. The Region has 246 million head of sheep and goats, accounting for 14 percent of the total population of these animals in developing countries. For 2000-2030, the sheep and goat population in the region is expected to grow at the same pace (0.9 percent per annum) as in 1967-1997. There is a great variety of production systems for sheep and goats, from extensive pastoral systems, which interact seasonally with arable areas, to feedlots in major urban areas. There are important linkages between all these systems. Historically (1967-1997), poultry numbers (one billion in 1995/97) have increased rapidly at 6 percent per annum, compared with 3.8 percent per annum for all developing countries. The growth is forecast to slow down to 1.7 percent per annum for the period 2000-2030, similar to the developing world (1.6 percent per annum), resulting in an estimated population of 1.8 billion in 2030. In many countries a few very large production units dominate this industry, which limits the opportunity for small-scale producers to enter into the market. During the last decade, cattle and buffalo numbers in the region increased at 0.2 percent per annum A higher growth of 1.6 percent per annum is expected for 2000-2030, resulting in a population of 63 million in 2030 (all developing countries 0.9 percent per annum). Some analysts consider that this is unduly optimistic for the region as it is not well suited to further expansion in cattle production.

The current total annual meat production in the region is 6 million tons, accounting for 6 percent of the total meat production in the developing world. For 2000-2030, the meat production is projected to grow 3.0 percent per annum until 2015 and 2.4 percent per annum for 2015-2030, slightly faster than the average rates in the developing world (2.7 and 1.9 percent per annum, respectively). The present milk production in the Region is 25 million tons (12.8 percent of the developing world total). Expected growth for 2000-2030 will be at a similar rate as in the past with 2.1 percent per annum until 2015 and 1.9 percent per annum for 2015-2030, lower than forecast for all developing countries (2.6 percent per annum for both periods).[7]

[7] FAO, 2000. Agriculture: Towards 2015/30. Technical Interim Report. Global Perspectives Unit. FAO, Rome. April 2000.

3 Irrigated Farming System

Irrigated Farming Systems are found throughout the region. They encompass two quite distinct sub-systems: Large-scale Irrigation-Based Farming Systems, common in a number of countries within the region, including Iraq, Syria and Egypt, and Small-scale Irrigation, found scattered in such countries as Egypt, Yemen, Oman, Syria and the Maghreb. Each of these sub-systems is discussed separately below.

BOX 1: A TYPICAL LARGE-SCALE IRRIGATED FARMING SYSTEM HOUSEHOLD

A household in this system might have access to 2.5 ha of land and grows a range of cereals, pulses, fruit crops and cash crops. In addition, the household manages small numbers of cattle and sheep.

LARGE-SCALE IRRIGATED SYSTEMS

Large-scale Irrigated Farming Systems are usually found along the major river systems downstream from dams and most have an ancient history of development. The Large-scale Systems contain an estimated total population of 80 million people, including some large cities, and an agricultural population of 16 million. They cover an area of 19 million ha, of which an estimated 6.6 million ha is equipped for irrigation. Owner-occupiers or tenants farm an estimated 5 million ha. These systems are dominated by intensive year-round cropping of a wide variety of annual crops. Many systems suffer from recurrent problems of water misuse and mismanagement, salinity, sodicity, and gypsum soil problems (Euphrates). Several of these systems represent significant areas within the overall cropped area of the country (e.g. the Nile delta) and also feature ancient cultivation with sophisticated water management. These systems are usually highly diversified, growing a mixture of cash crops (e.g. cotton and sugar beet), vegetables and other high-value crops, and fodder. Cropping intensity ranges between 120 and 160 percent. Some of these systems have livestock (cattle, sheep and goats) associated with them. Many of these systems have combinations of State and private land ownership and conflicting management objectives, and weak institutions appear to be common problems.

Total area	19 million ha
Cultivated land	5 million ha
Annual Rainfall	low and variable
Irrigated land	6.6 million ha
Growing period	0-120 days
Total population	50 million
Agricultural population	16 million

SYSTEM DESCRIPTION

Typically, these systems are characterised by large-scale centralised management of water access and distribution. They may also have land managed in large blocks with mechanised systems. In other systems, water access and distribution is managed centrally but the land has been allocated to large numbers of tenants or owners who individually manage small plots, from 0.5 to 5 ha, and share other inputs and marketing facilities. Water user associations (WUAs) are becoming more common in these situations, dealing with ongoing operation and maintenance of the irrigation systems and ensuring the implementation of better water sharing procedures.

Other fully irrigated systems have emerged in recent years that are privately financed and operated. Water is extracted using tubewells and distributed through sprinkler or trickle systems to farmers mainly growing high-value crops for export. These systems present a challenge to older irrigated systems, but also a threat to small-scale systems that rely on simpler water lifting devices as water tables are declining. In such places the rate of extraction exceeds the rate of recharge, which is resulting in rapid decline in groundwater levels and the generation of significant drawdown externalities (e.g. the Sana'a Basin in Yemen, the Souss Plain in Morocco, the Bekaa Valley in Lebanon).

SYSTEM-SPECIFIC TRENDS AND ISSUES

The history of the larger centrally managed schemes is not very encouraging. Many have been plagued with problems of poor management of water, disputes over water access and quality and quantity issues. The primary technical issues are: surface schemes working below design capacities and at low efficiencies, rapid depletion of aquifers, poor water scheduling, rising groundwater tables, continued soil degradation, salinity, sodicity, declining soil organic matter levels and low crop yields. Energy and machinery costs are very high in some places. In addition to this, there are institutional and financial issues related to the responsibility of users for organisation and management of the systems and for cost recovery.

In view of the poor record of sustainability of these state-managed irrigation schemes, the present trend is towards greater involvement of water users in management. However, the involvement of the users in decision making regarding water management faces legal and institutional constraints related to the modalities of transfer of management responsibility and to the legal basis for devolution of authority over irrigation facilities.

Measures aimed at reducing crop demand for water through appropriate rationing or switching to crops with a lower water requirement are now being promoted in the region. This requires clear economic incentives to be identified and accepted by end-users in order to raise farm incomes and boost on-farm investments in modern equipment. However, water and irrigation services are but one of many input costs and may not be significant in relation to other costs such as seed, fertilizer, pesticide and energy.

STRATEGIC PRIORITIES AND INTERVENTIONS

The most important priority is the promotion of water demand management in irrigated agriculture through a range of economic, regulatory and advocacy instruments. Such approaches have to be locally tailored to suit the prevailing socio-cultural settings. These initiatives have to be embedded in national agriculture and water management policies and will require sector-wide alignment. In addition, the irrigation systems will need to become more flexible to accommodate the perennial hydrological risk in the region. Conjunctive use and aquifer storage and recovery will become important tools in managing this risk. The overall management of these large schemes is in need of major overhaul if the needs of the poor are to be addressed. Interventions should include:

- identification and implementation of economic incentives to reduce water demand;
- promotion of water user institutions that can ensure the equitable sharing of water resources among all legitimate users, increased efficiency of water use, the restoration of soil health by raising organic matter levels and improved soil and water management;
- development of farmer-participatory irrigation management systems in which growers (owners, tenants, share-croppers and livestock owners) play a much more active role in the research, development and management process;
- provision of a legal framework for farmers' associations, co-operatives and companies, facilitating rural savings and loan initiatives;
- development of innovative technologies, co-operatives, credit, training and education for the small farm sector; and
- development of irrigation scheduling strategies that can be implemented at the farm level, which will provide a major opportunity for water savings

In view of the emerging emphasis on water quality, it is expected that institutional factors such as regulations on levels of use of pesticides or nutrients will be a major factor influencing future irrigation research programs.

The foreseen increase of demand by non-agricultural users will lead to other users bidding for agricultural water. The result will be increasing competition

BOX 2: IMPROVED ON-FARM PARTICIPATORY WATER MANAGEMENT TO REDUCE MINING OF GROUNDWATER[8]

Water shortage is one of the most critical issues facing the Middle East and North Africa Region and is likely to be exacerbated in the future because of high population growth and continuing decline in the renewable resources resulting from climate change, pollution and overdraft of groundwater. Despite this alarming situation, on-farm water use efficiency is low.

Field activities in Yemen have shown the technical and financial practicability as well as the social acceptance of introducing water saving measures into the present farming systems to enhance crop production and quality and reduce or even stabilise decline in groundwater on a wide scale. Evident as it may seem, this was not possible five years earlier, because of the overall context (traditional practices, social reluctance to modern technology, very low technical capacity and social structure of the production systems.) Existing policies related to water development and management are often not well-adapted and not adequately implemented, and socio-economic and institutional set-ups still need further strengthening. Crop produce is faced with serious marketing problems, both internally and for export. In addition, low quality standards and post-harvest treatment make the produce less competitive. The private sector is found to play only a minor role, in comparison with its potential.

Yemen presents an extreme situation; however, the issues and problems raised illustrate the trends for the entire region. Technological improvements in Irrigated Farming Systems remain essential but they cannot in isolation absorb all the rural population nor eliminate rural poverty. They should be accompanied in an integral manner by the reform of macro-policies, alleviation of rural poverty through community development, strengthening of institutions, particularly civil society and the private sector, and enhancing marketing and export conditions.

for water over time, making it an even more valuable input. This will tend to shift water supplies towards higher-value crops with more sophisticated equipment.

SMALL-SCALE IRRIGATED SYSTEMS

SYSTEM DESCRIPTION

In this system, owner-occupiers or tenants typically farm very small units; 0.02 to 1 ha, often within an area of larger, rainfed systems in plains or on partially terraced hillsides. They usually contain fruit trees and intensively grown vegetables. They are often found in isolated areas and provide food and other products for local markets. Some of these systems involve traditional irrigation practices, water rights and self-organisation.

These systems are characterised by limited water supplies, which lead to either very limited production opportunities, or to opportunist actions following flooding or exceptional run-off. The cropping pattern and the type of crop developed are adapted to the water supplies and regime experienced over the years. This type of farming can occur throughout the plains areas of the region, as well as on terraced, sloping lands where it may be derived from an ancient system.

SYSTEM-SPECIFIC TRENDS AND ISSUES

The key issues are the scarcity of water resources, the relatively high cost of inputs, chemical pollution of water and soils and inadequate access to major national and international markets. Water shortage and food deficit are among the crucial issues facing small farmers in the region and should be given priority. A participatory introduction of technological packages including the improvement of local practices and introduction of adapted, more advanced ones has proven to be effective in tackling the issue of water shortage. With extremely limited possibilities for the expansion of available water resources except at prohibitive costs, the only solution left is to optimise the output from the existing resources.

STRATEGIC PRIORITIES AND INTERVENTIONS

Such small irrigated systems in ecological niches offer opportunities for testing and introduction of new, and newly collected, varieties of major crops and trees. Stress tolerance, and the ability to grow in soils of low fertility, are important characteristics. More adaptive

[8] For further details, see related case study.

research is needed in these areas. There are also possibilities for the development of organic farming, beginning with a reduction in the dependence on pesticides and with application of the principles of biological pest and disease control. There is a strong and growing demand in Northern Europe for organic foods and other agricultural products grown without chemical inputs, and there is an opportunity to grow crops that are suited to specific niche situations. The key to this would be to support small producers with access to these markets. This can be accomplished through region-branded marketing groups and introductory preferential access. Priority problems are the lack of equitable access to water resources. If, as is evident in some areas, a number of powerful individuals are controlling and capturing the bulk of the available resource, particularly with the advent of modern drilling and pumping equipment, policy initiatives to promote more equitable access will be essential.

4 Highland Mixed Farming System

SYSTEM DESCRIPTION

This system contains an estimated total population of 65 million people and an agricultural population of 27 million. It covers an area of 74 million ha and is farmed by owner-occupiers or tenants. Annual rainfall is between 800 and 200mm. These systems use high altitude arable and common grazing lands with cold winters and dormancy or very slow growth of plants and fodder over this period. The cereals that form part of these systems are adapted to survive under snow and extended cold periods. Wheat and barley dominate these systems which are generally monoculture with occasional fallows. Surrounding these cropped areas are common grazing lands, which may be used by owners from the same region or by pastoralists migrating to the plains for the winter season.

As a sub-set of this system, on high-altitude sloping lands in several countries, level terraces created several thousand years ago (e.g. in Yemen) have been planted with fruit trees, coffee, qat, olives and vegetable crops, sometimes with supplementary irrigation in the summer months for crops such as melons or high-value fruits.

Total area	74 million ha
Cultivated land	22 million ha
Annual Rainfall	200-800 mm
Irrigated land	5 million ha
Growing period	0-180 days
Total population	65 million
Agricultural population	27 million

BOX 3: A TYPICAL HIGHLAND MIXED FARMING SYSTEM HOUSEHOLD

A household in this system may have a small area of cropped land (4ha) which is primarily used for cereal production (about 3ha), and access to common grazing land for sheep and goats (4 per family). The family may also have a cow.

SYSTEM-SPECIFIC TRENDS AND ISSUES

In these systems there has been a decline in the quality of the natural resource base through the reduced maintenance of terraces and increasing water erosion leading to losses of productivity. This has been accompanied by emigration to urban and plains areas. Decline of soil fertility through continuous cropping and low nutrient return is an issue in some plateau areas. Where livestock are present, overgrazing close to settlements and water points has also contributed to soil degradation. Increased competition from subsidised imports of meat and dairy products continues to impoverish small producers.

STRATEGIC PRIORITIES AND INTERVENTIONS

There are a number of possible interventions that can alleviate some of the above problems. The primary need is for the development of more sustainable watershed planning and management systems, for the introduction of conservation tillage systems and for the better integration of crops and livestock. Such technical changes can only be effective through

BOX 4: PARTICIPATORY WATERSHED MANAGEMENT AND POVERTY REDUCTION[9]

The Highland Mixed Farming System of the Middle East and North Africa is particularly prone to soil degradation and erosion. A pilot project undertaken over an area of 70,000 ha in the Atlas Hills of Tunisia has demonstrated the feasibility of improving watershed management in combination with improved income opportunities for participants. The area is dominated by smallholders with fragmented holdings on slope land with extensive erosion, and has many landless families. Average family incomes are estimated at US$110/month, of which seasonal migration and other off-farm labour account for about half. Degradation of vegetative cover and soil erosion is extensive in the zone, and conflicts over resource access were increasing, while technologies offered by public extension services were often inappropriate.

The project aimed to alleviate poverty through improved watershed management and the introduction of relevant technologies, including diversification, within a participatory framework. Activities included forestry, agro-forestry, tree platforms (micro-terraces), small-scale earth bunds, small checkdams consolidated with fodder species, hill reservoirs and small irrigation schemes. Consultative processes aimed at resolving conflicts between farmers and the Government over access to, and use of, national forest areas resulted in changes in tree species used, the opening of access paths, and the contracting of local labour for many forest activities. Large water retention schemes, which mostly benefited downstream landowners, were replaced with farmer-selected technology options implementable on individual farms. Support was provided for tree crop establishment (olive, almond, fruit trees) combined with contoured intercropping of legumes. Critical to the whole programme has been the process of farmer organisation into user and special-interest groups and the strengthening of locally active NGOs.

Although the project is still underway, so that sustainability cannot be readily assessed, an estimated 75 percent of the families have participated in one or more activities, while Government support systems have been restructured to provide options based on appropriate technologies and cost sharing with farmers. The combination of participatory approaches, conservation measures and income creation will offer considerable potential for development elsewhere in the region as well.

participation of producers in the planning and management process and the establishment of appropriate local institutions that can ensure equitable benefits to all producers.

Similarly, there is a need for more equitable regulation and control of common grazing resources, which can only take place effectively with full participation of all stakeholders. Older systems of management may need additional measures and a modern legal basis to take account of new capital financing of livestock. Drinking water scarcity for both humans and animals in the mountain areas is one of the serious problems facing these regions. A great number of new water points should be established.

Finally, there is a need for policies regulating imports so that local producers can compete on an equal basis and that there is not an escalating pressure to increase stocking rates.

[9] For further details, see related case study.

5 Rainfed Mixed Farming System

SYSTEM DESCRIPTION

This system contains an estimated total population of 40 million, and an agricultural population of 16 million. It covers an area of 23 million ha and is farmed by owner-occupiers or tenants. Annual rainfall is between 1000 and 300mm and the growing period ranges from 180 to 365 days. A wide diversity of crops and trees are grown in well-established patterns around settlements. In the humid areas, tree crops (olives, fruits and nuts) are an important component and may dominate the system. They may be inter-cropped with cereals and vegetables while the trees are immature, but when mature they may become monoculture. Wheat, barley, lentils, chickpeas, potatoes, sugar beet and faba beans are the main annual crops, often grown in the sequence: cereals-legumes-summer crops. The summer crops are grown following a winter fallow. Vegetables, oil crops and flowers may also be grown, often with protection (polythene tunnel houses) in order to capture specialised markets in Northern Europe and elsewhere. Many farms are intensively capitalised with a high level of inputs, and farmers are very sensitive to market opportunities. There are a number of specialised dairy and poultry systems within this ecological zone. These may also include summer crops grown following winter fallow or with some supplementary irrigation. In the drier areas, cereals become more dominant in the system and there is often a greater interdependence of farming families who frequently share resources and equipment. Systems are diversified and interact seasonally with livestock (mainly sheep and goat) owners in the use of crop residues and other fodder.

Total area	23 million ha
Cultivated land	14 million ha
Annual Rainfall	1000-300 mm
Irrigated land	0.6 million ha
Growing period	180-365 days
Total population	40 million
Agricultural population	16 million

BOX 5: A TYPICAL HUMID RAINFED MIXED SYSTEM FARM HOUSEHOLD

A typical system farm would manage about 5 ha in several parcels of land of different quality around the village. Cereals (about 3 ha) and legumes are managed collectively in blocks to aid mechanisation of operations and post-harvest grazing management. The farm has small areas of olives, fruits and vines. A cow and a few sheep are kept around the village. Off-farm income is substantial, mostly from seasonal employment in the city.

SYSTEM-SPECIFIC TRENDS AND ISSUES

The principal trends and issues in these systems are poor access to quality land by increasing numbers of small farmers; soil erosion on slopes during rainstorms and erosion by wind on light, over-cultivated, exposed soils; increasing attempts by farmers to diversify crops; but weak strategies and policies of research and extension institutions, which are not addressing the main needs of small farmers. Other trends include the decreasing proportion of wheat and the increasing use of legumes in the rotation, increasing farm size and mechanisation (including the rapidly rising use of supplementary irrigation), migration to urban areas and the increasing dependence on off-farm income to secure food and livelihood security. Women are

becoming increasingly marginalised in the production process and their labour is displaced as men dominate the mechanisation processes for all the main crops.

Population density continues to increase and there is also increasing global influence on farming systems, both from imports of subsidised cereals and from the problems of access to markets. Subsistence farming is declining in these areas. Large-scale commercial interests are involved in high-input farming of export crops and livestock. At the same time there appears to be little commitment by many governments to supporting the sector, particularly the small farmers, through regulation of imports and specific support for poorer farmers. Near the coast, the system is under considerable pressure in some areas by demand for land for urban settlement, tourism and other forms of economic speculation (Lebanon, Tunisia, Maghreb). This could also represent an opportunity for those farmers who wish to become more involved in the tourism sector.

STRATEGIC PRIORITIES AND INTERVENTIONS

This system appears to have the greatest potential for increasing output through more effective management of natural resources and markets. Interventions and developments which could have a significant impact are: integrated water resources management, conservation agriculture for slopes and vulnerable soils, the introduction of new crops and varieties to cope with short growing periods and droughts and, to suit small farming systems, terrace restoration, contoured soil and water management, cover cropping under trees and watershed management by local communities or associations. In order to ensure success of these changes, the following actions are required:

- Land reform programmes which were begun years ago should be continued, focusing on farm amalgamation, more equitable distribution of land and water resources and better access to services;
- Identification of economic incentives for improved water resource management;
- Continuing research on systems of land and water management with the active participation of small farmer groups and an exploration of traditional techniques used in the region;
- Communally based initiatives for long-term watershed resource management, including the restoration of terrace systems and the reintroduction of intercropping systems. Strengthening of the roles of women in watershed resource management and restoration;
- Development of organic food production for domestic and international markets – e.g. olives, vines, pistachio, fruits, raisins, dates, herbs and vegetables. Assistance with market entry is needed for collective small farmer groups;
- Development of simple processing methods, direct marketing by producers, and storage;
- Development of social and other infrastructure that will encourage young people to remain in rural areas;
- Reform of the institutions that are designed to serve farmers;
- Restructuring and retraining of farmer-sensitive research systems and farmer-driven extension systems with farmer-researcher partnerships. Particular focus is needed on technologies for small-scale women farmers and women's labour. Much can be adapted from the widespread experience elsewhere in Asia and Africa. Farmer study tours and interregional workshops for farmers, researchers and extensionists could be valuable;
- More adaptive research, both agricultural and socio-economic, on crop-livestock integration and risk reduction, stability and sustainability of farming systems. There is a dearth of high-quality, recent farming systems case studies from this region and there needs to be more investment in this area; and
- Development of policies to control actions and practices with major negative environmental impacts such as frequent, deep ploughing, excessive use of pesticides and excessive water extraction for irrigation. A review of water pricing policies is needed and the introduction of water use quotas should be considered to contribute to greater equity of access to water.

6 Dryland Mixed Farming System

SYSTEM DESCRIPTION

This system contains an estimated total population of 50 million, and an agricultural population of 13 million. It covers an area of 42 m ha and is farmed by owner-occupiers or tenants. Annual rainfall for this system is between 300 and 150mm. Arable land in the system is 17 million ha and cropping is dominated by cereals (mainly barley and wheat), grown in alternation with single or double season fallows. Occasionally, and in higher-rainfall areas, legumes (lentils and chickpeas) may be grown. Interactions with pastoral systems are strong as sheep may graze whole-crop barley in a dry year and the stubble of the harvested crop in average or wetter years after the end of the cropping period. Small areas of irrigated vegetables may be grown in association with these systems.

BOX 6: A TYPICAL DRYLAND MIXED FARMING SYSTEM HOUSEHOLD

A typical household in this system will have about 7 ha of arable land located in small parcels on different types of land around the village. The household grows wheat and barley and a small area of legumes. The family has a few cows and small numbers of sheep (9 on average), which are grazed around the village and for part of the year in the steppe. Poorer families have some members who work for larger farmers or have temporary or more permanent work in urban areas.

SYSTEM-SPECIFIC TRENDS AND ISSUES

This system is primarily dependent on wheat and barley production together with a strong interaction with small livestock (primarily sheep). The reliability of cropping is highly dependent on rainfall and the whole system is vulnerable to inter-annual and seasonal variations (both temporal and spatial) in rainfall. In the recent past, there has been a decline in wheat area and renewed use of indigenous barley varieties. The most critical issue appears to be limited access to new crops and varieties by most farmers. A further issue has been the poor integration of cropping and livestock systems because policies and price ratios have worked against this potentially stabilising feature. Human nutrition in these systems is also an issue, as diets tend to lack variety and quality. In these circumstances, farmers rely more on livestock systems for subsistence and cash income. Migration to urban areas has been increasing as a result of these trends, and remittances to families remaining in these areas play a significant role in food security. Some of the more arid areas with lighter soils have severe wind erosion problems during the dry season.

Total area	42 million ha
Cultivated land	17 million ha
Annual Rainfall	300-150 mm
Irrigated land	3 million ha
Growing period	120-180 days
Total population	50 million
Agricultural population	13 million

STRATEGIC PRIORITIES AND INTERVENTIONS

Priorities are regulatory measures for access and use of land and water resources and technology development and introduction with a focus on the poor.

Specific interventions needed include:

- Development and adaptation of appropriate and financially accessible technologies for conservation agriculture on slopes and vulnerable soils. In many areas this can only be achieved after a significant change in land ownership and distribution patterns through land consolidation;
- While irrigated systems remain a high priority, there is a need for a shift in resource allocation from irrigated agriculture to rainfed farming if there is to be a realistic focus on poverty alleviation. Irrigated and rainfed systems interact strongly and it is not efficient to strengthen one without addressing the problems of the other. A systems perspective in land and water resource management planning activities should be encouraged and ultimately adopted by the provincial and district planning bodies. This will allow them to plan comprehensively while also maintaining a flexible response at local levels. Such bodies would benefit by extending their representative membership, including all stakeholders who can participate in decision making;
- Interventions through extension and distribution outlets that are likely to have some impact on the poor are: the generation and distribution of a wide range of new, and newly collected, varieties of major crops. Water conservation training, exploration and re-development of traditional water management techniques, intercropping, application of appropriate technology and O&M training for that technology; and
- A new approach to research to develop crop varieties with a shorter growing period, drought resistance and qualities that suit small farm systems (i.e. both grain and straw quality). Pilot studies to consider the socio-economic and cultural impact of the characteristics of the new crops - whether they meet the needs of the society in which they will be used.

Interventions requiring collective action (resource user groups) are the development of conservation methods such as wind erosion control through windbreaks, water harvesting methods, stubble mulch or minimum or zero tillage methods feasible for all farmers, and shrubs that can also be used as fodder.

A new approach is required into the way in which research is organised and managed to better serve these systems. There needs to be more proactive research with the active participation of smaller farmers, particularly women, on the development of these interventions.

Participative, on-farm research on crop-livestock integration, and on resource conservation with a focus on risk reduction and sustainability of systems is likely to produce long-term benefits to the poor in these systems.

7 Pastoral System

SYSTEM DESCRIPTION

This system is found in most countries of the region. The system contains an estimated total population of 30 million and an agricultural population of 9 million. It covers an area of 255 million ha. Some pastoralists also cultivate small areas of crops. Annual rainfall in this system is less than 150mm. Pastoralists may have a predominance of sheep in their herds and flocks, but many also have goats, donkeys and camels. There are an estimated 60 million sheep and goats and 7 million cattle and buffalo, including 3.7 million dairy cattle, in this system. These systems are based on mobility of flocks, which move with the availability of grazing (related to seasonal rainfall distribution) and the availability of water.

This movement may be between more humid and drier lowland areas, or between the plains and highland areas. In the past, water was only available from fixed water storage systems, but the use of mobile water tankers has enabled livestock owners to travel larger distances seasonally. Crop residues, subsidised grains and purchased fodder make up the remainder of feed requirements. Pastoralists are often partially funded by urban capital or will manage stock owned by urban dwellers. The technology associated with the management of modern pastoral systems has resulted in great pressure on steppe grazing lands from high-intensity grazing.

Total area	255 million ha
Cultivated land	3 million ha
Annual Rainfall	150 mm
Irrigated land	3 million ha
Growing period	0-120 days
Total population	30 million
Agricultural population	9 million

BOX 7: A TYPICAL PASTORAL FARMING SYSTEM HOUSEHOLD

A typical pastoral household has access to a very small extent of cultivated land (1-2 ha), often cropped on an opportunistic basis. The family generally has access to about 100 ha of grazing land, and sometimes to larger areas through customary or rental arrangements, to support sheep, goats, and cattle.

SYSTEM-SPECIFIC TRENDS AND ISSUES

Pastoralists remain an important linking group across the major farming systems in the region. Because of the continually rising demand for meat, primarily from urban areas, pastoral systems will remain important in the rural space, even with the rise in importance of urban-based livestock feedlots.

The principal long-term problem for pastoralists throughout the region is desertification. There is a link between desertification and poverty. It is the reason for the steady decline in pastoral incomes resulting in complex demographic, economic and social changes. Total rainfall is the dominant limiting factor in the dry rangelands. Drought diminishes rangeland productivity, but also adversely affects feed quality and species diversity. Drought also affects the composition and size of the herd. Under such conditions, for example, goats suffer least and recover most quickly. If drought continues to the extent of rangeland desiccation, pastoralists abandon the area.

However, heavy grazing of the rangelands by livestock is believed to be the most widespread cause of vegetation and land degradation throughout the region. In the hyper-arid zones, the livestock survive

for a period on xerophytic shrubs and ephemeral grasses, and once these plants are grazed the animals have to be moved somewhere else. For this reason, there appears to be a balance between carrying capacity and livestock in the hyper-arid zones. In the arid and semi-arid zones, livestock density is above the potential carrying capacity most of the year, and these are the areas where most of the desertification takes place.

Intensive grazing around settlements is often related to the sedentarisation of nomadic herders. The settlement of former nomads entails concentration of their herds on grazing land around their new homes. Under drought conditions, these herders are forced to concentrate their animals in areas where most drinking water is available, causing the complete disappearance of the most palatable herbaceous cover, particularly around boreholes that provide drinking water for humans and animals all year round.

The availability of more secure watering points also induces pastoralists to change their herd composition in favour of sheep, which further increases grazing pressure around the watering points. While increased water supplies are necessary in the drylands for a proper use of natural resources and to alleviate adverse living conditions, the almost inevitable result is the concentration of population and livestock around these watering points, which disturbs the fragile ecosystem.

One of the most important recommendations approved by the 1977 United Nations Conference on Desertification dealt with land degradation in rainfed farming areas. The recommendation called for the establishment of legal limits to cultivation by tractor ploughing in marginal drylands, which are more suited for grazing. It was based on the fact that these areas are particularly vulnerable to extensive clearing and excessive mechanical cultivation. However, the recommendation has not been implemented in the region. Opportunistic ploughing of rainfed marginal areas may produce a few good harvests in the short term, but will, in the longer term, lead to erosion. The natural vegetation on such land often constitutes the better rangeland of the pastoralists. As a result of erosion, the land is lost to both agriculture and pastoralism. The animals are thereby pushed on to less productive rangeland, which becomes further impoverished as a result. Implementation of this recommendation would lead to important ecological benefits. Centrally planned economies continue to marginalise and exclude pastoralists from most forms of support. This is unfortunate as pastoral systems with well-balanced grazing management are the most sustainable way in which natural resources in low-rainfall areas can be managed and conserved.

BOX 8: RANGE REHABILITATION IN PASTORAL FARMING SYSTEMS[10]

The case study focuses on the Al Badia steppe area of Syria, which receives less than 200 mm/annum of rainfall and which has been subject to widespread deterioration of the rangelands and loss of wildlife habitats (and consequently of wildlife). An FAO project has been active since 1996 over 108,000 ha of rangeland and 22,000 ha of wildlife reserve. Its main focus is on reversing the degradation of the rangelands, rehabilitating areas with the participation of the local Bedouin population and re-introducing oryx (*oryx leucoryx*) and sand gazelle (*Gazella subgutturosa marica*) to the Talila wildlife reserve. In addition to the rehabilitation of nearly 10,000 ha using seed of native species (*Salsola vermiculata and Atriplex leucoclada*) and innovative and cost-effective direct seeding technologies, the project has initiated grazing management strategies; introduced an environmental monitoring system; collected data on livestock production; identified and implemented options for income generation and employment for local community members, particularly women; improved the technical skills and capacities of national project staff, training technicians, extension officers and Bedouin promoters; and sensitised the Bedouin community.

Major impacts and lessons learned include range rehabilitation by reseeding native species, the importance of community participation, project implementation flexibility, longer-term assistance for sustainability, the need for both local and national drought strategies and the need for focus on land tenure issues. Follow-up investment is needed for replication in other areas of Syria and in other countries in the region.

[10] For further details, see related case study.

STRATEGIC PRIORITIES AND INTERVENTIONS

The highest priority for this system is greater flexibility and integration in agropastoral systems. Increased capitalisation and specialisation has led to the marginalisation and neglect of many truly pastoral groups. Without some attention, protection and support, many are likely to disappear. The long-term maintenance of the resource base in semi-arid areas can only be assured by strong collective responsibility; this probably will require formal contractual arrangements between pastoralists and cultivators on the kinds of interaction that are desirable from perspectives of equity and environmental management.

Pastoral (steppe) areas could be managed sustainably through the revival of, and support for, older institutions for control of communal grazing areas by pastoralists themselves (the Hema system). However, this would be only a partial solution as many herds are now financed by urban-based owners, who frequently have different priorities to those of pastoralists. Intervention is needed to monitor management systems including both urban-based and pastoral stakeholder groups and to establish codes of conduct and management that ensure the long-term sustainability of natural resources on the range. This will require training programmes for both urban and pastoral participants in monitoring and management of herds and range condition.

In addition to the revival and development of local institutions, there is a need for new legislation that will protect the steppe environment and ensure sound long-term management of soil and pasture resources. Such legislation, critical to the sustainability of the farming system, should reinforce or create conditions ensuring that the long-term interests of groups dependent on the rangelands for their livelihood prevail over the short-term interests of individuals or groups external to the range.

More investment is also needed in research on fodder bushes and intercropping systems. There needs to be support for research institutions (ICARDA and its collaborating national research and extension partners) engaged in the introduction of bushes and intercrops adapted to local rangeland conditions. The techniques for developing this are known but not widely available. Local adaptive research with farmers and pastoralists will spread their application.

8 Strategic Priorities and Interventions for the Region

The review of the characteristics, trends and potentials of the main farming systems in the Middle East and North Africa region indicates the close interdependence of people, water and land-based resources. There are also clear linkages between different farming systems, particularly between livestock and cropping systems. Investment in the agricultural and rural development sectors, apart from irrigation, has been relatively modest. Two groups who have been outside most development initiatives have been poorer farmers in dryland areas and pastoralists, who occupy a unique role in the rural economy and in the long-term maintenance of a stable environment in dry areas. In view of the interdependency of resource management systems, the neglect of one farming system could have a major impact on people dependent on other systems.

The most significant trends over the past 30 years have been the rapid urbanisation of parts of the population and the consequent growth of cities. This trend is likely to continue, resulting in rapidly rising demands for water and food, particularly cereals and livestock products. In the rural areas, the growth in the proportion of income earned from non-agricultural activities is likely to continue and this has to be considered when strategic options for potential investment are being reviewed.

The key strategies for the region are grouped below under five major themes which are considered to be essential elements in any overall support programme for the revitalisation of farming systems and rural livelihoods in the region. They are all to a large extent interdependent and they cut across the farming systems.

NATURAL RESOURCE MANAGEMENT AND CLIMATE

The issues related to natural resource management arise from the continuing deterioration in quality of both water and soil resources. In addition, non-renewable water resources are under increasing threat from excessive extraction in several areas.

Soil erosion by wind and water continues, often as a consequence of inappropriate cultivation methods and heavy grazing pressure in specific areas. Climatic changes are likely to result in greater extremes of drought conditions, which may well affect the low-rainfall areas more severely than those that currently have moderate rainfall.

Steadily rising demands for livestock products in urban areas and unregulated growth of urban- and rural- based industrial forms of livestock management are resulting in unprecedented pressures on the landscapes of the steppe and highlands and on the people who manage these livestock. The whole industry needs to be analysed and understood in a systemic way in order to regulate it in a rational manner and ensure the long-term sustainability of rural livelihoods.

The priorities that need attention are:

- The revival and adaptation of older systems of rational, rotational grazing land management that involve all stakeholders in planning and monitoring resource changes.
- Watershed-based (rather than individual farm) soil and water management systems.
- The development of sustainable groundwater management systems.

- Long-term, sustainable soil and water management techniques for annual and perennial cropping.
- Conservation and development of the unique flora and fauna of the region.

SCIENCE AND TECHNOLOGY

Research and extension institutions and systems have been notably weak and unproductive for many years and there has been a serious lack of systemic thinking about the nature of natural resources and how they might be managed more sustainably in order to reduce poverty. Science and technology should be revived with a clear focus on the needs of the majority of rural and urban people, particularly the poor, and which protects the stability of natural resources. The key areas appear to lie not only in the nature and practice of science and technology, but in training and in the institutions that serve these areas.

Such an initiative requires investment in training for dynamic and learning research and extension systems. The professionals within these systems could learn valuable lessons on research into technology design and maintenance from within the region (e.g. the Nile delta) and from other parts of the world. Farmers should be part of this process and contribute their particular knowledge on seeds, drought and salinity tolerance and the collection, storage and reuse of water. Research and extension support for these systems needs to be much more imaginative and interdisciplinary than at present. Most simply, researchers and extensionists need to work more on strategic and systemic research and development goals. A number of key interventions will be on:

- More research on the development of more sustainable and integrated farming and livelihood systems, through greater diversification, IPM and integrated soil and water management.
- The incorporation of farmers, both men and women, into the research and dissemination process.
- Design and planning for better on-farm water management efficiency, conjunctive use, salinity tolerant crop and fodder varieties, water re-use.

  It will be logical to continue to invest national and international resources in support for increasing the technical efficiency of irrigation systems of all kinds as these can give farmers greater choice in enterprise and production practice. Irrigated systems, unlike many others, offer the possibility for greater diversification, intercropping and tree or crop intensification. However, similar principles can be applied elsewhere in both more humid and dryland rainfed systems.
- Diversification and shift to water-saving cropping patterns.

  This requires rapid development and accessibility to farmers of micro-water distribution systems which are currently used only by a relatively small group of commercial farmers. There is also a continuing need to develop these relatively new technologies in a sensitive manner and to involve women in this work. New systems of cropping sequences, inter-cropping and in-season management need to be explored by proactive farmer-researcher groups. These priorities apply not only to irrigated systems, but also to areas of higher rainfall and to areas where management of rainfall in a particular season can affect whether a crop is harvested or not.
- The introduction of conservation agriculture techniques, equipment and strategies that make better use of labour, soil and water resources.

  The need to increase labour productivity implies that forms of mechanisation are required, which may well entail more sharing of equipment and labour. This could be facilitated through local institutional mechanisms, which oversee the strategic needs for sustainable land and water management in a district or sub-region. The kinds of techniques which could have application in the region have been in place for many years in other dry areas of the world and involve: zero or minimum soil disturbance, careful monitoring of soil and water relationships, the development of rational options for long-term cropping choices and patterns and the involvement of farmers groups in the decision-making process.
- Technologies geared specifically to women producers and processors
- Development of organic foods (crops and livestock) and medicinal plant production and processing systems.

GLOBALISATION AND MARKET DEVELOPMENT

The rapid development of global, highly competitive markets has resulted in great pressures on existing production and marketing systems, with many smaller producers being squeezed out. Support is needed for many medium-sized and smaller businesses to adapt to these changing conditions. The trends in farming in the region over the past thirty years indicate a steady out-migration from farming by younger people, particularly men, to local towns and cities, and even out of the region altogether. Farm amalgamations and take-overs are occurring, but there are still many millions of small farms, often managed by women and older men.

Non-farm income generation has become an important way in which many small farming families secure their food and other needs as their land resource base shrinks in size and quality. These trends are likely to continue and any new initiatives and investments designed to help alleviate poverty must take account of this.

Strategies that offer opportunities to enhance existing enterprises and also create new options will include:

- The development of small enterprises for the processing and marketing of regionally labelled crops and livestock products.
- Support for collective action among producers in all aspects of the crop and livestock research and multiplication process. This could include seed selection, testing and multiplication, water and soil management technology development, design, testing and construction of land management and harvesting equipment for small producers.
- Support for technologies that specifically address the needs of women – both as farmers and as people who have untapped skills in food and fibre processing, manufacturing and marketing.
- Savings clubs or organisations of small producers that will develop reinvestment funds for land and water improvement and small enterprise development.
- Credit schemes for landless or very small landholding rural people for the purchase of irrigation, cultivation or harvesting equipment, which could be owned collectively and hired.
- Fostering of consumer (European) – producer linkages through communication systems and exchanges for niche goods (organic foods, herbs, medicines).

POLICIES, INSTITUTIONS AND PUBLIC GOODS

In many areas of the region, land holding patterns have changed little for many years. Remnants of older systems of community land management persist but these have been overlain by the impact of modernisation in agriculture, which has encouraged individualisation of land holdings and the breakdown of these, once vital, linkages. Currently these systems are fragmented, have low productivity and suffer from lack of investment. They also suffer from a steady decline in labour as young men and women migrate to urban areas. These systems suffer from a lack of dynamism and innovative drive, due, in part, to uncertain land tenure arrangements, a lack of effective local institutions and unchanged soil and water management practices. In addition, although livestock do interact with arable agriculture, there is little true synergistic integration (see below).

This problem has been recognised for many years, but the only places where it has been resolved (for the benefit of a few people) has been where smaller farmers have been bought out by wealthier groups or individuals. There remain many hundreds of thousands of smaller farmers who are unable to resolve the problem. There are ongoing attempts to consolidate holdings through land reform but this is a slow and difficult process.

Key policy and institutional reforms in this process will be:

- Consolidation and rationalisation of land holdings with a focus on the common, long-term interest and survival of the community, or communities, who occupy a water catchment area.
- Development of more collective forms of land management that will allow the introduction of more efficient soil cultivation and management technologies.

  This could be facilitated by the establishment of community resource management and livelihood groups. These are appearing all over the world now, sometimes spontaneously, both in developed and developing countries.
- Legislation that will control the grazing pressure on drylands and uplands. This action has to be linked to policies and regulations on the importation of cheap grains used for intensive livestock systems.
- The establishment of livestock producer marketing groups with a wide membership, i.e. not only pas-

toralists but also urban-based entrepreneurs who are involved in financing the industry.

- The establishment of action research groups responding to the different management needs of different types of livestock owners and managers.

  These need to consider the wider aspects of livestock systems management including the seasonal availability of feed, fodder and water and their distribution in space (both across systems in the plains and between these and highland systems). Such integrated action research will benefit both livestock and arable producers.

- Special support for the owners of small numbers of livestock who constitute the majority of livestock owners. This could take several forms, including new arrangements for access to supplementary feeds, research findings, planting materials and seeds, marketing arrangements and transport.

- Regulation of water use, particularly related to the use of non-renewable groundwater.

  This is perhaps one of the most sensitive issues which will affect both the course of agriculture and the future of urban areas in the next 30 years. There is a need for better monitoring methods and techniques for managing water that involve all stakeholders in an equitable and participatory manner. Legislation to ensure equitable sharing of water resources needs to be supported through national and international agreements.

- In addition to this, democratic local institutions need to be established, including various forms of water users groups that control, regulate and manage water efficiently and equitably. Without these in place, any number of technical improvements will not be sustainable or effective.

- Decentralisation of power structures relating to rural development and livelihoods.

- Creation of new forms of integrated agricultural and natural resource research and extension systems.

- Policies and interventions to encourage better partnerships between public and private sector stakeholders in management of scarce resources.

- Policies that will allow greater access to information on markets, new soil and crop technologies, integrated pest and soil management techniques, the removal of trading and price distortions (for example, on grains) that affect the poor more than the well off, access to credit for production, processing and marketing needs.

INFORMATION AND HUMAN RESOURCES

A key element in the revival of agriculture in the region is investment in the development of greater access to local and international information systems. Core activities will be:

- Improving access to market information and opportunities for new crop and livestock products at local, regional and global levels.

- Restructuring and reorganisation of higher agricultural education systems, which will focus on rural and rural-urban livelihood systems rather than production agriculture; and redesign of curricula to work more on systemic, interdisciplinary approaches to learning (i.e. not only on disciplines and commodities).

- Improve access to local and international market knowledge for small producers.

- Improve access to relevant information for women farmers and rural workers.

- Focus the education of young rurally based people on the opportunities for development of agro-industries, ecotourism and tourism focusing on the rich history of the region.

- Revive research and extension systems to bring them more in line with the recent participatory approaches to research and development.

IMPLICATIONS OF CHANGED DEVELOPMENT ASSUMPTIONS

The foregoing analysis has been largely based on the FAO AT2015/30 projections, but alternative scenarios may occur. For example, full trade liberalisation would level the playing field for agricultural production throughout the region. Because the region does not have a comparative advantage in many traditional farm products, this would force adjustment in Rainfed and Highland Mixed Farming Systems, possibly towards high-value products for niche markets at a faster rate than estimated in this study. Examples

could be olives and olive oil and primary and processed fruits and vegetables such as citrus, grapes, raisins and tomatoes. In the Large-scale Irrigated Systems that are well served by markets, food grains such as wheat and rice as well as horticultural production could expand. Likewise, pastoral systems and associated feedlot chains would change following expected increases in the prices of feed grains.

PRECONDITIONS AND IMPLEMENTATION MODALITIES

The priority roles of the State are to support the development of vital infrastructure (roads, water supplies, services, power systems), regulation of resource use and pricing of increasingly scarce resources, notably water. The region has suffered in the past from excessively centralised planning and implementation of plans, particularly in agriculture, and from a policy bias against agriculture. Such policies have been counterproductive and have been a significant disincentive for many smaller farmers, artisans and entrepreneurs. Greater devolution and subregional disbursement of resources appears to be essential if agriculture in this region is to develop in a dynamic manner. As part of this strategy, there needs to be greater participation in the development of collective stakeholder responsibility for management and protection of land, water and grazing resources. Such participation requires the strengthening of local institutions and community empowerment.

There are many private sector investments in agriculture and agriculture related industries. The region is also influenced by multinational companies, many of who have agendas not always sympathetic to the needs of poorer farmers. It should be possible to develop more constructive partnerships between the private sector, major donors and the State in order to address the most urgent needs of the poor in rural areas. A crucial area will be the regulation and management of livestock, both in the towns and in the rural areas. This can only be done through extensive partnerships of stakeholders. As part of a new approach to research and development, national research and extension systems need to be integrated and both need profound changes in training content and methods in order to become more effective in addressing the needs of poorer farmers. In addition modern, scientific approaches should be used in mapping and monitoring changes in natural resource distribution and use, particularly water.

Annex: Maps