CEDARE

Centre for Environment and Development for the Arab Region and Europe

Report

Country Specific Social and Economic Conditions for Farming Systems in Mediterranean Partner Countries

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EXECUTIVE SUMMARY

This is the first report that portrays the socio-economic conditions in relation to the farming systems of the Mediterranean countries, mainly Egypt, Italy, Morocco, Syria and Turkey. The report is a result of desk-review.

The structure and priorities of States are response to continuous transformations globally and locally. Since independence, agriculture in Egypt, Syria and Morocco was at the centre of development plans. Land reforms, which included redistribution of land among landless peasants, were part of these plans. In the past two decades, new emerging economic sectors, such as manufacturing and tourism, gained interest, and started to compete with agriculture as the leading economic sector that serves as the locomotive for economic development. Following adopting of Economic Reform and Structural Adjustment, the agricultural sector was faced with the bitter solution, which negatively impacted the petit farmer and pastoralists.

The total population of North Africa and Middle East is growing and is expected to grow in the near future, 2025. Growing population will put extra load on natural resources and will require meticulous planning and management of growth and development. The majority of the population in countries included in the study is young that will require education and health services, jobs, etc. in the near future. Aside of Italy, countries under investigation, as many countries of the MENA region, are middle-income countries with moderate scores on the UN Human Development Index (HDI). Adult illiteracy in many countries is still high, and prevails particularly among women. Without basic education, women cannot be fully active in development of their communities and reproduction of adequate labour. Poverty is the main problem and challenge to social sustainability in the region.

A particular farming system illustrates the structural complexity and interrelationships between various components of the system; and also shows the variety of natural resources available to farm. Most of the land is desert, yet it can provide opportunities for the coming generations. Policies and institutions, markets and information linkages strongly affect the functioning of any farming system. Identified farming systems are: irrigated; highland mixed; rainfed mixed; dryland mixed; pastoral; sparse (arid); coastal artisanal fishing; and urban based.

The Nile River is among the major rivers that contribute to agricultural production. Second, the rugged terrain to the north of Morocco is another major agricultural production area. Third, significant areas of land in both Italy and Turkey are among the world cropland. Both Morocco and Egypt are facing serious water shortage. This could be resulting from constant available amounts of water and a growing population. Morocco has the lowest WPI followed by Syria, and Italy has the highest score. Egyptian agriculture is the farming system that is most dependent on water compared to other countries included in the analysis.

Land is an essential factor of production, particularly agricultural production. Total cropland in Egypt is not sufficient to support its population by examining the cropland per one thousand persons.

Agricultural inputs are in the form of labour and invested capital. The number of agricultural workers is declining as the countries move toward industrialization. Egypt and Italy uses considerable amounts of fertilizers as indicated by average annual fertilizer use. Italy has the highest share of organic farming, followed by Egypt. Italy has the most complete series of data and the highest pesticide use intensity. Morocco seems to have the highest intensity use given that Italy has the highest number of tractors as well as more total cropland than Morocco. This suggests that tractors might not be used only for agricultural production in the Moroccan countryside. Italy has the least number of

agricultural labours compared to the rest of the countries in the analysis. It has the highest number of harvesters in use.

Turkey has the highest average production of cereals compared to countries included in the analysis. However, Egypt, despite limitations in both land and fresh water, has the highest percent change in average production of cereals. Italy has the highest average crop yield of roots and tubers. Egypt has the highest average crop yield of pulses compared to other countries included in the study. Egypt and Morocco has the highest percent change in average production of meat.

The overall trend of the share of agricultural products in the GDP is declining in all countries. The decline might be resulting from emerging other economic sectors, such as manufacturing and tourism. However, the food production index for all countries is growing, except Turkey that experienced some fluctuations. Only Italy and Turkey had stable domestic cereal production during the last decade. Morocco and Egypt have the highest share of net cereal imports and food aid – an alarming fact given the growing population.

The most significant trend over the past three decades is accelerating urbanization and the consequent growth of cities. This trend is likely to continue, resulting in rapidly rising demand for water and food. Food shortages is expected, especially cereals and livestock products. The decline in numbers of agricultural labour pressures the farming systems in the countries included in the study to depend on capital-intensive production techniques that require massive investments for both horizontal and vertical agricultural expansion. These States have to allocate sufficient investments for Research and Development (R&D) of new varieties, efficient use of fresh water resources, and the safe recycling and re-using of treated wastewater. Investments have to also include financing importing adaptive technologies in production, harvesting and post-harvesting techniques, particularly with applying the regulations of the World Trade Organization that protect intellectual rights; and address the issue of dwarf farm size.

There are a number of environmental challenges for boosting capacities for more agricultural products. Insufficient amounts of fresh water, and degrading the quality of fresh water comes atop this list of issues. Desertification and drought is another challenge. Loss of biodiversity and the risks of lacking systems to deal with biosafety is another challenge. Finally, countries need to serious formulate and implement actions for adaptation to minimize risks resulting from climate change.

Countries included in the analysis need to develop physical infrastructures and provide their constituents with proper levels of social services. These countries will have to institute mechanisms for proper and sensible use of natural resources. The second priority is to devise systems for saving water; and third, is to address the issue of poverty at large in the countryside. Finally, these States have to pay considerable attention to ultra-poor groups, especially farmers in drylands and pastorals.

Strategic avenues for action include sustainable resource management; and improved irrigation management. Re-oriented agricultural services; revitalized agricultural education systems; and rationalized agricultural policies are among these strategic avenues.

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1 INTRODUCTION

This is the first report that portrays the socio-economic conditions in relation to the farming systems of the Mediterranean countries, mainly Egypt, Italy, Morocco, Syria and Turkey. The report, first, summarizes transformation of governments and policies, and then discusses the overall picture of the population of the selected countries, and then examines the farming systems in the region. Next, the report addresses issues of inputs for agricultural production, output of the agricultural sector including exports. The report then addresses the relationship between food, agriculture and water, followed by analysis examining trends and priorities of the farming systems in the MENA region, and ends with conclusions.

The report is a result of desk-review. Its intention is to initialize a dialogue to then examine the possibility of introducing new crops, productions techniques, and possible mainstreaming environmental concerns within the processes and decisions for agricultural production that can contribute to encouraging processes of sustainable agricultural and rural development at large.

2 TRANSFORMATION IN GOVERNMENTS AND POLICIES

All States in countries included in the analysis are constitutional republics, except for Morocco. Egypt, Syria and Morocco were under foreign occupation till the 1950s and 1960s. Land reform was at the hub of agricultural development strategies. The major objectives of agricultural development plans mainly during the last two decades were of several folds: 1) insure food security; 2) contribute to job generation; and 3) closing the gaps of regional disparities within the country. Farms in southern Mediterranean region tend to be small and fragmented. This dispersed farming has for decades prevented economies of scale in production, inputs, and marketing, raising the cost of production and keeping agriculture relatively inefficient. All undertook extensive land reform programmes in the period 1950 – 1975, achieving significant benefits in favor of peasant farmers, landless workers and pastoral nomads, and substantially improving access to European export markets, and reducing the high rates of malnutrition, illiteracy and landlessness which have prevailed in the low income traditional rain fed agricultural sector. The State-interventionist approaches adopted (supported by high levels of capital investment) by the land reforms included: 1) recovery of foreign-owned land; 2) ceilings on maximum land ownership; and 3) provision of subsidized modern agro-inputs, irrigation water, free extension services and primary education.[1]

Although not all expropriated land was redistributed to the poor, and the State became the largest landowner in the region, establishing State farms. Land reform and new land settlement schemes contributed to agricultural growth across the region, including technical change, providing beneficiaries with security of tenure, and contributing substantially to poverty reduction. Rapid urbanization, the oil boom and rising domestic consumer demand all contributed to rising agricultural incomes. Inequality persists in North African agriculture, and as land distribution and rural investment fell away during the 1970s and 80s, richer farmers and those with larger land holdings came to benefit disproportionately from agricultural services. Large numbers of landless rural laborers remain, whose livelihoods are threatened by population growth, the falling quality of agricultural land and the withdrawal of State support during the structural adjustment period of the 1980s and 1990s. The arid and semi-arid rangelands fringing the Sahara remain under customary

[1] African Union Commission, African Development Bank and Economic Commission of Africa, Land Policy in Africa: A Framework To Strengthen Land Rights, Enhance Productivity And Secure Livelihoods based on Quan, Julian The importance of land tenure to poverty eradication and sustainable development in Africa, DFID/ NRI 1997

forms of pastoral management. Islamic land law has also had a significant influence on tenure relations in North Africa.[2]

There have been major reversals of land reforms and rural development strategies across in Northern Africa in the past two decades. Perhaps the most dramatic has been in Egypt with its Law 96 of 1992 but economic liberalization has reversed post independence reforms in many other countries too. Unlike other parts of the Third World, North Africa agricultural sector could have benefited from high oil prices in the 1970s. The revenues that accrued from the sale of oil might have funded radical and far-reaching agrarian reform but it did not. Investment in agriculture across Egypt and Morocco slumped in the 1970s and 1980s as regimes imported food and consumer goods rather than produce them nationally.[3] Gross investment in agriculture between 1980 and 1992 fell in Egypt from 31 to 23 percent; and in Morocco from 23 to 22 percent.[4]

3 POPULATION, HEALTH AND WELL-BEING

3.1 POPULATION AND HEALTH

The total population[5] of North Africa and Middle East is growing and is expected to grow in the near future, 2025. To the contrary, the population of industrial societies, such as that of Europe, is expected to decline by the target year. Table 1 shows that the total populations of the countries included in the analysis, except Italy, are growing. Table 1 shows that the population momentum in the MENA region, i.e., the number of years needed for the a population to double itself in the MENA region seems to be within 20-30 years, which will put extra load on natural resources and will require meticulous planning and management of growth and development.

TABLE 1 DEMOGRAPHIC AND HEALTH INDICATORS: TOTAL POPULATION (THOUSANDS)

Year	Country				
	Egypt	Italy	Morocco	Syria	Turkey
1950	21 834	47 104	8 953	3 495	20 809
2002	70 278	57 449	30 988	17 040	68 569
2025 (projected)	94 777	52 364	42 002	27 410	86 611

Source: World Resources Institute. 2007. *EarthTrends: Environmental Information*. Available at http://earthtrends.wri.org. Washington DC: World Resources Institute, Country Profiles on-line at http://earthtrends.wri.org

Sustaining high rate annual population growth, as depicted in Table 2, is the reason for this outstanding population growth. Except Italy, all countries included in the analysis experience high rates of annual population growth. The table also shows that the urban populations of Egypt, Syria, and Turkey are growing fast. Urban population growth consists of both natural population growth and urban-rural immigration, which can have its own implications on agricultural labour needed for

[2] African Union Commission, African Development Bank and Economic Commission of Africa, Land Policy In Africa: A Framework To Strengthen Land Rights, Enhance Productivity And Secure Livelihoods (op. cit.)

[3] Bush, Ray and AbdelAal, Mohamed, "Land and Conflict in the Middle East and North Africa," Mediterranean Programme, 5th Mediterranean Social and Political Research Meeting, Workshop 11, Florence 24-28 March 2004

[4] Bush, Ray and AbdelAal, Mohamed, 2004 (op. cit.)

[5] Total Population refers to the de facto midyear population of a country. The U.N. Population Division compiles and evaluates census and survey results from all countries, adjusting data for the miscalculation of certain age and sex groups, misreporting of age and sex distributions, and changes in definitions, when necessary. These adjustments incorporate data from civil registrations, population surveys, earlier censuses, and population models based on information from socioeconomically similar countries. All projections assume medium levels of fertility.

agricultural production. Rates of rural population growth in most countries, as the Table indicates, are also high.

TABLE 2 DEMOGRAPHIC AND HEALTH INDICATORS: AVERAGE ANNUAL POPULATION GROWTH RATE, 1980-2000 (%)

Year	Country				
	Egypt	Italy	Morocco	Syria	Turkey
Total	2.2	0.1	1.9	2.2	2.2
Urban	2.1	0.0	0.4	2.7	2.4
Rural	2.4	0.1	3.5	1.1	2.0

Source: World Resources Institute. 2007. *EarthTrends: Environmental Information*. Available at http://earthtrends.wri.org. Washington DC: World Resources Institute, Country Profiles on-line at http://earthtrends.wri.org

The majority of the population in countries included in the study, except Italy, is young, Table 3. This young population will require education and health services, jobs, etc. in the near future. The problem in Italy, contrary to other countries included in the analysis, is the aging population, which explains the declining population growth. Thus, on one hand, Italy is losing its population and labour force, and other countries of the MENA region are gaining population and building their labour power. Issues of dependant population are different; yet require attention. Finally, Tables 1, 2 and 3 suggest that MENA countries are on a path to be highly urbanized societies.

TABLE 3 DEMOGRAPHIC AND HEALTH INDICATORS: PERCENTAGE OF POPULATION

Percentage of Population	Country				
	Egypt	Italy	Morocco	Syria	Turkey
Under age 15, 2002	34	14	34	39	30
Over age 65, 2002	4	19	4	3	6
Living in urban areas, 2000	45	67	56	55	75

Source: World Resources Institute. 2007. *EarthTrends: Environmental Information*. Available at http://earthtrends.wri.org. Washington DC: World Resources Institute, Country Profiles on-line at http://earthtrends.wri.org

The Average Fertility Rate (AFR)[6] in the MENA region is high, as presented in Table 4, which explains sustaining high rates of births and natural population growth, where mortality is another variable that is declining in the region as Table 5 depicts. Infant Mortality Rate is an approximation of the number of deaths per 1,000 live births per year who die within on year of birth. The data are based on a review of all available national sources by the Population Division of the UN Secretariat. Under-Five Mortality Rate (U5MR) is the probability of a child dying between birth and age five expressed per 1,000 live births. It is an indicator of enhanced health services provided to the public. Female Life Expectancy at Birth and Male Life Expectancy at Birth is another estimate for improved health services. It is the average number of years that a newborn baby is expected to live if the age specific mortality rates effective at the year of birth apply throughout his or her lifetime. Signs of declining mortality indicate to certain extent improvements in health services, and attention to maternal, motherhood and child care.

[6] Average Annual Population Growth Rate refers to the percentage growth in the midyear population of each country. The values are estimated using demographic models based on several kinds of demographic parameters: a country's population size, age and sex distribution, levels of internal and international migration, fertility and mortality rates by age and sex groups, and growth rates of urban and rural populations. Information collected through recent population censuses and surveys is used to calculate or estimate these parameters.

TABLE 4 DEMOGRAPHIC AND HEALTH INDICATORS: AVERAGE FERTILITY RATE

Year	Country				
	Egypt	Italy	Morocco	Syria	Turkey
1975-1980	5.3	1.9	5.9	7.4	4.7
2000-2005	2.9	1.2	3.0	3.7	2.3

Note: Total fertility rate is an estimate of the number of children an average woman would have if current age-specific fertility rates remain constant during her reproductive years.
Source: World Resources Institute. 2007. *EarthTrends: Environmental Information*. Available at http://earthtrends.wri.org. Washington DC: World Resources Institute, Country Profiles on-line at http://earthtrends.wri.org

TABLE 5 DEMOCRATIC AND HEALTH INDICATORS: BIRTH AND MORTALITY

Variable	Country				
	Egypt	Italy	Morocco	Syria	Turkey
Infant Mortality Rate, 2000-2005*	40.0	5.0	42.0	22.0	39.0
Under-five Mortality Rate, 2000**	43.0	6.0	46.0	29.0	45.0
Life Expectancy at birth (years)**					
Female	69.9	81.9	70.5	73.1	73.2
Male	66.7	75.5	66.8	70.6	68.0
Birth attended by trained personnel, 1994-2000, (%)	61.0	--	40.0	76.0	81.0

Note:
(*) Data are for the most recent year within the range specified
(**) In deaths per 1,000 live births. Infant mortality rate refers to children under one year of age.
Source: World Resources Institute. 2007. *EarthTrends: Environmental Information*. Available at http://earthtrends.wri.org. Washington DC: World Resources Institute, Country Profiles on-line at http://earthtrends.wri.org

However, the issue of health services and medical care cannot be determined only by indicators such as infant mortality and under-five mortality rate. Table 6 shows information concerning the spread of HIV/AIDS epidemic in the MENA region. Percent of Adults Ages 15-49 infected with HIV/AIDS is the estimated percentage of people aged 15-49 living with HIV/AIDS. These estimates include all people with HIV infection, whether or not they have developed symptoms of AIDS, alive at the end of 2001. To calculate the adult HIV prevalence rate, the estimated number of adults living with HIV/AIDS at the end of 2001 was divided by the 2001 adult population (aged 15–49). The figures do not indicate a serious situation.

TABLE 6 DEMOGRAPHIC AND HELATH INDICATORS: HIV/AIDS EPIDEMIC

Variable	Country				
	Egypt	Italy	Morocco	Syria	Turkey
Adults and children infected with HIV/AIDS, 2001 (Number)	8 000	100 000	13 000	--	--
Percent of Adults Age 15-49 infected with HIV/AIDS, 2001	0.1	0.4	0.1	--	0.1
Number of children orphaned by AIDS since the beginning of epidemic,	--	--	--	--	--

Variable	Country				
	Egypt	Italy	Morocco	Syria	Turkey
2001					

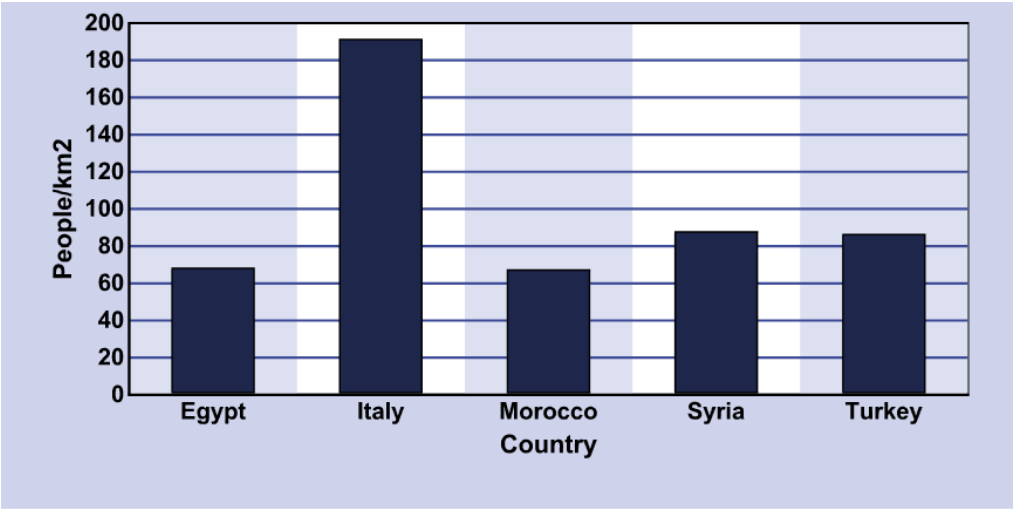
Source: World Resources Institute. 2007. *EarthTrends: Environmental Information*. Available at http://earthtrends.wri.org. Washington DC: World Resources Institute, Country Profiles on-line at http://earthtrends.wri.org

However, according to Ramia and Eid-Fares (2005), the World Health Organization estimates that at least 21.3 million hepatitis C virus (HCV) carriers in the Eastern Mediterranean countries, which is close to the number of carriers estimated in the Americas and Europe combined. In their review, on the epidemiology and distribution of HCV genotypes in the Eastern Mediterranean countries, Ramia and Eid-Fares found that genotype 4 is prevalent in most of the Arab countries. They concluded that from the limited number of clinical trials on the treatment of chronic HCV genotype 4 using peginterferon alfa-2b in combination with ribavirin are encouraging. However, efforts to develop more effective antiviral therapies and the establishment of an effective HCV vaccine remain the largest challenges for the near future.

3.2 Population and Spatial Distribution

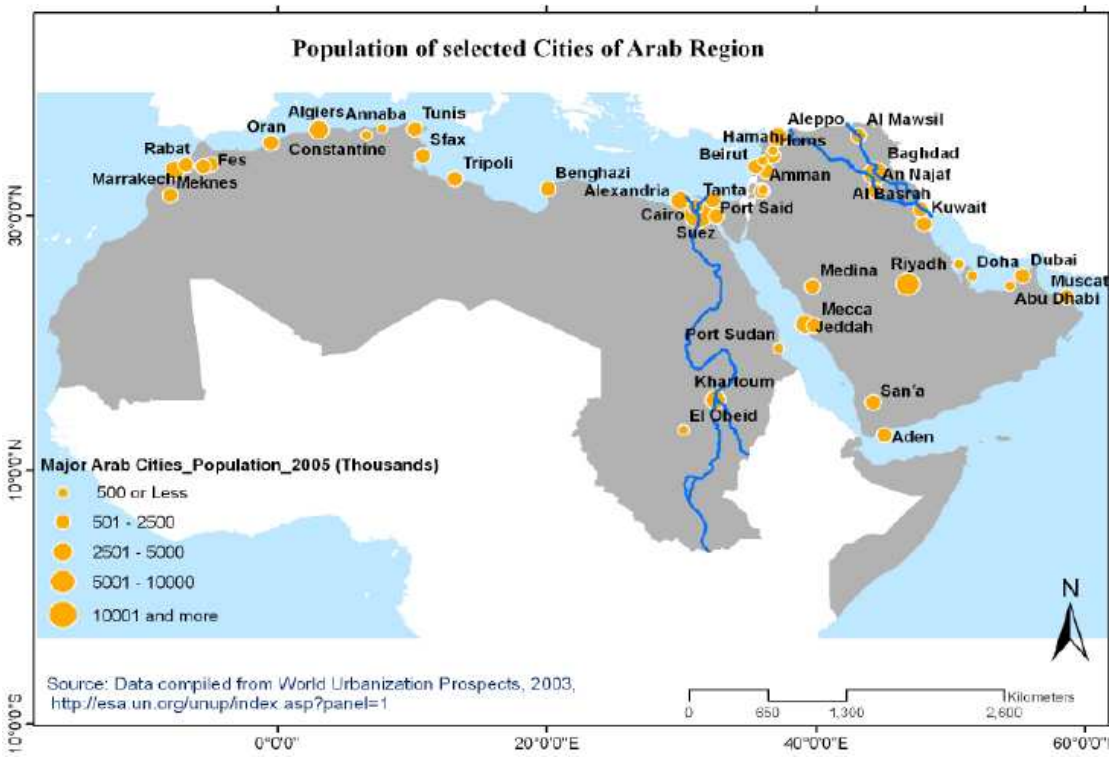
Most of the land is desert, yet it can provide opportunities for the coming generations. The overall population densities do not seem to be high for the MENA region countries. The information presented in Figure 1 is illusive. It, however, shows that vast areas of land in the region is idle, and requires proper planning to reclaim and cultivate. The majority of the populations of MENA region are within 100 km away from the Mediterranean coast line or around the major source of fresh water, such as the Nile River, as Figure 2 shows.

FIGURE 1 POPULATION DENSITY (PEOPLE PER SQUARE KILOMETRE), 2000



Source: Graphed based on information from World Resources Institute. 2007. *EarthTrends: Environmental Information*. Available at http://earthtrends.wri.org. Washington DC: World Resources Institute, Country Profiles

FIGURE 2 POPULATION OFSELECTED CITIES OF THE ARAB REGION



Source: CEDARE GIS Unit, "Chapter on Human Settlements," Environmental Outlook for the Arab Region, CEDARE, UNEP-ROWA forthcoming, July 2009

3.3 POPULATION WELL-BEING

Aside of Italy, countries under investigation, as many countries of the MENA region, are middle-income countries with moderate scores on the UN Human Development Index (HDI). Table 7 shows that most urban population have connections to improved water source and wastewater collection schemes. Rural populations do not enjoy similar levels of physical infrastructures. This urban-rural gap can explain reasons for moving to the city and abandon agricultural land for an opportunity for higher living standards.

TABLE 7 WATER AND SANITATION

Variable	Country				
	Egypt	Italy	Morocco	Syria	Turkey
Access to improved Sanitation, 2000					
Urban	100	--	86	98	97
Rural	96	--	44	81	70
Access to an improved water source, 200094					
Urban	99	--	98	94	81
Rural	96	--	56	64	86

Source: World Resources Institute. 2007. *EarthTrends: Environmental Information*. Available at http://earthtrends.wri.org. Washington DC: World Resources Institute, Country Profiles on-line at http://earthtrends.wri.org

Adult illiteracy in many countries is still high, and prevails particularly among women. Without basic education, women cannot be fully active in development of their communities and reproduction of

adequate labour, Table 8. The wide spread of illiteracy hinders possibilities for raising awareness and efforts for capacity building and development.

TABLE 8 SCHOOL ENROLMENT AND LITERACY

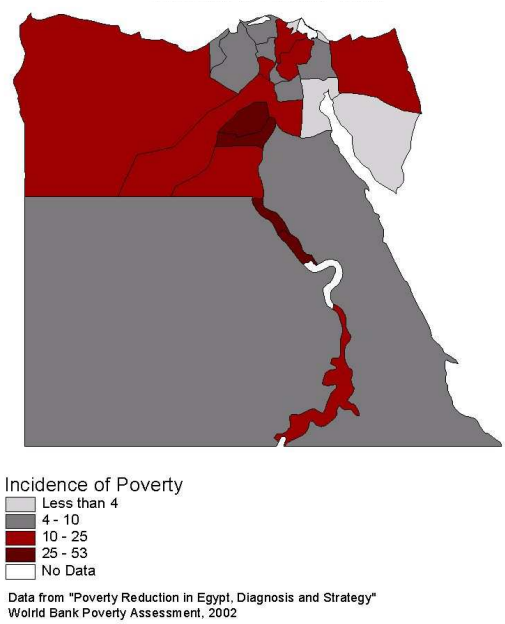
Variable	Country				
	Egypt	Italy	Morocco	Syria	Turkey
Net Primary School Enrolment and Literacy					
1980	--	--	--	--	--
1997-1999	92	101	79	93	100
Net Secondary School Enrolment, 1997-1999					
Female	70	89	32	36	49
Male	80	87	43	39	68
Gross tertiary school Enrolment, 1996-99	39	47	9	6	14
Adult Literacy rate, 2002					
Female	46	98	38	63	78
Male	68	99	63	89	94
Youth Literacy Rate, 2002					
1980	52	100	42	71	88
2002	71	100	70	88	97

Source: World Resources Institute. 2007. *EarthTrends: Environmental Information*. Available at http://earthtrends.wri.org. Washington DC: World Resources Institute, Country Profiles

3.4 CHALLENGES TO SOCIAL SUSTAINABILITY

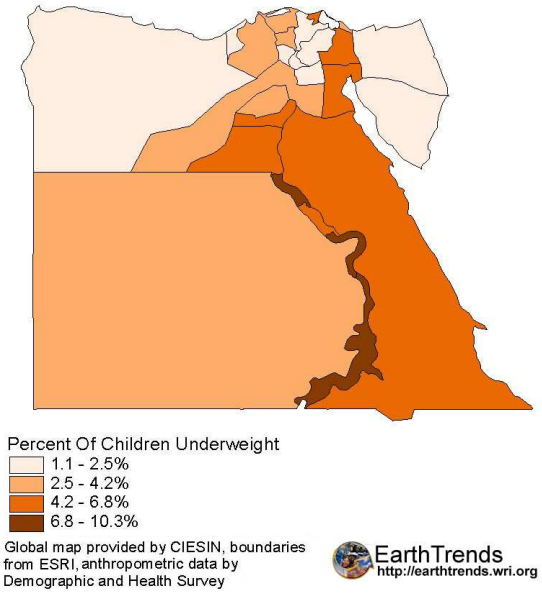
Poverty is the main problem and challenge to social sustainability in the MENA region. Available country-level information on poverty, such as the case of Egypt, shows that poverty in both urban and rural areas. However, rural areas, particularly central Egypt as Figure 3 shows, are significantly affected. Poverty manifests itself in various forms including, but not limited to financial inability to satisfy basic needs. Poverty can be rendered in the form of lacking physical infrastructures, such as wastewater collection, and social services, such as proper education and health services. Children who are under-weight is another indicator for lacking proper health services, but also indicate poverty levels. Figures 3 and 4 show that incidence of poverty in Egypt are positively associated with percent of children underweight. Figure 5 shows that the southern area of Morocco, which happens to be the disputed Sahara Republic, experiences the highest percentage of children underweight. In Turkey, the eastern section of the country experience high concentration of underweight children, which probably is the poorest part of the country, Figure 6.

FIGURE 3 EGYPT, INCIDENCE OF POVERTY, 2000



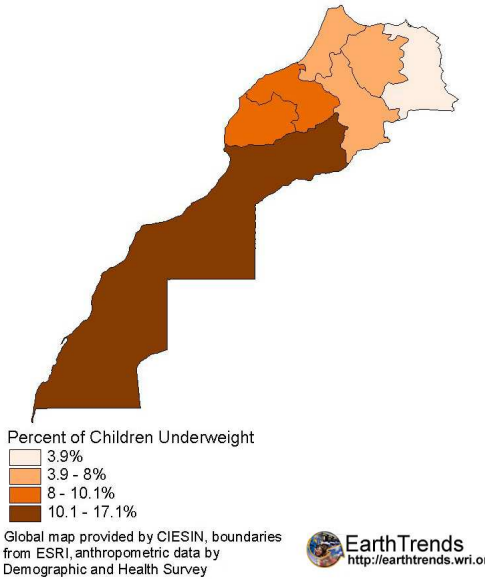
Source: World Resources Institute. 2007. *EarthTrends: Environmental Information*. Available at http://earthtrends.wri.org. Washington DC: World Resources Institute,

FIGURE 4 EGYPT, PERCENT OF CHILDREN UNDERWEIGHT, 2000



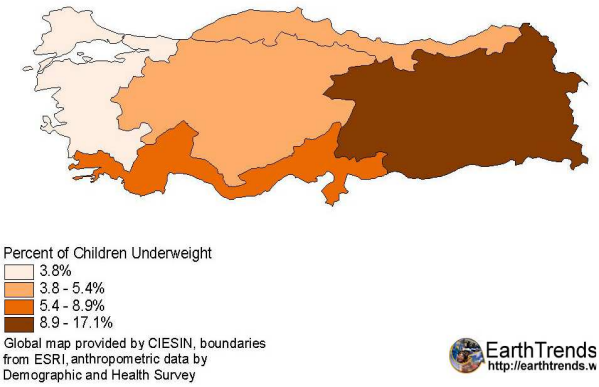
Source: World Resources Institute. 2007. *EarthTrends: Environmental Information*. Available at http://earthtrends.wri.org. Washington DC: World Resources Institute,

FIGURE 5 MOROCCO, PERCENT OF CHILDREN UNDERWEIGHT, 1992



Source: World Resources Institute. 2007. *EarthTrends: Environmental Information*. Available at http://earthtrends.wri.org. Washington DC: World Resources Institute,

FIGURE 6 TURKEY, PERCENT OF CHILDREN UNDERWEIGHT, 1996



Source: World Resources Institute. 2007. *EarthTrends: Environmental Information*. Available at http://earthtrends.wri.org. Washington DC: World Resources Institute,

4 FARMING SYSTEMS

The theory of production, which is part of the economic theory, is the analysis of transforming factor inputs into outputs according to a production function, where production is dependent on: a) technology, b) the mix of factor inputs, i.e., labour and capital, c) factor prices and d) marginal productivity.

In agriculture, farming systems is a means of organizing resources depending on inputs processes and outputs. Inputs include nature of the land, labour, government subsidies, climate, knowledge and abilities of the farmer, and other factors; while processes include ploughing and harvesting; and outputs are milk, eggs, and straw. Different types of farming system include intensive agriculture and extensive agriculture. The system model can be applied to all types of farming. Different types and patterns of farming result from variations in inputs – physical, cultural, economic, and behavioural factors. Outputs constitute the end product, the cost of producing which, in relation to its value, will determine the profit margin.

"A farming system...is defined as a population of individual farm systems that have broadly similar resource bases, enterprise patterns, household livelihoods and constraints, and for which similar development strategies and interventions would be appropriate. Depending on the scale of the analysis, a farming system can encompass a few dozen or many millions of households."(Hall et. als, 2001a: 9)

A particular farming system illustrates the structural complexity and interrelationships between various components of the system; and also shows the variety of natural resources available to farm. These resources normally include different types of land, various water sources and access to common property resources – including ponds, grazing areas and forest. To these basic natural resources may be added climate and biodiversity, as well as human, social and financial capital (Hall et als. 2001a). The resource endowment of any particular farm depends on population density, the distribution of resources among households and the effectiveness of institutions in determining access to resources to produce foods and agricultural inputs for manufacturing activities.

Policies and institutions, markets and information linkages strongly affect the functioning of any farming system. Macroeconomic policies closely associate with farming systems. Tax reduction, for example, have positive impact on investments at large including agricultural production. In Egypt, the Government, within the Economic Reform and Structural Adjustment Program (ERSAP) in the mid 1980s included eliminating subsidies for fertilizers and pesticides along with freeing prices of agricultural products. The aim was more efficient use of agricultural inputs. An indirect positive return of this decision was limiting pressures on the ecosystems and witnessing revival of many species (flora and fauna) known in the Nile Delta and Valley, such as the Ibis species including the Cattle Egret. Egypt incurred the loss of an estimated three thousand feddans[7] of valuable agricultural land to develop the ring road around the Greater Cairo metropolitan area, in addition to the urban sprawl, which most of it is informal, at the expense of the valuable agricultural land.

The Farming System Approach considers both biophysical dimensions, such as soil nutrients and water balances, and socio-economic aspects, such as gender, food security and profitability, at the level of the farm – where most agricultural production and consumption decisions are taken. The power of the approach lies in its ability to integrate multi-disciplinary analyses of production and its relationship to the key biophysical and socio-economic determinants of a farming system.

[7] One feddan is about 4200 square metre, i.e., around one acre

To present the analysis of farming systems and their future development within a framework that is broadly comparable between systems and across different regions, Hall and others (2001a) used key biophysical and socio-economic determinants to group them together into five categories:

- Natural resources and climate;
- Science and technology;
- Trade liberalisation and market development;
- Policies, institutions and public goods; and
- Information and human capital.

Hall and others (2001a) used classified of the farming systems based on the following criteria:

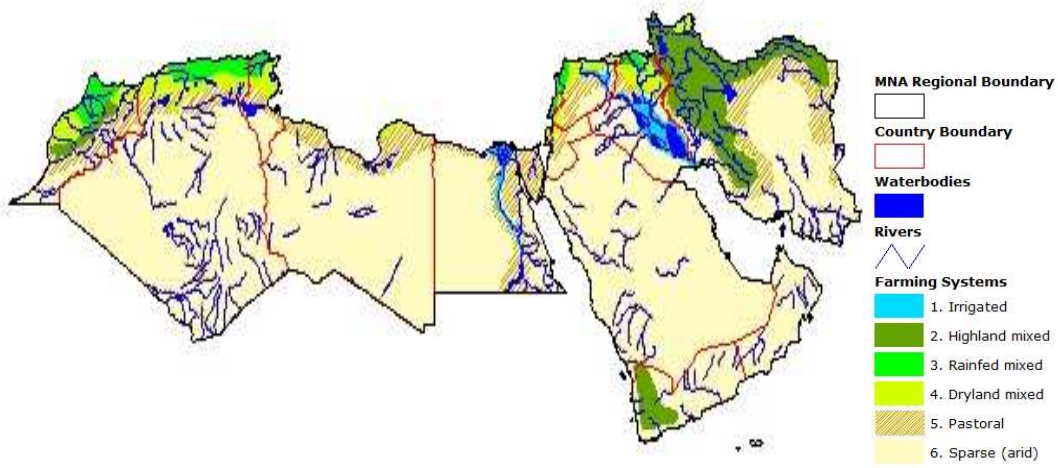
1. **Available natural resource base**, including water, land, grazing areas and forest; climate, of which altitude is one important determinant; landscape, including slope; farm size, tenure and organization; and
2. **Dominant pattern of farm activities and household livelihoods**, including field crops, livestock, trees, aquaculture, hunting and gathering, processing and off-farm activities; and taking into account the main technologies used, which determine the intensity of production and integration of crops, livestock and other activities.

Based on these criteria, Hall et al. (2000b) distinguished the following broad categories of farming system are in North Africa and the Middle East that Table 9 summarizes and indicated in Figure 7:

1. ***Irrigated Farming System***. The system contains both large and small-scale irrigation schemes. The large-scale subsystem contains a total population of 80m and an agricultural population of 16m. It encompasses 8.1m ha of cultivated land that is almost totally irrigated and schemes are found across all zones. They include high-value cash and export cropping and intensive vegetable and fruit cropping. The small-scale irrigation subsystem also occurs widely across the region and although not as important in terms of population, it is a significant element in the survival of many people in arid and remote mountain areas. Owner-occupiers or tenants typically farm very small units – from 0.02 to 1 ha – often within an area of larger, rainfed systems. Major crops are mixed cereals, fodder and vegetables. The prevalence of poverty within both subsystems is moderate.
2. ***Highland Mixed Farming System***. This system is the most important in the region in terms of population – with 27m engaged in agriculture – but contains only 7 percent of the land area. Out of a total area of 74m ha, cultivated area covers 22m ha, with nearly 5m ha irrigated. There are two subsystems; one dominated by rainfed cereal and legumes plus tree crops (fruits and olives) on terraces, while the second is based on livestock (mostly sheep) on communally managed lands. Poverty is extensive, as markets are often distant, infrastructure is poorly developed and the degradation of natural resources is a serious problem.
3. ***Rainfed Mixed Farming System.*** The system has an agricultural population of 16m, but occupies only two percent of the regional land area, resulting in high population densities. Cultivated area is 14m ha, including tree crops and vines, with 8m cattle. Supplementary winter irrigation is now used on 0.6m ha of wheat and on summer cash crops. More humid areas are characterized by tree crops (olives and fruit), melons and grapes. There is some dry-season grazing of sheep migrating from the steppe areas. Poverty is moderate, but would be higher without extensive off-farm income from seasonal labour migration.
4. ***Dryland Mixed Farming System.*** The system is found in dry sub-humid areas and contains an agricultural population of 13m people with 17m ha of cultivated land. Population density tends to be lower than in the other main cultivated systems and average farm sizes are larger. The main rainfed cereals are barley and wheat, grown in a rotation involving an annual or two-year fallow. The risk of drought is high and considerable food insecurity exists.

Livestock, including 6m cattle and a greater number of small ruminants, interact strongly with the cropping and fodder system. Poverty is extensive among small farmers.

FIGURE 7 MAJOR FARMING SYSTEMS: MIDDLE EAST AND NORTH AFRICA



Source: FAO, http://www.fao.org/farmingsystems/FarmingMaps/MNA/01/FS/index.html

TABLE 9 MAJOR FARMING SYSTEM OF THE MENA REGION

Farming Systems	Land Area (% of)	Agricultural Population (% of region)	Principal Livelihoods
Irrigated	2	17	Fruits, vegetables, cash crops
Highland Mixed	7	30	Cereals, legumes, sheep, off-farm
Rainfed Mixed	2	18	Tree crops, cereals, legumes, off-farm work
Dryland Mixed	4	14	Cereals, sheep, off-farm work
Pastoral	23	9	Sheep, goats, barley, off-farm work
Sparse (Arid)	62	5	Camels, sheep, off-farm work
Coastal Artisanal Fishing	1	1	Fishing, off-farm work
Urban Based	<1	6	Horticulture, poultry, off-farm work

Hall et. als. Farming Systems and Poverty Improving Farmers' Livelihoods in a Changing World, Summary, FAO and World Bank, Rome and Washington D.C. 2001b, p. 13 based on FAO data and knowledge.

Maybe expand with a table about farm structure in the 5 countries - the average farm size (distribution) and area different commen crops

5 Inputs for Agricultural Production

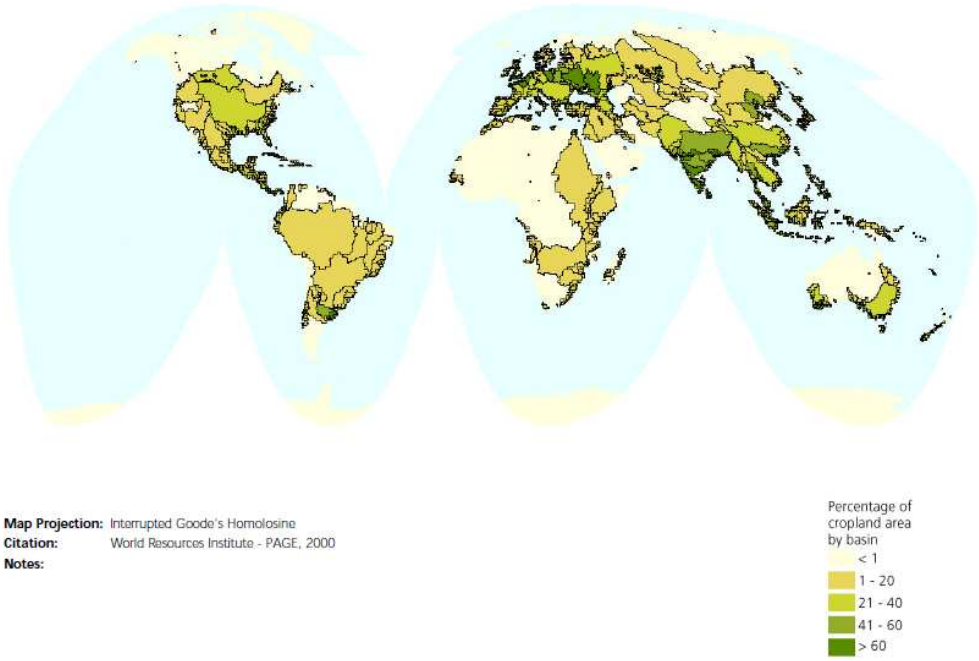
5.1 Water

Modifying rivers, lakes, and wetlands and changing land-use patterns in the whole watershed affect freshwater systems. The pattern and extent of cities, roads, agricultural land, and natural areas within a watershed influences infiltration properties, transpiration rates, and runoff patterns, which in turn impact water quantity and quality. Figure 8 presents the distribution of watersheds containing intensive agriculture. Watersheds with intensive agricultural development are likely to experience

water quality degradation from pesticide and nutrient runoffs and increased sediment loads. The figure shows that intensively cropped land is concentrated in five areas: Europe, India, eastern China, Southeast Asia, and the mid-western United States, with smaller concentrations in Argentina, Australia, and Central America. Africa is striking in its lack of intensively cropped land, with the exception of small patches along the Mediterranean coast and in South Africa. This reflects the minimal use of chemical inputs and the low level of agricultural productivity in most African countries. Figure 9 shows the areas with intensive cropland within watersheds, therefore showing the potentially important within basin differences. The figure shows the results for Europe (west of the Ural Mountains) and the Middle East. There are 4,033 sub-basins in Europe. Here, the most intensively cultivated land area forms an arc extending from northern France to the Ukraine. Crop intensity is higher in basins in northern France, the Netherlands, and southern England, and in the sub-basins of the Oder, Vistula, Dnieper, and Don rivers in Eastern Europe. There are also intensively cropped areas in parts of the Danube basin and sub-basins close to the Black Sea, particularly around the Sea of Azov.

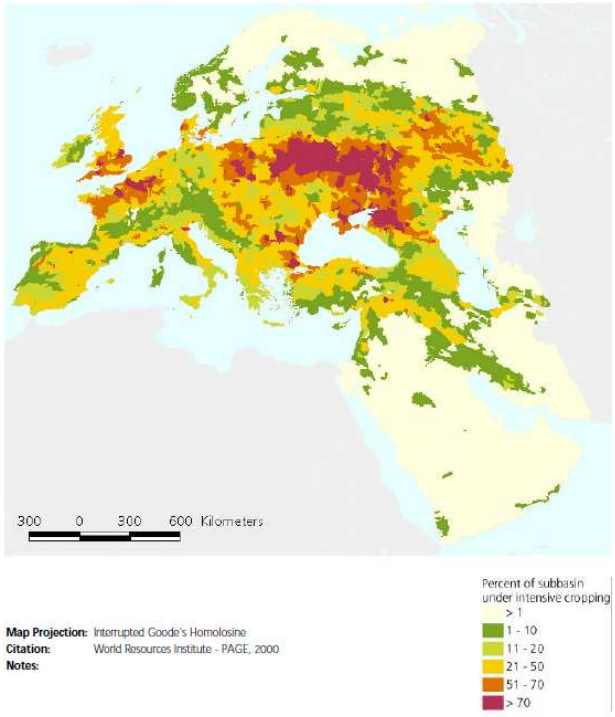
The two figures show that, first, the Nile River is among the major rivers that contribute to agricultural production. Second, the rugged terrain to the north of Morocco is another major agricultural production area. Third, significant areas of land in both Italy and Turkey are among the world cropland.

FIGURE 8 CROPLAND AREA BY RIVER BASIN



Source: World Resources Institute. 2007. *EarthTrends: Environmental Information*. Available at http://earthtrends.wri.org. Washington DC: World Resources Institute,

FIGURE 9 INTENSIVE AGRICULTURAL LAND USE BY RIVER SUBBASIN IN EUROPE AND THE MIDDLE EAST



Source: World Resources Institute. 2007. *EarthTrends: Environmental Information*. Available at http://earthtrends.wri.org. Washington DC: World Resources Institute

Per Capita Actual Renewable Water Resources gives the maximum theoretical amount of water actually available, on a per person basis, for each country. In reality, a portion of this water may be inaccessible to humans. Actual renewable water resources are defined as the sum of internal renewable resources (IRWR) and external renewable resources (ERWR), taking into consideration the quantity of flow reserved to upstream and downstream countries through formal or informal agreements or treaties and possible reduction of external flow due to upstream water abstraction. The overall trend in the countries under investigation, except Turkey as the Table shows, is a decline in per capita share of available amounts of fresh water. Table 10 shows that both Morocco and Egypt are facing serious water shortage. This is could be resulting from constant available amounts of water and a growing population.

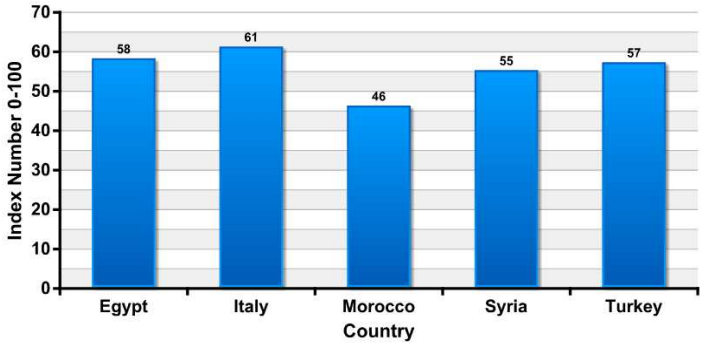
TABLE 10 ACTUAL RENEWABLE WATER RESOURCES: PER CAPITA, CUBIC METRE PER CAPITA

Country	2006	2007
Egypt	772.8	758.6
Italy	3,290.3	3,288.5
Morocco	907.9	894.7
Syria	1,345.8	1,313.8
Turkey	2,879.0	3,050.8

Source: World Resources Institute. 2007. *EarthTrends: Environmental Information*. Available at http://earthtrends.wri.org. Washington DC: World Resources Institute, Country Profiles

The Water Poverty Index (WPI)[8] measures, for a given country, the impact of water scarcity and water provision on human populations. WPI is a number between 0 and 100, where a low score indicates water poverty and a high score indicates good water provision. WPI is the culmination of an interdisciplinary approach that combines both the physical quantities relating to water availability and the socio-economic factors relating to poverty to produce an indicator that addresses the diverse factors that affect water resource management. Accordingly, Morocco has the lowest WPI followed by Syria, and Italy has the highest score, Figure 10. Both Egypt and Turkey have almost equal scores. This calls for attention to the use of water at both national and farm levels to conserve and protect water resources from wastes and irrational use.

FIGURE 10 WATER POVERTY INDEX, INDEX NUMBER 0-100; LOWER SCORES INDICATE WATER SCARCITY AND POOR WATER PROVISION



Source: Graphed based on data compiled from World Resources Institute. 2007. *EarthTrends: Environmental Information*. Available at http://earthtrends.wri.org. Washington DC: World Resources Institute, Country Profiles on-line at http://earthtrends.wri.org

Water use intensity is the amount of water used in the agricultural sector per hectare of temporary and permanent cropland in the year specified. This indicator shows a country's dependence on irrigation for agricultural production. Data are given in cubic meters per hectare per year.

All water use is attributed to one of three categories: agricultural, domestic, or industrial. Water use for agriculture is defined as the water withdrawals that are attributed to the agricultural sector, used primarily for irrigation.

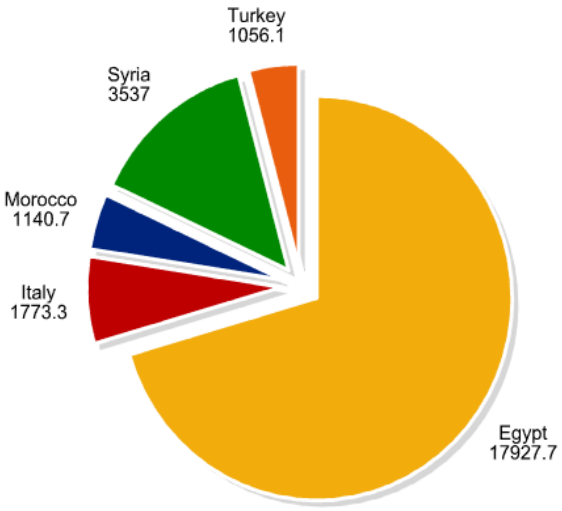
WRI calculates water use intensity by dividing a country's total water withdrawals for agricultural purposes by the total area of temporary[9] and permanent[10] cropland in that country for that year.

[8] WPI is comprised of five component indices: Resources, Access, Capacity, Use, and Environment. Each of these component indices is made up of sub-indices

[99] Temporary cropland, called "arable land" in FAO terms, refers to land under temporary crops (double-cropped areas are counted only once), temporary meadows for mowing or pasture, land under market and kitchen gardens, and land temporarily fallow (less than five years). The abandoned land resulting from shifting cultivation is not included in this category. Data for "arable land" are not meant to indicate the amount of land that is potentially cultivable.

[10] Permanent cropland refers to land cultivated with crops that occupy the land for long periods and need not be replanted after each harvest, such as cocoa, coffee and rubber; this category includes land under flowering shrubs, fruit trees, nut trees and vines, but excludes land under trees grown for wood or timber.

FIGURE 11 AGRICULTURAL INPUTS: WATER USE INTENSITY, 2000, CUBIC METERS PER HECTARE PER YEAR



Source: Graphed based on data compiled from World Resources Institute. 2007. *EarthTrends: Environmental Information*. Available at http://earthtrends.wri.org. Washington DC: World Resources Institute, Country Profiles on-line at http://earthtrends.wri.org

It seems that the Egyptian agriculture is the farming system that is most dependent on water compared to other countries included in the analysis, followed by the Syrian agriculture, Figure 11. Egypt grows two crops that require large amounts of water: rice and sugar-cane. Rice is a central element in the daily Egyptian diet. It also represents a significant share of the Egyptian agricultural exports, as will be indicated later in this report.

5.2 LAND

Land is an essential factor of production, particularly agricultural production. Since gaining independence, land reform was often central to strategies of MENA region countries for agricultural development within the overall strategies for national development. Horizontal agricultural expansion depended on implementing ambitious plans for land reclamation aiming to attract congested populations outside crowded and densely populated areas. Developing mega national projects within general spatial plans for national development was applied in Egypt, Morocco and Syria.

Following on the notice that gross densities mentioned earlier are elusive once more returns in this subsection. Table 11 shows that total cropland[11] in Egypt is not sufficient to support its population by examining the cropland per one thousand persons. To the contrary, other countries are endowed with cropland to support their populations. The Table shows that all cropland in Egypt is fully irrigated, which is not the case in other countries within the analysis.

[11] Total cropland is comprised of both arable and permanent land in a given country for each year. Arable land is land under temporary crops (double cropped areas are counted only once), temporary meadows for mowing or pasture, land under market and kitchen gardens, and land fallow for less than five years. The abandoned land resulting from shifting cultivation is not included in this category. Data for "Arable land" are not meant to indicate the amount of land that is potentially cultivable. Permanent Crops is land cultivated with crops that occupy the land for long periods and need not be replanted after each harvest, such as cocoa, coffee and rubber; this category includes land under flowering shrubs, fruit trees, nut trees and vines, but excludes land under trees grown for wood or timber.

TABLE 11 AGRICULTURAL LAND

Variable	Country				
	Egypt	Italy	Morocco	Syria	Turkey
Total cropland (000 ha), 1999	3,300.0	11,422.0	9,445.0	5,502.0	26,672.0
Hectares of cropland per 1,000 population, 1999	3.3.0	199.0	322.0	349.0	406.0
Arable and permanent cropland as a percent of total land area, 1998	3.3	37.0	22.3	29.6	34.8
Percent of cropland that is irrigated, 1999	100.0	23.6	13.8	21.6	16.9

Source: World Resources Institute. 2007. *EarthTrends: Environmental Information*. Available at http://earthtrends.wri.org. Washington DC: World Resources Institute, Country Profiles on-line at http://earthtrends.wri.org

5.3 Labour and Capital

5.3.1 Labour

In addition to land, labour and capital are two key factors of production. Number of agricultural workers[12] is declining as the countries move toward industrialization. This is evident from the growing urban population indicated early, and the declining agricultural works as percent of the total labour force. Results of the latest census, 2006, suggest that the agricultural workers who represented about 40 per cent of the total labour in 1990, as mentioned in Table 12, has declined to about 29 per cent in 2006 (Central Agency for Public Mobilization and Statistics, Results of the 2006 Census).

5.3.2 Capital

5.3.2.1 Fertilizers

Invested capital is represented in various forms. Respective amounts of invested capital and labour allocated to agricultural production in countries under inquiry are depicted in Table 12 and Figures 10-13. The Table shows that Egypt and Italy uses considerable amounts of fertilizers as indicated by average annual fertilizer use[13] (total and intensity[14] depicted in Figure 12. The construction of High Aswan Dam has saved Egypt from number of droughts that hit Africa in the 1970s and 1980s, as well as a number of excessive ebbs in the 1990s. The dam however prohibited silt and other organic nutrients that the river enriched the Egyptian soil. Egyptian farmers used fertilizers, both organic and chemical to substitute for the degrading fertility of the soil.

TABLE 12 AGRICULTURAL INPUTS

Variable	Country				
	Egypt	Italy	Morocco	Syria	Turkey
Total (thousand metric tons)	1,188.0	1,772.0	328.0	371.0	2,203.0
Number of tractors, 1997	90,000.0	1,480,000.0	43,226.0	87,442.0	874,995.0

[12] Agricultural workers as a percentage of the total labor force is the proportion of the total labor force recorded as working in agriculture, hunting, forestry, and fishing. Labor force comprises all people who meet the International Labour Organization's definition of the economically active population.

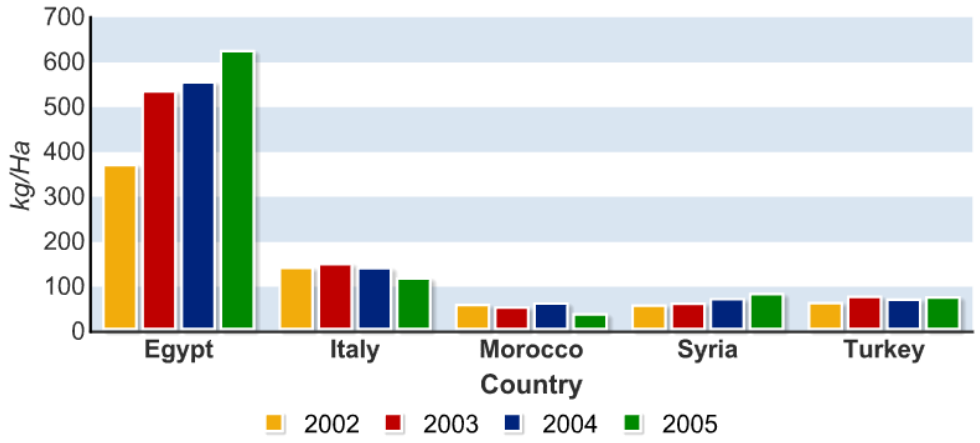
[13] Average annual fertilizer use is the use in metric tons of the nutrients nitrogen (N), potash (K2O), and phosphate (P2O5). Data refer to the fertilizer year 1 July - 30 June. For countries that report their fertilizer statistics on a calendar-year basis, data are shown under the fertilizer year that begins in that calendar year; for example, 1991 data are under the fertilizer year starting on 1 July 1991. Data is collected through the FAO fertilizer questionnaire.

[14] Fertilizer Intensity is calculated by fertilizer use by total cropland (above) for a given country.

Variable	Country				
	Egypt	Italy	Morocco	Syria	Turkey
Agricultural workers as a percentage of the total labour force , 1990	40.3	8.6	44.7	33.2	53.1

Source: World Resources Institute. 2007. *EarthTrends: Environmental Information*. Available at http://earthtrends.wri.org. Washington DC: World Resources Institute, Country Profiles on-line at http://earthtrends.wri.org

FIGURE 12 AGRICULTURAL INPUTS: FERTILIZER USE INTENSITY



Source: Graphed based on data compiled from World Resources Institute. 2007. *EarthTrends: Environmental Information*. Available at http://earthtrends.wri.org. Washington DC: World Resources Institute, Country Profiles on-line at http://earthtrends.wri.org

5.3.2.2 Organic Farming

Organic land area is the percent of total agricultural area either fully converted to organic agriculture or in the process of conversion as a percentage of a country's total agricultural land. Definitions of organic agriculture vary among countries. "Organic agriculture is a holistic production management system which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles, and soil biological activity....This is accomplished by using, where possible, cultural, biological and mechanical methods, as opposed to using synthetic materials, to fulfill any specific function within the system."[15] "Organic

Sekem an Egyptian Initiative

SEKEM takes on its responsibility by working for sustainable development locally and in the region. SEKEM is producing an extensive variety of high quality consumer products in the fields of natural pharmaceuticals, delicious organic food and beautiful textiles, information technology and ecological services. The products are made from ingredients from biodynamic farming. This method undertakes to restore and maintain the vitality of the soil and food as well as the biodiversity of nature.

The name SEKEM is the transliteration of a hieroglyph, meaning "vitality".

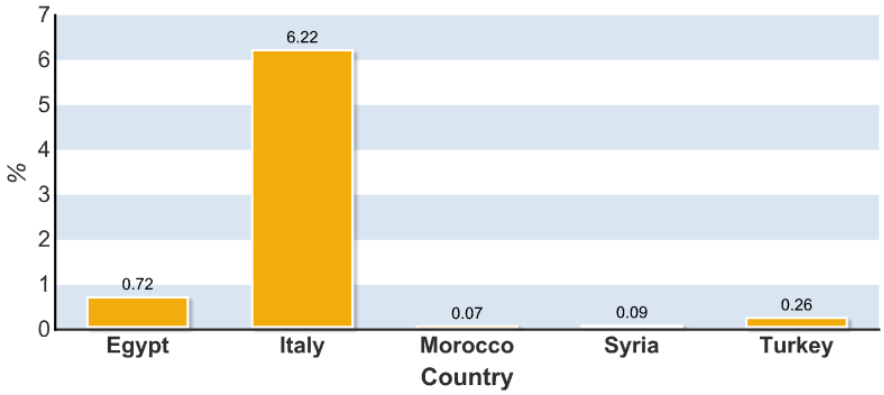
Source: About Sekem, http://www.sekem.com/english/about/default.aspx?PageID=1

[15] FAO/WHO Codex Alimentarius Commission Guidelines for the Production, Processing, Marketing and Labelling of Organically Produced Foods,

production systems are based on specific and precise standards of production which aim at achieving optimal agro-ecosystems which are socially, ecologically and economically sustainable. Terms such as 'biological' and 'ecological' are also used in an effort to describe the organic system more clearly. Requirements for organically produced foods differ from those for other agricultural products in that production procedures are an intrinsic part of the identification and labelling of, and claim for, such products."[16]

Italy has the highest share of organic farming, followed by Egypt, Figure 13. This could probably result from Italy's membership of the European Union, which requests specific standard and practices in the agricultural production. Egypt and Turkey have special agreements with EU member countries, and in Egypt, there are areas devoted to organic farming and exporting their products to European markets, such as SEKAM

FIGURE 13 ORGANIC FARMING: ORGANIC LAND AREA AS A PERCENT OF TOTAL AGRICULTURAL AREA, (%)



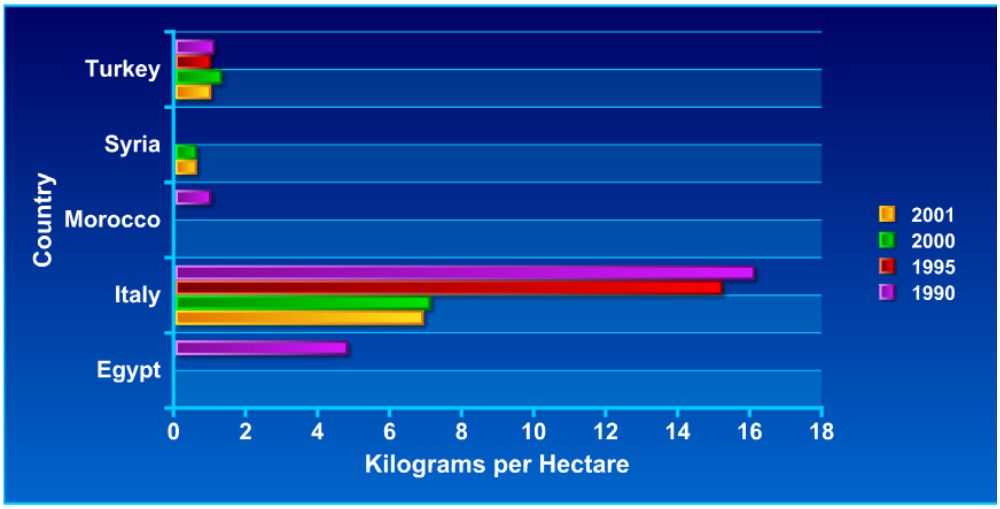
Source: Graphed based on data compiled from World Resources Institute. 2007. *EarthTrends: Environmental Information*. Available at http://earthtrends.wri.org. Washington DC: World Resources Institute, Country Profiles on-line at http://earthtrends.wri.org

5.3.2.3 PESTICIDES

Pesticide use includes quantities of pesticides used in (or sold to) the agricultural sector. Figures are generally expressed in terms of active ingredients. Pesticides include: insecticides, mineral oils, herbicides, fungicides and bactericides, seed treatment fungicides and insecticides, plant growth regulators, and rodenticides. A strict inter-country comparison on the basis of the database is not feasible because (1) The country coverage and time series are incomplete due to a high rate of non-response, and (2) Although countries have been requested to report data in terms of active ingredients, some countries may have reported in formulation weight (including diluents and adjuvants) without specific indication. (Country Profiles on-line at http://earthtrends.wri.org). Italy has the most complete series of data and the highest pesticide use intensity, Figure 14.

[16] Ibid.

FIGURE 14 AGRICULTURAL INPUTS: PESTICIDE USE INTENSITY

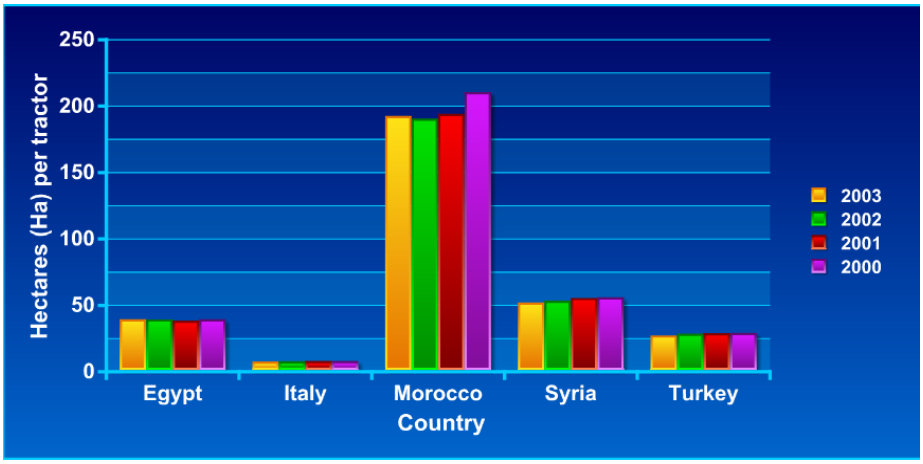


Source: Graphed based on data compiled from World Resources Institute. 2007. *EarthTrends: Environmental Information*. Available at http://earthtrends.wri.org. Washington DC: World Resources Institute, Country Profiles on-line at http://earthtrends.wri.org

5.3.2.4 MACHINERY

Number of tractor and intensity of use, Table 12 and Figure 15, are two other indicators of invested capital in the agricultural production. Tractor use intensity is the number of hectares of arable and permanent cropland per tractor. Data on tractor use intensity is useful for understanding the nature of production systems. Tractors tend to be used in areas with flatter lands and scarce labour. The number of tractors in use refers to a country's total number of wheeled and crawler tractors used in agriculture. Garden tractors are excluded from this total (EarthTrends). Morocco seems to have the highest intensity use given that Italy has the highest number of tractors as well as more total cropland than Morocco. This suggests that tractors might not be used only for agricultural production in the Moroccan countryside, i.e., there are other uses of tractors beside agricultural production. This is normal in Egypt. Tractors are used on the farm, but also to transport products and inputs, and many are used in the construction sector in rural areas.

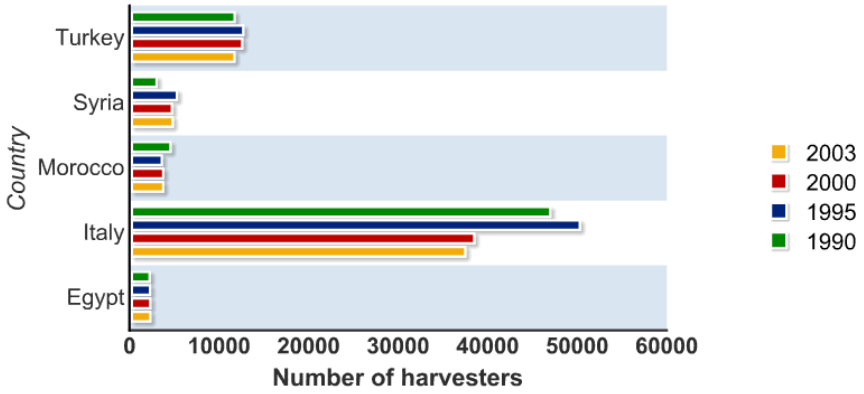
FIGURE 15 AGRICULTURAL INPUTS: TRACTOR USE INTENSITY



Source: World Resources Institute. 2007. *EarthTrends: Environmental Information*. Available at http://earthtrends.wri.org. Washington DC: World Resources Institute, Graphed based on data compiled from Country Profiles on-line at http://earthtrends.wri.org

Number of harvesters in use is another measure of invested capital in the agricultural production process that refers to a country's total number of self-propelled machines that reap and thresh in one operation. It seems that there is an inverse relationship between the number of employed agricultural labour and number of harvester in use. Italy has the least number of agricultural labours compared to the rest of the countries in the analysis. It has the highest number of harvesters in use. This is reflecting substitution of labour with invested capital, i.e., machinery, which is normal in an advanced, industrialized economy. Other countries in the analysis are currently in a transition towards a more industrialized, and thus are experiencing decline in number of agricultural workers, and growing use of tractors and harvesters in the agricultural production processes, Figure 16.

FIGURE 16 AGRICULTURAL INPUTS: HARVESTERS IN USE



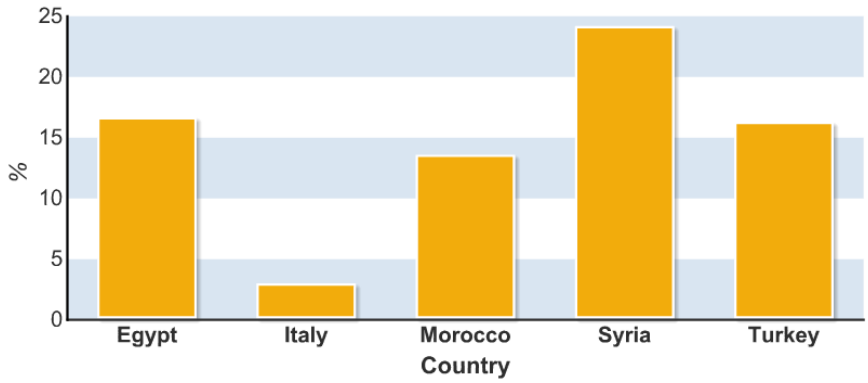
Source: Graphed based on data compiled from World Resources Institute. 2007. *EarthTrends: Environmental Information*. Available at http://earthtrends.wri.org. Washington DC: World Resources Institute, Country Profiles on-line at http://earthtrends.wri.org

6 AGRICULTURAL PRODUCTION

Production includes the quantities of a commodity sold in the market (marketed production) and the quantities consumed or used by producers (auto-consumption). Harvesting losses, threshing losses, and unharvested portions of the crop are not included. The time reference on crop production is based on the calendar year; data for any particular crop are reported under the calendar year in which the entire harvest or the bulk of it took place. In a number of cases, crops assigned by countries to a particular split year may appear under two different calendar years.

In advanced, industrialized economies, such as that of Italy, the contribution of the agricultural sector to the national economy is minimal, since other sectors, such as manufacturing and services tend to be the major economic activities. Other countries included in the analysis were agrarian societies that are currently in the stage of economic take-off indicated by declining number of agricultural labour, urban growth and expansion, and the emergence of other non-economic sectors to spear head the national economy, such as tourism and manufacturing, for example, Figure 17.

FIGURE 17 PERCENT OF GDP GENERATED FROM AGRICULTURAL ACTIVITIES, 2000



Source: Graphed based on data compiled from World Resources Institute. 2007. *EarthTrends: Environmental Information*. Available at http://earthtrends.wri.org. Washington DC: World Resources Institute, Country Profiles on-line at http://earthtrends.wri.org

Agricultural product, as reported in Table 13, consists of cereals, roots and tubers, pulses, and meat. Production data were collected mostly through annual FAO surveys to governments. Data have been grouped in 12 month periods ending 30 September of the years stated in the tables. For example, animals enumerated in a given country at any time between 1 October 1999 and 30 September 2000 is shown under the year 2000.

Average production of cereals refer to the amount of cereals produced in a given country or region each year. Cereals include wheat, barley, maize, rye, oats, millet, sorghum, rice, buckwheat, alpiste/canary seed, fonio, quinoa, triticale, wheat flour, and the cereal component of blended foods. Data relate to crops harvested for dry grain only. Mixed grains and buckwheat are included, although the following cereals are excluded: crops harvested for hay, crops used for grazing, and crops harvested green for food, feed or silage. Average cereal crop yields refer to the amount of grain produced per unit of harvested area of cereals in a given country or region each year. For cereal crop yields, area data relate to harvested area. Some countries report sown or cultivated area only; however, in these countries the sown or cultivated area does not differ significantly in normal years from the area actually harvested, either because practically the whole area sown is harvested or because the area surveys are conducted around the harvest period. For most countries, FAO does not directly record yield data but instead divides production data by the area harvested for a particular country and year. In all cases, yields are computed from detailed area and production data expressed in hectares and metric tons.

According to Table 13, Turkey has the highest average production of cereals compared to countries included in the analysis. However, Egypt, despite limitations in both land and fresh water, has the highest percent change in average production of cereals. This is probably due, in part, to the agricultural policies formulated and implemented in the early 1980s that liberalized the market and confined the role of the Egyptian Ministry for Agriculture and Land Reclamation to research and extension, and encouraging all non-governmental institutions including cooperatives and private sector companies more space to operate efficiently and effectively.

Average production and yield of roots and tubers covers all root crops grown principally for human consumption, such as cassava, yucca, taro, and yams; root crops grown principally for feed are

excluded. Italy has the highest average crop yield, Table 12. This is probably because of better management of natural and human resources.

Average production and yield of pulses includes those harvested for dry harvest only, such as lentils, pigeon peas, cowpeas, and vetches, and does not exclude those used for feed. According to Table 13, Egypt has the highest average crop yield compared to other countries included in the study.

Average annual meat production refers to the mass of meat in metric tons produced annually in a given country. Total meat production comprises horse meat, poultry meat and meat from all other domestic or wild animals such as camels, rabbits, reindeer and game animals. Both commercial and farm slaughter are included. Meat production for most species is calculated from multiplying the number of animals slaughtered by the average dressed carcass weight. Dressed carcass weights exclude offal and slaughter fats. Data relate to animals slaughtered within national boundaries, irrespective of their origin. Data compiled in Table 13 suggest that Egypt and Morocco has the highest percent change in average production of meat.

TABLE 13 AGRICULTURAL PRODUCTION AND YIELDS

Variable	Country				
	Egypt	Italy	Morocco	Syria	Turkey
Cereals, 1999-2001					
Average production (000 metric tons)	19,657	20,584	3,492	3,990	28,829
Percent change since 1979-81	142	14	-3	30	14
Per capita production (tons per person)	290	358	117	246	--
Percent change since 1979-81	56	12	-37	-30	-23
Average crop yield (kg per ha)	7,238	4,920	670	1,304	2,187
Percent change since 1979-81	79	39	-17	13	17
Roots and tubers 1996-1998					
Average production (000 metric tons)	2,439	2,113	1,195	419	5,122
Average crop yield (kg per ha)	19,278	22,997	18,694	18,879	X
Pulses, 1996-1998					
Average production (000 metric tons)	545	121	248	235	1,724
Average crop yield (kg per ha)	3,025	1,585	686	838	981
Meat					
Average production (000 metric tons)	1,395	4,162	580	353	1,330
Percent change since 1979-81	217	18	134	106	86

Source: World Resources Institute. 2007. *EarthTrends: Environmental Information*. Available at http://earthtrends.wri.org. Washington DC: World Resources Institute, Country Profiles on-line at http://earthtrends.wri.org

7 AGRICULTURAL EXPORTS

Agricultural raw materials exports as a percent of merchandise exports is the percentage of the total value of all merchandise leaving a given country's borders attributable to agricultural raw materials. Table 14 shows the agricultural raw materials as percent of merchandise exports in the past decade. The overall trend is declining. Italy, once more as affirmed earlier, does not depend on agricultural products as the major source of national income. The decline might be resulting from emerging other economic sectors, such as manufacturing.

TABLE 14 TRADE IN GOODS: AGRICULTURAL RAW MATERIALS EXPORTS AS A PERCENT OF MERCHANDISE EXPORTS

Country	1990	1995	2001	2002	2003	2004	2005	2000
Egypt	9.5	6.1	5.3	8.1	7.0	7.0	..	5.0
Italy	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.7
Morocco	2.9	3.4	1.4	1.6	1.8	1.7	1.9	2.0
Syria	4.5	7.0	4.3	3.4	3.0	3.6	..	4.6
Turkey	3.0	1.5	0.9	0.8	0.8	0.7	0.5	1.1

Source: World Resources Institute. 2007. *EarthTrends: Environmental Information*. Available at http://earthtrends.wri.org. Washington DC: World Resources Institute, Country Profiles on-line at http://earthtrends.wri.org

8 FOOD AND AGRICULTURE

The food production per capita index[17] presents net food production (after deduction for feed and seed) of a country's agricultural sector per person relative to the base period 1999-2001. The food production per capita index covers all edible agricultural products that contain nutrients; coffee and tea are excluded. For all countries, as Table 15 presents, the trend is growing, except for Turkey that is showing some fluctuation.

TABLE 15 FOOD PRODUCTION PER CAPITA INDEX, PERCENT (%) OF 1999-2001 AVERAGE FOOD PRODUCTION PER CAPITA

Country	2005	2000	1995	1990	1985	1980	1975
Egypt	106.0	102.7	88.6	78.8	70.2	68.6	70.0
Italy	101.8	99.7	95.2	91.9	97.1	103.1	92.5
Morocco	109.3	93.6	78.2	110.8	87.6	87.6	82.1
Syria	106.8	102.8	100.8	93.1	104.2	122.8	92.7
Turkey	98.8	104.5	97.9	104.8	99.2	100.7	97.0

Source: World Resources Institute. 2007. *EarthTrends: Environmental Information*. Available at http://earthtrends.wri.org. Washington DC: World Resources Institute, Country Profiles on-line at http://earthtrends.wri.org

Variation in domestic cereal production is found by taking the average variation (absolute deviation from mean) of cereal production between 1992 and 2001 and dividing this by the mean production. This is an indicator of whether cereal production is stable enough to ensure a predictable food supply. According to Table 15, only Italy and Turkey had stable domestic cereal production during the last decade. The second indicator for food security is net cereal imports and food aid, which is the percent of total consumption, indicates whether countries are able to produce sufficient grain for domestic consumption. It is calculated by dividing net imports (imports minus exports) by total cereal consumption (production + imports – exports). Morocco and Egypt have the highest share – an alarming fact given the growing population as mentioned earlier.

[17] The food production per capita index represents a price-weighted aggregate of the total volume of food production calculated using the Laspeyres formula divided by population. Net production quantities of each commodity are weighted by 1999-2001 average prices and summed for each year. The aggregate for a given year is divided by the average aggregate for 1999-2001 to produce the final index.

Food aid as a percent of total imports, the third indicator of food security, is calculated by dividing total food aid by net cereal imports (imports minus exports).[18] Only Italy and Turkey that do not import food or receive food aid unlike the remaining countries in the analysis.

Average Daily Per Capita Calorie supply is the fourth indicator for food security. It is the amount of available food per person, per day, expressed in kilocalories.[19] The fifth indicator for food security is calorie supply from animal products. It is the amount of available food from animal products per person, per day. Animal products include: all types of meat and fish; animal fats and fish oils; edible offal; milk, butter, cheese and cream; and eggs and egg products. Malnutrition associates with poverty that is in informal urban areas and rural settlements of most MENA region countries. Lacking food security is among the factors causing this phenomenon. The resultant is indicated earlier in Section 2.4 and in the last record of Table 16 is significant numbers of underweighted children.

TABLE 16 FOOD SECURITY

Variable	Country				
	Egypt	Italy	Morocco	Syria	Turkey
Variation in domestic cereal production, 1992-2001 (average percent variation from mean)	10.7	2.9	48.3	16.7	6.5
Net cereal imports and food aid as a percent of total consumption, 1998-2000	33.7	22.8	54.1	21.6	0.4
Food aid as a percent of total imports, 1998-2000	0.3	--	2.0	5.1	--
Average daily per capita calorie supply,1999 (kilocalories)	3,323.0	3,629	3,010	3,272	3,469
Average daily per capita calories from animal products, 1999 (kilocalories)	241	937	198	407	374
Percent of children that are underweight, 1995-2000*	12.0		9.0	13.0	8.0

Note: * Data are for the most recent year available within the given time range.
Source: World Resources Institute. 2007. *EarthTrends: Environmental Information*. Available at http://earthtrends.wri.org. Washington DC: World Resources Institute, Country Profiles on-line at http://earthtrends.wri.org

9 CHALLENGES AND OPPORTUNITIES

9.1 TRENDS

The above discussion, affirms the findings of Hall and others (2001 a and b). Accelerating urbanization and the consequent growth of cities is the most significant trend over the past three decades. This trend is likely to continue, resulting in rapidly rising demand for water and food. Furthermore, often this urban growth is at the expense of valuable agricultural hinterlands. Over the past thirty years, the population of the countries included in the report, except Italy, had doubled, and will double in the coming two decades. Food shortages is expected, especially cereals and livestock products. Rapid

[18] Import and export data have, for the most part, been supplied to FAO by governments. Cereal food aid shipments are included in FAO's import and export calculations. Information on food aid shipments has been provided to FAO by the World Food Program

[19] 1 kilocalorie = 1 Calorie =4.19 kilojoules

population growth puts pressures on the limited available natural resources, particularly fertile land and available fresh water resources.

The decline in numbers of agricultural labour in the MENA region pressures the farming systems in these countries to depend on capital-intensive production techniques that require massive investments for both horizontal and vertical agricultural expansion. The region will need to allocate sufficient investments for Research and Development (R&D) of new varieties, efficient use of fresh water resources, and the safe recycling and re-using of treated wastewater. Investments have to also include financing importing adaptive technologies in production, harvesting and post-harvesting techniques, particularly with applying the regulations of the World Trade Organization that protect intellectual rights.

The research of Hall and others on the MENA region conclude that "although there is limited scope for further expansion, cultivated land use will increase to 82 percent of total potential. However, the newly cultivated land will often be seriously constrained by climate, slope or poor soils. During 2000-2030, the total irrigated area is forecast to grow by 20 percent. This will bring total irrigated area to a level equal to 77 percent of all land with irrigation potential. Overall irrigation water requirements are expected to grow by 14 percent and efficiency of water use is estimated to reach 65 percent. The overall total of 6 percent projected growth in calorie consumption is low, but the region will still achieve an average daily intake of 3 170 kcal by 2030; comfortably exceeding the developing world average of 3 020 kcal" (Hal and others, 2001a: 13).

9.2 Environmental Issues

9.2.1 Water Scarcity

Water scarcity is an issue in almost all countries of the MENA region. Major rivers of Syria and Egypt flow from outside the country. The only solution is through diplomatic and regional cooperation. The Nile Basin Initiative (NBI) is an example for this regional cooperation.

The solution is not complete without adopting stern measures to explore cost-effective and efficient solutions to manage water resources from the supply side, such as the use of solar energy in desalinating sea water; and irrigation improvements at the farm level to manage the demand side. These measures require, first and for most, political will; education, training and awareness; and a bundle of legislative and economic instruments to encourage the use of new technologies and accept changes to cope with the emerging challenges.

9.2.2 Biodiversity and Biosafety

Sustainable agricultural development, and improved nutrition and food security associate with protecting biodiversity. This is possible through introducing innovative interventions including but not limited to promoting mixed agricultural systems, such as rice-fish farming; integrated pest management; adopting actions to limit desertification and managing drought; integrated land use planning that encourages peri-urban agriculture,[20] and so forth.

These actions cannot be complete without considering actions for biosafety. It is important to establish and develop gene banks to protect national species. It is also essential to regulate the importation and handling foreign species.

[20] According to Wikipedia, Urban agriculture is the practice of cultivating, processing and distributing food in, or around (peri-urban), a village, town or city.

9.2.3 CLIMATE CHANGE

The adverse impact of climate change on soil and fresh water resources threatens the possibility for food security and sustainable development at large. Moreover, risks of climate change include introducing new pests and diseases that affect the health of humans, animals and plant production. The contribution of Greenhouse Gases (GHG)[21] from most of MENA region countries is limited, and thus measures for mitigation are also limited. However, these countries have to be prepared for the negative impacts of climate change in the form of economic losses, population migration and social instability and environmental degradation. Hence, MENA region has to formulate and implement strategies, policies and action plans for adaptation that addresses their vulnerability.

9.3 PRIORITIES

There are a number of priorities that need to be addressed. First, countries of the MENA region need to develop needed physical infrastructures, such as water supply facilities, power systems and roads, as well as social services, such as schools and health care facilities, for an integrated sustainable human development. The countries have to institute mechanisms to regulate the use of natural resources while fostering markets to protect and regenerate scarce resources, particularly fresh water and arable land. This will require a revision of all former State regulations that aimed to equality, such as subsidies and State monopsony, and disturbed market mechanisms. These actions also include establishing producer marketing groups; and forming action research groups. Dwarf farm size is an obstacle towards modernizing agricultural production because of lacking economies of scale. The solution is an innovative system of managing agricultural production via a partnership between major private sector, and small farmers and land holders. The support of industrialized, advanced economies is needed, as well as internal arrangements to apply principle of good governance in decision-making and management of natural resources. Strengthening the local institutions including local authorities and other Civil Society Organization, such as NGOs, cooperatives and private sector companies is a must. Their participation in the decision making is not an end, rather a step towards building partnerships and enabling stakeholders to control their future and the destiny of their children.

Second, patterns for saving water are another priority area in the region. This is possible through adopting irrigation systems that can offer the possibility for greater diversification, intercropping and tree or crop intensification. The sufficient condition for the success of this intervention is rapid development and access by farmers to micro-water distribution systems that are currently used only by a relatively small group of commercial farmers. It also requires new systems of cropping sequences, inter-cropping and in-season management. Proactive farmer-researcher groups will have to explore these options for action. Introducing techniques of conservation agriculture techniques, equipment and strategies that maximize the use of labour, soil and water resources are also of the highest importance in the region.

Third, although number of agricultural labour is declining, and the share of agriculture in the GDP is also declining, however, agricultural production and water resources are still vital to the livelihoods of many farming households. For most agricultural labour in the MENA region, working for another economic sector is among the means for escaping poverty. The second alternative to escape poverty

[21] According to Wikipedia, Greenhouse gases are gases in an atmosphere that absorb and emit radiation within the thermal infrared range. This process is the fundamental cause of the greenhouse effect. Human activities have an impact upon the levels of greenhouse gases in the atmosphere, which has other effects upon the system, with their own possible repercussions. An increase in anthropogenic greenhouse gas concentrations is very likely to have caused most of the increases in global average temperatures since the mid-20th century.

is to increase off-farm income. Diversifying and intensifying on-farm improvement strategies are the third alternative to escape poverty.

The fourth priority is poor farmers including farmers in drylands and pastoralists. Poor farmers and pastoralists are the most vulnerable groups to economic reform and environmental degradation. They can experience instability, and degradation of natural resources that are the basis for their activities. For general sustainable development, countries of the region are currently accepting the need to re-orient development initiatives to alleviate poverty based on sustainable resource use through:

1. ***Sustainable resource management***. Natural resources need to be conserved, through improved watershed management in hill and mountain areas, soil conservation in sloping lands and improved range management in pastoral areas. Components include: strengthening local resource-user groups; better management practices; and improved long-term policies.

2. ***Improved irrigation management.*** Raising the efficiency of irrigation water management central to support intensifying and diversifying of production. It is at the crux of efforts to reduce the rate of resource depletion. Schemes based on both surface and underground water technology; and adjustments to water charges and other regulatory measures are among the components of these policies.

3. ***Re-oriented agricultural services.*** Re-orienting agricultural research systems to fully involve farmers will add force to intensification in the Irrigated and Rainfed Mixed Systems and enterprise diversification in all systems. These policies depend on implementing extension services based on a variety of public and private service providers; and greater support for rural agribusinesses to create off-farm employment for farmers.

4. ***Revitalized agricultural education systems.*** Training of agriculturalists who will work in both the public and private sectors rests on new approaches to science and higher education learning systems. These policies include programmes for adopting significant advances in interdisciplinary learning and systemic thinking, which have played such an important role in agricultural education elsewhere in the world.

5. ***Rationalized agricultural policies.*** These are policies that re-orientate development initiatives towards poverty alleviation through sustainable resource use. Components of these policies include eliminating subsidies for importing cheap grains, as well as other forms of support for low urban prices at the expense of poorer farmers and pastoralists.

10 CONCLUSIONS

The most significant trend over the past three decades is accelerating urbanization and the consequent growth of cities. This trend is likely to continue, resulting in rapidly rising demand for water and food. Food shortages is expected, especially cereals and livestock products. The decline in numbers of agricultural labour pressures the farming systems in the countries included in the study to depend on capital-intensive production techniques that require massive investments for both horizontal and vertical agricultural expansion. These States have to allocate sufficient investments for Research and Development (R&D) of new varieties, efficient use of fresh water resources, and the safe recycling and re-using of treated wastewater. Investments have to also include financing importing adaptive technologies in production, harvesting and post-harvesting techniques,

particularly with applying the regulations of the World Trade Organization that protect intellectual rights; and address the issue of dwarf farm size.

There are number of environmental challenges for boosting capacities for more agricultural products. Insufficient amounts of fresh water, and degrading the quality of fresh water comes atop this list of issues. Desertification and drought is another challenge. Loss of biodiversity and the risks of lacking systems to deal with biosafety is another challenge. Finally, countries need to serious formulate and implement actions for adaptation to minimize risks resulting from climate change.

Countries included in the analysis need to develop physical infrastructures and provide their constituents with proper levels of social services. These countries will have to institute mechanisms for proper and sensible use of natural resources. The second priority is to devise systems for saving water; and third, is to address the issue of poverty at large in the countryside. Finally, these States have to pay considerable attention to ultra-poor groups, especially farmers in drylands and pastorals.

Strategic avenues for action include sustainable resource management; and improved irrigation management. Re-oriented agricultural services; revitalized agricultural education systems; and rationalized agricultural policies are among these strategic avenues.

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