PTT työpapereita 151
PTT Working Papers 151

SUSTAINABLE AGRICULTURE AND FORESTRY IN THE MEDITERRANEAN PARTNER COUNTRIES AND TURKEY: FACTORS, INDICATORS AND CHALLENGES

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Helsinki 2013

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PTT työpapereita 151
PTT Working Papers 151
ISBN 978-952-224-129-0 (pdf)
ISSN 1796-4784 (pdf)
Pellervon taloustutkimus PTT
Pellervo Economic Research PTT

Helsinki 2013

Kniivilä, M., Mili, S., Ait El Mekki, A., Arovuori K., Ben Saïd, M., Çağatay, S., Horne, P., Kıymaz, T., Laajimi, A., Martinez-Vega, J., Pyykkönen, P., Soliman, I., Thabet, B., 2013. Sustainable agriculture and forestry in the Mediterranean Partner Countries and Turkey: factors, indicators and challenges. PTT Working Papers 151. 104 p. ISBN 978-952-224-129-0 (pdf), ISSN 1796-4784 (pdf)
Abstract. The aim of this study is to define the main factors of sustainable agriculture and forestry in Egypt, Morocco, Tunisia and Turkey. The study is based on the review of existing literature and country level analyses. In the study indicators which can be used to measure sustainability are defined and examined and data on these is collected. Major challenges of the sector in the study countries are tentatively examined. According to the study relatively much data is available, but not enough to guarantee balanced sustainability assessments. More data is needed especially on resource quality and land degradation, agricultural productivity and to some extent also on rural poverty. To biodiversity and cultural values should be given stronger emphasis than is currently done. For better understanding of the development, data gathering systems in the countries should be widened so that data is collected periodically and also from the regions and that in data collecting all aspects of sustainability are taken into account.
Keywords: *sustainability, agriculture, forestry, indicators, Mediterranean Partner Countries*

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Tiivistelmä. Tämän tutkimuksen tavoitteena on määrittää keskeisimmät tekijät, jotka vaikuttavat maa- ja metsätalouden kestävyyteen Egyptissä, Marokossa, Tunisiassa ja Turkissa. Tutkimus perustuu aiempaan kirjallisuuteen ja maakohtaisiin analyyseihin. Tutkimuksessa määritellään kestävyyttä kuvaavat indikaattorit, kerätään maakohtaista indikaattoritietoa sekä arvioidaan alustavasti maa- ja metsätalouden kannalta keskeisimpiä haasteita tutkimusmaissa. Tehdyn arvion mukaan indikaattoritietoa on tutkimusmaissa suhteellisen paljon saatavilla, mutta ei kuitenkaan riittävästi. Lisää tietoa tarvitaan erityisesti resurssien laadusta ja maan ja maaperän kunnon heikentymisestä, maatalouden tuottavuudesta ja maaseudun köyhyydestä. Luonnon monimuotoisuutta ja kulttuuriarvoja olisi korostettava nykyistä enemmän. Tiedonkeruujärjestelmiä olisi tutkimusmaissa kehitettävä niin, että niillä voidaan kerätä aikasarja- ja aluedataa ja tietoa kestävyyden kaikilta osa-alueilta.
Avainsanat: *kestävyys, maatalous, metsätalous, indikaattorit, Välimeren kumppanuusmaat*

SUMMARY

This working paper has been produced as a part of a large EU financed project, SUSTAINMED (Sustainable agri-food systems and rural development in the Mediterranean Partner Countries). The overall objective of the project was to examine and assess the impacts of EU and national agricultural, rural, environmental and trade policies in the Mediterranean Partner Countries (MPCs) and Turkey.

The aim of this study is to define the main factors of sustainable agriculture and forestry in Egypt, Morocco, Tunisia and Turkey. The study is based on the review of existing literature and country level analyses. In the study indicators which can be used to measure sustainability are defined and examined and data on these is collected. Major challenges of the sector in the study countries are tentatively examined. As issues impacting on sustainability are difficult to divide into purely economic, social and environmental factors, framework for sustainable agriculture and forestry is here formulated by using five factors, which allow inter-relations between different dimensions of sustainability. Framework is based on FAO, UNECE and FOREST EUROPE (2011) framework.

Factor 1 of the sustainability framework, "Resources and their productive functions", is a basic and fundamental requirement for use and availability of any natural resources. It can be considered as the core of sustainable resource use simply because if there is no resource there are no benefits related to that. Factor 1 and Factor 3 ("Protective functions") connect as degraded resources provide less protective functions and beneficial services and are likely to cause increase of disservices. Land, soil and water degradation has also direct socio-economic impacts (Factor 2). Degradation undermines possibilities to increase agricultural productivity, self-sufficiency and food production, and thus weakens possibilities to respond to the basic needs of the growing population. Similarly as resource existence, biodiversity (Factor 4) is in a long run and at a larger scale a prerequisite for other benefits provided by agriculture and forestry. As locally and in a short run the weakening of biodiversity may have positive impacts on agricultural production, maintenance of biodiversity is often overridden by other objectives. Also cultural values (Factor 5) are often considered less valuable, but their dismissal significantly weakens social sustainability and social justification of the actions and lead to serious problems in a long run.

Framework for sustainable agriculture and forestry is universally applicable and applies to the MPCs and Turkey as well. Country examples presented in this study highlight many issues that are generally considered essential in sustainability considerations and have similarities with the general framework. Issues emphasized include resource maintenance (resource quantity and resource quality, Factor 1), socio-economic functions like income and employment generation and poverty reduction (Factor 2), and also the enhancement of the protective functions provided by the resource (Factor 3). As Mediterranean Partner Countries and Turkey are developing economies, in decision-making issues that have primarily economic and social aspects have major importance. The maintenance of cultural values (Factors 5) and to some extent also biodiversity (Factor 4), which are generally considered as important factors of sustainability, were not specifically emphasized in the country examples. As they are, however, essential part of sustainability, neglecting them would lead especially in a long run to sustainability problems and the need to include them into the sustainability framework is obvious. In decision-making reasonable balance between different factors has to be found.

From the sustainability perspective evaluation of the current situation is not sufficient, but in policy-making a special emphasis should be given also to the recognition of and anticipation to the future challenges. Sustainability challenges vary between countries and country groups in the world. In the MPCs and Turkey water availability and water quality create a special challenge for sustainability of agriculture. Water availability is closely linked to agricultural productivity, which is also a major challenge in the countries. Other important challenges are rural poverty, desertification and degradation and unbalanced regional development. All these are very much linked to each other. However, other challenges recognized should not be neglected. E.g. the full impacts of climate change are yet to be experienced and neglecting gender aspects will cause in a long run hindered economic growth and social problems.

According to the study in the study countries there is relatively much data available on the main sustainability factors and challenges, but not enough to guarantee balanced sustainability assessments. More data is needed especially on resource quality and land degradation, agricultural productivity and to some extent also on rural poverty. To biodiversity and cultural values should be given stronger emphasis than is currently done. For better understanding of the development, data gathering systems in the countries should be widened so that data is collected periodically and also from the regions and that in data collecting all aspects of sustainability are taken into account.

Contents

1. INTRODUCTION

This working paper has been produced as a part of a large EU financed project, SUSTAINMED (Sustainable agri-food systems and rural development in the Mediterranean Partner Countries). The overall objective of the project is to examine and assess the impacts of EU and national agricultural, rural, environmental and trade policies in the Mediterranean Partner Countries (MPCs) and Turkey[1]. SUSTAINMED will provide relevant research to support the promotion of sustainable agriculture and forestry in the study countries.

Sustainable development is a very wide, and to some extent also a vague concept. It is also recognized, even if often neglected, principle in many livelihoods. As natural resources are not infinite, the economic growth is hampered if sustainability is not taken into consideration. At the end of the day this leads to the decrease of the overall welfare.

The use of indicators is a practical and efficient tool for measuring sustainability. Indicators can be used to measure e.g., the state of certain factors, their development over time as well as to examine the impact of different policies. Indicator development is often at least to some extent based on DPSIR-framework (Smeets & Weterings 1999), which measures drivers, pressures, state and responses related to the specific issue to be assessed. For agriculture and forestry there exist frameworks in which main factors and indicators of sustainability have been defined. Examples of these are presented e.g. in Kniivilä et al. (2012).

In international development politics sustainable development has gained major emphasis since the late 1980s when the Brundtland report (World Commission on… 1987) was published (e.g. Vogler 2007). As a consequence of global sustainable development processes also regional and national processes and strategies have been launched. Development is, however, slow and even if there has been much progress, unsustainable practices and policies are widely applied. At the same time when old, unsustainable practices are replaced with more sustainable ones, also new challenges have emerged. One of the major challenges is climate change.

[1] Project countries include Egypt, Morocco, Tunisia, Syria and Turkey. Turkey is a candidate country for EU membership, other four countries are Mediterranean Partner Countries (MPCs). Syria is not included in the analysis of this working paper.

In developing countries unsustainable use of natural resources is often a consequence of poverty. In the EU's Mediterranean partner countries (MPCs) and Turkey rural poverty is still a significant problem. Rural population is highly dependent on agriculture and thus the productivity, growth and sustainability of the sector have a direct impact on the poor and poverty. One of the major problems of sustainability in the region is land and soil degradation and desertification. Direct costs of degradation include losses in agricultural production and loss of environmental benefits provided by forests. Indirect costs caused by degradation can be even larger than direct costs (Benoit and Comeau 2005).

This paper has two main aims. Firstly, the main factors of sustainable agriculture and forestry are defined and special challenges for sustainability in MPCs and Turkey are examined. In the earlier phases of the SUSTAINMED project indicators for sustainable agriculture and forestry, in the European context, have been defined (Appendix I). The second aim of this paper is to evaluate the suitability of these indicators for assessing sustainability of agriculture and forestry in the MPCs and Turkey. Analyses of this study are based on the examination of each study country from the sustainability perspective as well as indicator data collected from the countries. General frameworks and indicators presented in Kniivilä et al. (2012) are used to help the process.

The report proceeds as follows. In Chapter 2 factors and indicators of sustainable agriculture and forestry are shortly and generally discussed. Framework and indicators defined in the earlier phases of the project are presented (Appendix I, also Kniivilä et al. 2012), and a more general framework for the sustainability of the sector is outlined. In Chapter 3 the major factors of sustainability of the sectors in the MPCs and Turkey and the most important challenges for the sustainability are defined and discussed. This is based on the country studies (Appendix II-V), a query sent to country specialists as well as the more general framework presented in the Chapter 2. Chapter 4 discusses about data availability. In Chapter 5 the applicability and relevance of the presented indicators in the context of MPCs and Turkey is analyzed and discussed. Analysis is based especially on the examination of the availability of relevant data, but also on the assessment of the capability of the used indicator framework to catch the most relevant aspects of sustainability in the study countries. Chapter 6 concludes and gives policy recommendations.

2. FACTORS AND INDICATORS OF SUSTAINABLE AGRICULTURE AND FORESTRY

2.1 Indicator database

In the earlier phases of the SUSTAINMED project different dimensions and factors of sustainable agriculture and forestry especially at the European context have been discussed (Kniivilä et al. 2012). Based on this discussion as well as on the review of literature a list of indicators for measuring sustainability of agriculture and forestry was compiled (Appendix I). List of indicators is designed from the European perspective and the idea has been to cover the main aspects of sustainability. In practice for some indicators there may be challenges in data collecting even in the European countries at the moment. The list, however, sets a framework on that what kind of data would be needed for a proper assessment of sustainability.

The selection process of indicators has been made under two basic premises: first, coherence with the existing frameworks of sustainable development (Kniivilä et al. 2012); second, relevance of the indicators for their socioeconomic and territorial context. The process is a demonstration of how to translate general and to some context abstract frameworks to a concrete proposal of a set of indicators that can be quantified, monitored and evaluated. The approach for selecting indicators also was conceived as a reference scheme for the MPCs and Turkey, with the necessary changes and adaptations to each country setting. Data for each country was collected (Appendix I). Country specialists were asked to provide also regional indicator data if available.

As shown in Appendix I the selected indicators are classified by themes or sectors. Three sectors have been considered: agriculture, livestock, and forestry, which are the direct targets of the research. In addition four broad themes affecting transversally the previous sectors have been included: landscape, biodiversity, climate change, and some measure of the EU-RDP's horizontal axis.

Sustainability of agriculture and forestry has three basic dimensions – environmental (or ecological), economic and social. As many of the issues related to sustainability of the sector touch several dimensions, they can be considered to be of socio-economic or environmental-economic nature. Due to linkages and inter-relations, issues impacting

on sustainability are in fact very difficult to divide into purely economic, social and environmental factors.

Based on existing frameworks for sustainable agriculture and forestry a set of sub-factors of sustainability are presented in the matrix of the Appendix I. These sub-factors are diverse, partly overlapping and have causality between them, which highlights the complex nature of sustainability. Sub-factors refer to specific resource (land, forest, water) or means to achieve sustainability goals (e.g. urban planning, good agricultural practices) and they are used in order to build a bridge between rather general dimensions and very specific indicators of sustainability.

Indicators used to assess sustainability should be such that they catch, as much as possible, the state of the resource, pressures the resources are facing, impacts of the changes in the resource, responses to and drivers for the change. The matrix includes state, pressure and response indicators.

2.2 Factors of sustainable agriculture and forestry

As issues impacting on sustainability are difficult to divide into purely economic, social and environmental factors, framework for sustainable agriculture and forestry is here formulated by using five categories (factors), which allow inter-relations between different dimensions of sustainability (Figure 1). Figure 1 is a modification of the framework presented in Kniivilä et al. (2012) and based on the framework used in the pan-European process for sustainable forest management (FOREST EUROPE, UNECE and FAO 2011). Very similar criteria have also been defined in the Near East process on criteria and indicators for sustainable forest management.

Framework presented in Figure 1 can be considered as a starting point for sustainability assessments. In order to be able to make a balanced assessment of sustainability there should be indicators and data available of all five factors. Sub-factors of sustainable agriculture and forestry presented in the matrix of Appendix 1 can be classified under these five main factors.

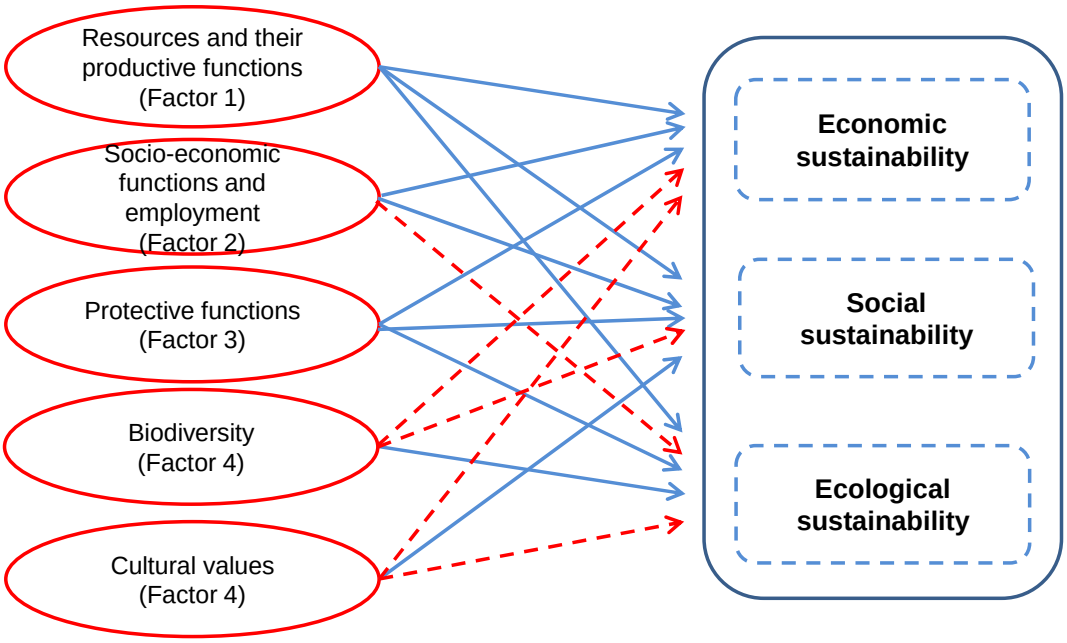

Figure 1. *Sustainable agriculture and forestry, factors to be maintained and enhanced. Based on FOREST EUROPE, UNECE and FAO (2011) and Kniivilä et al. (2012).*

Factor 1, "Resources and their productive functions", is a basic and fundamental requirement for use and availability of any natural resources. It can be considered as the core of sustainable resource use simply because if there is no resource there are no benefits related to that. It is also closely linked to the traditional idea of sustainable use of renewable resources, i.e. that the utilization of the resource during a given time period should not exceed the growth of the resource during the same period. Maintenance of resource does not include only the volume, but as well the quality of the resource, e.g. avoidance of land, soil and water degradation and maintenance the health of forests.

Land and soil degradation, including salinization, erosion, desertification and deforestation, is a serious problem in all countries analyzed in this study. E.g. in Morocco 95% of the territory is threatened by desertification. The situation can in the future further worsen in the study countries due to climate change. Resource degradation is not limited only to land, soil and forests, but in many regions also water resources are at high risk. Scarcity of water resources makes the problem even more serious. For example in Tunisia major challenges for sustainability come from the heavy emphasis put on excessive intensification via subsidized farm inputs, which has resulted in near full mobilization of water resources.

In the study countries direct economic importance of forests is minor compared to agriculture due to minor forest cover. However, forests have especially environmental significance. Reforestation and afforestation efforts have been carried out in the

countries, but forest fires, unsustainable use of forests, land clearance and illegal logging pose still a threat to them.

Factor 1 and Factor 3 ("Protective functions") connect as degraded resources provide less protective functions and beneficial services and are likely to cause increase of disservices. Degradation and loss of protective functions is also an easily accelerating process starting e.g. from forest degradation and finally leading to soil degradation and desertification. Land, soil and water degradation has also direct socio-economic impacts (Factor 2). Degradation undermines possibilities to increase agricultural productivity, self-sufficiency and food production, and thus weakens possibilities to respond to the basic needs of the growing population. It weakens possibilities to earn a decent living from agriculture, increases poverty and may increase rural-urban income inequality, migration and immigration. Degradation may lead to increase in food prices and further to increased social problems.

Similarly as resource existence, biodiversity (Factor 4) is in a long run and at a larger scale a prerequisite for other benefits provided by agriculture and forestry. As locally and in a short run the weakening of biodiversity may have positive impacts on agricultural production, maintenance of biodiversity is often overridden by other objectives. Also cultural values (Factor 5) are often considered less valuable, but their dismissal significantly weakens social sustainability and social justification of the actions. This may lead to serious problems in a long run.

3. DETERMINANTS OF SUSTAINABLE AGRICULTURE AND FORESTRY IN THE MPCS AND TURKEY

3.1 Major factors of sustainability

The evaluation of major factors of sustainable agriculture and forestry and the current state of the sectors in the MPCs and Turkey are presented in Appendices II-V. In the country reports all three dimensions of sustainability - economic, ecological and social - are highlighted, even if the weight is not same for all sustainability dimensions and there are also differences between countries in the emphases. Which specific issues are emphasized depends on the state and special characteristics of the country and its agricultural sector.

Framework for sustainable agriculture and forestry presented in Figure 1 is universally applicable and applies to the MPCs and Turkey as well. Country examples presented in appendices highlight many issues that are generally considered essential in sustainability considerations and have similarities with the general framework. Issues emphasized include resource maintenance (resource quantity and resource quality, Factor 1), socio-economic functions like income and employment generation and poverty reduction (Factor 2), and also the enhancement of the protective functions provided by the resource (Factor 3). As Mediterranean Partner Countries and Turkey are developing economies, in decision-making issues that have primarily economic and social aspects have major importance.

The maintenance of cultural values (Factors 5) and to some extent also biodiversity (Factor 4), which are generally considered as important factors of sustainability, were not specifically emphasized in the country examples. This is understandable as their link to the basic needs is less direct. As they are, however, essential parts of sustainability, neglecting them would lead especially in a long run to sustainability problems and the need to include them into the sustainability framework is obvious.

In decision-making reasonable balance between different factors has to be found. In practice due to differences e.g. in the development phase of the countries as well as in natural conditions, countries differ in that which factors are emphasized most. There are also differences in the needs and objectives at the different levels of economy. Objectives and actions which may be rationale at the grassroots level may lead to undesired outcomes at the national level.

3.2 Future challenges

From the sustainability perspective evaluation of the current situation is not sufficient, but in policy-making a special emphasis should be given also to the recognition of and anticipation to the future challenges. In order to do this and based on the country reports and general literature a list of possible challenges was formulated in this study. The list included 16 issues and possibility was given to add issues missing from the list. Country experts and country teams evaluated the list and selected the ten most important challenges for their countries and indicated the relative importance of each selected issue[2]. The list of issues and the results of the query are presented in Table 1. Results obtained cannot be considered as conclusive, as the query was responded by a limited number of experts per country.

Water availability is clearly the most important challenge for the countries as it was ranked among the three most important challenges by all country specialists. Similarly increasing agricultural productivity had high priority among most of the countries. There is more variation in the consideration of the importance of other issues.

In general, however, the following five issues can be considered as the major challenges for all study countries:

- Water availability (for agriculture) (also water quality)
- Increasing agricultural productivity (also increasing gross value added in agriculture)
- Rural poverty (also rural unemployment/underemployment)
- Desertification/soil degradation
- Unbalanced regional development (also rural-urban inequality)

Maintaining or increasing food security was considered as an important challenge only in Morocco. Also challenges related to climate change adaptation were in general not considered to be among the most important challenges. Loss of biodiversity was considered as an important challenge only in Turkey, which also has the highest standard of living among the study countries. The result is logical as in the literature environmental consciousness is often considered to be correlated with economic wellbeing (i.e. being one of the explanatory factors behind the environmental Kuznets curve). Gender equality was not considered as one of the major challenges for agricultural sustainability, but still as relatively important.

[2] Question for country expert consultation was as follows: "Please, select ten (10) issues which you consider as the most important challenges for sustainability of the sector in your country and indicate their importance. Number 1 indicates the most important challenge, number 10 the tenth most important challenge."

In addition to more general factors of sustainability presented in earlier chapters these five challenges are of major importance when designing future policies for agricultural sector. In order to assess the current state and evaluate the success of the policies, data on factors and challenges is needed. Availability of this data is assessed in the following chapters.

Table 1. *Major future challenges for sustainability of agriculture and forestry in the MPCs and Turkey. Letters refer to challenges listed at the end of the table. In Egypt some challenges were considered as having equal importance.*

Importance of the challenge	**Egypt**	**Morocco**	**Tunisia**	**Turkey**
1st	A	L	C	C
2nd	B	E	G	A
3rd	C	A	A	F
4th	D, F	K	D	E
5th		M	H	G
6th	E	J	K	H
7th	J	C	E	O
8th	K	H	I	J
9th	H, O	I	J	K
10th		O	L	N

A = Water availability for agriculture	I = Deforestation
B = Water quality	J = Rural-urban income inequality
C = Increasing agricultural productivity	K = Unbalanced regional development
D = Increasing gross value added in agriculture	L = Maintaining/Increasing food security
E = Rural poverty	M = Climate change adaptation
F = Rural unemployment/underemployment	N = Loss of biodiversity
G = Soil degradation	O = Gender equality
H = Desertification	P = Urbanization

4. DATA PROVIDED BY COUNTRIES

4.1 Factors of sustainability

Indicator matrix in Appendix I includes 61 indicators. For about 60 per cent of these indicators, data at least for one year was provided for three countries or more. Time series data for at least three countries out of four was received for one third of the indicators. Availability of data on environmental and economic indicators was approximately the same. However, it should be noted that environmental dimension was here considered rather widely and for example many indicators measuring different aspects of land or water use were classified under this category. E.g., time series data on protected areas was received poorly. Also there was no indicator on threatened species, which should be added. Important environmental indicators are also indicators on greenhouse gas emissions. In most of the countries there was data on that for one year, but basically no time series was yet available, or that data was not provided. Data on landscape diversity, measured by several indicators, was poorly provided, which was, however, an expected outcome.

Most of the indicators can be classified under Factor 1 or 2, as these factors are the widest and most inclusive. On Factor 4 there are only some indicators in the matrix and there are no indicators directly related to the Factor 5. However, division of indicators under five main factors is not straightforward as many of the indicators can be classified under several categories.

In Table 2 selected indicators of the matrix of the Appendix I, measuring most directly each factor, are listed, and it is indicated from which countries data was received. Table includes also suggestions on additional indicators that should be used in sustainability assessments in order to get more comprehensive understanding of the development. Indicators have been added after the query and country specialists were not asked to provide data on those indicators. Indication on the availability of data is in that case based on other sources. Inclusion of additional indicators is based on their relevance for sustainability of agriculture and forestry in the target countries, as pointed out in the country reports and in general literature on sustainability.

Indicators related to Factor 1 are here divided in to indicators measuring either quantity or quality of the resource. Data on Factor 1 is well available when the basic indicators on

the quantity of the resources are considered. However, data on resource quality is rather poorly available. Additional indicators and data would be needed on salinization, erosion and desertification.

Basic data on socio-economic functions and employment (farm income, agricultural employment, food consumption) was also well available and provided (Factor 2). Not much data on agricultural productivity was received. Productivity is of major importance when economic sustainability is considered. Some additional indicators would be needed on rural poverty and unemployment. Some of these can be found in the World Bank's World Development Indicators database (World Bank 2012). Furthermore, it would be important to have data on gender equality. World Development Indicators database provide several candidate indicators, but there are no indicators measuring specifically gender equality in rural areas. Indicator "Share of women employed in the non-agricultural sector" has been included as an additional indicator. Data on this is well available.

In Factor 3 forests have special importance as their role in many of the case study countries is environmental and have importance as a provider of protective services. Basic data on forest area exists. More data on afforestation would be useful. Limited amount of data was provided on protective forests. Also FAO's Global Forest Resources Assessment (FAO 2010, FAO 2005) provides data on the share of forests designated for protective purposes with possibilities to have also some time series data. Data on desertification rate would be needed.

There is a limited amount of indicators on Factor 4 in the original matrix. Data was well available on some issues impacting on biodiversity, e.g. on forest area or organic farming. Share of protected areas has a more direct impact on biodiversity. Some data on that was received, but basically no time series data. Number of threatened species is a basic indicator of biodiversity and is included here now as an additional indicator. Various data on threatened species is provided e.g. by the IUCN (IUCN's Red list of threatened species).

Measurement of cultural values (Factor 5) is more complicated than the measurement of other factors. Based on the European forest indicators (FOREST EUROPE, UNECE and FAO 2011) an indicator measuring the number of sites in rural areas designated as having cultural values has been added. Another additional indicator is an indicator on areas managed for scenic and recreational purposes which has been presented in the indicator list of the Near East Process for the sustainable forest management. Availability of data on these indicators is not known.

Table 2. *The main factors of sustainability, data provided (or availability indicated) for the most important indicators measuring the specific factors. Many of the indicators here as well as in the wider list of indicators in Appendix I can be classified under several factors. Numbers in the table refer to the countries which provided the data (1=Egypt, 2= Morocco, 3=Tunisia, 4= Turkey).*

	Data for one year	**Time series data**
Factor 1: Resources and their productive functions		
Indicators measuring quantity:		
indicator 1: percentage of utilized agricultural land	1, 2, 3, 4	1, 3, 4
indicator 2: percentage of arable land	1, 3, 4	1, 3, 4
indicator 9: total agricultural water consumption	1, 2, 3, 4	1, 3, 4
indicator 15: loss of arable land	2, 3, 4	3, 4
indicator 38: rate of forest area	1, 2, 3, 4	1, 3, 4
indicator 41: afforestation rate (wooded lands)	2, 3, 4	4
indicator 43: tree biomass	3, 4	3
additional indicator: renewable internal freshwater resources (WDI)	1, 2, 3, 4	1, 2, 3, 4
additional indicator: agricultural irrigated land (WDI)	2, 3, 4	2, 3, 4
Indicators measuring quality:		
indicator 5: nitrate in groundwater	3	-
indicator 10: organic farming	1, 2, 3, 4	1, 3, 4
indicator 34: organic animal farms	4	-
indicator 40: defoliation	4	4
indicator 45: rate of burned area	2, 3, 4	3, 4
additional indicator: salinization (UN Statistical Division)	-	-
additional indicator: soil erosion (UN Statistical Division)	-	-
additional information: desertification (UN Statistical Division)	-	-
Factor 2: Socio-economic functions and employment		
indicator 18: farm income	1, 3, 4	1, 3, 4
indicator 19: agricultural productivity	3	3
indicator 20: public budget RDP	1, 3, 4	1, 3, 4
indicator 29: agricultural employment	1, 2, 3, 4	1, 3, 4
indicator 30: non-farming enterprises	4	4
indicator 31: small farms	1, 2, 3, 4	1, 3
indicator 33: food consumption	1, 2, 3, 4	1, 3, 4
indicator 48: expenditures for forest services (productive function)	2, 3, 4	4

indicator 49: expenditure for forest services (other services)	3, 4	4
additional indicator: poverty headcount ratio at rural poverty line (WDI)	1, 2, 4	4
additional indicator: share of women employed in the non-agricultural sector (WDI)	1, 2, 4	1, 2, 4
additional indicator: rural unemployment	-	-
additional indicator: share of rural population of total population (WDI)	1, 2, 3, 4	1, 2, 3, 4
Factor 3: Protective functions		
indicator 15: loss of arable land	2, 3, 4	3, 4
indicator 36: stocking density	1, 3, 4	1, 3, 4
indicator 38: rate of forest area	1, 2, 3, 4	1, 3, 4
indicator 41: afforestation rate	2, 3, 4	4
indicator 47: protective forests	3, 4	4
additional indicator: salinization (UN Statistical Division)	-	-
additional indicator: soil erosion (UN Statistical Division)	-	-
additional information: desertification (UN Statistical Division)	-	-
Factor 4: Biodiversity		
indicator 10: organic farming	1, 2, 3, 4	1, 3, 4
indicator 12: pesticide intensity	1, 3, 4	1, 4
indicator 38: rate of forest area	1, 2, 3, 4	1, 3, 4
indicator 46: protected forests	3, 4	4
indicator 52: Simpson diversity index	3	
indicator 55: percentage of terrestrial protected areas	2, 3, 4	4
additional indicator: number of threatened species (UNEP, IUCN)	?	?
Factor 5: Cultural values		
additional indicator: number of sites in rural areas designated as having cultural values	?	?
additional indicator: areas managed for scenic and recreation purposes	?	?

4.2 Sustainability challenges

Water availability and water quality are highly important issues for the study countries and were considered as one of the major challenges. There is data available on water consumption in agriculture (indicators 9 and 13), also time series data, but not much data on water quality (indicator 5, nitrate in groundwater). Indicator matrix did not include indicators directly measuring water availability. WDI database includes indicators on renewable internal freshwater resources and on agricultural irrigated land. These have been included to the Table 3 as additional indicators. Data on those is well available.

For economic sustainability agricultural productivity is of major importance. Increasing productivity was also considered by countries as one of the major challenges. Productivity is a combination of several issues and it is impacted e.g., by agricultural practices, labor skills, availability of inputs and investments, but also by issues like land ownership, farm structure and natural conditions. As Table 3 shows there is data available on several issues impacting on productivity, also time series data. However, not much data was provided on actual productivity (indicator 19, measured as the average productivity of main crops).

Among the major challenges that the agricultural sectors of MPCs and Turkey are facing are land and soil degradation and desertification. Some aspect of that is measured by indicator 15 (loss of arable land). Data was also received on certain issues impacting on degradation (e.g. the rate of forest area, stocking density). However, as pointed out earlier more specific indicators and data would be needed on soil quality and desertification.

Also rural poverty and unbalanced regional development were considered as important challenges from the study countries perspective. In the indicator matrix of Appendix I as poverty indicators are used indicators 31 and 33, which measure the share of small farms and the share of family income allocated to food consumption. For both of these indicators data is relatively well available. However, also an indicator measuring directly rural poverty needs to be included. Data on poverty headcount ratio at rural poverty line (of rural population) is available on the World Development Indicators database. The database provides data also on poverty headcount ratio at urban poverty line. Together with the similar indicator at rural level it can be used to help the assessment of rural-urban inequality.

Table 3. *Major challenges, data availability. Numbers in the table refer to the countries which provided the data (1=Egypt, 2= Morocco, 3=Tunisia, 4= Turkey).*

	Data for one year	**Time series data**
Water availability and water quality		
indicator 5: nitrate in groundwater	3	-
indicator 8: water consumed in areas under gap	-	-
indicator 9: total agricultural water consumption	1, 2, 3, 4	1, 3, 4
indicator 13: agricultural water consumption (water intensity)	1, 2, 3, 4	1, 3, 4
additional indicator: renewable internal freshwater resources (WDI)	1, 2, 3, 4	1, 2, 3, 4
additional indicator: agricultural irrigated land (WDI)	2, 3, 4	2, 3, 4
Increasing productivity and gross value added in agriculture		
indicator 11: fertilizer intensity	1, 2, 3, 4	1, 4
indicator 12: pesticide intensity	1, 3, 4	1, 4
indicator 18: farm income	1, 3, 4	1, 3, 4
indicator 19: agricultural productivity	3	3
indicator 22: intensity agricultural labor index	1, 3	1, 3
indicator 23: full time farmers	1, 2, 3, 4	1, 3, 4
indicator 26: agricultural machinery intensity index	1, 2, 3, 4	1, 3, 4
indicator 29: employment in agriculture	1, 2, 3, 4	1, 3, 4
indicator 31: small farms	1, 2, 3, 4	1, 3
Rural poverty and rural unemployment		
indicator 29: employment in agriculture	1, 2, 3, 4	1, 3, 4
indicator 30: non-farming enterprises	4	4
indicator 31: small farms	1, 2, 3, 4	1, 3
indicator 33: food consumption	1, 2, 3, 4	1, 3, 4
additional indicator: poverty headcount ratio at rural poverty line (WDI)	1, 2, 4	4
additional indicator: rural unemployment	-	-
additional indicator: share of rural population of total population (WDI)	1, 2, 3, 4	1, 2, 3, 4
Desertification/soil degradation		
indicator 15: loss of arable land	2, 3, 4	3, 4
indicator 36: stocking density	1, 3, 4	1, 3, 4
indicator 38: rate of forest area	1, 2, 3, 4	1, 3, 4
indicator 41: afforestation rate	2, 3, 4	4
indicator 45: rate of burned forest area	2, 3, 4	3, 4
indicator 47: protective forests	3, 4	4
additional indicator: salinization (UN Statistical Division)	-	-
additional indicator: soil erosion (UN	-	-

Statistical Division)		
additional information: desertification (UN Statistical Division)	-	-
additional indicator: agricultural irrigated land (WDI)	2, 3, 4	2, 3, 4
Unbalanced regional development and rural-urban inequality		
indicator 20: public budget RDP	1, 3, 4	1, 3, 4
additional indicator: poverty headcount ratio at urban poverty line (% of urban population) (WDI)	1, 2, 4	4
additional indicator: poverty headcount ratio at rural poverty line (WDI)	1, 2, 4	4
additional indicator: share of rural population of total population (WDI)	1, 2, 3, 4	1, 2, 3, 4
additional indicator: rural unemployment	-	-

5. THE RELEVANCE AND APPLICABILITY OF THE INDICATORS

For balanced sustainability assessments data on all major factors and challenges of sustainability would be needed. Data query made in this study shows that relatively much data could be provided. Data is well available e.g., on the Factor 1 when the basic indicators on the quantity of the resources are considered. Basic data on socio-economic functions and employment (e.g., farm income, agricultural employment, food consumption) was received also relatively much (Factor 2). Much data related to the several challenges of the agricultural sector in the countries was received.

However, even more data is needed in order to guarantee balanced sustainability assessments. It was also noticed that the original indicator framework presented for the countries needs to be amended by some indicators in order to cover better all aspects of sustainable agriculture and forestry. In general, more data would be needed especially on resource quality and land degradation, agricultural productivity and to some extent also on rural poverty. To biodiversity and cultural values should be given more emphasis than was given in the indicator framework provided for the countries or in the actual country reports.

In sustainability assessments the availability of times series data is essential. According to the data query of this study there is time series data available. However, still more would be needed on some specific issues. In some cases the value of an indicator in a single point of time may be enough for assessing how sustainable the current state is. This is possible if critical threshold value for the indicator is known. In many cases, and especially if the impacts of policies are evaluated, there is an obvious need to have data from different points of time.

Furthermore, regional data, which would be needed for more profound and elaborated analyses, was available only in Turkey. Regions differ in their characteristics especially in large countries. There are also specific policies for regions. Lack of regional data complicates specification of suitable policies and decision-making.

In this study the factors and indicators were defined for sustainable agriculture and forestry, not for rural development, which is a much wider concept. Thus, indicators presented here cannot be used as such when assessing wider rural development. E.g. gender aspect has not been specifically emphasized here, but in rural sustainability

assessments a significant emphasis should be given to the role of women. For the society the marginalization of women is disadvantageous for many reasons, including economic ones. Important gender related indicators also in rural areas include possibilities of girls to attend school and the labor participation rate of women, especially outside agriculture. A fundamental indicator reflecting several dimensions of sustainability is maternal mortality ratio. Often rural areas lack behind urban areas in all above-mentioned issues.

6. CONCLUSIONS AND RECOMMENDATIONS

In this study the main factors of sustainable agriculture and forestry were defined for the selected MPCs and Turkey. These general factors do not apply only to these countries, but their nature is more universal. However, despite their importance, not all factors are given the same emphasis in practical decision-making.

In general the importance to maintain and enhance existence of resources and their productive functions and socio-economic functions created by the use of resources are rather well recognized. Biodiversity and cultural values, which have less direct and not so easily measurable impacts on well-being, are in decision-making often less emphasized or even neglected. To some extent this is a problem not only in the study countries but in more developed countries as well, especially when cultural values are concerned. However, the importance of all factors needs to be recognized, also in practical decision-making, in order to avoid future sustainability problems, and relevant data on the issues should be collected.

Sustainability factors are universal, but sustainability challenges vary between countries and country groups in the world. Developing stage and natural conditions of the country are among the issues impacting on the challenges, but as well e.g. the pattern and history of land use. In the study countries water availability and water quality create a special challenge for sustainability of agriculture. Water availability is closely linked to agricultural productivity, which is also a major challenge in the countries. Other important challenges are rural poverty, desertification and degradation and unbalanced regional development. All these challenges are very much linked to each other.

In the policy processes high priority should be given to the challenges that have been emphasized here. However, as they may have come up especially because of their urgency, other challenges recognized should not be neglected. E.g. the full impacts of climate change are yet to be experienced and neglecting gender aspects will cause in a long run hindered economic growth and social problems.

The study showed that there is quite much data available on several important sustainability aspects. However, the data collected does not yet guarantee balanced sustainability assessments. There is still lack of data on certain issues, especially when time series data is needed. Furthermore, as there can be significant differences between the regions of a country, detailed data on regions would be useful. For better understanding of the development, data gathering systems in the countries should be widened so that data is collected periodically and also from the regions and that in data collecting all aspects of sustainability are taken into account.

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Appendix I. (see separate excel file)

Indicators of sustainable agriculture and forestry and data provided by country specialists (or indication of data availability) (see separate excel file).

Appendix II. Country Report: Egypt

By Ibrahim Soliman, Zagazig University, Egypt

1. Agriculture and forestry in Egypt

1.1 Geography and topography of Egypt

Egypt lies in the northern corner of Africa. It is bounded by the Mediterranean Sea in the north, the Red Sea in the east, Libya in the west and Sudan in the south. The total area of Egypt is approximately 1 million km^2. The country is geographically divided into four main divisions: Nile Valley and Delta, Western Desert, Eastern Desert and Sinai Peninsula.

Nile Valley and Delta (approx. 33 000 km^2) extends from the North Valley to the Mediterranean Sea and is divided into Upper Egypt and Lower Egypt, extending from Wadi Halfa to the south of Cairo and from North Cairo to the Mediterranean Sea. The River Nile in the north is divided into two branches, Damietta and Rashid, embracing the highly fertile agricultural lands of the Delta.

Western Desert (approx. 680 000 km^2) extends from the Nile Valley in the east to the Libyan borders in the west, and from the Mediterranean in the north to the Egyptian southern boarders. It is divided into the Northern and Southern Sections. The Northern Section includes the coastal plain, the northern plateau and the Great Depression, the Natroun Valley and Baharia Oasis. The Southern Section includes Farafra, Kharja, Dakhla, and El-Owainat in the far south.

Eastern Desert (approx. 325 000 km^2) extends from the Nile Valley in the west to the Red Sea, Suez gulf, and Suez Canal in the east, and from Lake Manzala on the Mediterranean in the north to Egypt's southern borders with Sudan in the south. The Eastern Desert is marked with the Eastern Mountains that range along the Red Sea with peaks that rise to about 3000 feet above the sea level. This desert is a store of Egyptian natural resources including various ores such as gold, coal, and oil.

Sinai Peninsula (approx. 61 000 km^2) has a triangular shape having its base at the Mediterranean in the north and its apex in the south at Rass Mohammed, the Gulf of Aqaba to the east and the Gulf of Suez and Suez Canal to the west. It is topographically divided into three main sections: the Southern Section, the Central Section and Atteeh Plateau. The Southern Section involves extremely tough terrain which is composed of high-rise granite mountains. The Central Section comprises the area bounded by the

Mediterranean to the North. Atteeh Plateau to the south is a plain area having abundant water resources derived from rainwater flowing from southern heights to the central plateau.

The Egyptian climate is influenced by the factors of location, topography, and general system for pressure and water surfaces. These aspects affect Egypt's climate dividing it into several regions. Egypt lies in the dry equatorial region except its northern areas located within the moderate warm region with a climate similar to that of the Mediterranean region. It is warm and dry in the summer and moderate with limited rainfall increasing at the coast in winter. The annual average day and nighttime temperatures in Lower and Upper Egypt are 20 and 25˚C and 7 and 17˚C, respectively. Egypt is dependent on three main sources of water: the River Nile, rain fall and floods in addition to ground water.

1.2 Agricultural resources of Egypt

The total agricultural area was in 2009 around 3.7 million hectares (Table 1). The major component of the agricultural land is the Nile delta and its valley till the southern border of Egypt, which is called the old land. It represents 70% of the total agricultural area. The rest is reclaimed desert land called new land. Most of agricultural land (97.6%) is surface irrigated by Nile water. The rest is 2% underground water and 0.4% rain fed, concentrated at the north west of Mediterranean shore. More than 80% of water resources in Egypt are utilized in agriculture, (Soliman 2010). The share of permanent crops (fruits, alfalfa and sugar cane) was 22% of the agricultural area. The share of dates palm and forest is less than 4% of the total agricultural area.

Agricultural land is only 57% of the cropped area of Egypt (Table 2). This means that the intensification factor of Egyptian agricultural system in land use surpasses 176% a year (cropped area/agricultural area). The intensification rates of old and new land are 189% and 147%, respectively. There are three cultivated seasons: winter (October-May), summer (May-August), and Nile (August-October). The area of the winter season, mainly wheat and Egyptian berseem fodder, occupies by 44% of the total, followed by summer season, mainly rice, maize and cotton, around 39% of the total, then fruit trees 9%, and the fourth category is Nile season crops, mainly short season rice, maize and some green fodders, around 5%. Sugar cane and alfalfa as perennial crops (last for more than one year on land) occupy together 3% of total cropped area. The share of date-palm is 1%, while forestry acreage is nil (0.1%) and located, entirely, in new land regions, which were originally desert areas. It should be mentioned that fruit trees, date-palm and alfalfa areas are concentrated, mainly, in the new (reclaimed) land.

Table 1. *Agricultural land resources in Egypt in 2009.*

Land resource type	1000 hectares	% of total
Agricultural area	3,689	100%
Old land	2,586	70%
New land	1,103	30%
Permanent crops	769	21.6%
Forest area	69	2%
Dates palm	70	2%
Total area equipped for irrigation	3,666	99.6%
Rain-fed area	15	0.4%

Source: FAO 2012 "FAOSTAT. Internet Site/Agriculture/Resources/LAND RESOURCE DATA

Table 2. *Total agricultural and cropped area in agricultural year 2008-2009.*

Category	Old land	% of category	New land	%	Total	% of cropped area
Agricultural land	2,585,743	53%	1,103,207	68%	3,688,950	57%
Winter season	2,224,245	46%	659,750	41%	2,883,995	44%
Summer season	2,054,012	42%	469,394	29%	2,523,406	39%
Nile season	246,844	5%	48,517	3.0%	295,361	5%
Sugar cane	117,527	2%	15,492	1.0%	133,019	2%
Alfalfa	2,973	0.1%	31,330	1.9%	34,303	1%
Fruit trees	221,057	5%	369,912	22.8%	590,969	9%
Palm dates	19,614	0.4%	17,311	1.1%	36,925	1%
Forestry	328	0.01%	9,411	0.6%	9,739	0.1%
Cropped area	4,886,600	100%	1,621,117	100%	6,507,717	100%

Source: compiled from (MALR), Ministry of agriculture and land reclamation of Egypt (2009), "Agricultural economics bulletin" issued by the Economic Affairs Sector, the Central Department of Agricultural economics, various issues, July 2010, Dokki, Cairo, Egypt.

1.3 The role of agriculture in employment, GDP and foreign trade

The annual average of the period 1995-2007 showed that agricultural sector provided about 31% employment opportunities of the total workforce (Table 3), contributed approximately by 16% of GDP, and by nearly 9% of total exports (Table 4). The agricultural sector has achieved a steady increase in the volume of investments directed to the sector. Agricultural investments reached about 1.13 billion US$ in 2005/2006 and rose to approximately 1.5 billion US$ in 2006/2007 even though it had not passed 6.3% of total public investment (Al Bahnasawy 2009).

While 35% of the economically active population was employed in agriculture in 1995 (Table 3), the share of agricultural sector in the GDP was in the same year only 17% (Table 4). In 2007 the share of agricultural sector was 27% and 15% of GDP.

There was a low growth rate of the Egyptian agricultural production over the last decade, associated with imbalance between a low share of this sector in GDP and relatively higher share in total employment. Such imbalance implied lower productivity, in terms of average value of agricultural output per agricultural worker. The agricultural labour productivity reached only 50% of the overall labour productivity (Table 3). Egypt has remained a net importer of agricultural products, although its agricultural trade deficit has decreased in recent years (Table 4).

Therefore, to double the agricultural sector growth rate is vitally required. Such target implies either vertical or horizontal increase of the sector, or even both. Horizontal increase means additional arable land, which is limited by water resources availability. As Egypt has a constant quota of Nile water, the available approach is by raising the water use efficiency and looking for nonconventional water resources. Vertical expansion implies to raise the productivity, which in turn, relay upon the potential yield in comparison with the existing yield, either for crops or livestock. Such potential yield is approached via improvement of farming practices, input intensification and biotechnology (cultivation of high yield varieties) (Soliman et al. 2006).

Table 3. *Role of agricultural sector in employment.*

	Total economically active population (1000)	**GDP/ worker**	**Employed in agriculture (1000)**	**Employed in agriculture/ total (%)**	**Agricultural output/ agricultural worker**
1995	18531	3,224	6489	35%	1,568
1996	18850	3,761	6455	34%	1,801
1997	19169	4,105	6417	33%	2,012
1998	19489	4,159	6377	33%	2,189
1999	20559	4,254	6599	32%	2,255
2000	20935	4,514	6577	31%	2,343
2001	21242	4,301	6544	31%	2,260
2002	22136	3,887	6700	30%	2,106
2003	22828	3,616	6760	30%	1,919
2004	23504	3,326	6807	29%	1,724
2005	24160	3,753	6839	28%	1,915
2006	24757	4,534	6847	28%	2,307
2007	25559	4,864	6900	27%	2,702
Annual average	*21671*	*4,039*	*6639*	*31%*	*2,087*

Source: Data calculated from FAOSTAT/Population Data.

Table 4. *Role of agricultural output and trade in the Egyptian GDP and total foreign trade.*

Period	population, million (2)	exchange rate (1$/EGP) (1)	total gdp million US$(2)	agricultural GDP million us$	% (agriculture output)/GDP	total exports million US$ (3)	agricultural exports million US$ (3)	% (agricultural exports)/ total	total imports million US$ (3)	agricultural imports million US$ (3)	% (agricultural imports)/ total
1995	57	3.391	59749	10177	17%	4957	536	11%	11739	3370	29%
1996	58	3.392	70896	11623	16%	4609	521	11%	14107	3863	27%
1997	59	3.39	78684	12910	16%	5345	442	8%	15565	3459	22%
1998	61	3.388	81063	13958	17%	5128	572	11%	16899	3557	21%
1999	62	3.42	87463	14880	17%	4445	586	13%	17008	3665	22%
2000	63	3.43	94492	15407	16%	6388	518	8%	17861	3532	20%
2001	65	3.76	91371	14789	16%	7068	620	9%	16441	3338	20%
2002	66	4.33	86049	14110	16%	6643	772	12%	14644	3438	23%
2003	67	5.13	82548	12970	16%	8205	938	11%	14821	2741	18%
2004	69	6.158	78171	11735	15%	10453	1314	13%	17975	3014	17%
2005	70	5.997	90682	13095	14%	13833	1169	8%	24193	3948	16%
2006	71	5.753	112254	15794	14%	18455	1088	6%	30441	3890	13%
2007	74	5.714	124324	18643	15%	19224	1503	8%	37100	5440	15%
Annual average	65	4	87519	13853	16%	8827	814	9%	19138	3635	19%

Source: Calculated from: (1) Central Bank of Egypt, Annual Report, Several Issues, August 2010, (2) Ministry of Economic Development, Egypt: Annual Statistical Reports, (3) FAOSTAT.

1.4 Organic agriculture in Egypt

The Egyptian Center of Organic Agriculture (ECOA), publishes regularly data on the organic agricultural acreage, yield and production by crop. However, such center concerns only the certified farms. Thereof, the total organic agricultural area in Egypt rose from 4,020 ha in 1998 to 19,211 ha in 2008 (Table 5), at a growth rate of 16% per year, and the organic agricultural area of vegetables, field crops, fruits and aromatic and medicinal crops dramatically increased at a growth rate of 13%, 15%, 23%, and 15% respectively (Table 6). The 19,211 ha in Table 5 in 2008 represent only certified organic agriculture areas and there are approximately another 20,990 ha in 2008 in the transition period (Table 7), so the total area of organic land in Egypt has approximately surpassed 40,000 ha in 2008.

Table 5. *Total organic agriculture area in Egypt by (ha).*

Year	Area of total organic agriculture		Vegetables		Field crops		Fruits		Aromatic medicinal plants	
	ha	%	ha	%	ha	%	Ha	%	ha	%
1998	4019.75	100%	1180.67	29%	2071.02	52%	218.82	5%	548.1	14%
1999	4874.79	100%	1118.49	23%	2439.78	50%	310.8	6%	1004.22	21%
2000	5666.39	100%	1091.18	19%	2734.2	48%	374.64	7%	1464.54	26%
2001	7401.51	100%	1320.97	18%	4271.44	58%	1036.06	14%	770.66	10%
2002	6066.39	100%	1155.88	19%	2907.24	48%	441	7%	1560.3	26%
2003	9342.02	100%	1764.29	19%	4531.8	49%	623.7	7%	2419.2	26%
2004	13032.35	100%	2436.98	19%	5250	40%	869.82	7%	4471.32	34%
2005	15176.89	100%	2840.34	19%	6111	40%	1008	7%	5212.62	34%
2006	17889.92	100%	3378.15	19%	7854	44%	1182.72	7%	5469.24	31%
2007	18876.05	100%	3206.82	17%	9381.67	50%	3205.54	17%	3075.76	16%
2008	19210.92	100%	3257.69	17%	9483.6	49%	2878.83	15%	3164.41	16%
Average	11051	100%	2068	19%	5185	47%	1105	10%	2651	24%

Source: Egyptian Center of Organic Agriculture (ECOA), published agricultural records

Table 6. *Time trend and annual growth rate in Egyptian certified organic agricultural area (1998-2008). Estimated from Table 5.*

Crop category	Intercept	Time response estimate (1)	Adjusted R^2	F ratio	Annual average (ha) (2)	Annual growth rate = (1)/(2) (%)
Total Area	1266.35	783.74	0.64	98.14	11051	16%
Vegetables Area	708.35	271.99	0.86	142.09	2068	13%
Field Crops Area	1266.35	783.74	0.91	98.14	5185	15%
Fruits Area	-153.46	251.60	0.64	19.03	1105	23%
Aromatic & Medicinial plants	597.45	410.70	0.54	12.82	2651	15%

Table 7. *Aggregate organic agricultural area in Egypt.*

Year	2005	2006	2007	2008	2009	2010
Total agricultural area	3,523,000	3,533,000	3,538,000	3,542,000	3,689,000	3,671,000
Agricultural organic area (ha)	24,600	14,200	19,200	40,000	56,000	82,000
% of agricultural organic area in total agricultural area	0.7%	0.4%	0.5%	1.1%	1.5%	2.2%

Source: Compiled and calculated from FAOSTAT (FAO Statistics Division), February 2013

The main goal of organic farms in Egypt is to enhance the agricultural exports. This means that organic production in Egypt is driven by the demand of the foreign market that imports Egyptian organic products. In 2006 the number of organic farms in Egypt was 460, which increased to 1000 farms in 2007 (Figure 1). Thereof, the number of organic farms in Egypt doubled in one year because of high revenue that was generated by the development of the demand for organic agriculture. Therefore, farmers get encouraged to adapt the organic agriculture methods (Mohamed 2012). However, this study abstracted from the published ECOA data in 2013, that there are 282 farms distributed allover Egypt. Such farms as recorded were certified by ECOA. It seems that the rest, difference between what cited in Mohamed's thesis and what abstracted by this study from ECOA, are not certified. The future of organic agriculture in Egypt seems promising as its share in total agricultural area doubled from almost 1% in 2008 to more than 2% in 2010 (Table 7). Not only that but such area increased by 24% a year between 2005 and 2010 (using equation 1). Such result confirms the recommended official support that should be devoted, technically and financially to such sector in Egypt. The not high adjusted R square of the organic agriculture crops but the vegetables reflects the fluctuation in the area of such crops, in spite of the significant growth rate. Figure 2 presents such fluctuations around the time trend line. This result could confirm that the area varies by the change in the international demand for the Egyptian organic agricultural products.

[Ln(Area)2010 –Ln(Area)1995]/5 = rx100 , the annual growth rate (1)

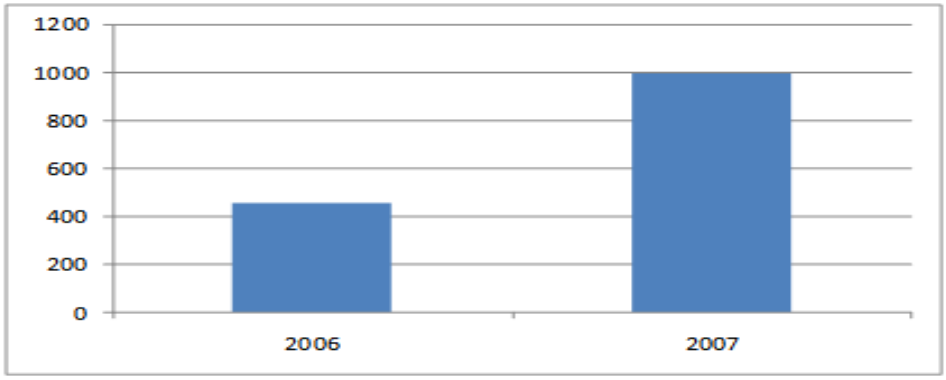

Figure 1. *Development of organic agriculture area in Egypt. Source: Mohamed, M. 2012. Consumers' Motivations and Barriers towards Organic Food: The Case of Egypt. M.Sc. Thesis, Department Of Business Economics and Management, Mediterranean Agronomic Institute of Chania, Crete, Greece.*

In brief, there are four well-known categories of organic agriculture in Egypt: vegetables, fruits, field crops and aromatic and medicinal plants. The share of each category, as shown in Table 5, relatively varied over the concerned period. However it was 17%, 49%, 15% and 17%, respectively in 2008. Vegetables are in particular, potato, onion, garlic,

beans, sweet and hot peppers, cucumbers, cantaloupe, strawberries, tomatoes, squash, carrots and peas. Fruits include grapes, apricots, peaches, apples, lemons, oranges, tangerines, pears, pomegranates, and mango. Field crops are cotton, peanut, sesame and flax. Aromatic and medicinal crops include caraway, anise, chamomile, mint, basil, thyme, hibiscus, cumin, parsley, balls, dill, lemon grass, coriander and wormwood.

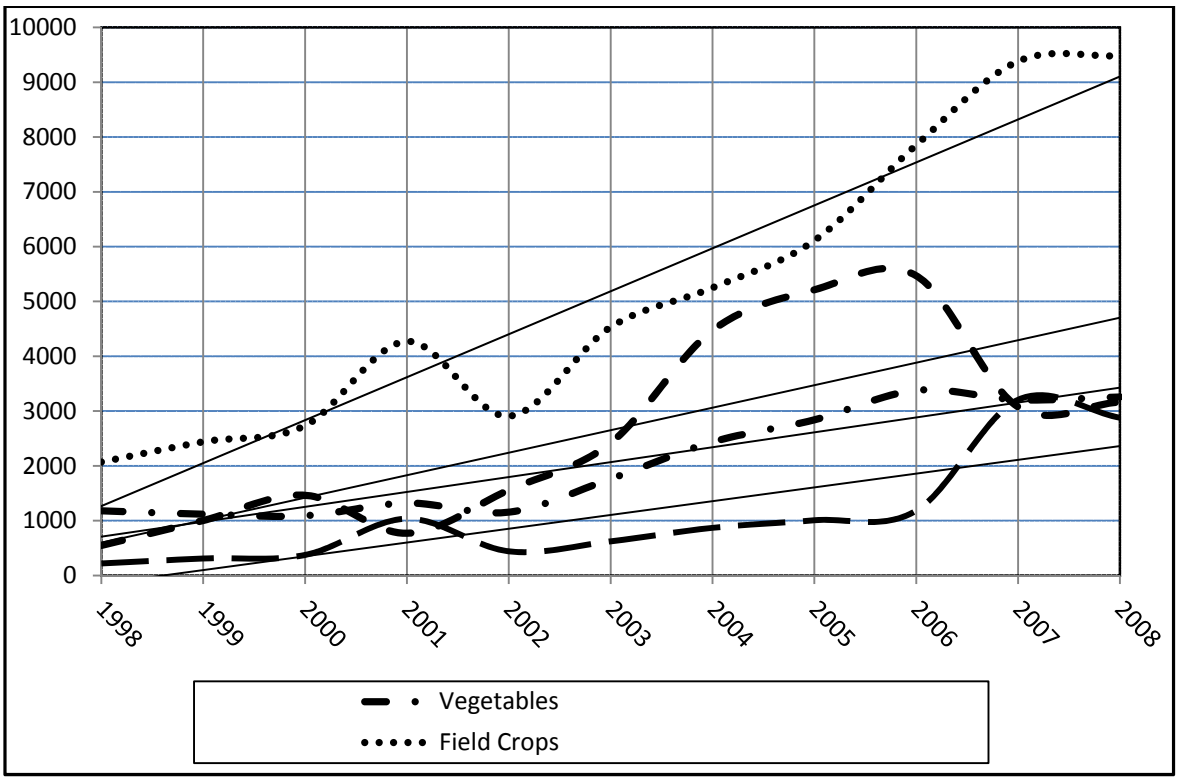

Figure 2. *Time trend of the certified organic agricultural crop categories in Egypt (1998-2008). Source: Drawn from Table 5 and Table 6.*

1.5 Forests and forest sector in Egypt

Even though forest share in total vegetated land (agriculture plus forest) is very small, there are evidences that forest area is increasing to some extent. Investigation of the time trend of forest area in Egypt shows that there was a gradual expansion in the forest area in Egypt over the period (1990-2009) from around 44,000 hectares in 1990 to around 69,400 in 2009 (Figure 3). Annual increase in forest area was 1418 hectares a year over the studied period (Table 8).

Most of the forest output (98%) in Egypt is for fuel use (Table 9). Only 2% is industrial roundwood. While fuelwood products in cubic meter increased at 0.7% a year over the period (2007-2010), industrial roundwood supply was constant. Forest industries in Egypt depend mainly on imported wood. Forest product imports increased from about 1691 million US$ in 2007 to more than 2099 million US$ in 2010, i.e. at 7.2% annual

growth rate. Although, exports of forest products increased at a much higher rate than imports, at around 14% a year, the deficit in forest products trade increased at about 7% a year between 2007 and 2010. The exports were about 109 million US$, which resulted in a deficit in forest products foreign trade of about 1991 million US$ in the year 2010. Thereof, the export value of forestry products was not able to cover more than 4%-5.2% of the imports of such sector over the period 2007-2010.

Table 8. *Share of forest area in land use in Egypt compared to agricultural land use, years 2008 and 2009.*

Land pattern	2008 (1000 ha)	%	2009 (1000 ha)	%	Annual growth rate
Total organic agricultural area (part of agricultural area)	40.00	1.11%	56	1.49%	33.6%
Permanent crops	900.00	24.93%	805	21.42%	-11.2%
Arable land	2,642	73.17%	2,884	76.73%	8.8%
Agricultural area = Permanent crops +arable Land	3,542	98.09%	3,689	98.15%	4.1%
Forest area	68.80	1.91%	69.4	1.85%	0.9%
Agricultural area + forest area	3,610	100%	3,758	100%	4.0%

Source: FAOSTAT

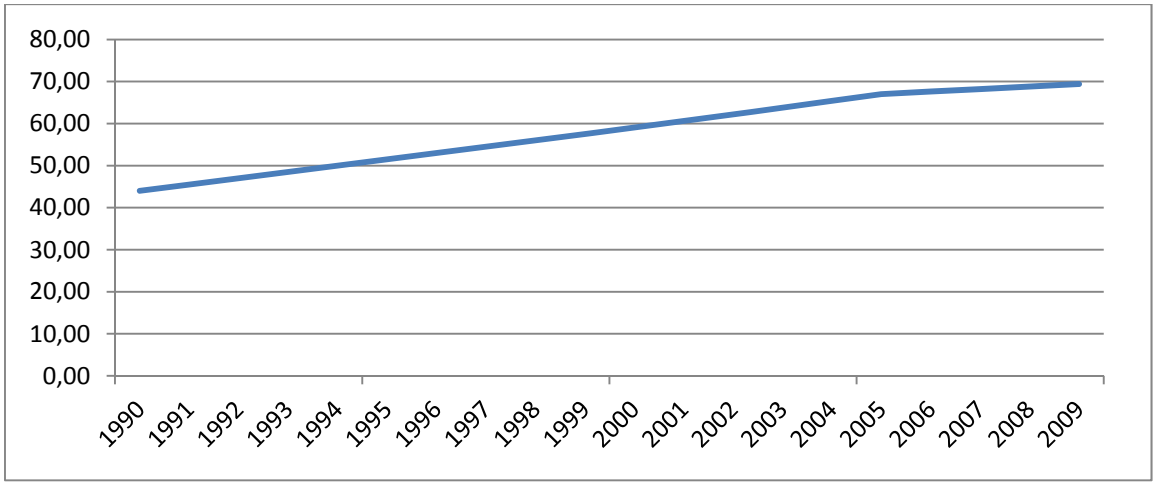

Figure 3. *Trend in forest area of Egypt (1990-2009) (1000 ha). Data source: Compiled and calculated from FAOSTAT.*

***Table 9**. Forest products of Egypt (m^3 in 2009).*

	2007		2008		2009		2010		Annual growth rate
	m^3	%	m^3	%	m^3	%	m^3	%	
Fuelwood (total)	17,170,300	98	17,283,000	98	17,396,556	98	17,511,447	98	0.66%
Industrial roundwood (total)	268,000	2	268,000	2	268,000	2	268,000	2	0.00%
Grand total	17,438,300	100	17,551,000	100	17,664,556	100	17,779,447	100	0.65%

Data source: Compiled and Calculated from FAOSTAT.

2. Policy framework related to sustainable development in Egypt

2.1 Background: Definition of sustainable development in Egypt

Sustainable development implies not only to conserve the available resources of the economy, but it also has to develop such resources to afford the expanding demand for both quantity and quality of the forthcoming generations. Therefore, there should be a sufficient share of the national investments to be allocated for resource development, including protection of environment. Such concept shifts the conventional economic growth rate to be a sustainable growth rate. The later supposed to be less than the former, but achieves the suitability in development (Soliman 1992).

The official authority in Egypt has adopted the concept of sustainable development at least theoretically since the onset of the 21st century. The official definition of sustainable development is as follows: "As the available natural resources must support a rapidly increasing population, sound management of such resources, together with a continuous improvement of sustainable development entails a pattern of growth in which economic, social, as well as environmental conditions are equally considered and carefully balanced, leading to living standards for future generations which are no worse off, if not better, than present ones. In this respect, environmental protection and a balanced use of natural resources must constitute an integral part of the development process (Ministry of Environment 2011).

2.2 Agricultural land resource management and governmental policies

Despite the scarcity of accurate data and information on areas withdrawn from agricultural land to non-agricultural uses, the study tried to extrapolate the development of these areas, and has also tried to classify non-agricultural uses patterns to their social and economic implications on rural communities (Table 10 and 11). The study used the few available studies, and public administration data for land protection, tried to extrapolate the evolution of agricultural land to non-agricultural uses during four decades, where the available studies showed these changes at time interval periods of time rather than annually. The withdrawn pattern has several types of nonagricultural usages. Some occurred legally and some illegally and some were just set-aside due getting an opportunity to build upon, and some are confined to dredging, and the other was already building for activities related to the agricultural sector, such as livestock, poultry or buildings for storage or packing plants and refrigerators in addition to residential construction, others are officially public goods like roads and schools. Therefore, the study estimated the average annual total agricultural land withdrawn for non-agricultural purposes in successive time periods during the period 1970-2010, in chronological sequence. Thereof, it showed that the cumulative total agricultural area withdrawn for non-agricultural purposes was around 1274 thousand feddan, i.e. in an annual average of about 40,0003 feddans. However, there was a variation during the whole period influenced by economic, social, political conditions and the concomitant legislation and policies by successive governments. About 40 percent of that area was withdrawn in the 1970s, with an average of approximately 50,000 feddans a year, then this rate dropped during the 1980s to about 27,000 Feddan per year, due to a law preventing construction on agricultural land (No. 116 of 1983), then declined at a greater rate during the 1990s to about 14,000 Feddan annually by the decision of the military Governor (Prime Minister) in 1996. However, at the onset of the present century and until the 25th of January 2011 revolution, the rate rose to over 35,000 feddan as a result of the government's reluctant response to prevent such action due to the pressing claims of urban space expansion, which withdrawn about 100,000 feddan to municipal space expansion of the villages and cities of Egypt.

It seems that among the agricultural land taken for other than agricultural purposes were mostly formally approved, as shown in where the total area drawn without a license (illegally) amounted to about 70388 feddans over the period 1983–2011, although this space was at a decreasing annual rate until 2005, from about 3,865 in the period 1983-1987 to about 1,000 Feddan in the period 1996-2005. As a result of insecurity after January 2011 there has been a surge in the drawn area recorded by the General Directorate for the protection of Land that reached beyond 14,000 Feddan until

[3] One feddan = 4200 $m^{2,}$, i.e. One hectare = 2.38 feddans

mid-2012, i.e. in one year. Comparing the total land withdrawn for purposes other than agriculture (Table 7) with the agricultural land withdrawn without a license it showed that the latter did not represent more than 9.1% of the total for the same period. This evidence showed that shifting the agricultural land uses for other purposes were affected by government policies rather than individual attitudes.

Table 10. *Total land withdrawal from agricultural to non-agricultural uses (1970-2010), 1000 feddans*.

Time period	Total farmland withdrawn	Annual average
1970-1980	500[1]	50
1980-1990	270[1]	27*
1990-2000	140[1,2]	14**
2000-2010	350[2]	35***
2011	14.3	14.3
Total	1274.3	40

*The Act 116 of 1983 to prevent construction on the agricultural land, **Issuing of the military Governor (Prime Minister) Command in 1996 and ***Issuing of the New urban space map of the villages and rural towns. Sources: 1) Soliman and Raja Rizk (1991), 2) Ministry of agriculture and land reclamation, Directorate General of land protection, unpublished data

Table 11. *Agricultural land drawn for urban purposes without official approval.*

Time interval	Total	Annual average
1983-87	19325	3865
1988-1992	17290	3458
1993-95	7734	2578
1996-2005	11743	1174
2011	14296	14296*
Total	70388	2427

* Since the 25th of January 2011 until 15 February 2012. Sources: Abdul Aziz N, Mohamed, A., I., (2007); A Report of the Directorate General for the protection of land, site of the seventh day Newspaper, 15 February/2012

2.3 Water resource management and government policies

Water is a limiting factor in development programs in agricultural and non-agricultural sectors. The per capita share of water resources in Egypt dropped from approximately 1024 m3 in 2002 to about 709 m3 in 2010 (Central agency for public mobilization and statistics (CAPMAS) 2012). The Egyptian water resources quota amounted to about 70.9 billion cubic meters in 2010, including the durable share of approximately 78% from the Nile River. However, it is going to be a risky source due to the recent arguments between the upstream and downstream states. The depleting sources from the groundwater in the Valley and Delta reached about 9%. 1.8% was from unstable natural resources such as rainwater and floods. The efforts of reuse and recycling of drainage

water of irrigation had a share of 9% of Egyptian water resources in 2010. Recycling sewage water had a share of 1.83%. In other words, the unstable sources had a share of 10.7% (rainfall, floods and groundwater) and about 11% were unstable in quality with a potential contamination (rotate drainage water and sanitation).

Agriculture accounted for nearly 82.5% to irrigate about 8.7 million feddans, distributed among more than 10 million holdings (farms) through a canals network of 40,000 km and a drainage network of about 20,000 km. The municipal water resource use represents about 12.9%, followed by industry 1.6%. The losses drain in the sea was about 3% of total water available in 2010. The long surface irrigation network made it difficult to manage this system and view many wastage of water, which also contributed to the behavior of farmers in water use.

Among the main reasons for the quantitative waste of water is inefficient water delivery. Estimations on the efficiency of water delivery based on previous studies are shown in Table 12. These estimates on losses are much higher than figures in official statistics. Thereon, agriculture is not only major consumer of limited water resources, but is also the main culprit in the loss. These studies confirmed that the continuous complaint of the farmers, especially in the summer season, from lack of enough water quota delivery to their fields is due to underestimation of the water losses till the field that are made by the Ministry of irrigation.

The second reason for waste of water is inefficient irrigation systems (Abdul Al 1990). In Abdul Al (1990) it was shown that about 2 billion m3 of water would be saved by changing the distribution patterns of water. Al Said (1997) estimated that surface irrigation efficiency was in general about 60% for crops and about 50% for rice.

The third reason is the low level of efficiency of water management at the farm level, which is incompatible with the principle of sustainable development, as well as the non-balanced withdrawal of groundwater reservoirs and not having a national water conservation program for rains and seasonal floods in desert areas.

The fourth reason for the waste of water is indirect and it is due to the failure of the national policy to establish a rational cropping pattern, which minimizes the water use. Such failure has enlarged after the full application of the free market mechanism in Egypt after 1995 as there is no price for water provided for irrigation. The farmer bares only the cost of lifting water to the field. Even though, the fuel is provided at subsidized price. Therefore, the farmers go for the most profitable crops, which may be water consumers such as rice (Al-khawlani 2009 and Al Saied 2011). Farm holdings fragmentation is another barrier to apply a national cropping pattern with special allocation of crops in identified economic belts.

Table 12. *The amount of water at Aswan and their relative importance of losses till the field in different time periods.*

Time Period	The amount of water at Aswan in milliard cubic meters	% of Water Losses			% of water distribution efficiency
		till canals	till fields	total	
1981 - 1986	51.69	10.23	15.37	25.6	74.4
1987 - 1992	55.04	9.84	9.61	19.46	80.54
1993 - 2008	53.99	17.41	11.71	29.12	70.88

Sources: Suheir Caesar Arsainos (1997): The economics of water use in Egypt.Master thesis, Department of agricultural economics, Faculty of agriculture, Minia University. Al said, A., K., (2012): Impact of Agricultural Policies on Resource Efficiency. PhD Thesis, Department of Agricultural Economics, Faculty Of Agriculture, Minia University. Central Agency For Public Mobilization and Statistics, (2012): Egypt In Figures.

In addition to quantitative waste of water there is also qualitative waste of water. Such deterioration is a result of changes in the physical or chemical characteristics and contamination with bacteria (Geweili, Soliman and Rezeq 1988, the Advisory Council 1997, Ikram 2011). This may happen due to several reasons including drainage of industrial wastes and the remnants of chemical fertilizers and pesticides in the course of the peripheral canals, the imbalance between programs delivering drinking water and sewage networks, overlap of salt water with irrigation water, and the excessive withdrawal of freshwater aquifers. In addition there is a general lack of environmental awareness not only among members of society, but also among decision-makers in official institutions. One reason for the lack of awareness is that social costs of the impact of pollution are not assessed (Soliman 1995).

3. Sustainable agriculture and forestry in Egypt

3.1 Evaluation of sustainability indicators

The model of the Egyptian sustainable agriculture indicators relayed upon the model designed for Spain and Finland (Kniivilä et al. 2012). However, the forest resources sustainability indicators of the provided indicator matrix were omitted and replaced by a content analysis section, of the forests performances. For agricultural indicators only 24 ones were considered in this study, rather than 37. Most of omitted ones were under organic agriculture set. However, there is a separate study on organic agriculture in Egypt (Mohamed 2012). Measurements of some indicators were modified without changing the objective of the original one in the reference study. For example the

livestock carrying capacity was calculated per 1-ha of cultivated fodder area, as Egypt is lacking actually range area for livestock rising. Also, the Public Budget RDP indicator, as the Share of public budget allocated to sustainable rural development programmes, including governmental expenditure on agri-environmental schemes (including organic farming) and other governmental expenditures on agriculture, was replaced by the Share of Public Investments in agricultural and Irrigation sector, measured as the % of (Public Investments/ Total Investments). Such modifications were made because of two reasons, lack of available data that coincide with the reference model and/or the differences of the Egyptian agricultural sector in comparison with Spanish and Finnish agriculture.

With respect to the time dimension of the estimated indicators, some concepts were considered:

- To record at least two points in time over the last two decades, in order to show up the trend of the indicator.
- The whole interval was classified by subintervals.
- The study tried to find a logical concept in such classification of intervals to simulate, as possible, the schedule of the development plans followed in Egypt since eighties of the last century. They were a set of successive five years plans. The first one was 1981-1987.

The reference that has a time series of most of the required indicators was the Aqua-Stat Department of FAO. It provides several indicators of agricultural development at five years intervals. These are 1987-1992, 1993-1997, 1998-2002, 2003-2007, 2008-2012.

Thereon, other indicators, which were not presented by the Aqua-Stat department of FAO have been estimated either an annual average of each concerned five years development plan, or at least for a mid-year within each concerned subinterval.

3.2 Towards sustainable agriculture

Some recommendations for future policies:

- To recycle the municipal drainage water for expansion in forests, with suitable trees, particularly, around cities, to avoid desertification, pollution and to generate additional economic value added to the Egyptian resources.
- Recycling of municipal drainage water, means treatment with isotopes, the Egyptian Corporation for Atomic Energy is capable to provide such service. 5% of traded agricultural commodities, mainly for exportation, is treated with such technology.
- A national integrated rural development program is the approach to reach sustainable agricultural development. Such program stems from the concept that

agriculture is a life style of rural communities, rather than an economic enterprising. Such recommendation requires another extensive study.

- To assure effectiveness of existing legislations for environmental protection and conservation of water and land resources. This requires enlargement of the economic penalties and reform of the current authorities.
- An extensive program is required for building up awareness towards the concept of social price. The existing market failure in Egypt stem from the lacking of effective implementation of environmental protection and natural resources development.
- The noncertified organic agricultural farms are about 595 of the certified ones. Therefore, a national program should be designed and implemented to scale them up to be certified farms. Another associated program should be implemented to encourage exportation of agricultural organic products. NGOs association and educational institutions should work on awareness of the people towards organic agriculture. The government should establish a credit financing schedule that provides incentives ton both firms and farms working in organic agriculture products.

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Appendix III. Country Report: Morocco

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1. Introduction

Studies conducted in Morocco in the field of protection of natural resources agree on a unanimous finding and alarming for most of them. It is the degradation of these resources, already handicapped by their relative limitation. The consequences of such degradation can be disastrous not only on biodiversity and maintaining the natural balance but also the living standards of affected populations and the sustainability of their production systems.

To address these issues, governments have successively implemented plans and specific programs initiated most often with technical and financial agencies of multilateral or bilateral cooperation such as the World Bank, FAO, UNDP, EU, USAID and GTZ. The objectives of this intervention aimed at reducing pressure on resources, environmental protection and improvement of living standards of populations and thus contributing to economic and social development.

This report is the contribution of the Moroccan team to the Sustainmed WP6 deliverables. It is designed to reach the main objective of this WP following the outline that has been conceived to come first with a country description in connection with the sustainable development issue (Section 2). Then, Section 3 reports on case of sustainable farming and forest systems in Morocco. The last section gives an overview on the existing data regarding the sustainable development indicators.

2. Agriculture and forestry in Morocco

2.1 The importance and role of agriculture and forestry in the economy

Agriculture is considered one of the main pillars of the Moroccan economy. Its contribution to the GDP lies between 12 to 17% (14.5% in 2009) and can grasp almost 40% of the workforce for employment. The total agricultural area is about 9 million hectares of which nearly 85% are cultivated in rained production system. Irrigated agriculture is practiced in about 1.4 million hectares and in average contributes to 45% of the value added of the agricultural sector. At the overall, Moroccan agriculture is still quite fragile because of its close dependence with the weather (rainfall in particular) that is able to influence not only the agricultural GDP but also the national GDP.

Incentives for investment in agriculture are mainly grants and subsidies provided by the State under the Agricultural Development Fund (ADF). The main components of the State intervention are farm equipment mechanics, soil amelioration and hydro-agriculture management, animal production intensification, agricultural products valuation and struggle against climatic hazards including drought. Moreover, the agricultural sector enjoys a tax exemption on income until 2013.

Cereals are the major crops in the context of cropping production system in the country. They annually hold 60% of the Useful Agricultural Area (UAA), an area of about 5 million hectares. Barley remains the most widely grown cereal with nearly 42% of cereal area, followed by tender wheat (38%) and durum wheat (18%). The level of grain production is strongly linked to climatic conditions, especially rainfall. Yields per hectare are relatively low with an average of 15 quintals for tender wheat, 13 quintals for durum wheat and 10 quintals for barley. For the agricultural campaign 2010-11, which is marked by record rainfall, the production of the three cereal species reached 45 million quintals, 20 million quintals and 37 million quintals respectively (Ministry of Agriculture 2012).

For sugar crops, it is cultivated in average of 55,000 hectares annually with sugar beet, which harvest an average of 2.5 million tons (57,500 ha and 2.92 million quintals in 2009-10). The cultivated area and total production of sugar cane are relatively less important which reached about 18,000 ha and 900,000 T respectively (16,900 ha and 913,000 quintals in 2009-10).

For vegetable oil production, olive occupies an area of over than 600,000 ha with an average of production varies from 300.000T to 800.000T. The sunflower area is depending on weather conditions and especially the spring rains. In 2009-10, it reached 25,500 ha for a production estimated at 32.300T with an average yield of 1.27 tons per hectare.

Regarding livestock production, the number of animals reached approximately 2.8 million head of cattle, against 17 million head of sheep and 5 million head of goats. The total production of red meat is estimated at 400.000T per year. It is almost equivalent to white meat that has grown remarkably during the last decade with the development of poultry farms.

Milk production is estimated at about 1.8 billion liter produced mainly in the irrigated areas scattered among the country. It had also improved very significantly since the launch of the dairy plan in 1975 with respect of cattle genetic improvement and the adoption of more efficient technical driving.

Regarding the fisheries sector, Morocco has a coastline of 3,500 km and a maritime area of over one million km2. The potential production reached 1.5 million tons and actual output varies between 700.000T and 950.000T. In addition to its role in supplying the domestic market with fish products, the sector contributes nearly of 45% of food industry exportation and contributes up to 2 %-3% of GDP.

As for the forest sector, Morocco has wooded forest structure covering an area of 5,814,000 ha with as many as 30 forest ecosystems and more than 4,000 plant species, including some 500 endemic (e.g., Argan tree). These structures consist of 63% deciduous (evergreen oak, cork oak, acacia and argan) and 20% softwood (cedar, juniper, pine, cypress and fir Atlas). The remaining 17% is occupied by lower structures (matorral and secondary species) and often results in forest degradation. The average rate of afforestation is about 8%, well below the optimum level (15 to 20%) needed for environmental and ecological balance.

The forest space in Morocco is multifunctional and plays many key roles. The environmental role is that of conserving biodiversity, productivity of land and water, and protection of dams. The forest also plays a leading role in the fight against desertification. However, a disturbing reality is to think about: 95% of Moroccan territory is threatened by desertification. The forest also has a social role in terms of allowing firewood collection, grazing and job creation for the benefit of rural populations. It is reinforced throughout more than 0.64 billion Euros worth of annual supply of 60 industrial units and more than 6,000 craftsmen and timber industry, cork, etc. It creates 100 million work days, 28,000 jobs in the forestry companies, 14,000 jobs in the processing sector, 26,000 jobs in the collection of firewood, 40,000 jobs in the field of travel and 4,544 jobs in the public service. Also, forests account for 40% of rangelands and annually produce 1.5 billion forage units (FU), or 17% of the national feed balance (Haut Commissariat aux Eaux et Forêts 2012).

However, forest ecosystems are experiencing a worrying deterioration due dysfunctions, caused by population pressure, overgrazing and urbanization. These issues were amplified by the harsh weather conditions experienced by Morocco over the past three decades. Nowadays, specialists assume that the forest area shrinks 31.000 a year due to land clearing and cutting practiced by the residents and seasonal fires. Consequently, the forest resources must be strengthened and has continuous monitoring in view of its conservation and sustainable development to get better contribution in the national economy. It is to be noted that Morocco imports over than three-quarters of its wood requirements from France (17%), Sweden (17%), Spain (13%) and Brazil (8%). The increasing demand for firewood is one of the sources of forest degradation since it is the second energy source used in Morocco, after the fuel.

2.2 Agricultural sector structure

According to the results of the last general census of agriculture (Recensement Général de l'Agriculture) undertaken in 1996, Moroccan agriculture is practiced by 1,496,349 farms covering a total Utile Agricultural Area (UAA) of 8.7 million hectares. Units of less than 5 ha represent 71% of the total number and occupy only about 24% of the total UAA. Those who occupy the largest part of the area (43.2%) have a size laying between 5 and 20 ha and account for 25% of the total. The large estates (> 100 ha) cumulate 8.7% of the UAA even if their number is limited to 3182 farms, an average of 238.65 ha UAA per unit. This imbalance in the structure of agricultural land Moroccan is a serious handicap to development of effective land tenure.

To overcome such constraints, successive governments have responded by implementing sector programs that aim to improve the performance of farms, particularly through the launch in 2000 of the Rural Development Strategy 2020. Since then, structural policies related to agriculture and food sectors continue their focus on investment incentives in primary production as well as in processing and marketing steps. Such a policy choice has been strengthened during the last three years in the public goal of modernizing production systems capable of competing with foreign markets. The measures taken in this regard are largely funded by the state budget. The actions are increasingly conducted within the framework of integrated projects that are developed on the basis of a partnership management. In addition to investment incentives, they concern the development of agricultural land and land tenure.

Besides, land tenure in Morocco shows that the property status is for 76% of the total UAA. The remaining area is allocated to the collective land (17.7%), Guich land ceded to the tribes who used to fight in the favor of Moroccan Sultans (2.8%), Habous wich is the land of religious brotherhoods (0.6%) and land that belongs to the state (3.1%) (Ministry of Agriculture 2007). Except the property status, the common factor in other statutes is that the beneficiaries are just profiting from the usufruct right. Therefore, those land statutes rise serious problems that limit the investment incentives to improve production systems within farms that are mostly of small acreage because of heritage considerations.

On the other hand, the development of agricultural land is intended to improve efficiency of the agricultural land both in irrigated and rain-fed areas. For irrigated areas, the Ministry of Agriculture has maintained and strengthened its efforts to extend and rehabilitate irrigation schemes. In 2009, these efforts have been realized, through the start or completion of works on over than 140,000 ha (Ministry of Agriculture 2011). Similarly, the rehabilitation has involved areas that are part of integrated development projects focused on small and medium irrigation (Développement Rural Integrés sur la

petite et moyenne hydraulique, DRI-PMH). In this regard, the rehabilitation of perimeters located in the provinces of Khénifra, Azilal and Haouz has exceeded 11,100 ha, set in with an integrated development approach targeting the local population.

3. Policy framework related to sustainable development in Morocco

Since the United Nations Conference on Environment and Development (UNCED), also called 'the Earth Summit', held in Rio de Janeiro, Brazil in 1992, the concept of sustainable development has taken all his vigor and importance in Morocco. This conference allowed the world to call on environmental issues by implementing an action plan called Agenda 21 'as a program of sustainable development in the 21st century. Ten years later, the World Summit on Sustainable Development (WSSD) in Johannesburg in 2002 was to assess the achievements of the Rio Summit and determine the process of boosting international cooperation for sustainable development. The Moroccan government, through its State Department of Environment, actively participated in all events organized around the issue of environmental protection including under the United Nations Environment Programme (UNEP) and the Mediterranean Action Plan (MAP).

As the considerations of resource degradation are directly related to the well-being, the government developed and adopted a new policy based on an approach integrating environmental issues in the socio-economic development. This policy has led to the development in 1995 of the National Strategy for Sustainable Development (NSSD) which determines the policies and main lines of national policy on the environment. Then, and to better structure and operationalize the strategy in question, the National Action Plan for the Environment developed in 2002 (NAPE 2002) presents the various programs launched since the early 1990s including the watersheds management plan, the national action program to fight against desertification and the National Forestry Programme (NFP). Most recently, Morocco has established 'the National Charter for the Environment and Sustainable Development' at the instigation of the high royal directives in 2009.

National Strategy for Sustainable Development (NSSD)

NSSD takes into consideration the social and economic development policy and economic improvement of the standard of living. Its development required a concerted and deep reflection of the different actors on the situation of natural resources, their main constraints and defining a new approach to their conservation in the context of

sustainable development in Morocco. Its main environmental priorities are (MATUHE 2002):

- Protection of water resources;
- Protection and conservation of soil;
- Reduction of waste and improvement of their management, and
- Improvement of the air quality and reduction of air pollution.

Note, however, that the action of the State for natural resource management has faced some constraints that have relatively limited its effectiveness, namely (MADREF 2001):
The institutional framework characterized by the multitude of stakeholders involved in natural resource management;

The management method where inconsistencies are often rated in terms of development of natural areas for development of livestock, forestry or land;
The preponderance of repressive measures at the expense of incentives of regulations governing the exploitation of natural resources;

The inadequacy of existing administrative structures and their mechanisms of project management in the small scale territories.

All these constraints pushed in the direction of the necessity of a participatory approach between all stakeholders involved in natural resource management. Through refocusing the environmental policy on the population across a national environmental plan, Morocco wants to develop the environmental culture in any action of natural resources in a sustainable manner.

The National Action Plan for the Environment (NAPE 2002)

With the Environmental Charter (see below), the NAPE is currently the basis of the environmental policy in Morocco. It helps fulfill the National Strategy for Environmental Protection and Sustainable Development in acting an approach that integrates environmental protection and long term socioeconomic development Its actions focused on the following priority areas (MATEE 2007):

- Protection and sustainable management of water resources;
- Protection and sustainable management of soil resources;
- Air protection and promotion of renewable energy;
- Sustainable management and protection of natural environment;
- Reduction of natural disaster and major technological risks;
- Improvement of urban environment and suburban areas;
- Environmental management and communication
-

With regard to water and soil, the sustainability of the resource base is of central concern to policy makers in an environment increasingly threatened by the problems of recurrent drought, deforestation and desertification. These constraints are resulting in growing pressure on available resources, which increasingly requires important human and financial resources for their conservation. But the action as part of sustainable development projects should not only alleviate this pressure but also improve the living conditions of affected populations.

The Environmental Charter

The National Charter of the environment and sustainable development, launched by His Majesty King Mohammed VI in 2009 is a strong signal to all actors in Morocco towards a greener environment. It allows the local authorities to take concerted action and make decisions that ensure the protection and preservation of the environment in their respective territories. These authorities are also asked to develop integrated programs that are able to ensure the sustainability of natural and cultural resources on a decentralization basis. Their actions are mainly directed to the distribution of drinking water, sanitation, waste disposal, forest protection and maintenance of green spaces. In practice it means that local authorities have engaged in the Agenda 21 approach which also illustrates the practical action of a sustainable development approach.

4. Major challenges of sustainable agriculture and forestry in Morocco and policies related to them

Water scarcity, soil erosion and desertification are a real scourge for resource protection in a large part of Moroccan territory. The phenomenon is most notable in arid areas for drought and some mountainous areas for water erosion. With the sustainable development policy, government programs work in the sense of active participation of affected populations. Indeed, currently, it is admitted by all that successful interventions cannot be guaranteed without the effective integration of these populations actions. To do so, the implementation of the policy of resources protection is based on a legislative and regulatory framework introduced since the beginning of last century. Recent interventions in the form of integrated development plans have also contributed significantly to a better understanding of the issues raised and the means to implement for their resolution.

The implementation of legislative and regulatory provisions

The legislative determines the forms and modalities of state intervention in order to ensure the sustainability of natural resources in the various ecosystems. It involves

several government institutions, especially the Ministry Department of Water and Environment, the Ministry of Interior, the Ministry of Agriculture and Fisheries, the High Commissariat for Water, Forests and Desertification Control and the Ministry of Health. With this regard, the key legislation acts that govern the intervention of the state are:

- The Royal Decree in 1917 on the conservation and exploitation of forests,
- The Order 16/04/1946 on the development of forest,
- The Royal Decree 25/07/1969 on protection and restoration of soils,
- The Royal Decree 20/9/1976 on the organization of people's participation in the development of forestry,
- The Law 33-94 on the perimeters of development in rain-fed areas;
- The Water Law 10-95 which provides among others the creation of water basin agencies,
- The Royal Decree 12/5/2003 promulgating the Law 12-03 on the impact on the environment.

It should however be noted that this arsenal is considered by most observers as too repressive or unrealistic compared to the conditions of its application. Therefore, its effectiveness is often questioned as the people concerned sufficiently do not adhere for sustainable development advocated by policy makers.

The adoption of improved irrigation schemes

The policy of mobilization of water was rather timid during the colonial period and even until 1966. As from 1967, a significant impulse of this policy by the construction of many dams was given ('Dams policy' also called 'Policy of the million irrigated hectares'). Thus, Morocco developed a water storage capacity of more than 16 billion m3 through more than 100 medium/large dams. It also developed an important infrastructure of underground mobilization of the water resources (drillings and wells) making it possible to exploit annually nearly 2.7 billion m3. These efforts allowed the installation of a total surface area of 1,458,160 ha including 1,016,730 ha arranged in collective networks of irrigation by the care of the State and 441,430 ha arranged in the form of individual irrigation by private initiative. Today, this surface accounts for 16.7% of the useful agricultural surface of the country.

All in all, the irrigation of surface relates to nearly 1,178,700 ha, either 80.8% of the arranged total surface areas, sprinkling extends on 137,660 ha (or 9.4%) and the located irrigation (drip irrigation), it accounts for 9.8% with 141,800 ha (9.8%).

Now, the challenge is that the demand for water would be in 2020 at close to 14.5 billion m3 including 90% for the irrigation and 10% for drinking water and industrial. The efforts that are undertaken to extend the drip irrigation area have to be pursued. In this context, the Agricultural Development Fund (ADF) is used to help farmers shift from the flooding system (in the irrigated areas) to the drip irrigation system.

The soil protection against erosion

The problem of erosion in Morocco is linked to the combined effect of both natural and human factors that directly act on the sustainability of natural resources. This durability is supposed to guarantee the reproducibility of these resources along with population survival. Among the main natural factors include erratic rainfall and low forest coverage rate of no more than 10% of the total land area. Human factors are also very aggressive and cause damage most often irreversible. These include over-exploitation of forest resources and grazing for domestic needs, the expansion of croplands by clearing and de-stoning and inappropriate use of tillage techniques in the case of sloping cultures.

The consequences of erosion problems are perceived both upstream and downstream. In the upstream, land degradation results in reducing their productivity and their capacity to store runoff. Downstream, the impact is easily noticeable on the mobilization capacity of water intended for human consumption and agriculture in the dams. Such problems are posed to varying degrees depending on the importance of specific erosion that can distinguish four distinct zones (MATEE 2007):

- The Rif with a specific degradation of more than 2000 t/km2,
- The pre-Rif with a specific degradation of 1000 to 2000 t/km2,
- The area of the Middle Atlas with a breakdown between 500 and 1000 t/km2,
- The rest of Morocco including the Anti-Atlas with a degradation of less than 500 t/km2.

It is interesting to note that the first state interventions in the fight against erosion have been launched in the 1960s with the project Derro (Rif Oriental Rural Development). The actions undertaken as part of this project involve land development work, tree crops planting and development of water sources.

Currently, and following the experience gained in this project, the new approach takes into account the following aspects (HCEFLCD 2006):

- The consolidation of the role of forests in the fight against erosion by determining the limits of use rights and the establishment of an appropriate institutional structure;
- Increased investment in mountainous areas that pay attention to harmonization of the needs of water mobilization and soil conservation in watersheds.

- The promotion of participatory approach and adapting the legal framework for this approach in order to improve the design and implementation of projects aimed at limiting the degradation of water and soil.

Two types of actions are generally carried out in the soil and water conservation devices namely, mechanical devices (low walls, stone beads, sills, benches and elements of benches, terraces, etc.) and vegetative devices (pastoral, forestry or arboricultural). The government intervention has so far involved an area of nearly 550,000 ha. Fruit plantations and protective reforestation concerned respectively about 50% and 23.5%, pasture improvements and pastoral activities 15.5% and mechanical and biological water conservation systems 11% (HCEFLCD 2006). It is obvious that the interest of beneficiaries varies depending on the system adopted. Maintenance difficulties are generally seen in the case of mechanical devices but the agreement of the farmers is essential when it comes to biological devices.

The intervention against desertification

The early interventions against desertification include those undertaken in the late 1970s for the benefit of oases in Ouarzazate and Errachidia provinces by stabilization techniques of sand dunes that are threatening the oasis ecosystem. Subsequently, and after the adoption of the UN Convention on the Fight against Desertification in 1994 and its entry into force in 1996, sustainable development actors have conducted consultations on the scourges of desertification and drought that led to the establishment of the National Action Program to Combat Desertification (NAP-CD) in 2001.

The NAP-CD aims at consolidating the various sectoral programs that were designed to control desertification given the needs expressed by the concerned populations. Thus, in general, this program operates in the same areas acting on the preservation of natural resources. The program includes actions to mitigate desertification by installation of windbreaks, encouraging the development of integrated forest and peri-forest areas, the promotion of rainwater collection and consolidation of sustainable pastoral development. To be successful, the approach has however to be based on participatory and collabourative partnership. The objective is to strengthen the emerging consensus around the balance of natural resources especially in Saharan areas.

5. Case of sustainable farming and forest systems

In Morocco, the various strategies and action plans to develop sustainable farming systems have been materialized on the field by the introduction of projects undertaken in a participatory and collabourative way. Some of these projects have a national dimension (the case of rain-fed perimeters) while others are more regional (forest areas) or local (specific watershed areas).

Development of forest areas

With regard to forest patrimony, the National Forest Plan (NFP), adopted by the National Forest Council (NFC) in 1999 has the objective of sustainable management of forest resources. Its areas of intervention include the protection water and soil, the socio-economic development of rural populations, the protection of biodiversity and environmental services of forests, timber production for industry and handicraft service production (scenery, recreation and leisure) for urban populations (HCEFLCD 2004). On the other hand, the Master Plan for Reforestation (MPR) is also in the forestry development strategy. Launched in 1997, it aims to ensure a sustainable supply of forest products based on a participatory approach and develop partnerships to expand the reforestation. Its implementation involves, among others, grants from the National Forest Fund (FNF) in nature (plants) or cash to encourage the planting of shrubbery and alignment as well as reforestation for timber production in collective and private land.

Under these plans, the government ruled an integrated development project oriented to the forest areas in 2004 (Développement Rural Intégré – Forêts, DRI-Forêts) with the support of the World Bank for a period of 6 years. Its main objective was the improvement of living conditions of populations and the introduction of sustainable management of forests in partnership with concerned stakeholders through: They are characterized by low vegetation cover and fodder resources, problems of soil protection and binding conditions for rural development. SWC, the actions planned by the DRI project - Forests are:

- The forest management activities in the purpose of re-generating the cedar stands and improving the productivity of oak wood for the production of energy,
- The improvement of water and soil conservation using dry stone thresholds and gabions, treatment of ravines, stone lines, stone walls, etc.,
- The improvement of the forest vegetation through the planting of fodder trees and crop trees (olive, almond, fig, apple, etc.) in basins, terraces, or fruit benches.
- In sum, the execution of the project activities is part of the logic of an integrated forest management that put water and land resources at the center of interest

that focuses on the improvement of people's incomes while ensuring the sustainability of these resources.

Sustainability of Water Resources in Morocco: the case of WPM Project

Within the framework of bilateral cooperation with the U.S.A, USAID and the State Secretariat for the Environment have established in 1996 a project entitled 'Sustainability of Water Resources in Morocco' (PREM) with a total budget of U.S.$ 16 million. This project is part of the national strategy for sustainable development of water resources in Morocco by encouraging community participation and involvement of local communities, the private sector, NGOs and professional associations in the promotion of environment. PREM project actions were undertaken during the period between 1996 and 2002. Then, the program has become Watershed Protection Management (WPM). In sum the actions of PREM and WPM were concentrated on (USAID 2001):

- Monitoring and mitigation of erosion by planting olive trees, biological and mechanical stabilization of ravines, grass strips, etc.
- The improvement of production systems by introducing new techniques related to arboriculture, goat farming, beekeeping and rabbit,
- The management of water resources,
- The professional organization and training of people (including women) and agricultural extension,
- The promotion of value-adding activities such as crushing the olives and almonds of argan trees.

The purpose of all actions is the improvement of socioeconomic conditions of the populations in the targeted watersheds in question with their actual involvement through the intervention of village committees. Being in direct contact with project managers, such committees have played key roles in the establishment and monitoring of various activities, which effectively has helped to the objectives achievement.

Development of rain-fed production systems

Development of rain-fed areas remains one of the most significant challenges for the government. To achieve such a goal, the government implemented in 1994 a generation of development projects in these areas called Périmètres de mise en valeur en bour (PMVB) governed by the 33-94 Act which deals with the development of agricultural land, pasture improvement and soil conservation. The objective of the PMVB projects is to promote a modern and efficient agriculture at these perimeters through:

- The intensification of agricultural production (plant and animal),
- The improvement of forest grazing and rangeland;

- The improvement of irrigation schemes by adoption of drip irrigation,
- The technical supervision and coaching of agricultural cooperatives.

Other actions are focused towards a rational exploitation of land such as the construction of benches and implementation of forest or fruit plantations, hedges or windbreaks and grassland perennial or semi-perennial. All transactions are secured by the administration, after consultation with the local board of agricultural development established by the 33-94 Act in each PMVB.

Integrated rural development in rain-fed area projects (Développement Rural Intégré – Mise en Valeur Bour, DRI-MV) represent the next generation of development projects in rural areas who have not benefited from significant public investment in the past. Launched in 2004 for six years, they also are governed by the 33-94 Act that determines the basis for the rural development strategy in rain-fed regions in connection with the Rural Development Strategy of the World Bank known under the concept of 'Reaching the Rural Poor'.

DRI-MVB projects represent one of three categories of projects that have been conducted under the Rural Development Strategy 2020 supported by the World Bank. The second category has been designed for small and medium hydraulic areas (DRI-PMH) and started in 2001 in the poor mountainous areas with small scale irrigation. The third integrated development project (DRI - Forests) has targeted the management of natural resources including watersheds and forest area (Banque Mondiale 2003).

Management of natural resources

In this chapter, the government has undertaken, among others, the Integrated Rural Development Projects - Natural Resource Management (DRI - GRN) within the framework of MEDA program of cooperation between Morocco and the European Union. Their objectives are aimed at improving living conditions of rural populations and sustainable management of natural resources in seven Northern provinces of Morocco, namely Al Hoceima, Nador, Oujda, Taounate, Tetouan and Taza through (MADRPM 2007):

- The protection and management of forest ecosystems in the Rif region (Northern Morocco) with the participation of local residents;
- The watersheds management in this region,
- The participatory and sustainable development of plains in Nador and Oujda Provinces.

The program DRI-GRN was implemented in a total estimated area of 1.35 million hectares with a population of around 1.2 million people. Launched in July 1999 and for

reasons of readjustment during the execution of different phases, the project activities lasted until 2009.

6. Evaluation of sustainability indicators

The environmental evaluation is in duty of the Secretary of State for the Environment that coordinates the investigations on environmental impact assessment (EIA) and chairs the National Committee of EIA. This interdepartmental committee is mandated, among others, to comment on the environmental acceptability of projects.

Morocco was committed in 1997 to the Mediterranean Commission for Sustainable Development (MCSD). Each member of this commission has to calculate 130 sustainable development indicators (SDI) under the coordination of the Blue Plan. For Morocco, this mission was entrusted to the National Observatory of the Environment in Morocco (NOEM) with the purpose of examining the relevance of the list proposed by the MCSD in the Moroccan context, and then, selecting and calculating those which illustrate the problems and identify priorities of Morocco's environmental and sustainable development (MATEE 2007).

In 2003, the National Committee of Sustainable Development Indicators (NCSDI) organized a consultation and validation workshop during which a list of 65 SDIs was presented. The list can be used with constant updating. The selected list meets the recommendations of Agenda 21 of the United Nations and is an instrument of reference for the National Action Plan for the Environment. The thematic framework of sustainable development indicators is organized into chapters on population and society, spaces and areas, economic activities and environmental sustainability (see the list in Table 1). Each chapter covers several topics, according to a classification based on that adopted by the MCSD. For each topic, the indicators are presented as fact sheets that give the definition for each indicator, the calculation unit, the methodology, data sources identified, the body responsible for monitoring, the history of the indicator, the periodicity of production, geographic coverage, and commentary showing the link between the indicator and sustainable development and its trends in Morocco.

Unfortunately, so far no value of this list has officially been officially calculated. Meanwhile, the Ministry of Energy, Mines, Water and Environment has undertaken actions that aim to reach this goal through the creation in 2011 of 16 Regional Observatories on Environment and Sustainable Development (ROESD) in partnership with the 16 regions of the Kingdom. ROESD are responsible for ensuring the environmental monitoring and measuring results and performance of corrective actions initiated by environmental programs upgrading. Their main mission is to produce an

annual report on the state of the environment in each region. They recently have been charged for the assessment of the indicators list mentioned above. According to the Environment Department representatives, the results of this evaluation could be available by the first months of 2013.

Table 1. *The List of Sustainable Development Indicators in Morocco according to the National Observatory of the Environment.*

Chapter 1: Population and society	
Factor	**Indicator**
Demography and population	1. Rate of population growth 2. Total fertility rate
Standard of living, Employment, Social Inequality, Poverty and unemployment	3. Number of active women in the population for 100 men 4. Rate of population living below the poverty line 5. Employment rate
Culture, Education, Training and Awareness	6. Illiteracy rate 7. Enrollment rates 8. Share of expenditures allocated to vocational training 9. State spending for Education 10. Public expenditure for the conservation and enhancement of historic and cultural heritage
Health and Hygiene	11. Life expectancy at birth 12. Infant mortality per 1000 live births 13. Access to drinking water 14. Maternal mortality per 100,000 births 15. Mortality rates due to waterborne diseases and infectious
Consumption patterns and production	16. Annual energy consumption per capita
Chapter 2: Territories	
Factor	**Indicator**
Dwellings and urban systems	17. Loss of farmland due to urbanization 18. Rate of slums 19. Urbanization rate 20. Area of green space per capita in cities over 100,000 inhabitants.
Rural and arid mountains and hinterland	21. Completion rates of integrated programs for rural areas forest 22. Total area of forest lost annually 23. Forest cover and afforestation rate 24. Rate of reforested areas in the cleared area

Coast and coastal development	25. Population density in the coastal provinces (people / km). 26. Coastal Erosion 27. Protected coastal area
Sea	28. Maritime oil 29. Quality of coastal seawater

Chapter 3: Economic Activities and Sustainability	
Factor	**Indicator**
Macroeconomics	30. GDP composition by sector 31. Current GDP per capita 32. Foreign Direct Investment 33. External debt / GDP
Agriculture	34. Fertilizers and pesticides used per hectare 35. Share of irrigated agricultural land 36. Share of units in the pastoral forage feed balance.
Fishing Aquaculture	37. Value and volume of fishery products 38. Number and average power of fishing boats
Mining Industry	39. Number of rehabilitated mining and quarrying after activity 40. Industrial waste water.
Services, Trade	41. Number and area of large commercial areas
Energy	42. Energy balance by source 43. Share of renewable energy resources
Transport	44. Structure, volume and rate of increase in transport mode
Tourism	45. Number of nights per 100 inhabitants 46. Number of beds per 100 population 47. Number of international tourists per 100 inhabitants

Chapter 4: Environment	
Factor	**Indicator**
Freshwater and wastewater	48. Annual rate of mobilization of water resources 49. Index of overall water quality 50. Rate of connection to the sewerage and sewage treatment 51. Rate of dams silting
Soils, vegetation and desertification	52. Area affected by soil erosion, desertification and salinity 53. Changes in land use

Biodiversity, ecosystems	54. Size of protected areas 55. Endangered Wildlife
Solid waste, domestic, industrial and hazardous	56. Production, gathering, and destination of solid waste
Air	57. Emissions of Greenhouse Gases 58. Emissions of sulfur oxides and nitrogen 59. Frequency of exceeding standards in O3, SO4, NO2, Pb and MPS-3 60. Consumption of substances that deplete the ozone layer
Natural and technological hazards	61. Flooded areas.
Sustainable development and political actors	62. Number of associations for the environment and / or Sustainable Development 63. Public expenditure on environmental protection as % of GDP 64. Existence of national environmental and / or strategies of Sustainable Development 65. Number of Agenda 21 measures adopted by local authorities

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Appendix IV. Country Report: Tunisia

By Boubaker Thabet, Abderraouf Laajimi and Moncef Ben Saïd, INAT, Tunisia

1. Agriculture and forestry in Tunisia

1.1 Agriculture in the overall economy

While declining over time as the other sub-sectors are growing, the agriculture and forestry sectors continue to play important roles in the Tunisian economy, both at macro and micro levels. While no longer at the 30% level, as was the case four decades ago, the relative share of agriculture in GDP is presently around 12% (Table 1), but more importantly increasingly fluctuating. The year-to-year contribution to Tunisian GDP depends on the overall performance of the economy[1] but varies also in relation to prevailing agro-climatic conditions. During favorable years, such as the year 2011, and in view of the general slowdown in the overall economy, the contribution of agriculture to GDP could reach 14%[2], whereas in years past of severe drought, that contribution declined to about 10%.

Table 1. *Agriculture in the overall economy (%) in 2000-2010. Own calculations based on INS statistics.*

Indicator	Share of agriculture /GDP	Share of ag. exports/total	Balance of ag. trade	Overall trade balance
Average	11.8	9.3	71.1	74.2
Annual Growth rate[3]	-2,59	-2,58	-0,60	-0,16
Coefficient of variation[4]	11.7	17.5	26.3	5.3

[1] As is presently the case. The agriculture sector performance during the years 2011 and 2012 has been higher than that of the overall economy as a general deceleration process took place in the country following the political uprisings that took place in the country during that period.

[2] Final statistics are not available yet.

[3] The calculation of the growth rate utilizes the following formula. Annual growth rate = (100/T)*Σlog(Xt/Xt-1)), where T is the number of years over of which the growth is computed minus one.

[4] The coefficient of variation is not defined here in the standard statistical way, in the sense that it does not use as a numerator the usual coefficient of variation (square root of the sample variance). Instead, the mean of the sum of absolute deviations, from the mean, is used as an indicator of variability, as suggested by Norton and Hazell. For that matter, the respective comparative values using the standard statistical definition of the coefficient of variation, in this case, are 15.5, 22.2, 33.7 and 6.5. While suggesting similar relative variability as one goes from one variable to another, they are nevertheless higher.

The overall declining nature, as indicated by the negative growth rates shown above, translates however the significance of the overall downward trend in the agricultural economy. The trade balance deficit of both agricultural products and in general seem to be stabilizing as the respective annual growth rates are less significant than the performance of the entire agricultural sector. The variability in the balance of agricultural sector is about five time higher than that of the overall balance case.

1.2. Importance to rural development and employment

Available statistics suggest that important gaps exist between urban and rural areas as GDP per active worker is 47% higher in urban areas and the spread in income per head is almost four times higher as well (Table 2). As for employment, national statistics indicate that the contribution of agriculture to general employment is anywhere between 16 and 18%. The breakdown of that employment is shown in the Table 3.

Table 2. *Income breakdown (year 2002 data).*

Categories	**Agriculture**	**Rest of the economy**	**Total**
Income (GDP)			
Amount (10^6 dinars)	6.6	48.4	55 10^9 dinars
Share (%)	12	88	100
Active population[5] (10^6)	.5	2.5	3.0
Total population (10^6)	4	6	10
GDP per active *(Dinar per year)*	13200	19400	18300
GDP per head *(Dinar per year)*	1650	8100	5500

Source: INS

Table 3. *Agricultural employment (%).*

Categories	**1961-1962**	**1994-1995**	**2004-2005**
Farm operators	38	51	54
Family labour	49	42	36
Non-family labour	13	7	10
Total	100	100	100

Source: Ministry of Agriculture (2005)

By activity, livestock is leading the picture in view of its labour using character (43%), followed by tree crops (24%), then cash crops (17%) (Table 4). In terms of employment duration, livestock activities stand by far ahead of other agricultural activities with near

[5] Assuming all statistically declared active as truly active

60% of permanent demand for family labour and even in the case of occasional wage earners, with near 38%. Seasonal demand for labour is typical of tree crop activities, particularly during olive harvests. Cash crops come next with about 49%. It may be worth noting also that the cereals sector, which uses about a third of the arable land of the country, provides a limited amount of employment, in view of its increasingly mechanized nature. Food legumes provide less employment in total than cereals, obviously, but, on a hectare basis, they provide much more. The overall picture of the employment breakdown by group of activities shown below.

Table 4. *Labour generation by activity (%).*

Activity	**Farm operators**	**Family labour**		**Wage earners**		**Total**
		Permanent	***Temporary***	***Permanent***	***Temporary***	
Cereals	7,0	4.6	5.9	6.4	8.8	6.4
Food legumes	1.2	0.8	1.0	1.2	2.1	1.2
Forages	4.2	3.2	2.7	3.8	3.7	3.5
Cash crops	17.8	13.8	14.7	18.4	25.2	17.2
Tree crops	23.5	15.1	22.4	21.3	48.6	24.5
Other activities	4.3	4.1	2.9	10.9	3.6	4.5
Livestock	42.0	58.3	50.4	37.9	7.9	42.7
Total	100	100	100	100	100	100

Source: Ministry of agriculture

2. Main agricultural commodities

Main agricultural activities are typically the activities on which domestic consumption is traditionally based. The total arable land of 16 million hectares is almost evenly distributed between cereals, olive trees and other crops (other fruit trees, cash crops, etc.) (Table 5). As can be seen from the data shown below, durum wheat and barley are the predominant crops. Soft wheat is cultivated but contributes only by 25 to 30% of domestic intake of that commodity. This results from the fact soft is a fragile activity, as compared to durum and barley, in view of the climatic variability of the country. Olive oil which is a traditional activity has shifted in status as it has become more of an export one as national policy has supported imported other relatively inexpensive vegetable oils to protect the purchasing power of the consumer.

As for livestock products, their contribution to agricultural GDP is highest (close to 40%). They are made up of meat (beef, sheep, goats, etc.) and milk, which is primarily of a cattle origin. The structure of the herds is indicated in the Table 6.

Table 5. *Major agricultural activities*[6].

Crops	**Areas (10^3 ha)**	**Production (10^3 quintals)**	**Yield (Quintals/ha)**
Cereals	1457.6	17367.2	11.9
Durum	758.0	10746.6	14.2
Soft wheat	142.3	2501.4	17.6
Barley	557.4	4119.2	7.4
Dry food legumes	83.723	82490.0	9.9
Olive oil		176	
Areas	1743		0.101 ton/ha or 101 kg/ha
Trees	71206		0.0025 ton/tree or 2.5 kg/tree
Potatoes	24.8	3630.0	146.4
Forestry products			

Source: Ministry of agriculture

Table 6. *Livestock structure and production.*

Activities	**Numbers (10^3 heads)**	**Production (10^3 tons)**		**Yield (kg/head)**
Cattle	447	Meat	50.3	112.5
Pure breeds	48.5%			
Cross breeds	51.5%	Milk	110.5	247.2
Sheep	4098	49.2		12.0
Goats	825	Meat	9.6	11.6
Poultry				
Meat		151.0		
Eggs (10^6 units)		1566.3		

Source: Budget économique, Ministry of agriculture

3. Agricultural sector structure, farm structure and ownership

As in many developing nations, land tenure is highly fragmented in Tunisia, with 53% of the holdings of less than 5 ha but cultivating only 9% of the agricultural land (Table 7). At the same time only 3% of farmers have access to more than 45% of the land.

[6] Units are indicated in the first row of the table unless otherwise specified.

Table 7. *Farm structure in Tunisia.*

Farm size (ha)	% of total area			% of total holdings		
	1976	1980	2005	1976	1980	2005
< 5	6	6	9	41	42	53
5-10	11	10	12	23	22	20
10-20	16	18	17	20	20	15
20-50	21	23	23	11	12	9
50-100	12	12	11	3	3	2
> 100	34	24	26	2	1	1

Source: Enquête structure, Ministry of Agriculture (2005)

Irrigation

Investment in irrigation has been among the top priorities of Tunisian public authorities in view of the general aridity of the country. Irrigated areas have increased over the years (Table 8). They stand at about 450 000 ha, i.e., 7 to 8% of the total agricultural land.

Table 8. *Irrigated perimeters (10^3 ha).*

Year	Irrigable	Irrigated	Percentage of irrigated (%)
1997	372	317	85.2
2000	376	301	80.1
2003	397	314	79.1
2006	428	344	80.4
2008	435	362	83.2
2010	457	391	85.6

Source: Ministry of Agriculture (2010)

As appears from these numbers, the intensification through irrigation does not seem to be dependent only on the creation and expansion of irrigated perimeters, in spite of the existing public incentives (subsidized irrigation water and irrigation equipment along with machinery). It presumably depends on other factors such as credit availability, marketing facilities of produce, technical knowhow, and adequate insurance programs to help farmers manage risk and uncertainty, in addition to socio-economic structural constraints; chief among these is the generally limited size of farming operations.

Other inputs

By and large, agriculture in Tunisia has moved over decades past into the mechanization intensive mood. As a result, animal traction has, to a large extent, disappeared from the country along with the animals that used to serve for that purpose. Camels and camel

raising activities have become hardly visible, except for tourist entertainment. This was encouraged initially by inexpensive world energy prices during the sixties and early seventies as well as by public incentives that were put into place to cope with increases in those same prices, following the energy crisis that occurred later on during the seventies and onward.

Apart from the increasing costs of energy sources, excessive use of mechanization in cultivation practices has proven to be detrimental to soil both quantitatively (erosion) and qualitatively (fertility). An apparent return to traditional techniques of soil cultivation by using animal traction in view of its suitability, particularly to small scale farming conditions, along with a drive into other resource conservation techniques using limited or no tillage is increasingly observed in the country.

4. Policy framework related to sustainable development in Tunisia

As in many developing countries and for social considerations for the most part, Tunisia has adopted the inexpensive food policy approach by subsidizing staple food commodities at the consumption level, namely the cereals products, sugar and vegetable oil. This translated into much higher consumption levels of these products than otherwise would be the case.

At the same time, nominal prices at the production levels were maintained constant during decades which, together with fluctuating production resulting from climatic conditions, led to increasing import needs of these products. This was also encouraged by stability in world prices during a long period of time.

One can see almost six-fold increase in budget expenditures on imported wheat (Table 9), as compared to average expenditures during the period 2000/06, all for the sake of maintaining domestic wheat prices at their levels prior to the rising in their respective world levels. This has resulted in a revision in domestic cereals producer prices which were increased on three different occasions, the third one of which was then called exceptional measure, meaning transitory, but in reality more likely to be permanent.

Table 9. *Public budget outlays on the main cereal products (106 dinars).*

	Average 2000-2006 (1)	**2007/08 (2)**	**(2)/(1) %**	**2009**
National production	82.8	101	+ 22.0	215
Durum	65.3	73	+ 11.8	179
Soft wheat	17.5	28	+ 60	36
Imports	82.0	557	+ 579	345
Durum	28.8	264	+817	197
Soft wheat	53.2	293	+ 551	148
Total wheat	164.8	658	+ 299	560
Total cereals	170	723	+325	640

Source: World Bank, May 2009

Price and income support policies

The preservation of income purchasing power of both consumers and producers will in all likelihood be at the center of future economic policies. Trade-off, however, will be searched by public decision makers between the need to promote economic growth, which implies the reduction in inefficiencies that may result from increasing bureaucratic running of the economy, and the necessity to promote social stability through reductions in inequities.

As a specific possible measure to sustain incomes for low income segments of the population (in agriculture and outside) there will be the activation of the minimum wage laws either by increasing their levels significantly or via enhancing their scope. Other policy measures that are likely to be designed and implemented will aim at identifying specific incentives to encourage inland, as opposed to coastal, investment.

Input use policies

They are related to the above point dealing with price and income support policies. The recent past has been marked with a quasi-elimination of subsidies on farm inputs, in line with the WTO guidelines, with the exception of irrigation water and some farm equipment. In spite of this public rhetoric, many forms of aid still exist: special subsidies to equipment (machinery and irrigation), livestock breeding, insurance programs, subsidies to agricultural investments, promotion of organic farming, etc. What will future agricultural policy bring in terms of new orientations is hard to tell at the moment.

From the reading one makes of the political rhetoric expressed by the numerous political parties competing for elections and the across-the-board bold promises being

made, it is unlikely that the process of opening up of the economy on the rest of the world, in line with the WTO guidelines, will be enhanced in the near future to come.

Rural development policies

There is a major concern in Tunisia now that the inland rural areas have not had their fair share in terms of rural development promotion, in comparison to urban and coastal ones. Besides, there is increasing evidence that poverty in rural areas may turn out to be much more critical than the generally favorable picture based on previous statistical aggregate indicators revealed.

Indeed, it is now publicly admitted that quite a bit of variation surrounds the national average publicly announced of 3.8% at the end of the year 2010. It appears that the spread around that average goes as high as 12% (INS), and may even exceed 20% in some places of the country, according to some unauthorized sources.

Recent rural development policy concentrated on improvements in rural infrastructure (roads, schools, health facilities, drinking water services, extensions of irrigated areas, etc.). Where agricultural occupation is limited by farm size and/or other constraints, financial injections are increasingly provided by especially designed institutions such as the Solidarity Bank or ENDA Arab International. So far, these funds have been activated primarily in urban areas. It is likely that expanding such financing mechanisms and microfinance sources in general, to rural and agricultural activities, will be at the forefront of upcoming rural development policies.

Agro-environmental policies

In view of the aridity of the Tunisian climate, natural resource (soil and water) preservation will certainly continue to be at the center of future policies, as it has been in the past. Conservation programs and their corresponding budgets have hitherto been geared towards water mobilization through dams and hill reservoirs construction, in the case of water, and erosion breaks and brakes, in the case of soil.

Efficiency considerations along with maintenance problems of these conservation projects, along with limited budget resources, are raising new questions as to their economic and environmental relevance. Alternative techniques of resource conservation based on relative soil immobilization through reduced tillage, or absence thereof, are being contemplated and experimented.

On the basis of international information and experience, it appears that these techniques could enhance and stabilize farm incomes through the reduction of negative

externalities generated by excessive mechanization at the farm level, such as soil and water erosion. Conservation agriculture is also bound to have positive environmental impacts outside specific farm boundaries by better harvesting rain water runoffs, thus better protecting and valuing water catchments and possibly protecting neighbouring infrastructure facilities such as roads, both in rural and urban areas.

Infrastructure policies

By and large Tunisia has a fairly adequate public agricultural infrastructure, as compared to similarly natural resource endowed countries. Access to most areas is fairly decent but requires maintenance, in most cases.

Perhaps among the most lacking aspects of infrastructure in Tunisia is the one that could facilitate marketing services (internal and external). This includes transport means and refrigeration centers to store, package agricultural produce and mitigate marketing power that may prevail on agricultural markets. The provision of such services may require the input and collabouration of farm operators through the setting up, and/or activation, of farm organizations.

Such a rehabilitation of farm organizations could turn out to be very critical as national agricultural exports are confronted with increasing competition as well as qualitative restrictions from world markets. Meeting these challenges could be facilitated through collective work effort.

Consumer policies

Support to consumers through administrative price control is not likely to disappear in a near future; particularly that the "street power" in Tunisia has proven to be strong and effective. There is however an increasing awareness that constantly pursuing cheap, or inexpensive in some cases, food policies has resulted in world record, or at least high, consumptions levels of certain products (cereals globally, bread specifically, other cereals by-products, sugar and fats).

Beyond the budgetary considerations, there is a growing social concern that these policies have resulted, or at least contributed to, increasing obesity and health problems of the population, as a consequence. Hence future prospects for public consumer policy are likely to give more attention to qualitative and safety aspects of consumption and progressively deviate from the exclusively quantitative feeding objective of the consumer that has been pursued so far.

Rural development programs

Integrated Agricultural Development Programs and Regional Development Programs involve several Development actions represent about 3.1% of the public budget allocated to rural development. The general trend of GDP in Tunisia shows an increase, in current terms, over the last decade, bringing the GDP from in 2000 34187.6 million of TND to 52593.9 million of TND in 2011.

5. Major challenges of sustainable agriculture and forestry in Tunisia

Sustainability in Tunisia is generally perceived in terms of a process by which the agriculture and forestry sector performances are increasing and exhibit declining fluctuations through time. This involves a simultaneous and integrated sustained growth of both sectors with an emphasis on resource preservation (soil, water and rangeland).

The major challenges for the sustainability come from the heavy emphasis put in years past on short term performance based on excessive intensification via subsidized farm inputs (mechanization, fertilizers, pesticides, etc.). This has resulted in near full mobilization of water resources along with soil erosion and degradation. Furthermore, medium to long term climate changes, introducing either increased temperature spreads and/or water flood frequencies, are amplifying the severity of sustainability challenges.

6. Evaluation of indicators

Agriculture and livestock

The utilized agricultural land represents approximately 5,300,000 ha, so about one third of the total country area. The arable land is near 5 million ha. Hence, the land potential allocated to agricultural activities is small.

In general, the land tenure is characterized by a big fragmentation of farms. Moreover, recent studies show that the phenomenon of fragmentation of farms in Tunisia tends to increase as a result of succession divisions, through heritage and demographic pressure. This process can be observed since the early '60s, the farms number shifted from 325,000 in 1962 to 470,000 in 1995 and 516,000 in 2005. As a consequence, the average farm size has decreased from 16 ha in 1962 to 10.3 ha in 2005. In addition, the percentage of farms of less than 10 ha reached 75%.

The average income generated per hectare is around 778 dinars, but indicates a low level of intensification and hence a low valuation of the agricultural land.

The mechanization rate in agriculture remains low, in view of the low number of machines particularly, the tractors available (1/100 ha) and accessible to users. In fact, the development of agriculture activities is still related to the efficiency of infrastructure and community facilities available to farmers. The quality of services presented by these facilities influences the willingness of producers to invest and modernize their farms.

The agriculture sector is by far the largest consumer of water in Tunisia and will remain so beyond 2030, even if the extension of irrigated areas is not subject to a rapid growth in the short or medium horizon. Tensions over water, especially in private irrigated areas, from groundwater, and competition between different sectors are serious threats to the irrigation sector, forcing farmers to the use of other water resources (e.g. marginal water).

Water resources, vital for agricultural development in Tunisia, are relatively limited. Their potential is estimated at 4,855 million m^3 (Mm^3) per year where 4,655 Mm^3 are considered exploitable. In 2010, the mobilization rate is estimated at 95% of the exploitable resources, against only 80% in 2010. As to water quality, only 50% of these resources have a salinity level less than 1.5 g/I and can therefore be used without important restriction in the agriculture sector.

Irrigated areas in 2010 are estimated at 436,000 ha (8% of the total agricultural utilized land). However, these areas represent a relatively small land allocated to irrigated crops. The water consumed by the agricultural sector reached 2,141 Mm^3 in 2010 which represents almost 80% of the total demand for water.

Therefore, rational management of water demand is considered as an important challenge to improve the management of water resources and hence agricultural development. Indeed, in terms of availability, good quality water resources are more and more scarce and limited in the medium and long term, given the weakness of the potential that can be still mobilized.

The challenges in this area consist of one hand to protect and better manage resources by reducing losses and waste (encouraging and strengthening techniques of water harvesting), and to use less quality water such as treated wastewater and brackish water. Indeed, parallel to the mobilization of conventional water resources, the development of non-conventional water resources was undertaken in Tunisia, including the

reutilization of treated wastewater for agriculture and desalination of brackish water for the particular purpose of drinking water.
In Tunisia, organic farming started in the late 1980s, but over a short period, it has developed a strategic, institutional and regulatory, framework. Area under organic farming showed a big expansion. Olive growing is the activity most concerned by organic practices, followed by the date palms, then almonds, jojoba, vegetables, medicinal and aromatic plants. Most of the production of organic produce in Tunisia is for export. However, organic animal produce still remains non-significant in Tunisia.

In order to take advantage of new opportunities provided by international markets for organic products, including olive oil and dates, and better valorize the comparative advantage of Tunisia (climate, early production, competitive prices, and proximity to European markets), the Tunisian public authorities have paid special attention to the development of organic agriculture. A series of incentives (grants of up to 70% of the cost of certification and 30% of materials for organic farming) and support have been given in order to promote the organic farming, which contributed to the recorded expansion of such activity. However, despite the growth in exports of organic products registered in recent years, the potential development of organic farming in Tunisia remains limited as yields of organic crops are low, resulting possibly from lack of technical knowhow for producers in the organic farming domain.

Many cattle and sheep herds are very small (30% of beef cattle have between 1 and 3 cows by farm and 42% of sheep flocks are represented by less than 20 females). These farms have in general low small area where the potential of feed crops is limited.

At the national level and for all crops categories, the total amount of fertilizer used is growing over the last three decades. Nevertheless, the consumption of nitrogen is very small compared to the use of Phosphate (P). While the average consumption of Nitrogen (N) at international level is almost three times that of Phosphate (P), in Tunisia the amounts of N and P do not show a big difference. The pesticides consumption shows an average use rate of 1.14 kg/ha. This level remains very low compared to other countries (Netherlands: 9.4kg/ha; France: 4.6hg/ha).

Tunisia has undertaken several actions to identify the nature and extent of needs to improve the quality and safety of food products, to enhance business competitiveness and to boost exports (National Plans for quality promotion, Upgrading programs, etc.). In this context a law adopted (Law No. 99-57 of 28 June 1999; decrees of application No. 2008-827 of 24 March 2008 and No. 2008 to 1003 of 7 April 2008) related to Controlled Denomination of Origin (Appellation d'Origine Contrôlée, AOC) and Indication of Provenance (IP) for agricultural products. Such laws aim at protecting the particularities

and specificities of agricultural products and increase their value through the adoption of official signs of quality.

At present 7 DO are registered for wine products, while 3 IP are registered for other agricultural products. An important effort is being presently carried to register other products, under the IP label. The relationships linking the specific product characteristics and specificities of a territory to a production and processing system of specific or traditional products help improve the use of existing resources, enhance quality, create added value and ensure sustainability in rural area.

Regarding the age of farmers, it should be noted that the proportion of farmers aged over 60 increased from 21% in the early sixties to 37% in 1994 to reach 44% at present. This picture reveals the influence of age and instruction level on the adoption of innovations in the agricultural sector, particularly new systems which can prove to be more sustainable.

The evolution of food consumption and its structure in Tunisia has experienced significant structural changes: the decrease in the relative share of food expenditures in accordance with the Engel economic law and the relative increase in the share of processed products. Indeed, the food budget share was near to 42% in 1975, and reached 34% in 2005. It is likely that the household consumption survey conducted in 2010, the results of which are expected shortly, show a food consumption pattern even more revealing. Over the last decades, the process of economic growth is reflected through improved living standards and materialized by an increase in real incomes. This growth is likely to alter the composition of food demand and its rhythm of evolution.

Forestry, landscape and biodiversity

Apart from the forests in the humid and sub-humid bioclimatic atmosphere where environmental conditions are relatively favorable (North, North-West and North-East), all forest areas are subject to the arid climate and poor soil constraints, in addition to human actions and their adverse effects, clearing, fires and overgrazing.

Regarding reforestation efforts over the last two decades, Tunisia seems to have been relatively successful compared to other countries in the Mediterranean region and Africa as a whole. A decline in deforestation is noted, however, over the last five years.

Tunisia contains a wide variety of natural environments that have allowed the development and enhancement of biological diversity and differentiation of continental and marine ecosystems. A great effort was implemented at a national level to include some natural area under the category of Protected Areas. At present Tunisia accounts

for 17 National parks, 27 Natural Reserves. As to wetlands, 20 sites are listed in Ramsar Convention.

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Appendix V. Country Report: Turkey

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1. The concept of sustainability and the role of agriculture and forestry

1.1. The concept of sustainability

Sustainability refers to use of the biosphere by present generations while maintaining its potential yield (benefit) for future generations; and/or non-declining trends of economic growth and development that might be impaired by natural resource depletion and environmental degradation[1].

Sustainability is generally used in relation with development to form 'sustainable development' concept that refers to development that meets the needs of the present without compromising the ability of future generations to meet their own needs[2]. It assumes the conservation of natural assets for future growth and development.

1.2. Importance and the role of agriculture and forestry in Turkey

The agricultural sector has been Turkey's largest employer and a major contributor to the country's Gross Domestic Product (GDP), exports and rural development. Turkey is an important producer and exporter of agricultural commodities on world markets.

Although its importance relative to the industrial and service sectors has been declining, agriculture still remains a key part of Turkey's society, employing about one quarter of the workforce and generating most of income and employment in rural areas. Primary agriculture's share in employment decreased from 32% in 2001 to almost 23% in 2011, but the contribution to GDP is smaller – declining, over the same period, from 11.9% to around 9.0%. Agriculture's share in total exports remains stable at around 10%.

The climatic and geographical conditions across the country permit a wide range of farming activities. Turkey is in general self-sufficient in foodstuffs. Roughly 24.4 million

[1] Glossary of Environment Statistics, Studies in Methods, Series F, No. 67, United Nations, New York, 1997.
[2] World Commission on Environment and Development (Brundtland Commission), 1987, Our Common
Future, Oxford University Press, Oxford, United Kingdom.

hectares of agricultural land gives the total amount of agricultural arable land resource in Turkey. About 67% of Turkey's agricultural land is sown field area, 17% is fallow and remaining land area is devoted to vegetables and fruit cultivation. Forest area is about 21.3 million hectares (Table 1).

Table 1. *Agricultural land and forest area (thousand hectares).*

	2008	**2009**	**2010**
Cultivated field area (sown)	16.460	16.217	16.333
Cultivated field area (fallow)	4.259	4.323	4.249
Vegetable gardens	836	811	802
Vineyards	83	479	478
Area of fruit trees	1.693	1.686	1.749
Area of olive trees	774	778	826
Total agricultural land	24.505	24.294	24.437
Forest area	21.189	21.390	21.537

Source: TURKSTAT 2011.

Although more commercial farms have been emerging, most of them still consists of small-sized holdings or family farms, and are highly fragmented. The agricultural labour force, almost half of which is women who mainly work as unpaid family labour, experiences a high incidence of poverty and poor education. Nearly two-thirds of farms are smaller than 5 hectares (ha). There are 3.1 million agricultural holdings on a total of 24 million ha of land and more than 90% of farm households have no more than 20 ha of land. Larger and more specialised farms are in general located in the Aegean and Mediterranean regions of Turkey.

Subsistence and semi-subsistence farming is an important feature of Turkish agriculture. These types of farms are characterised by low productivity, high hidden unemployment and low competitiveness. However, they have crucial importance for providing income security and livelihood to the majority of rural population. Farms at all sizes are fragmented, with nearly one-quarter consisting of six or more disjointed parcels. Average parcel sizes have continued to decline in recent decades, largely due to Turkish Inheritance Law.

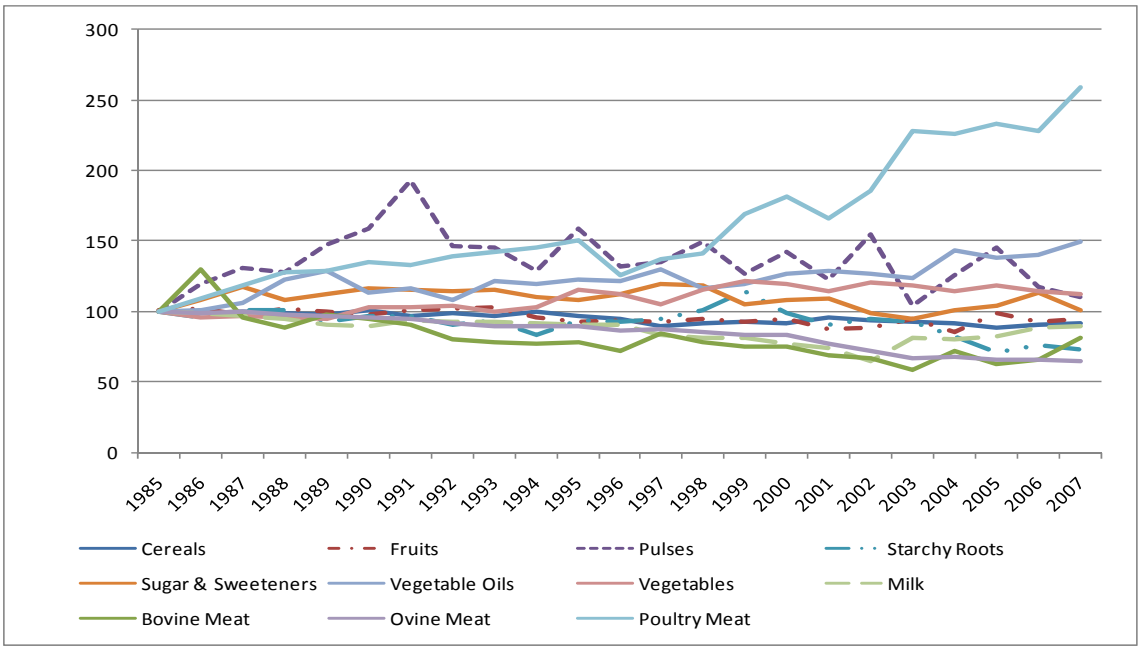
The average cultivated area per holding is about 6 ha and remained almost unchanged between 1991 and 2006 (6.1 ha in 2006 as compared to 6.0 ha in 2001 and 5.8 ha in 1991). The structure and specialisation of farms correspond to the social and economic conditions in rural areas as well as the climatic conditions[3].

[3] OECD. Evaluation of Agricultural Policy Reforms In Turkey, Paris, TAD/CA/APM/WP(2011)1, March 2011.

1.3. Self-sufficiency

Regarding to FAO statistics[4], the change in the food supply per capita in Turkey shows the change of the capability and capacity of countries' agriculture sector to nourish her households. The per capita supply of poultry meat has sharply increased over time, while that of bovine and ovine meats have decreased since 1985 (Figure 1). Per capita supply of milk has gradually increased since 2002 after a ten-year downward trend, while that of cereals, sugar and fruits' have remained relatively stable. The per capita supply of vegetables has slightly increased and that of vegetable oils is better compared to the beginning of 1990s. The trends of per capita supply of starchy roots and pulses are downwards compared to ten years ago.

Figure 1. *Evolution of per capita food supply, 1985-2007 (1985=100).*
Source: FAOSTAT



To support the situation that is revealed above, the self-sufficiency situation for field crops can be examined (Table 2).There is an ongoing deficit for oil crops and maize, while for pulses it seems to decrease over time. Wheat is close to the self-sufficiency level, while rice is in deficit. As an important starchy root, potato is self-sufficient. Although, the self-sufficiency ratios for livestock have not been calculated by Turkstat, according to OECD[5], most livestock products are near self-sufficiency levels. However,

[4] FAO. FAOSTAT,Commodity Balances, viewed at: www.fao.org.
[5] OECD. Evaluation of Agricultural Policy Reforms In Turkey, Paris, TAD/CA/APM/WP(2011)1, March 2011.

as it was mentioned before in the previous sections, consumption of meat and meat products are much lower than in most developed countries and red meat importation was started in 2010 in order to decrease rising domestic meat prices. That increase is probably a matter of supply deficit rather than a speculative action in the market.

Table 2. *Self-sufficiency ratios for crops (%).*

Crops	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10
Wheat	106,5	94,3	96,4	98,4	106,3	120,6	99,8	96,5	94,5	114,8
Maize	73,8	64,9	65,8	66,9	85,8	93,2	86,5	81,4	79,9	80,0
Rice	41,3	40,6	35,7	69,3	49,0	63,8	71,3	60,5	75,7	60,5
Sunflowerseed	70,1	43,2	84,8	52,9	51,6	40,3	56,9	38,3	46,6	49,4
Sugar	144,2	115,5	127,7	104,8	108,9	115,4	95,2	97,8	112,8	113,2
Dry beans	95,5	92,1	106,4	113,5	86,6	82,7	86,2	70,9	83,7	78,8
Chickpeas	115,7	131,8	134,2	148,3	127,0	122,6	124,7	121,0	127,7	118,2
Potatoes	101,9	101,1	101,6	103,8	101,6	99,1	102,9	104,6	100,6	100,2

Source: Turkstat[6].

1.4 Forests

The forests of Turkey can be classified into three types depending on the properties of their ecosystems: humid forests, semi-arid forests, and forests at zones of transition from forested areas into steppes in the arid regions. Forests can be further classified by ecological region, to wit the Mediterranean, Eastern Black Sea, and Western Black Sea ecological regions. According to the type of forest trees, forests can be classified into two types: coniferous forests and deciduous forests. There are also forests with a mixture of these two types. Depending on the mixture, they may be referred to as pine, cedar, fir, beech, or oak-beech mixed forests. While the mountain forests and alpine meadows with high endemism characterize the Eastern Black Sea Region, the Western Black Sea Region has deciduous forests of woody species. The world's largest natural cedar forests, on the other hand, are located in the Taurus Mountains in the Mediterranean Region. These ecological region forests are considered to have high endemism ratios as they contain large numbers of endemic plant species. In the Aegean and Mediterranean Regions, there are humid, semi-humid, coniferous, and dry forests (oak, black pine, and red pine), besides the shrubs and maquis.

About 27% (21 million ha) of the land area of Turkey is officially recognized as forestland. In the forest ecosystem of Turkey, degraded forests and coppice-land make up close to 52 % of the total forestlands of the country. The forests of Turkey are notably rich in terms particularly of biodiversity, structural characteristics and types of forest trees. In these forests, 5 pine species, 4 fir species, 2 species each of beech, hazelnut, elm,

[6] Turkstat. Agricultural Commodity Balances, 2011,viewed at:http://www.tuik.gov.tr/bitkiselapp/tarimdenge.zul

hornbeam and ash, about 20 oak species, 10 maple species, 5 birch species, and numerous subspecies grow naturally.

There are more than 8 million forest villagers living in 17,797 forest villages in Turkey. Studies show that between the years of 1937-1995, 200,000 ha of forestland (around 1 % of total forests) have been cleared and converted into farmland, mostly through illegal ways and means, and 27,000 ha of forestland have been converted into settlement areas.[7]

2. Policy framework related to sustainable development in Turkey

Main policy framework stands on harmonisation of Turkey's agricultural policies and institutional framework with those of the EU after the start of negotiations for the full membership of Turkey to the EU. For example, agro-environmental issues attained more prominence with the process of EU accession negotiations, as the adoption of the EU's *acquis* emphasises the integration of environmental concerns and good practices in land management and rural development, in general. In the area of rural development, the EU's Instrument for Pre-Accession Assistance on Rural Development (IPARD) is foreseen to facilitate Turkey's gradual alignment with the *acquis* concerning the EU Common Agricultural Policy (CAP). Moreover, the changes in the legislation concerning environment create new conditions for the agricultural sector. These changes are generally caused either by the international agreements or by the EU compliance efforts.

A number of policy documents are the references of Turkish governments to maintain sustainable agricultural production and environmental protection via monitoring the situation of agriculture, food and sustainability in the country and announcing the policy framework. These references are development plans, annual programs, laws and policies in implementation.

2.1. Development Plan

Fulfillment of international obligations in the framework of the principle of sustainable development, raising levels of self-sufficiency, usually for food security grounds, has been the objectives of the environmental and agricultural policies set out in the government's Development Plans. In the latest Plan, namely Ninth Development Plan (2007-2013)[8] of Turkey, under the pillar of 'Increasing Competitiveness' and in the

[7] http://www.cbd.gov.tr/documents/Conservation_Biological%20Diversity-yuhannesburg.pdf
[8] SPO. Ninth Development Plan (2007-2013), 2006.

section "Protecting the Environment and Improving the Urban Infrastructure" it is stated that 'conditions for protection and utilization of natural resources will be determined by taking the needs of the future generations into consideration and environmental management systems will be established in order to ensure equitable utilization of natural resources by everyone'. Further, it is aimed that 'fulfillment of international obligations will be realized in the framework of the principle of sustainable development and the principle of common but differentiated responsibility' and 'agricultural, environmental and technological policies will be assessed in an integrated manner in order to minimize the risks related to bio-security'.

In another section, namely, "Improving Efficiency of the Agricultural Structure" it is stated that 'achieving food security and safety and sustainable use of natural resources will be taken into account in creating an agricultural structure that is highly organized and competitive'.

Additionally, in another pillar 'Ensuring Regional Development' it is said that "it will be ensured that the operation and management of irrigation infrastructure is realized with participatory mechanisms, programs targeting producers will be implemented for efficient and sustainable utilization of soil and water resources."

2.2. Medium Term Programme[9]

The three-year MTPs are policy documents in between long-term plans and annual programs. In the "Protecting the Environment and Improving the Urban Infrastructure" section; sustainable utilization of natural resources are stated to be ensured through studies for protection, improvement and productive use of natural resources, particularly for biodiversity. It is also aimed that actions in the context of climate change mitigation will be carried out within the National Climate Change Strategy framework.

In the "Improving Agricultural Structure" section of the latest Medium Term Programme (2012-2014) the basic objective in the agricultural sector is to develop a well-organized and highly competitive structure by taking food security and safety concerns into account along with the sustainable use of natural resources. Additionally, other actions taking place in this document are; methods and means for preservation and effective use of land and water resources will be given priority, the scale of agricultural holdings will be increased via land consolidation efforts and required legal arrangements, and forests will be protected and exploited within the approach of

[9] SPO. Medium Term Programme (2011-2013) viewed at: www.dpt.gov.tr

sustainable management; afforestation, rehabilitation and urban forestry will be improved; activities against desertification and erosion will be accelerated.

2.3. Annual Programme[10]

The Annual Programme is the annual implementation handbook of Development Plan and MTP for the government. The objective for the environmental sector in this document is given as to achieve a sufficient environmental protection level through the protection of human health, natural resources and aesthetic values, as well as to make cities clean and safe places offering high quality of living in line with the principles of sustainable development. Moreover, the related work for the realization of given objectives are summarized along with the expected future developments.

In the same document, the primary objective for the agricultural sector is given as: to ensure food safety and security, and establish an organized and highly competitive structure while observing the sustainable use of natural resources. The ongoing work and measures are summarized under the relevant headings related to this sector.

2.4. Law on Agriculture

Law no. 5488 on Agriculture compiles the agricultural targets and support policies to reach them. In the Law, the priorities are; increasing agricultural production considering total demand, conservation and development of natural and biological resources, increasing efficiency in agricultural supports, improving food security and safety conditions, improving producer organizations, strengthening of agricultural markets, ensuring rural development. Agricultural support tools are used to sustain agricultural production as well as environmentally based agricultural land utilization.

2.5. Law on Veterinary, Phytosanitary, Food and Feed

Law no. 5996 of 2010 aims the Turkish food safety legislation to comply with that of the EU. In this context, the secondary legal arrangements on the use of pesticides and other environmentally harmful material that are utilized during agricultural production are put into force according to the relevant provisions of the Law.

[10] SPO. Annual Programmes viewed at: www.dpt.gov.tr

2.6. The Environmental Law

The Environmental Law no. 2872 of year 1983 aims at the protection of the environment, the common asset of all living things, in accordance with the principles of sustainable environment and sustainable development, determines and provides for the basic principles related to protecting and improving the environment and preventing its pollution. Law 5491 of 2006 Amending the Environment Law states the importance of protecting biological diversity and introduces penal sanctions against damage to the environment, including the destruction of biological diversity, when detected through inspection and audits.

2.7. The Forest Law

The Forest Law no.6831 states principles concerning forest management such as the planning, operation and conservation of forests. Protection forests, gene protection forests and seed sources are also designated under this Law.

2.8. The Soil Protection and Land Use Law

The Soil Protection and Land Use Law no. 5403 of 2005 sets the procedures and principles to ensure the conservation and development of soil by preventing its loss and degradation through natural or artificial ways and the planned use of land in accordance with the principle of sustainable development with priority for the environment.

2.9. The Law on National Mobilization for Afforestation and Erosion Control

Law no. 4122 of 1995 and the Regulation on Afforestation specify principles and procedures concerning the activities of afforestation and erosion control to be undertaken by governmental agencies and natural and legal persons in order to enhance the forest area and forest wealth, to restore and improve the balance between soil, water and plants, and to protect environmental values. The Regulation sets specifically the principles concerning the activities of afforestation, erosion control, pasture improvement, tree improvement, seed production, nursery and energy-forest establishment, development and restoration to be undertaken in accordance with the provisions of Forest Law 6381[11].

[11] The National Biological Diversity Strategy and Action Plan, Ministry of Environment and Forestry, 2008.

2.10. Agri-environmental policies/programs

National Rural Development Strategy

The NRDS was prepared within the context of economic and social harmonisation of Turkey to EU standards in the framework of the accession. It has been prepared in conformity with the National Development Plans and with the view to harmonisation with the EU's rural development policy – and provides the first rural development strategy plan for the country.

The main goal of NRDS is to develop and ensure that the sustainability of the living and job conditions of the rural community in their territory is compatible with that in urban areas, on the basis of utilising local resources and potential, and protecting the rural environment and natural and cultural heritage.

Four strategic objectives are identified and one of them is the *protection and improvement of the rural environment* by improving environment-friendly agricultural practices, protecting forest ecosystems and sustainable utilisation of forest resources and the management and improvement of protected areas.

These strategic objectives and priorities are compliant with the EU's rural development objectives. For example, in addressing the needs of agriculture and the wider needs of rural society in a sustainable way, the NRDS adopts a cross-sectoral, holistic approach for the development of rural areas. Its approach also aims at coherence with the strategy of the EU for rural areas. Like the EU, the NRDS sets priorities for the next programming period to improve the competitiveness of the agriculture, forestry and food sector. It also aims at improving environmental conditions and the quality of life in rural areas as well as diversifying rural economy and strengthening local capacity building.

Rural Development Plan (2010-2013)

Rural Development Plan (RDP) prepared on the basis of the NRDS which lays out Turkey's policies and strategies in the rural development area for the remaining of Ninth Development Plan Period. The actions and activities identified along the NRDS, form the basis of the RDP.

Main contribution of NRDS is foreseen to improve the work and living conditions of the rural population by using the human and natural resource potentials in a sustainable development approach. In the Ninth Development Plan, rural development has been assessed in the regional development context and with a multi-sectorial and horizontal

structure. On rural areas, rural development, which contains all the components of rural development and thus foresees not only agricultural production but also non-agriculture interventions, is a process of coordination, organization. Thus, one of the main necessities of RDP is to ensure the coordination between sectors. This process requires the joint planning and practicing of investments and services directed to improve the living conditions of the rural population.

The main framework of the goals and priorities are same as that of NRDS. In the details, RDP puts additonal priorities on improvement of irrigation infrastructure, agricultural land management, enhancement of producers' organizations andretaining sustainable agriculture.

Agri-environmental programmes

Agri-environmental programmes in Turkey are limited. The Environmentally Based Agricultural Land Protection programme (CATAK) is the first programme to be specifically targeted at addressing the negative impacts of agricultural practices on the environment. The CATAK programme has some similarities with EU agri-environmental measures in rural development programmes. The objectives of the Programme were to protect the quality of soil and water resources in agricultural lands, to ensure the sustainability of renewable natural resources and to decrease the adverse effects of intensive agricultural activities. In the area of rural development, the EU's Instrument for Pre-Accession Assistance on Rural Development (IPARD) will also facilitate Turkey's gradual alignment with the acquis concerning the EU Common Agricultural Policy (CAP). Further, the IPARD programme includes provisions for the implementation of pilot agri-environmental measures.

The National Environmental Action Plan

Economy-wide environmental policies also affect agriculture. The National Environmental Action Plan, which came in force in 1998, provides for national and regional plans to generate information to combat land desertification and reduce discharges of nutrients, and stipulates a number of regulations designed to control water and soil pollution, and protect biodiversity. A Nitrate Directive was adopted in February 2004, as part of the goal to harmonise with EU policies, but there is still a need to define the responsibilities of the organisations defined under the Directive. The Regulation on Water Pollution Control (1988) defines water quality criteria according to the purpose for which the water is destined, including treated waste-water used for irrigation.

There are also several initiatives underway to implement various EU Environmental Directives, such as the Habitats and Birds Directive, and the Water Directive. In the

context of adopting and implementing the EU Water Directive, the Regulation on the protection of water from nitrate pollution caused by agricultural resources was put into force in 2004.

Turkey's National Biological Diversity Strategy and Action Plan (NBSAP)

Turkey signed the Biosafety Protocol, which was prepared within the framework of Convention on Biological Diversity, on 24 May 2000. Turkey's National Biological Diversity Strategy and Action Plan (NBSAP) was prepared in 2001 under the coordinating role of the Ministry of Environment, with the intention that it should serve as a guide in implementing the Convention on Biological Diversity in harmony with other obligations and in addressing the problems caused by the loss of biological diversity. The NBSAP was updated in 2007 under the "Biological diversity Convention Implementation Project" conducted with UNEP/GEF grant support.

As a Party to the Convention on Biological Diversity, Turkey made commitments regarding the conservation of biodiversity at national and global levels, and therefore acknowledged the vital value and the socio-economic significance of biodiversity. Turkey took upon itself the responsibility of achieving the objectives of the Convention, which are conservation of biodiversity, sustainable use of its components, and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources. The five-year development plans, the National Environment Strategy and Action Plan, the National Strategy and Plan of Action on Biological Diversity, and national and international laws and regulations are the main documents guiding the policies and implementations in Turkey.

The National Plan of Action of Turkey to Combat Desertification

National Action Programme to Combat Desertification (2005) aims to determine the leading factors to desertification and the necessary measures to be taken to prevent and/or to reduce the negative impacts of desertification and drought were delivered to all related institutions by the Ministry. Programme will serve to prevention and/or reduction of the negative impacts of desertification and drought which create threat for the land, soil, water, flora, fauna and other natural resources of the country, as a result to secure the sustainability of development[12].

[12] http://www.unccd.int/ActionProgrammes/turkey-eng2006.pdf

Turkish National Forestry Programme (2004-2023)

The programme aims: to address forestry issues from a broad viewpoint within the framework of sustainable development; to plan and carry out forestry activities paying the required attention to changes both in the society and in expectations from forests, which expectations are multi-sided, and to developments; to build appropriate capacities and mechanisms to enable the preparation, implementation, monitoring, evaluation and development in a participatory manner of development policies and strategies for the forestry sector; to promote a positive relationship between forests and people and make it widespread; to promote harmony and relations between the forestry and other sectors; to raise awareness and strengthen interest, involvement, contribution and support of both the community and the interest groups to achieve a forest management, conservation as well as sustainable development of forests with a view to the country's balanced and sustainable development; to improve and strengthen the living conditions of the actually poor and forest dependent forest villagers living either in or around forests and therefore achieve a multi-sided benefit from forests by way of enhancing a multi-functional and participatory forest resources management; and to achieve maximum use of both local and foreign financing sources for the forestry activities[13].

Other

A number of regional development projects, most of which are partly financed by international development agencies and donors, aim at reducing the impacts of agriculture on the environment. The Southeastern Anatolia Project (SAP), which is the largest regional development project in Turkey, involves, among other objectives, expanding agricultural production in the region through building 22 dams and providing irrigation infrastructure for 1.7 million ha of land. The Anatolian Watershed Rehabilitation Project, jointly supported by the EU and the World Bank with funding of TRY 65 million (USD 45 million) over 2004 to 2012, aims at the restoration of degraded soils in order to increase farm and forestry production, and supports the monitoring and reducing agricultural water pollution in the lower parts of watersheds.

[13] www.ncsa-turkey.cevreorman.gov.tr; http://web.ogm.gov.tr/diger/biyocesitlilik/Sayfalar/default.aspx

3. Pressure on environment created by the agricultural activities

The key environmental concerns relate to: soil degradation, especially from erosion; over-exploitation of water resources; water pollution, including salinisation from poor irrigation management practices; and adverse impacts of farming on biodiversity[14]. The most widespread form of soil degradation is erosion, with approximately 86% of land suffering from some degree of erosion, mainly caused by water. Turkey loses as much as 1 billion tonnes of topsoil annually. The main causes of these elevated rates of erosion include: natural conditions, especially climate and steep topography, and mismanagement of cultivated land (e.g. inappropriate tillage; stubble burning; abandonment of rural infrastructure; especially terracing and inappropriate or excessive irrigation); deforestation (forest degradation due to forest fires; over-harvesting; illegal cutting; misuse of fuel wood or clearing of land for farm and urban uses); over-grazing and stubble burning in some regions.

Even though livestock density is less than half the level of European OECD member countries, over-grazing and other inappropriate pasture-management practices have left about 60% of rangelands prone to erosion, especially in the Aegean and Marmara regions. The eastern part of the country is less prone to erosion, as pasture is dominant[15].

Other forms of soil degradation are an estimated 6% of arable land suffering yield limitation due to salinization, and a further 12% being affected by waterlogging. Inappropriate irrigation and fertiliser-management practices, as well as excessive water extraction have been important causes of soil salinity in some areas, with the problem rapidly escalating in parts of the area under newly irrigated regions[16].

There are two aspects to the impact of agriculture upon water resources: agricultural water use and agricultural pollution. Water use is one of the most critical environmental issues facing Turkey. The pressure on water resources is increasing over time, as a result of global climate change; alterations in water consumption habits due to increasing socio-economic development and growing urbanisation; and the increasing demands of agriculture and the tourism industry.

[14] OECD. "Turkey Country Section", in *Environmental Performance of Agriculture since 1990*, Paris, 2008: www.oecd.org/tad/env/indicators.

[15] OECD. Evaluation of Agricultural Policy Reforms In Turkey, Paris, TAD/CA/APM/WP(2011)1, March 2011.

[16] OECD, 2008 op. cit.

Irrigated agriculture currently consumes 75% of total water consumption, which corresponds to about 30% of renewable water availability[17]. The irrigated area has increased by about 2.5 times since the 1970s. The objective of the General Directorate of State Hydraulic Works (DSI) is to increase the irrigated area from 5.1 to 8.5 million ha of irrigated land by 2020s. Around 35% of the water used for irrigation is derived from groundwater. Over-pumping of groundwater for irrigation is a major problem and many aquifers are being exploited beyond their natural recharge rate, especially in the Mediterranean region, which is a matter of concern, as two-thirds of the drinking water in the region is supplied from groundwater.

Agricultural pollution of water bodies from nutrients is a concern in specific parts of Turkey, such as the Aegean and Mediterranean regions. In agricultural areas, 2.5% of monitoring sites exceed recommended drinking water standards for nitrates in groundwater. However, inorganic fertiliser application appears to be below requirements, with national nitrogen fertiliser-use estimates at 65% below soil requirements and national phosphorus fertiliser use at 45% below requirements[18].

The intensity of pesticide use is low compared with developed countries. Horticultural production in irrigated areas of the Marmara, Aegean and Mediterranean regions accounts for a high value of pesticide use.

Turkey has a very rich biodiversity, but is coming under growing pressure from agriculture, although the impacts are poorly monitored. The increasing pressure on biodiversity is mainly due to intensification in fertile areas, with greater use of agro-chemicals, and construction of large rural development projects that alters the ecology of entire regions (e.g. SAP).

Farming accounts for around 6% of total national agricultural greenhouse gas (GHG) emissions. In Turkey the main agricultural and livestock production activities causing GHGs can be described as follows: livestock production; use of fertilisers; stubble burning; and to a lesser extent rice production. Agricultural GHG emission reductions are largely explained by the decrease in cattle, sheep and goat numbers (lowering methane emissions), partly offset by higher fertiliser use and crop production. With the projected expansion of agricultural production up to 2016 and rising direct on-farm energy consumption, it can be expected that agricultural GHG emissions may rise[19].

[17] Çakmak, E. *Agricultural Water Pricing*: Turkey, OECD, Paris, 2010.
[18] OECD, *Environmental Performance Review of Turkey*, OECD, Paris, 2008.
[19] OECD. Evaluation of Agricultural Policy..., March 2011.

4. Climate Change Mitigation and Adaptation Plan

National Climate Change Strategy (NCCS) Paper (2010-2013), which sets out reduction, adaptation, technology transfer, finance and capacity improvement policies within the framework of the principle of "common but differentiated responsibilities" for the response of Turkey to climate change in line with sustainable development policy, was approved by the High Planning Council on 3 May 2010.

Since Turkey is in the Mediterranean region, which is expected to be especially affected by climate change as described in the Forth Assessment Report of International Panel on Climate Change (IPCC), the National Adaptation Strategy (NAS) on climate change, in line with NCCS, is under preparation. The NAS is developed through a participatory process and based on country-wide vulnerability assessments.

The project on Turkey's adaptation to Climate Change, implemented by the Turkish government and the United Nations Development Programme (UNDP) has now been completed in 2007.

The survey, which was a pioneering study in this field, shows how Turkey is affected by climate change, especially in the form of water resource shortages and draught, and in agricultural and health sectors. The project includes Turkey's future projections and analysis on greenhouse gas emissions and the energy sector. In the scope of the project, the possible impacts of climate change were analysed and an inventory of the greenhouse gas emissions was prepared. The study also includes projected emission calculations until the year 2020. While alternative energy scenarios were evaluated in the context of the project, preventive measures to reduce greenhouse gas emissions were also researched; and public awareness raising campaigns were conducted.

This report is the first National Communication on Climate Change that Turkey needs to prepare regularly, as a party of the UNFCCC she signed in 2004[20].

In 2012, Turkey aims at finalizing its first 'National Climate Change Action Plan' (NCCAP) in line with NCCS and NAS. The NCCAP is developed through a national consultation process under the joint coordination of Ministry of Environment and Forestry and United Nations Development Programme (UNDP) in Turkey.

Undersecretariat of State Planning Organization has completed a report on the Identification of Rational Steps in the Field of Global Warming (KARAR) project, which was executed to determine the economic impacts of emission reduction in Turkey.

[20] http://www.undp.org.tr/Gozlem2.aspx?WebSayfaNo=866

Under the project, the amount of greenhouse gas emission reductions realized through policies and projects implemented between 1990 and 2006 has been estimated; medium and long-term emission reduction options have been modeled with their relevant costs, and the impacts of these costs on macroeconomics have been evaluated.

5. Major challenges of sustainable agriculture and forestry in Turkey

Some major irrigation projects, such as the SAP, have been undertaken with little consideration of environmental management or impacts, with the loss of valuable ecosystems (e.g. steppe, wetlands) and problems of salinity and agro-chemical run-off becoming widespread.

Irrigation is a threat to groundwater balance, since almost three quarters of the total freshwater extracted is used for agricultural purposes. The pressure of agriculture on groundwater is expected to continue to increase in the future, to meet growing needs of the expanding population. With the rise in demand for water from the agricultural sector, competition for water resources with other users will rise and environmental concerns may increase.

Most irrigation methods depend on gravity systems, which are characterized by low water efficiency and with as much as 60% of irrigation water being lost. Pressurized irrigation systems, however, are increasing. Farms tend to be irrigated from dams and reservoirs mainly subsidised by the government, with 1% of farmers using 15% of the irrigated land, while smaller farmers are more likely to irrigate from wells constructed at their own expense.

Considering agri-environmental issues, the absence of a widespread system of soil conservation practices has failed to improve soil quality, with over-grazing and the ploughing-up of grassland being important sources of the soil erosion. Notwithstanding the reforms, continued subsidies for water charges and electricity for pumping (and diesel for machinery) are undermining efforts to achieve sustainable agricultural water use, especially of groundwater[21].

Evidence suggests that the uptake rates of nutrient management practices are low, as many farmers have little access to necessary capital for investing in manure storage and

[21] OECD. Evaluation of Agricultural Policy Reforms In Turkey, Paris, TAD/CA/APM/WP(2011)1, March 2011.

other manure treatment technologies, and their knowledge of nutrient management practices is limited.
Moreover, Turkey is under a more special threat in terms of the long term impact of transgenic plants on plant sociology, genetic diversity of natural species, species distribution in the ecosystem, and the ecological equilibrium. This threat, which may cause a total annihilation of the existing gene resources, is very significant for biodiversity in Turkey, where the gene resources of a large number of wild plants are harbored[22]. There is a new law on Biosafety (Law no.5977 of 2010) to control the safety of imported raw or processed plant products and procedures to check the GMO content of imports. However, there is still little information on their importation and use in the country.

The economic pressures of high population growth in rural areas and the disintegration of agricultural lands due to the gaps in legislation cause the incomes of farmers to decline. This situation compels small farmers to engage in activities that threaten biodiversity, such as cutting forests to clear land, causing damage to pastures by overgrazing, and excessive gathering of plants. Unsustainable forestry policies and implementations also have adverse effects on biodiversity.

About 5.1 million ha of cultivated land are classified as 5th and 6th class by soil quality. A large portion of this land has been acquired by clearing forests and pastures. Unregulated and excessive grazing continues to damage fragile steppe ecosystems and put economic pressure on rural communities whose livelihood depends on animal husbandry.

Overgrazing, allowing goats to enter forests, atmospheric pollution, climate change, alien species, unregulated gathering of plant and animal species, hunting, damage caused by pests, forest fires and loss of forest property by illegal clearing of forestlands are the chief threats to forests, along with unresolved problems of ownership.

Another significant problem is the scarcity of specialists and technical staff in environmental protection programs in Turkey. Timing and experience factors, which are very important for biodiversity conservation, are affected by appointments and retirements when government changes hands. It is especially difficult to recruit experienced and qualified technical staff in rural areas and protected areas, where biodiversity is of much more concern[23].

[22] http://www.cbd.gov.tr/documents/Conservation_Biological%20Diversity-yuhannesburg.pdf
[23] Same web-site as footnote 22.

6. The most important factors of sustainable agriculture and forestry in Turkey

The high population movement in rural areas due to migration and fragmentation of agricultural lands due to the gaps in legislation lead to both non-economic use of agricultural resources and erosion in labour force. Income stabilizing agricultural policies and relevant changes in legislation concerning land use accompany with farmer training and education may help raising sustainability in agricultural production.

Although agriculture is not the sole source of highest pressure on water resources, the utilisation of pressurised irrigation techniques (drip irrigation), i.e. the optimisation of water drained onto fields and the careful management of irrigation, are critical issues, and practices to optimise these procedures should be adopted by farmers, as a contribution towards addressing one of Turkey's major environmental problems.

A need to make major changes to water policies in both the medium and the long run, and, as a consumer of approximately two thirds of the country's water resources, agriculture will be required to bear a significant share of the burden entailed by the necessary adjustments. Irrigation management practices to restrict water losses from the irrigation infrastructure, particularly in the high evaporation regions, need to be improved. Training farmers to adopt crop-soil-water management is of the highest importance. It has been estimated that if – instead of traditional methods – sprinkler and drip irrigation methods were utilised, farm efficiency would increase by 20% and 30%, respectively[24].

In the field of legislation, the legal framework needs to be strengthened. Several pieces of legislation and regulations have been created to address specific issues, but they do not form an integrated framework for the effective management of water resources. The existing laws and regulations do not provide definition of water rights. For example, extended periods of drought resulted in the full deployment of water resources in the western and central regions, involving the transfer of water from irrigation to domestic and industrial use[25]. The legislative arrangements should, at least, identify the levels of priority of water allocation for the intra- and inter-sectors (irrigation, municipalities, industry, fisheries, etc.).

[24] DSI, *Water and DSI, 1954-2009*,Ankara,2009: www.dsi.gov.tr/english/pdf_files/dsi_in_brief2009.pdf.
[25] Çakmak, E. Agricultural Water Pricing: Turkey, OECD, Paris, 2010.

Control of plant importation should be improved because of GMO threat and its unintended use both in agriculture and food production.
The selection and recruitment of specialists to balance the distribution of professional backgrounds will help to improve the implementation of current environmental plans and programs on environmental issues and to guarantee future developments complying the current system with the ones in developed countries.

Box 1. Case of unsustainable vs. sustainable farming systems in Turkey: Cotton production

According to Cullu[26], following the introduction of intensive irrigation on the Harran Plain (Southeastern Anatolia), a significant increase in salinity has been noted and this has been attributed to the shallow groundwater level, leading to considerable reductions in crop production. In order to determine the effect of salinity on crop yield, the soil electrical conductivity (EC) map was prepared and integrated onto the parcels using the geographical identification system (GIS). The results indicated that the major cotton and wheat areas had a high level of salinity. As expected, above the threshold levels high EC values in the soil resulted in a decrease in the yield of cotton and wheat. In another study[27], salinity is stated as an important and growing problem in the Harran Plain. Between 1997-2004 the land lost to salinization almost doubled. Primary causes are the high salinity of water used for irrigation and the continuous production of cotton (a highly water requiring crop). Crop rotation systems are seemed to be more profitable than continuous cotton production. Although some extension programs on rotation systems had been implemented, the adoption has been limited.

[26] Cullu, M.A. Harran University, Faculty of Agriculture, Department of Soil Science, Sanlıurfa, Turkey, 2002:
http://journals.tubitak.gov.tr/agriculture/issues/tar-03-27-1/tar-27-1-4-0209-13.pdf

[27] Binici,T.,Zulauf,C.R. and Cullu,M.A. Designing an intensive scheme for the adoption of crop rotation, 2007:
http://docsdrive.com/pdfs/medwelljournals/aj/2007/312-318.pdf

Box 2. Illegal logging and other sustainability problems of forestry

There are several causes of forest deforestation varying from mismanagement to illegal logging. Illegal logging has become almost the most serious and apparent threat to forest ecosystems at local, national, regional, and global level. The customary agricultural and wood cutting and gathering practices of forest villagers are unsustainable and these practices are what fundamentally cause deforestation and soil erosion in the forestlands of Turkey. Illegal logging activities, in Turkey, cover flora and fauna withdrawals, timber or other forest product smuggling, illegal tree felling, extended clear cutting, harvest without license, picking up harvest residues beyond personnel needs, wood transporting among the cities without legal permit, forestland encroachment, and so on. The common point that all those activities met is that the people have destroyed the forests illegally. According to official statistics available, since 1937, the quantity of illegal wood cut is 95,000 m^3/year industrial wood and 360,000/year m^3 firewood, totally 455,000 m^3/year. Among them, illegal tree felling is the first place in quantity extending beyond 64,000 m^3/year industrial wood and 177,000 m^3/year firewood. The second place is occupied by forestland encroachment; by this forest crime 135,000 m^3/year industrial wood and 123 000 m^3/year firewood has been illegally cut. Furthermore, some researchers estimate that illegal wood cut is more than 7 million m^3/year, which is one quarter of total official harvested woods. Besides, illegally cut fire wood is about 5-7 million m^3 according to forest experts and the industrial wood is about 150,000 m^3. If the estimate that each family living in forests consumes 7 m^3 of fuel wood for cooking and heating purposes is valid and as long as there are about 1 million families living in forests, the total quantity is about 7 million m^3 annually, which verifies the data collected by the researchers (but not verifies official statistics). However, this data is limited to just fuel wood and industrial wood fell down illegally[28]. In addition to the mentioned problem there are several other problems concerning forests. About 99% of forest fires in Turkey are caused by humans. In Turkey, an average forest area of 5,804 ha is under direct effect of forest fires annually in accord with General Directorate of Forests (GDF) statistics. Overgrazing, allowing goats to enter forestlands, atmospheric pollution, alien species, climate change, unregulated gathering of plant and animal species, hunting, damage caused by pests, and forest fires all affect the structure of forest ecosystems and threaten biodiversity[29].

[28] Gunes,Y. and Elvan O.D. The underlying causes of illegal logging activities in Turkey, 2005: http://www.fao.org/DOCREP/ARTICLE/WFC/XII/0313-B1.HTM

[29] http://www.cbd.gov.tr/documents/Conservation_Biological%20Diversity-yuhannesburg.pdf

7. Evaluation of indicators in Turkey

The data of factors and indicators that are standardly used to analyse the sustainability in different countries are seemed to be satisfactorily present in Turkey. However, a number of non-existing indicators should be calculated for Turkey in order to understand further the sustainability condition or the quality of data of a number of these indicators should be improved and updated. For example, data on good agricultural practice, nitrate in groundwater, economic function of several agricultural activities, indexes for diversity, connectance and fragmentation etc. are lacking for analysis. Further, data on agricultural labour market as well as water, energy and pesticide use in agriculture should be improved or updated in order to trace the changes in sustainability of agriculture over time.
The data of factors and indicators on agricultural activities and environment are analysed separately in two different cobweb charts below for 1995 and 2009 respectively. In Chart-1, the most interesting developments in 1995-2009 period for the agricultural indicators can be summarized as follows:

There is loss of arable land in Turkey which may be evaluated as a threat on self-sufficiency and agricultural sustainability if this land is allocated to non-agricultural use or non-environmental practices. The number of farms and employment are lessened in agriculture in a consequent manner.

Water consumption in agriculture increased as a matter of both new investments on irrigation schemes and possibly via over-exploitation of water in agricultural production.

The use of inputs like fertilizers and mechanization led by tractors increased. This is important for rising production, but may have adverse effects on environment. Shrinkage of fallow land also indicates to an increase in agricultural activities.

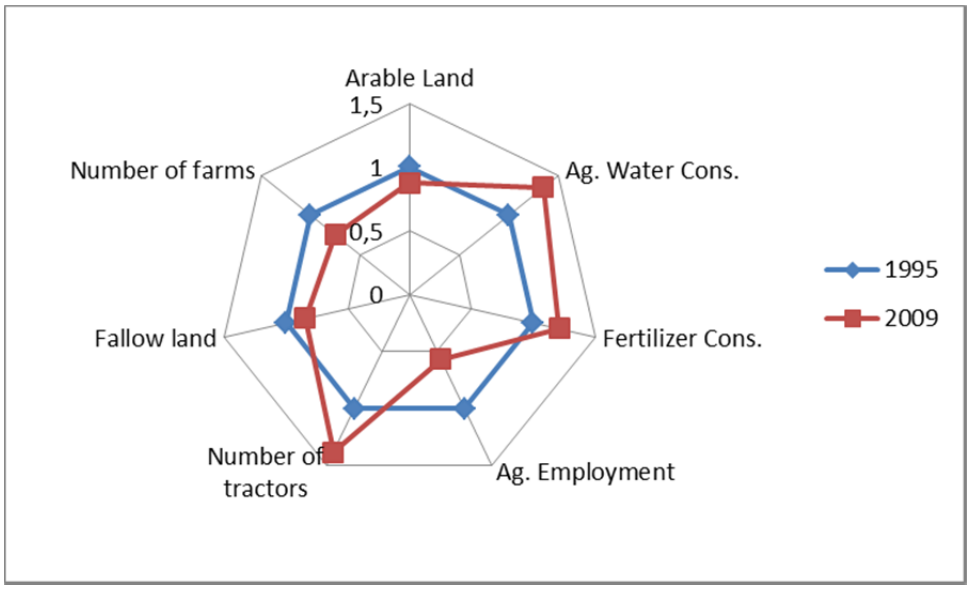


Chart-1. *Cobweb chart for selected agricultural indicators.*

Note: Agricultural water consumption figures denote 1990 and 2004 figures; Number of farms figures denote 1991 and 2006 figures.

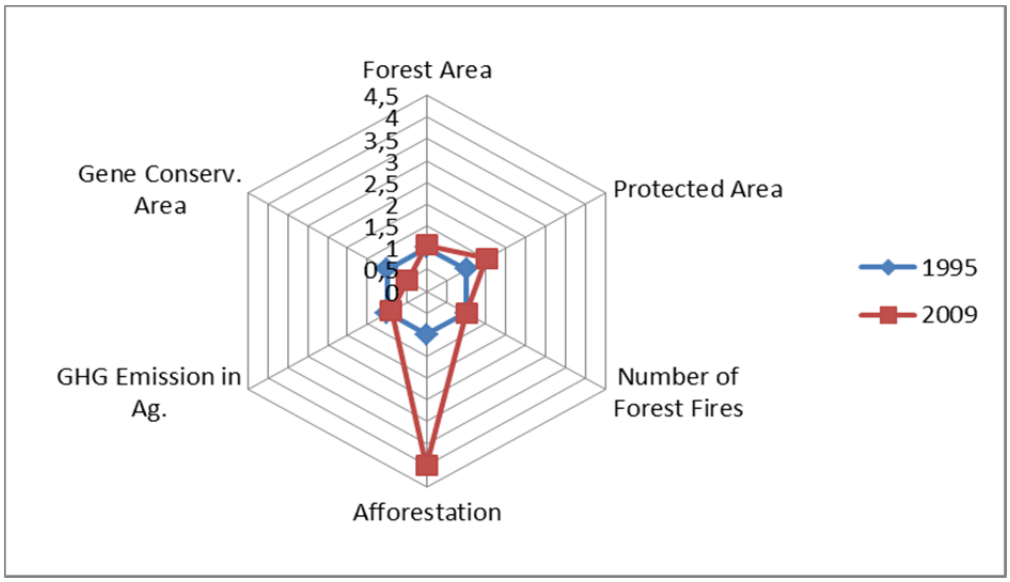


Chart-2. *Cobweb chart for selected environmental indicators.*

In Chart-2, which is for the evaluation of environmental indicators, the developments in the same period can be given as follows:

- Afforestation rate is very high and in the mentioned period afforestation increased four times.
- The size of protected area increased whereas gene conservation area diminished considering total forest area.
- Forest area, number of fires and GHG emission from agricultural activities stay the same in that period.

According to the above-mentioned assessment of the indicators, one of the priorities seems to be the update of the data that are needed to and collection of the lacking ones in order to have a thorough analysis of the sustainability in Turkey. In order to do that the relevant institutions should work in coordination and the flow of information should be guaranteed. The implementation of good agricultural practice and economic function of agricultural activities are two of the lacking-data fields. The Ministry of Food, Agriculture and Livestock and Turkish Statistics Institute are the two main institutions collecting or improving data or coordinating the related data collection, data compilation or data processing work.

Regarding to what indicators show in relation with sustainability, a number policies can be recommended to improve the current conditions. Firstly, as loss of arable land may be considered as a threat on self-sufficiency and sustainability, the Law on Soil Protection and Land Use and other relevant legislation should be implemented without exception. Water use in agriculture, which is an indicator that should be considered seriously, increased as a matter of several reasons mentioned above. The efficient use of water can be supported comprehensively and especially in water–poor regions such as central part of Turkey. In this context, the irrigation investments and supports related to irrigation are the ongoing good practices in Turkey. The use of inputs like fertilizers and mechanization led by tractors associated with decreasing fallow land indicates increasing agricultural production and rural activities. However, the probable environmental impacts should be assessed in order to have a broad idea on sustainability. As a measure of current conditions, the relevant studies can be widened and new ones can be started and further new indicators can be calculated by the authorities.

As the gene conservation area diminished considering total forest area, new policies may be taken into consideration to protect genetic resources regionally by Ministry of Forestry and Water Works. The GHG emission from agricultural activities is also an important measure of sustainability. The calculation methods and sampling of this indicator deserves to be further studied by the relevant institutions.

8. Conclusions

There is a good basis of legislation and there are a great number of policy documents on sustainability and sustainable agriculture and forestry in Turkey. All the problems attaining sustainability and carrying out sustainable agriculture and forestry are almost known. Though there are lacking data or data quality problems tracing sustainability in Turkey, the major changes and problems can be evaluated from existing parameters.

The coordination of sustainability problems and policy implementation can be improved between policy-makers and ministries. For example, in 2010 a Coordination Committee for Climate Change has been established under coordination of the Ministry of Environment and Forestry. In this committee most of the line ministries and related financial institutions are members to decide and implement national policies on the climate change.

Further, another new commission namely, National Sustainable Development Commission is formed by Ministries of Development, Environment and Forestry, Foreign Affairs and Internal Affairs for future studies on Rio+20 and development of a national strategy and plan of action on sustainable development. This commission is foreseen to be expanded to gather public and private sector, university, NGOs. These two groups related to sustainable development should coordinate relevant work in Turkey for future success on policies.

After the policies are clarified and coordination is actively elabourated for sustainable development, it would not be wrong to say that the follow-up of the policy framework and relevant data collection will be an easy process.

It is foreseen that the adverse impacts of agricultural activities and non-environment-friendly industrial practices will be going to be replaced by good practices during the membership negotiations of Turkey with the EU. The adoption of EU acquis and its full implementation especially in chapters of Food Safety, Veterinary and Phytosanitary and Environment is believed to be a chance for Turkey in the process of sustainable development.

The sustainable development indicators should be completed and closely followed in order to be transparent and comprehensive in this field.

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