CLIMATE CHANGE AND IMPACTS ON AGRICULTURE IN CYPRUS AND THE REGION

The agriculture of a region has always been highly dependent on the climate and the soil. Even though agriculture is one of the contributors to the release of greenhouse gases like methane, it is also a sector that is highly impacted by the adverse effects of climate changes. In the years to come, changes in the climate at the local level would affect the crops both in quantity and in quality, therefore affecting both the global food security .Places that receive more rainfalls have begun to be even wetter and the more arid places face longer droughts. Glacier retreat enhances the problem of water availability as the freshwater released from melting is lost and cannot be used for irrigation purposes. Rises in the temperature can lead to shorter growth cycles, therefore productivity will decrease. In addition to this, higher temperatures in combination with higher humidity favor the growth of insects and pests that are enemies for the different plants. The soil quality is threatened by desertification, flooding or sea water intrusion, all of them phenomena that decrease fertility. Apart from these agricultural adverse effects, food security and hunger would threaten the earth population, especially the developing world and economic problems would arise because of reductions in the income from agricultural activities and rises in the prices of commodities. The effects would vary from region to region and some would be positively affected because changes in the climate in these regions would make the weather milder for growth of plants. In other areas however the results would be negative, especially in the developing world where the most severe effects are likely to be observed. ftp://ftp.fao.org/docrep/fao/009/j9271e/j9271e.pdf
http://en.wikipedia.org/wiki/Climate_change_and_agriculture

Different models have been created to predict the effects and their severity in the case that actions are taken for adaptation of agriculture to climate changes or not taken. Institutions try to tackle the problem at the international level with proposals of measures to prevent any devastating effects. The World Meteorological Organization (WMO) and the United Nations Environment Programme had constituted the Intergovernmental Panel on Climate Change which is responsible for the risk assessment of climate change and for providing information on options for adaptation and mitigation. They gather the scientific information required by the different member governments in order to take decisions and imply policies in regards to climate change. The working group II of IPCC is the one that deals with the problems in the agricultural sector. Their latest report was released in 2007 with the title **"Climate Change 2007 - Impacts, Adaptation and Vulnerability"**. Chapter 5 describes the current problem in agriculture, the impacts from climate change, the global cost to agriculture and food security as well as options and capacities for improvement. More over, research gaps are identified. http://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-chapter5.pdf . In addition to these activities, IPCC is the main provider of information for the United Nations Framework Convention for Climate Change. UNFCCC is an international treaty that was formed to face global warming and it requires that the member nations run programmes to adapt to climate change. The well known Kyoto protocol is now a part of the treaty. Approaches for climate change in agriculture are investigated and proposed by the UNFCCC. FAO, the food and agriculture organization of the UN could not be missing

from such an effort to protect agriculture. FAO's work in regards to climate change is primarily to try to implement different adaptation approaches. Furthermore, by policy advice and technology transfer it provides to the public via the member countries, ways to get benefit from adaptation measures as well as to assist in the reduction of greenhouse gases emitted from agricultural activities http://www.fao.org/climatechange/49373/en/

Cyprus is located in the eastern part of the Mediterranean. It is a part of the EU but geographically it can be considered to be a part of Middle East. The Mediterranean is characterized by long dry summers and mild winters. Droughts are always an issue of concern in the area and sometimes the situation becomes very severe because the water resources are not enough to cover the needs of the people and of the soil. The recent example of Syria where around 160 villages had to be abandoned because of the drought of 2007/2008, rings the alert for action. The drought affected more the rural areas, where most probably agriculture and animal raising were the source of income. An important part of Syrian economy is dependent on agriculture which is also a main labor force. Hence, any subsequent changes in the climate would have even more adverse effects, both on agriculture and economy.
http://news.yahoo.com/s/afp/20090602/wl_mideast_afp/mideastsyriaenvironmentclimate

The problem of climate change and its effect on agriculture is mainly an issue of the local authorities of the region. Definitely the countries of this part of the world that belong in IPCC or the United Nations get help and advice on how to deal those problems. In addition to this, EU is concerned with the issue of climate change and has proceeded in planning and adapting measures for farmers. The Common Agriculture Policy which is an EU institution provides subsidies for farm support and rural development. Rural development is the second pillar of CAP and for the period 2007-2013 will be under financial framework. http://ec.europa.eu/agriculture/climate_change/index_en.htm. In addition to this, there is a specific program under the UN for Mediterranean countries called Mediterranean Strategy for Sustainable Development. http://www.un.org/esa/sustdev/natlinfo/indicators/egmIndicators/MSSD_latest_eng.pdf

Cyprus, due to its location is already facing problems from climate change. The main impacts of climate change in Cyprus are the water shortages and droughts that can lead to desertification. The rise in temperature and the increase in the susceptibility of fires in the forest areas make the problem even worse. Agriculture is one major sector that is negatively impacted from shifts in the climate. Agriculture in Cyprus falls under the control of Ministry of Agriculture, Natural Resources and Environment. The good news is that there has been some interest in the impacts of climate change in agriculture in Cyprus. In February 2009, a conference was organized by the ministry with the title "Climate change and agriculture". People from different political parties, the members of the commission of agriculture of the parliament of Cyprus, Agricultural Organizations, consultants, scientists involved with climate change issues attended the conference. The main conclusions from the conference are listed below: http://www.cyprus.gov.cy/moa/Agriculture.nsf/0/ab8220a37dd820cec2257569004ec1cf/$FILE/AGROTIS%20SIMPERASMATA%20HMERIDAS%2026.2.2009%20KLIM.pdf (greek)

-to expand the use of recycled water for agricultural purposes and to intensify the effort to inform the farmers about the proper use and management of water

-to promote measures and give motives to the producers to use land that is downgraded e.g. by the use of plant remnants

-to expand the land that is used for organic farming

-to improve the conditions of animal housing and to stop the import of animals that are not able to survive in the Mediterranean climate and to promote the use of local 'genetic material'

-to improve and expand the systems for waste management with emphasis in the production of biogas and to take advantage of the animal manure for fertilization purposes

-to increase the subsidies for research in the impacts of climate change on agriculture. The research results should be used as tools to take strategic measures for the problem

-to take advantage of the natural genetic resources for the promotion of crops that survive in dry conditions

-to investigate the possibility of cultivating special crops for the production of biofuels

Financial support however is coming also from the EU, specifically from the program of Rural development, part of the CAP.

These are very important steps for addressing the problem before it is expressed even more. What also should be done is to follow examples of measures that have been taken in other countries with similar climate for amelioration of the impacts on agriculture.

Israel is one of the countries in the region that share the same climate concerns as Cyprus. In the first report of UNFCCC for Israel, it is expected that by the end of 2100 the mean temperature will rise between 1.6 and 1.8ºC, the precipitation will decrease by 8% to 4%, the rain periods will be more intense but shorter and they will arrive later in the year. More striking, the evapotranspiration will increase by 10% and the severity and frequency of extreme weather events is likely to occur. Greater variability in the temperature will be observed and there will be rise in the temporal and spatial climatic uncertainty. http://nasa.proj.ac.il/Israel-Research/Climate_Change_Israel_National_Report.html#_Toc495168271

The impacts on agriculture in Israel can be found in a report by N.Yehoshua and M.Shechter, in the book Climate Change in the Mediterranean. They provide rough estimates of the damage with and without adaptation. The results emphasize the importance of planning in advance to deal with the damage in agriculture that is expected. Other models have been created by other scientists.

http://books.google.com/books?id=aYVelLgvLk4C&pg=PA196&lpg=PA196&dq=climate+change+and+adaptation+for+agriculture+in+israel&source=bl&ots=V_Jm9Q9npQ&sig=EtGm6dBNG7XUXm1gptR1jg-eR3A&hl=en&ei=oCU_SvS2PJPQjAej47wL&sa=X&oi=book_result&ct=result&resnum=7

Israel is gaining reputation in the field of agrotechnology. Crop breeding is a big field of research and can provide alternative solutions to the farmers. Another merging field where Israel seems to be a pioneer is the development of irrigation systems that reduce water consumption. Advice is provided to other countries or organizations for proper irrigation and demonstrations of the Israeli system take place for other people to follow. http://www.export.gov.il/Eng/_Articles/Article.asp?ArticleID=8695&CategoryID=399

An example of another region that is susceptible to the same global warming adverse effects is the State of California in the US. Even though its size is not comparable to Cyprus, and California is located along the Pacific Ocean, it is found in similar latitude. Reduced water availability, extended droughts, more floods in the winter, drier growing periods and increase in the incidence of wildfires are the main characteristics of the impact in the region. The State of California however, has been researching the impacts of climate change for more than ten years and has created programs and strategies for adaptation. Agriculture could not be dismissed. Research on agriculture is mainly under the PIER which sponsors Climate Change Research centre. The main goal is to identify the most susceptible species, predict their response to shifts in environmental stressors and to provide solutions to the farmers for proper management and preparation for such shifts. http://www.energy.ca.gov/publications/searchReports.php?pier_sub=GCC%20-%20Impact%20and%20Adaptation%20Studies%20-%20Ag%20and%20Forest A White Paper report has been released in February 2006 by the Climate Change Research Centre under the name Climate Change: Challenges and Solutions for California Agricultural Landscapes. http://www.energy.ca.gov/2005publications/CEC-500-2005-189/CEC-500-2005-189-SF.PDF The Climate Adaptation Strategies for forestry and agriculture are assigned to working group VI. Unfortunately, the most recent posted climate adaptation strategies for agriculture have been removed temporarily from the website. http://www.climatechange.ca.gov/adaptation/landscapes/index.html

What is already done at the national level in Cyprus for the purpose of addressing the impact of climate change in agriculture, is not enough. Immediate and more collective actions must be taken in order to adapt to shifts in the climate before the impacts in agriculture become unavoidable and irreversible.

To start with, more desalination plants need to function. Decreased precipitation and droughts are not something new for the climate of Cyprus. Therefore, droughts are expected to occur in the future too. The climate change scenario says that they will become even more intensive and they will be accompanied by rise in the temperature. Since the water resources, both surface and underground are running out and precipitation is decreasing, desalination should be expanded because the problem of water scarcity will always be there. The disadvantage of desalination plants is that they

are extremely energy consuming. Other forms of energy like the wind energy and solar energy could be utilized in order to limit the high demands of the stations. If they cannot be used directly for the plants, these forms of energy can be used to limit the energy consumed in other areas, therefore allowing more to be used by desalination plants.

As agriculture receives more than half of the freshwater in Cyprus, immediate action is required to promote alternative ways of irrigation. What has been proposed by the conference in February was to promote the use of recycled water for irrigation purposes. The use of recycled water is not wide spread at all. Subsidies are now provided to install water recycling systems for domestic purposes and for garden irrigation. The water saved in this way is not enough because of limited installations of the equipment. Greywater from toilets, bathrooms and sinks could have been collected and treated in a more massive scale and then directed towards the arable lands. Maybe efforts should start from the rural areas, where greywater could be collected from houses and be used after treatment for irrigation, without the need of long distance transfer.

Another way of increasing water availability is to install rain harvesting systems. Even though further decrease in precipitation is expected, this year has been very good for Cyprus for frequency of rainfalls. Rainfalls however were in some cases intense and infrastructure could not support that, so flooding was observed in streets and some houses. The water that was not absorbed by the soil, especially in the cities was all lost, ending in the sea. This was an enormous waste of water that could be saved to be used for irrigation. Rain harvesting systems could actually save a lot of water in this way, if we take into consideration how much water runs off to the sea.

The government through the ministry of Agriculture should start campaigns in order to inform farmers for alternative options for their crops and the methods they use. For example, organic fruits and vegetables are not cultivated in a wide scale in Cyprus and they tend to be much more expensive than conventional products. Organic plants do not have as intensive requirements as conventional products and starting now to expand their growth would be a good way to adapt with forthcoming changes.

Research in climate change and agriculture is definitely a field that requires attention. More scientists should be involved in projects in relation to the effect in Cyprus and financial assistance should be provided to reinforce their efforts. The data and the available literature on Cypriot agriculture and climate change are limited. More data should be collected and models should be made in order to predict the cost that climate change would have on agriculture and on economy, with or without implying measures to adapt to changes. Prediction models are very crucial, especially for stimulating the decision makers to take action and imply policies for adaptation measures.

Cooperation of the Agricultural Research Institutes that are part of the Ministry of Agriculture, Natural Resources and Environment with the newly established public Technological University could be beneficial in examining how the local crops will respond to further droughts and increases in temperature. More importantly, they should identify which species are more able to survive in such weather conditions and still be

profitable for the farmers as well as which plants can be grown in Cypriot climate and soil and be used as biofuels . The Cyprus University of Technology has a specific department of agricultural sciences, biotechnology and food science. Academic institutions are always a source of information and can be used for promotion of ideas. Therefore, research in agricultural sciences should be promoted and supported economically by the government and the results from the research should be used for the benefit of the public. Faculty and scientists should collaborate with people in the region that had already done some investigation or progress in regards to the impacts on agriculture. They should take advantage of other people experiences and proceed in designing adaptation measures for Cyprus, through comparison of similar conditions. Transfer of ideas and technological transfer should be mediated through the different institutions found in the region. According to UNFCCC, each country is responsible to form and implement programs for adaptation in climate changes. Hence cooperation and coordination of the different institutions found in the region would be more effective in maximizing the results. We should not forget that the issue of climate change should be addressed in the local level but with a more holistic approach. Any severe changes in any neighboring country could indirectly impact Cyprus. Cyprus could be a favorite destination for climate refugees and this would get the agriculture and economy into a viscous cycle.

All in all, a collective effort from both governmental and non governmental bodies, as well as public participation is demanded in order to avoid any devastating consequences for Cypriot agriculture and economy. More financial support and more research should be directed in the issue of climate change. Actions must be taken immediately because time is a counteracting factor. Collaboration from people within the country, the region and the globe is the key to maximize the efficiency of adaptation measures. Changing ideas through discussions and conferences should be therefore promoted. A list is included below with the name of different organizations, authorities, departments that should enhance their activation with the problem. The names of some people that should be contacted for events on climate change and agriculture are also included.

LIST:

1)Cyprus University of Technology http://www.cut.ac.cy/

Department of Agricultural Sciences, Biotechnology and Food science

Department of Environmental Management (for information on consequences in Economy)

Telephone +357 25 00 2500 **Fax** +357 25 00 2750 **Email** administration@cut.ac.cy

2) Federation of Environmental and Ecological Organizations of Cyprus (website under construction)

info@oikologiafeeo.org

3) Cyprus Green Party

Telephone: 0035722 518787
Fax: 0035722512710
http://www.cyprusgreens.org

4)Ministry of Agriculture, Natural Resources and Environment,1411
Nicosia
Cyprus

Tel. 0035722408307
Fax. 0035722781156
Email registry@moa.gov.cy

5) Meteorological Service
http://www.moa.gov.cy/moa/ms/ms.nsf/DMLcyclimate_en/DMLcyclimate_en?OpenDocument

Despina Pampaka