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Analyses

Climate change and water resources in the Mediterranean region

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In view of the creation of a free trade area by 2010-2020, it is increasingly important to fuel euro-Mediterranean partnership and gradually aim at the construction of a high quality agricultural and agri-food system. To this end, the horizons of research should be widened to cover the big issues of the Mediterranean agriculture, among which those related to the impacts of climate changes and water resources on Mediterranean agriculture.

It is thus of interest to examine the relationships between northern and southern Mediterranean countries as well as the consequences the new global challenges have on all the Mediterranean countries and the primary sector, and that should be faced through common strategies aimed at safeguarding the common resources of the Mediterranean, that is of the Mediterranean identity: climate, vegetation, typical agricultural products, the Mediterranean diet. Stressing the relationships between climate, water and agriculture is fundamental. Agriculture is, in fact, the biggest water user of a finite rather than an inexhaustible resource. In many Countries, agriculture is the second cause of greenhouse gas emissions and is strongly affected by climate change and global warming.

Climate change in the Mediterranean region

The assessment by the *Intergovernmental Panel on Climate Change* (IPCC) highlights that the huge warming of these last decades can be interpreted as a possible shift of the tropical climate belts towards the Mediterranean region. The Mediterranean region is basically characterised by two climate regimes in terms of temperature and rainfall: dry and temperate regime. The former includes arid and semi-arid belts; the latter comprises the continental and Mediterranean sub-climate. The Mediterranean climate is typical only of the coastal strip of the region.

The different climate conditions (temperature and rainfall) and soil fertility cause a difference in vegetation which exhibits three types of biomes in the Mediterranean region: the desert, the Mediterranean vegetation and temperate forests. Human activities are the cause of the peculiarity of the Mediterranean vegetation, as well as of its wide heterogeneity. Crops and pastures cover about 30% of the 850 million hectares surface area of the Mediterranean region. Woods and forests cover 8%, whereas the desert and municipal and industrial uses concern the remaining 52%.

According to FAO data, the Mediterranean basin represents 16% of the fruit world production and 13% of vegetables; it produces 97% olives, 85% nuts, 54% legumes, 45% grapes and 41% dates. The differences in temperature and rainfall, availability of water resources and the different soil tillage techniques give rise to varying production levels between northern and southern Mediterranean countries.

Contents of this issue:

At present, the Mediterranean agricultural production covers almost 40% of arable land, and since climate considerably affects the crop growing cycle, significant climate changes might unquestionably cause serious effects on the economic system in all those countries where the primary sector has a major weight.

It is quite important to make a thorough analysis of the climate scenarios in the Mediterranean basin starting from the IPCC theory based on which global warming will develop in the next years even assuming that greenhouse gas emissions will be constant. However, uncertainties in hydro-meteorological data do exist because of differences in data acquisition systems and the difficulties in data surveying in some areas, as in mountain and ocean areas, and in some special meteorological conditions. All scientists agree in asserting that the increase in greenhouse gas emissions causes a rise in temperature. It is thus evident that the development model of various countries will affect the determination of the possible climate scenarios, as indicated in the first IPCC Report elaborated in 2000. Between 2030 and 2060 a yearly temperature rise of one to three degrees might occur in the Mediterranean region with notable repercussions on crop growth and maturity rates. IPCC experts foresee extreme changes in rainfall in the Mediterranean basin with reductions ranging between 4 and 27%. Finally, apart from the uncertainties on climate variability, studies carried out so far agree on the increase in extreme events: drought in the western Mediterranean countries and southern Europe, thunderstorms and tornadoes in northern Europe countries.

Impact on water, soil and crops

In the Mediterranean basin, the effects of climate changes on water resources are related both to the increase in evaporation volumes and the change in the soil water content. The reduced water flow in the Mediterranean region is the consequence of a smaller inflow from snow melting and its dependence on the rainfall regime. Such a change in the hydrological cycle might cause a serious drop in water resources in central-southern European countries. In general, aquifers become vulnerable and they get exhausted or polluted (saline water cone, agricultural or industrial pollutants). Outcomes from scientific research have shown significant trends of temperature rise and poorly significant trends of rainfall reduction. The major effect of the on-going climate trends in plain areas is the increase in soil aridity and drought events. Fewer research works are available on the impacts of climate changes on underground waters that represent a major element of the hydrological cycle and the major source of water supply for arid and semi-arid regions.

Based on the latest assessments by the European Commission on climate changes, southern Europe regions and the whole Mediterranean basin will be subjected to increasingly frequent drought events and degradation of water quality. However, increased knowledge of the impact of climate change, through intense research activity on climate, is strongly required by the European Commission in the Green Paper on EU adaptation actions to cope with climate change (2007). To this end, the 7th Research Framework Programme of the EU (2007-2013) provides wide scope to climate changes. Equally, the national Conference held in Rome in September 2007 pointed to research as a strategic priority. In the course of 2008, the European Environment Agency (EEA) together with the *Joint Research Centre* (JRC) and the *World Health Organization* (WHO) published a Report on the impacts of climate change in Europe through a set of more than forty indicators that highlight the decrease in yearly rainfall, the decrease in river flow, the increase in wood fire, the decrease in crop yield, the increase of water demand in agriculture, the increased risk of desertification, the decrease in tourist flow, and the high risk of loss of biodiversity.

Still quite uncertain are also the effects of climate change on crops. To understand how climate change influences crops, concerns on the increase in CO_2 are inevitable. In general, the greater amount of carbon fixed through photosynthesis, due to a higher atmospheric CO_2 concentration, causes positive effects on growth (crop height, stem diameter, number of leaves, etc.) and on the plant production processes. The increase in atmospheric CO_2 and the resulting increase in temperatures strongly affect the geographic distribution of cultivated species and the length of growing cycles. The attenuation of the negative effects of ozone on crops is one of the positive effects of the growing atmospheric concentration of carbon dioxide.

Climate conditions determine the evaporative demand whereas the response to it depends on crop cover and the water status of the soil. Nevertheless, the future rainfall pattern being uncertain, the calculation of the future crop water requirements is uncertain as well. As for water use efficiency (WUE) two models are considered: the eco-physiological model, based on the ratio of transpiration to photosynthesis per unit leaf area, and the agronomic model based on the concept of water use and production. High carbon dioxide concentrations cause a greater increase in water use efficiency in leaves, and a smaller one in the whole plant.

Challenges faced by the coastal regions

Also the effects of climate changes on coastal areas of the Mediterranean have to be carefully considered. The problem of coastal erosion caused by natural conditions and human activities has to be tackled. The sea level rise, for instance, will cause a loss of 6% of land in Italy and the disappearance of half of the present wetlands in Europe. Increased urbanization and deforestation make the coastal situation even worse. It is already critical for about 50-80% of European inhabitants of the Mediterranean who permanently live along the strip of 60 km from the coast. This adds up to the continuous population growth in coastal areas because of which resident population in coastal countries has increased from 285 millions in 1970 to 428 millions in 2000. Population growth is inevitably associated with the concomitant growth of economic, tourist and recreational activities that give rise to pollution, coastal erosion, loss of agricultural soil, increased water use. Floods are a symptom of climate variability and of the rainfall regime in particular, which negatively affect the coasts and the sea by causing serious eutrophication phenomena. Since many models on climate change forecast an increase in extreme events, like floods, preventive and adaptation measures need to be prepared. Chapter XVII of Agenda 21 establishes the policies on Integrated Coastal Zone Management (ICZM).

The EU has always been actively involved in Mediterranean policy: from the Mediterranean Action Plan (MAP) approved in 1976 to Barcelona Convention for the protection of the Mediterranean Sea (1995). Over the same period, its interest has extended from the fight against sea pollution and for the protection of marine environment to efforts for sustainable development of coastal zones of the Mediterranean (MAP Phase II).

The establishment of a Mediterranean Commission on Sustainable Development (MCSD) in 1996, the EU approval of the European Neighbourhood Policy (ENP) with all the basin countries, the agreement signed in Paris on 13 July 2008 that officially recognised the willingness of building, through concrete projects quite often focused on sustainable development and environment, a Union for the Mediterranean (UfM), are crucial steps of a general plan to re-launch north-south cooperation in the Mediterranean basin, within which more important projects like depollution and sustainable development of the Mediterranean are pursued.

More incisive and effective measures need to be prepared to really ensure sustainable development of coastal zones and stop their degradation process. To this end, it would be sufficient to implement the principles of the Integrated Coastal Zone Management – scrupulously defined by the EU in 2000 – which allow mitigating the consequences of climate change and safeguarding one of the distinctive features of the Mediterranean region through integrating objectives and tools.

The links existing between climate changes, water resources, biodiversity and agricultural practices are quite complex. In future, extreme events are expected to intensify; in particular, the Mediterranean basin will have to face increasingly serious water scarcity. A solution to the problem can be found through innovatory and integrated water resources management, based on demand management and implemented through technical and non-technical interventions.

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8th CIHEAM ministerial in Turkey

At the invitation of the Turkish Minister of Agriculture and Rural Affairs, Mr Mehmet Mehdii Eker, the Ministers of Agriculture of the thirteen CIHEAM member countries will be holding their eighth meeting in Istanbul on 8 March 2010 in the presence of several high-ranking representatives of international institutions.

All regional climate models agree that the Mediterranean will be one of the regions most affected by climate change. The latter will have widespread effects on water availability and quality, the environment, forests and biodiversity, animal and plant production, the spread of agricultural and animal diseases, and the food security of populations, particularly in rural areas.

CIHEAM considers that these issues are central priorities for Mediterranean policy-makers and this meeting will provide the perfect opportunity to share ideas and pool experiences on measures needed to adapt agricultural systems to meet the challenge of climate change.

Aspects related to the said approach are many, some of them being:

- users' participation in management activities;
- water bodies monitoring and better control;
- use of high efficiency irrigation methods;
- optimization of water consumption in view of optimising water use productivity;
- use of adequately monitored unconventional waters;
- adaptation of capacity building and implementation capacities of agricultural policies.

Many recent studies have proved that users' participation in management activities of the irrigation systems results in a sounder use of available resources and also greater satisfaction by users who can better organise themselves. Moreover, in the absence of adequate monitoring of water bodies: i) it is not possible to guarantee the quality standards of the resource and, ii) adequate policies of modernization and control of withdrawals cannot be established. High efficiency irrigation methods allow increasing water use productivity by preventing wastes. The use of unconventional water resources is indispensable since it makes precious and additional water resource available. All the above, of course, would not be possible without developing adequate training measures at any level (from users to managers and decision-makers), and designing adequate policies. Faced with an uncertain future where difficult conditions are to be expected for the community, it would be desirable to exploit the existing water resources in the best possible way rather than looking for new ones, by preventing over-exploitation, using water in a sounder way, planning water uses and developing new environmentally-sound technologies. It is to be hoped that the present economic-financial crisis will not lead to withdraw into nationalistic attitudes that would be deemed to failure, but it will rather encourage opening up, integrating and creating increasing synergies based, of course, on common rules and objectives shared by all the countries, starting from the Mediterranean ones. Today, it would be important to carry out a thorough analysis of the cruxes and challenges of the free trade area for the Mediterranean agriculture through a research approach that reflects the real and up-to-date north-south to south-south relations as well as the new relations between the Mediterranean and the rest of the World.

Nicola Lamaddalena

Mediterra 2010

Mediterra 2010, the twelfth CIHEAM annual report, takes the form of an atlas. It is intended to serve as a pedagogical tool to help all concerned understand the Mediterranean area through the variables represented by agriculture, rural worlds, food and fisheries.

Its maps, graphs and summary analyses are also intended to highlight the geo-economic, social, territorial and political dynamics at work in the region.

The report is in eight main parts: Populations and economies, Mediterranean peoples, Areas and resources, Manpower and production, Territorial contrasts, Fisheries and aquaculture, Eating well, and the Mediterranean Region in the global context.

When the atlas was published in French and English, CIHEAM organised a press conference on 17 March in Paris. The Spanish version will be out in spring and publication of the Arabic version is scheduled for summer 2010.

Lebanese agriculture and climate change

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Such issues as climate change, global warming and global change feature prominently on today's international agenda and are treated with the utmost seriousness by scientists, academics, journalists and politicians. The future of our planet is a matter of concern to all of us, both individually and collectively, and while the current situation is the result of numerous factors and affects many different sectors, solutions will only emerge from a serious political commitment to genuine sustainable development. Such a commitment calls for action on many fronts, technological as well as scientific: we must produce less greenhouse gas (GHG), minimise our dependence on fossil fuels, improve our environmental performance, and reduce our ecological footprint (by reining in consumption and degradation of water and other resources).

Agriculture, while it has certainly suffered from climate change, has also been a major player in the process: acting as a carbon trap but also increasing GHG emissions and above all consuming water. For Lebanese agriculture, which has been undergoing wholesale restructuring since the end of the war, adaptation to climate change has been a delicate matter. The fact is that climate change is just one of many problems facing the country's agriculture, others being the low competitiveness of the most productive sectors, globalisation and the fragmentation of agricultural land under the pressure of urbanisation. According to the Lebanese Agricultural Atlas (Ministry of Agriculture, 2005), Lebanese agriculture is divided into seven agro-climatic regions with 40 homogeneous agricultural areas. Although the soil aptitude map shows that the agricultural land area may be as high as 462,000 ha, representing a third of the country's land mass, the usable agricultural area is only 248,000 ha. Of the country's 195,000 farmers, only about 66,000 of them farm full-time, using an area of 121,581 ha.

Agriculture nevertheless concerns a large number of Lebanese families: the population living solely or partly from farming accounts for 28% of the country's population. In addition to the effects of carving up the land, the sector must cope with the rising age of farmers, which is hardly symptomatic of a thriving activity. A breakdown of farmers by age group shows that 169,000 (86.7%) are over 35 and that younger Lebanese workers are presumably shying away from agriculture and opting rather for more productive sectors that pay higher salaries. This situation complicates the task of establishing a national strategy for agricultural development and identifying priorities. In terms of water resources Lebanon is certainly better off than its neighbours but this particular asset has been badly managed, as is shown by the fall in river flow and the quality of surface and groundwater (Shaban, 2009). However, the different climate change scenarios show that temperatures will rise by between 1.5° and 2°C and that seasonal and interannual rainfall levels in the Mediterranean Basin will become more variable (IPCC, 2007). Worse still, annual rainfall levels in Lebanon will fall by 200 mm, while the snow covered area will shrink from 2,500 km^2 to less than 2,000 km^2 (Shaban, 2009). At the same time, water requirements will continue to increase to meet human demand. These developments, which are aggravated by deterioration in the quality of surface and groundwater, present problems for the agricultural sector in general and water resources in particular.

The crops problem: It is necessary to identify and adopt species that are better suited to the new climate conditions and if necessary use biotechnologies to encourage or induce the development of drought-tolerant characteristics. Agriculturalists must base their approach on regional genetic resources, and in that respect the Arab world is a very rich target area. Annual crops and livestock will be particularly vulnerable to the expected climate changes, as will crops that are sensitive to sudden rises in temperature, such as fruit containing pips and stones. Perennial species, which yield substantial economic returns, are among the first to be used in adaptive strategies designed to mitigate the effects of climate change. This means citrus and banana trees in coastal areas, apple trees at higher altitudes and apricot and cherry trees in the Bekka valley (Chalak and Sabra, 2007). Under the conditions forecast, the areas suitable for apple tree cultivation will shift to mountain areas higher than 1,000 m. The range of varieties grown will therefore be restricted and late maturing varieties will be taken out of production. The walnut, apricot and cherry tree growing areas, for their part, will probably shrink as a result of the drought conditions prevailing in the north of the Bekka valley. It would be a good idea to select traditional deep-rooted stocks, such as *Mehleb* for cherry trees. *Mehleb* is a local root stock that reacts well to Lebanese soils even without irrigation.

It will be necessary to develop Mediterranean tree species that tolerate present pedoclimatic conditions, namely the olive tree, the almond tree, the fig tree, and the carob tree. In any event it is essential to protect existing genetic resources, such as the early flowering almond, which are currently exposed to a high risk of frost in spring. Provided that they are protected, early flowering will be an advantage, ensuring maximum use of rainfall. As to annual crops, the amount of land planted with wheat will probably shrink. At the same time, production of barley, which is more tolerant of conditions prevailing in the Bekka valley, is expected to increase. There will be a need for wheat varieties that are more drought tolerant (chiefly soft wheat), which is why it will be advisable to make use of existing genetic resources (landraces). Generally speaking, the reduction in rainfall will require crops with a high water demand to be replaced, as in the case of the new maize varieties (around 12,500 ha in the Bekka valley), which were introduced to produce silage. Mixing cereals (barley, oats) with annual Mediterranean legumes (vetches, clovers and medics) will provide a more reliable source of forage but the livestock sector will still be very seriously affected by the reduced plant cover on natural pastures and the shorter grazing period. The production of aromatic and medicinal plants, which require very little in the way of irrigation water, may offer a valuable alternative, particularly if an attempt is made to promote niche markets. It would seem essential to take the natural flora of the Mediterranean countries as a model, especially for large park developments, which require large quantities of water for irrigation.

The water problem: recent climate changes have already had a negative impact on surface and ground water resources. The amount of available water has diminished, threatening Lebanon with hydric stress. The area of irrigated agricultural land in Lebanon comprises 104,000 ha, 40% of which are in the Bekka valley (Lebanese Agricultural Atlas, 2004), and it is estimated that it could increase by as much 167,000 ha by 2015. It is reckoned that 44% of this land is irrigated by surface water, 22% by ground water and the remainder by a combination of the two. Of all the surface water networks, only two use pressurised water, whereas all the others use open canals.

MAI Chania

Mr Alkiniis Nikolaidis, Director of MAI Chania, has been honoured by the Chania Economic Science Association for his key contribution to the scientific, economic and social development of Crete.

The ceremony was held on 23 January 2010 on the occasion of a seminar devoted to the "National Strategic Reference framework, 2007-2013: outlook and potential for Crete".

Mr Nikolaidis was awarded the prize in the presence of Mr Stavros Arnaoutakis, the Greek Deputy Minister of the Economy, Competitiveness and Merchant Marine.

The efficiency of irrigation systems is rated at just 46% for the countries as a whole. Efficiency could be increased by various measures, including the adoption of more modern irrigation techniques. In Lebanon, most of the land (67%) is irrigated by gravity feed systems (furrows). Other techniques include aspersion, used on 29% of irrigated land (mainly in the Bekka valley), and localised irrigation, which is used much less (on 9% of land). The use of modern irrigation systems and deficit irrigation has already led to a 25% saving in water every season, but there is still room for further improvement (Nimah, 1983; Karam *et al*., 2003; Darwish *et al*., 2006).

There is also room for improvement in the field of water harvesting. Water harvesting may involve a range of different structures (hill lakes, average-sized reservoirs (500 m^3), concrete reservoirs and water harvesting reservoirs (some of them built on a very large scale), which offer effective technical solutions and are still woefully underused (Shaban and Darwich, 2009). Of course, Lebanon, which has a serious shortage of large reservoirs and water supply networks, has some leeway in this area and in that of artificial replenishment of aquifers. Reuse of treated water and slightly saline water in agriculture and agroforestry might also be considered as an alternative way of making up for the shortage of water. With the development of wastewater treatment stations – six are currently being built – and the availability of large quantities of treated water, recycling is becoming more and more promising and might be incorporated into a national strategy, which is more urgently needed than ever if Lebanon is to protect environments that are prone to pollution.

The soil problem: it is necessary to increase the drought tolerance and resilience of soils by providing for organic changes to conserve soils, and improve their structure and structural stability. Given the greater frequency of torrential rain, improving the physical chemical properties of soils makes them more resistant to water and wind erosion and increases their capacity for residual water retention, which benefits non-irrigated crops and reduces the impact of drought and the risk of fire. Moreover, the forest area shrank from 21% in 1963 to 13% in 2000. By maintaining the right balance between forest land, natural vegetation areas, agricultural land and urban areas it is possible to reduce the risk of water erosion and improve the natural replenishment of aquifers while also reducing the risk of seawater intrusion into the coastal aquifer.

Moreover, with good soil management and the use of an irrigation calendar based on soil properties, local climate conditions and crops' water needs (supplied by fertigation), it is possible to manage water and fertiliser more efficiently and also improve the yield per unit of water and nutriment. Such an improvement would have positive repercussions not only for the hydrological balance but also for crop productivity and farmers' incomes (Hamzé *et al.*, 1991). This development is particularly important in that recent studies have shown that agricultural practices that tend to be based on monoculture cycles, rarely involve rotation, and entail overfertilisation and use of agro-chemical products have led to loss of water, development of salinity in the soil and the contamination of soils and aquifers by nitrates.

The policy issue: campaigns to provide information and raise awareness are necessary – indeed indispensable – and must be organised as a matter of urgency. There must be public access to laboratory results, development of extension services, whose role is to convey information to farmers and promote modern irrigation techniques, introduction of integrated countermeasures and a greater acknowledgement of risks to health and the environment. Adaptation to climate change, mobilisation of unconventional water resources and innovative ways of managing available water, support for investment in specialised agriculture, development of quality control, traceability of products backed up with a pest/disease alert system, and prevention of zoonotic diseases are necessary components of a sustainable agricultural policy in the context of climate change.

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MAI Zaragoza

The 13th meeting of CIHEAM's sub-network on Mediterranean pasture and forage, to be devoted to "the contribution of pasture to conservation of Mediterranean biodiversity", will be held in Alicante, Spain, from 7 to 10 April 2010.

Organised by CIHEAM-IAMZ, the CIBIO (University of Alicante) and the SEEP (Spanish Society for the Study of Pasture), this meeting will be attended by Mediterranean researchers and experts who are working on the biological, agricultural and environmental aspects of pasture and forage crops.

Discussion will address pasture and forage based animal production systems, the selection of species and crops for low-input systems, and the influence of pasture management on biodiversity in the context of climate change.

More information available at: **www.13thmeetingoftheFAO-ciheam.eu**

The effects of climate change on animal health: current situation and recommendations

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The issues

Climate change will undoubtedly be one of the most serious challenges facing the world over the next hundred years. Climate influences human and animal health, both directly and indirectly, in many different ways. The Intergovernmental Panel on Climate Change considers that the rise in temperatures is already affecting health and increasing mortalities due to heat, distribution of infectious disease vectors and allergies to pollen (IPCC, 2007). In addition to higher temperatures, increased humidity, rainfall, wind and extreme weather events are also affecting health. Between 1940 and 2004, Jones *et al* recorded 335 emerging infectious disease (EID) events among humans, two thirds of which were of zoonotic origin (transmitted from animal to man and *vice versa*). In the decade 1990-2000, about one quarter of the newly emerged diseases were vector borne, ie transmitted by insects or acarians (Jones *et al*, 2008). The latter are among those most affected by climate change owing to their dependence on their environment. While it is undeniable that climate affects them, it would be simplistic and erroneous to attribute these EID events solely to climate change, inasmuch as they can be brought about by many other factors. A considerable effort is needed if the role of climate change in these events is to be quantified more precisely. Studies in the field of human health have focussed notably on malaria and dengue fever, and have sought to assess their future changes and distributions (Rogers and Randolph, 2006). Very many of them however are either qualitative or fail to take account of other possible causes of variations and their conclusions are widely debated within the scientific community. Animal health studies are even more fragmentary. According to a report drawn up by the World Organisation for Animal Health (OIE), most of the work highlights the urgent need for an integrated approach to all the ecological processes involved so that the diseases of tomorrow can be predicted, better understood and controlled (OIE, 2008). This report outlines the state of science on animal health and then puts forward recommendations on methods to be implemented in order to quantify the impact of climate change on animal health.

State of science

How climate influences disease

Climate exerts an influence on the dynamics and distribution of all players involved in the advent of a disease: the pathogen itself, possible hosts and vectors and transmission mechanisms. In particular it influences their chances of survival, the duration of their development cycle and their rate of reproduction. It also influences the behaviour of the hosts (migration, hibernation and activity) and vectors (dispersion, frequency of bite). The effect of climate on the spread of disease is particularly important because part of the epidemiological cycle occurs outside the host, either in the environment (with the pathogen surviving in the outside world), or in intermediate (cold-blooded) poikilotherm hosts or vectors. Climate also influences vectoral competence, ie the aptitude of the vector to infect itself, enable the pathogen to amplify and transmit it the next time it feeds. While temperature and rainfall levels have particularly severe consequences, other climate variables such as wind also have notable effects. These variables are still ill-defined because studies normally refer to their average value, whereas for physiological reasons it is imperative to take account of variations, accumulated values (degree-days), and threshold effects. Moreover, these variables interact with each other: the effect of strong heat may differ significantly with the level of humidity or the time of day. In many cases the effect of these interactions on diseases is still not fully understood. In addition to direct effects, climate change has indirect effects, which are no less important. For example, it affects human demography, land use (agriculture, forestry, etc.) and water resources, causing changes that in turn modify the distribution of wild and domestic animals, pathogen vectors, and hence the diseases.

MAI Montpellier

Under an agreement signed within the framework of the France-Unesco Heritage Convention, MAIM is responsible for running the site of a Mediterranean network dedicated to "pastoralism and society".

This site comprises a resources section, accessible to everybody and containing a range of media (film, photographs, texts and articles), and a section with links to related sites. The media are divided up to form three thematic areas showing the relationship between pastoralism, countryside and heritage, sustainable development, culture and society. The other part of the site is devoted to the network's activities (events, facts and figures, forum, etc.).

Moreover, this network will soon be publishing the proceedings of the Tirana Seminar in "Options Mediterranéennes under the title "Pastoralisme méditerranéen : patrimoine culturel et paysager et développement durable".

To access the site: **http://resopasto.iamm.fr**

Climate change can also produce movements of humans, animals and goods, which increase the likelihood that pathogens, vectors and infected hosts will spread and thus make the pathogens more pervasive. To sum up, in the coming decades the agro-ecological, social, economic and political consequences of global warming will undoubtedly give rise to a marked change in the distribution of vectors, hosts and pathogens and in the transmission of diseases.

The complexity of assessing the role of climate

Determining that the emergence of a disease is due to a climate phenomenon is a complex exercise: it is necessary to provide sound epidemiological data (number of infected cases and size of population exposed) gathered over long periods of time. Furthermore, the advent of a disease is the result of a combination of several favourable conditions: environmental (including climatic), socio-economic, political, demographic, immunity-based and behavioural. These conditions are often interlinked (for example, climate change leads to social, economic and political change) and it is very difficult to identify the part associated with climate change. Moreover, this set of conditions is a necessary but not a sufficient factor in causing the disease to occur. Regions may be suited to the development of a disease but the disease remains absent as long as the pathogen has not been introduced or if there are effective preventive measures in place. Despite the genuine progress made recently, great uncertainty continues to surround climate simulations, arising both from future emissions scenarios and from the intrinsic bias of existing climate models. Many component aspects of climate, such as wind, are still difficult to predict and much remains to be done if the indirect consequences (social, political, etc.) of climate change are to be better understood and forecast.

Bill of animal health

Studies of the impact of climate change on animal health have only just begun. In France expert estimations have been used to draw up a hierarchical listing of diseases whose distribution or incidence is likely to be modified by global warming and which are likely to have serious consequences for animal health, public health and the economy (OIE, 2008). Of the six most important diseases identified, five are vectoral (bluetongue, Rift Valley fever, West Nile fever, visceral leishmaniasis, and African horse disease) and one is water borne (leptospirosis). Four of them are zoonoses. The same conclusions apply to the diseases listed in the OIE compilation.

In the case of these diseases, although the influence of climate change is acknowledged, it still has to be determined whether this influence is predominant and whether it can explain certain EID events. With respect to West Nile fever, for example, a study made in the Camargue (France) showed that since 1945 mosquito vector densities had been closely related to agricultural policies, notably rice field subsidies and restrictions on the use of agricultural pesticides (Poncon *et al*, 2007).

Most studies provide a qualitative description of the effects of certain climate variables on diseases (OIE, 2008) and some measure the statistical relationship between transmission parameters, disease dynamics or distribution, and climate variables. Whereas the earlier studies sought to determine the effects of uniform variation of a single variable (usually temperature), the more recent ones involve several variables and take account of their great spatial heterogeneity. Some studies incorporate sets of climate simulations, including different emissions scenarios and several digital climate models.

Studies that serve to quantify and map future risks associated with the direct effects of climate change are still in short supply. In the field of animal health, it has been possible to subject bluetongue to quantitative analysis, thanks to two European projects: Circe (http://www.circeproject.eu/), which brings together researchers from many disciplines to assess the effects of climate change in the Mediterranean, and ENSEMBLES (http://ensembles-eu.metoffice.com/), one of whose aims is to encourage the application of climate models in various disciplines. We have taken this study as the basis for our recommendations (see below). Recent studies agree that we can expect, not an inexorable increase in diseases, but more probably shifts in their areas of distribution, with risks increasing in some places and decreasing in others. In different cases, and depending in particular on the distribution of the hosts, the outcome could be good or bad.

The impact of diseases transmitted by ticks has been the subject of many studies which, by describing the complexity of the epidemiological cycles (and in particular the large number of hosts involved and the many stages in the ticks' development), clearly show why it is necessary to take account of a large number of interacting factors: climate, land use, distribution and numbers of wild animals, agricultural practices, industrial activity, and people's income and behaviour. This complexity and the lack of knowledge of the way these factors will develop make it particularly difficult to estimate the impact of climate change on these diseases.

CIHEAM-FAO

A workshop on FAO-CIHEAM collaborative ventures was held in Rome on 23 February 2009 to take stock of activities currently in progress, notably those concerning products, terroir and forest resources, as well as a new joint publication initiative.

As part of their collaboration, the FAO and CIHEAM intend to produce a joint publication, which will probably take the form of a report on the food security situation and outlook in the Mediterranean region.

Work on the project is already underway, the aim being to issue the publication in 2011.

Recommendations

Climate influences both the distribution of pathogens, hosts and vectors and dynamics of their behaviour and also the mechanisms involved in the transmission of disease. We recommend that these relationships be elucidated step by step before they are incorporated into a model that can be tested under different climate change scenarios.

To begin with, the influences exerted by climate on the distribution, dynamics and parameters of transmission must be quantified by field and laboratory studies. Different aspects of climate need to be taken into account so that work can focus on the climate variables most relevant to the disease in question. It is necessary to determine the uncertainty of the relationships between variables and diseases and the extent to which they can be extrapolated. At the same time, climate models must be developed for all climate variables identified as relevant. This kind of approach calls for close collaboration between climatologists and biologists.

Next, it is necessary to develop a mechanistic model for the risk of transmission, incorporating both the statistical distribution models for the species involved and the mechanistic models for the population dynamics. At present the standard mechanistic model is the basic reproduction rate (R_0) model, which is used to determine the number of individuals following the introduction of one infected individual into a naive population. This type of epidemiological model is flexible (it can be adapted to all pathosystems and modes of transmission) and may incorporate species dynamics and distribution models. Moreover, it can be used to determine whether the transmission level is sufficient to cause an epizootic disease (R_0>1) or if it will die out spontaneously (R_0<1). It can thus be used to test scenarios (countermeasures or changes to the environment, for example) to see whether they would be successful in overcoming such a disease.

Such an integrative approach is needed to provide an overview of the risk of transmission. It is however essential to validate these models to make sure that the profiles observed in the past have been correctly reproduced before future climate simulations are incorporated for the purpose of mapping future risks.

While there has been a rapid increase in studies on the direct effects of climate change continue, a serious effort is still required regarding the indirect effects so that we can (i) better appreciate what tomorrow's social, environmental and economic landscapes will be like, (ii) better quantify how they affect transmission distribution, dynamics and parameters, and (iii) better decipher the interactions involved.

The complexity of the work calls for close collaboration between different disciplines (epidemiology, infectiology, entomology, climatology, ecology, sociology and modelling). Existing models should be updated as further progress is made in the field of climate modelling and we gain a better understanding of epidemiological systems and their development in response to changes that are likely to reshape future epidemiological landscapes. Understanding, modelling and mapping future risks to health will help us in the fight against diseases, enabling us to adopt a more effective approach, tailored to the severity of the risk and targeted at the periods and areas in which risks are high and the capacity of pathogen populations to adapt is low.

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Pillar II of the Morocco Green Plan: moves to adapt small agriculture to climate change

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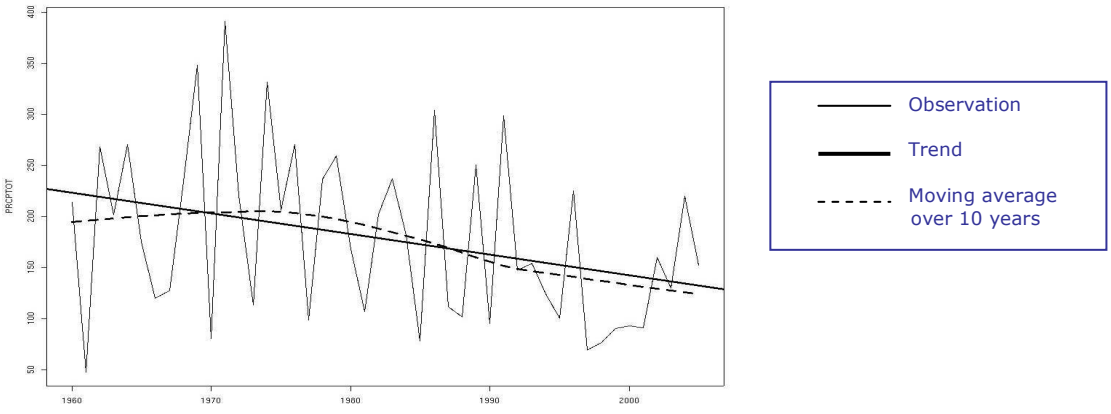
As we know, the Mediterranean Region, and notably the Maghreb, will suffer the full impact of climate change, which will be an *aggravating factor in a situation that is already critical*. Morocco, like other countries to the South and East of the Mediterranean, is characterised by a twofold vulnerability: the vulnerability of the productive base of agriculture; and social vulnerability and rural poverty. In such a context, pillar II of Morocco's Green Plan, dedicated to developing and supporting smallholdings, satisfies various needs, offers new opportunities and also makes new demands.

The vulnerability of the productive base of agriculture

The most crucial vulnerabilities are those relating to the biophysical environment and the vulnerability of the productive base of agriculture. Soils have been degraded by overfarming and bad conservation practices, cultivation of marginal land and a form of mechanisation ill suited to requirements. Areas of natural vegetation (range and/or forest land), which take up considerable space in mountainous and semi-arid zones, are an extension of the utilised agricultural area and are used by farmers for grazing, although they have been severely degraded. Lastly, most of the water sources mobilised have suffered from overexploitation, with corresponding and by no means negligible repercussions for local society and the local economy.

The climate changes observed over the past three decades, and those still to come, represent aggravating factors. For while climate irregularity has been a perennial problem for Moroccan agriculture, the increased frequency of drought is now almost a structural given of agricultural production. Agricultural growth was already very volatile 20 years ago and has become increasingly more so, testifying to the vulnerability of rain-fed production, which is subject to the vagaries of weather. Drought regularly causes substantial drops in national GDP: in 1995, AGDP fell by 45% and GDP fell by 12.4% (7.3% as a direct effect and 5.1% as an indirect effect). The most worrying aspect of climate change is the trend in average annual rainfall, which has been falling significantly since the nineteen-eighties (figure 1).

Figure 1. Annual average accumulated rainfall (1960-2005)



Source: National Meteorological Service

This fall affects hydraulicity, as is shown by the trend in 30-yearly average supplies to the Bin El Ouidane dam, located in a typical, representative catchment (figure 2).

MAI Bari

MAI Bari is participating in the international scientific project WASSERMed, which is studying water availability and security in southern Europe, North Africa and the Middle East.

The project involves a multidisciplinary analysis of present and future changes to hydrological balances caused by climate change in the Mediterranean Region and the consequences thereof.

In practical terms, the project has three aims: first, to review climate change scenarios and on that basis produce a model of a holistic water system that can be used to quantify risks and reduce uncertainties; second, to study the macroeconomic implications of water supply levels in terms of regional income, consumption, investment, trade flows and competitiveness; and lastly, to suggest specific adaptation measures for key sectors of the Mediterranean economy like agriculture and tourism.

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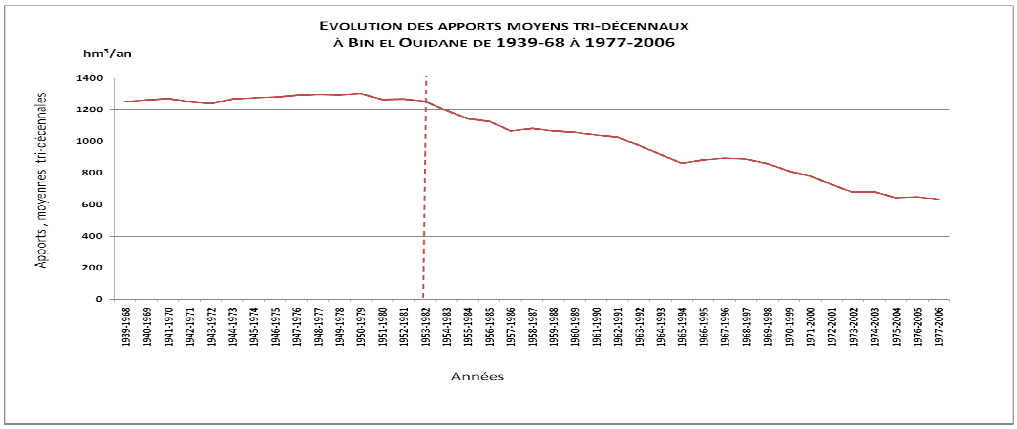
Figure 2. 30-yearly average supplies to Bien El Ouidane: 1939-1968 to 1977-2006



The study of the stationarity of the hydrological regimes in the Sebou Basin confirms that there have been statistically significant, convergent changes since the nineteen-eighties, and that they have been consistent with changes in rainfall. The following changes have been observed: reduction in annual modules, lower minimum water levels (fall in volume and intensity for longer periods), and reduced volumes during high water periods of shorter duration.

Climate variability, temporary regional climate deregulation associated with large-scale atmospheric oscillations of the El Nino (ENSO) or North Atlantic type (NAO) types, and climate change are possible explanatory factors. With climate change already perceptible, the trend towards aridification is bound to become more marked. It will affect many territories, entailing substantial changes in production systems and in some cases a return to pastoralism. With the growth in population and urban and industrial water requirements, local imbalances between water supply and demand are likely to become much worse and result in deadlock. Further progress is needed if we are to be prepared to respond to changes and keep irreversible damage to a minimum, notably through much more effective and economical management of blue and green water as well as restoration and sustainable management of land and biomass.

Social and territorial vulnerability and the importance of subsistence smallholdings

The second type of vulnerability relates to rural populations who depend on the productive base of agriculture. Of the 1,500,000 farms in Morocco fewer than 150,000 can be regarded as "enterprises" with access to the market, credit and information. While the importance of smallholdings is crucial, we can still draw a distinction between the 600,000 micro-farms, which take up just 8.5% of the UAA and 5% of irrigated land and provide only part-time employment, and the 750,000 SMFs (small and medium farms), which account for 70% of the UAA and 65% of the irrigated UAA and are likely to develop along the same lines as other businesses. The professionalisation and structure of these farms are key to agricultural development and hence to rural development. Social imbalances are aggravated by the geographical spread of farms over the region. Indeed, agro-systems with limited potential, whose productive base is vulnerable (arid, semi-arid or mountainous) account for two thirds of the total UAA, 70% of farms and 80% of agricultural and rural populations (table 1).

Table 1. Morocco's five main agro-systems: surface areas, farms and populations of each one

	Mountains	Presaharan/Saharan (oasis)	Semi-arid plains and plateaux	Favourable Bour zones	Large irrigated areas	Total
Number of farms (thousands)	437	85	520	288	100	1,493
Farms of less than 3 ha (%)	65%	82%	44%	47%	47%	53%
Rural population (millions)	3.72	0.86	5.12	3.05	*	12.75
Agricultural population (mil)	2.68	0.57	3.71	1.90	*	8.87
UAA (millions of ha)	1.66	0.24	3.84	2.28	0.71	8.73
Irrigated UAA	0.22	0.14	0.08	0.10	0.71	1.25
UAA/sup total agro-system	15	---	29	60	100	12%
	2/3 of the UAA 35% of the irrigated UAA 70% of farms 80% of the agricultural and rural population			1/3 of the UAA 30% of farms 20% of the agricultural and rural population		

Source: Agricultural Atlas, CGDA 2009, 1996 figures

MAI Chania

Mr Mihail Dumitru, who has been Romania's Minister of Agriculture and Rural Development since December 2009, is a former CIHEAM student. He obtained a diploma in agrifood economics at MAI Montpellier in 1992 and a Master's degree in rural economics at MAI Chania in 1994.

Two months before Mr Dumitru's appointment, another former CIHEAM student, Mr Tomaï, had been made Deputy Minister of Agriculture in the Albanian Government. Mr Tomaï was awarded his Master of Science degree in 1995 by MAI Chania, where he studied in the departments of Horticultural Science and Technology.

Poverty and delayed development in these regions are important factors in rural-urban drift. Poverty generates random survival strategies; moreover, without appropriate support policies, social and territorial imbalances and marginalisation will only be made worse by globalisation and climate change. The prospective study "*Agriculture 2030 : quels avenirs pour le Maroc ?",* conducted in 2006 by the High Commission for Planning in collaboration with the CGDA, warns of the risks of deadlock in the transition process. The study refers to these risks in its "*politiques au fil de l'eau*" (policy on the fly) and "*marchés triomphants*" (triumphant market) scenarios. It also suggests a possible third scenario, which would involves an agricultural and rural pact providing for a properly managed, progressive "opening up" process (liberalisation being, with some exceptions, asymmetrical) and far reaching changes in development policy.

The new Morocco Green Plan and its second Pillar

The adoption of the "Morocco Green Plan" in May 2008 in Meknes marked a fundamental shift in two areas. Priority in policy formulation was restored to agriculture, while agricultural policy, hitherto focussed on infrastructure and products, was redirected towards players, sectors and territories. The goal of achieving *"one million irrigated hectares"*, which dominated the country's agricultural policy since independence, has been superseded by that of creating *"one million farms"*. The plan has a second pillar dedicated to the co-development of smallholdings. The crucial need for economical and efficient water management is also taken into account under a national programme whose goal is to provide local irrigation systems for an extra 550,000 hectares within 15 years. The idea of adapting production more closely to the productive capacities of particular territories and thereby increasing output is one of the key points of the programme, justifying regionalised planning, and requiring the country to confront all the problems associated with adaptation. Regional agricultural directorates with considerable authority were set up in 2009. Because other sectors of the economy cannot create enough jobs and there is no possibility of large-scale emigration, agriculture can hardly be expected to follow the European model of professionalisation and substantial and rapid reduction in the size of the agricultural population. It will therefore be necessary to get round the severe problem posed by the small size of farms if production is to be aligned with the markets and made more progressive. Morocco's Green Plan accordingly gives priority to "aggregation" of land into larger entities. While players with strong managerial skills or new private investors might act as "aggregators" in the most favourable agricultural regions, they are unlikely to be found in "difficult" areas.

Co-development with substantial support from the state, donors and the Interprofessional Fund for Agricultural Research and Consultancy is required, which explains the need for Pillar II. Numerous challenges have to be faced: reducing poverty, relinquishing "dual agriculture" and moving towards pluralism in agriculture (making the most of the range of possibilities offered by the country and increasing market opportunities), promoting rural development, increasing food security, adapting to climate change and providing environmental and territorial services for the benefit of society as a whole. While Pillar II fulfils a need and provides an opportunity, it also presents real challenges and makes serious demands. Bringing 500-600 thousand farms in arid and mountainous regions into the market economy as quickly as possible while generating high added value, ensuring sustainable management of resources and supporting adaptation to climate change represents a genuine social, cultural and economic revolution. Its implementation will be no easy matter. In addition to the mobilisation of funds, it calls for the reaffirmation of a philosophy of action and the marshalling of skills and methods that will ensure effective facilitation and support. This is why the Council itself decided to facilitate an important review of these issues in 2008 and 2009. The review notably showed that the establishment of *local structures* with new support functions should be regarded as the "strategic cornerstone" of successful implementation and that "front and back offices" should be better differentiated and linked up. The adoption of new methods for drawing up local projects and the development of funding and contractualisation with groups of farmers for the purpose of implementing their projects are also essential. It is particularly necessary to make the most of experiences in the field of development, refine project procedures, train, research/act and build capacity – particularly that of the rising generations of agricultural developers and farmers' leaders. A dedicated resource centre for Pillar II, bringing together the four major centres devoted to education and research into agricultural and forestry and serving as a hub, will therefore be set up in Ifrane in 2010.

The "terroirs" approach: the central plank of Pillar II

The analyses conducted have also emphasised the strategic importance of the "terroirs approach" to the success of Pillar II. There are three sides to this approach, which need to be spelled out here. First of all it is necessary to promote *terroir* products in all their diversity, whether or not they qualify for PGI or PDO accreditation, in order to create locally appropriable added value and initiate economic regrouping and professionalisation. It is particularly important that small units with the combined functions of supplying, packaging, processing and marketing goods be set up and grow in economic importance.

Hopes have been raised by the number of success stories reported recently. There is also a need for a measured implementation of the new law on PDO and PGI, whose implementing decrees were issued a year ago, and to adopt an innovative approach to processing and marketing.

Second, local communities and farmers need to be better mobilised and given greater responsibility for the sustainable management of the natural resources of their terroirs so that they produce more goods and better services, including environmental services. It might mean, for example, changing production or adapting plants to reduced water inputs, planting olive groves of an agreed size, planting date palms, restoring fertility to soils and improving their water retention, reducing erosion, saving rain and irrigation water, managing high waters and runoff more effectively, ensuring that the UAA is better incorporated into its natural rangeland and forest environment, and helping young people set up in farming. It is necessary to promote technological innovation, research/action, "progress plans" at the farm and village *terroirs (douars)*, and expansion of pasture and irrigated land. If effective action is to be taken at village *terroir* level, it is necessary to clarify precisely how the pasture is used and, where appropriate, introduce long-term contractualised management charters and *payment for environmental services*. Trials also need to be carried out. The aforementioned payments are justified by possible loss of revenue in the short term, arising from the need to restore natural resources and adapt terroirs to climate conditions or pay players outside the local system for environmental and territorial services. Mountainous zones are of particular concern here, since the planting of new vegetation on them will help restore their function as "water towers", carbon traps and safeguards against the risk of flooding. Mountain dwellers must also work to prevent the risk of fire, preserve biodiversity (which is particularly important for the success of future adaptation to climate change), maintain urban-rural equilibrium and provide a quality landscape for visitors from the coastal towns and foreign tourists seeking beauty, nature, authenticity and relaxation.

The third and final part of the terroirs approach consists in putting in place baskets of goods and services other than those derived from the agricultural, craft industry and tourism sectors. Information and communications technologies, local urban services, and cultural (notably food) and environmental issues need to be taken into account if sustainable Mediterranean development is to be successful. The strong decentralisation and deconcentration now underway and the new strategy for mountains currently being drawn up should provide an opportunity for greater convergence in territorial approaches and hence a better policy mix.

A challenge for the Mediterranean

Taken together, the influx of large numbers of young people into the labour market, rural poverty, the opening up of the economy and climate change represent an unprecedented challenge for Morocco. The time needed to complete the rural development and transition processes is limited and there can be no going back. Successful implementation of Pillar II is an imperative: we must take a radical approach to the questions of development, poverty, planning and the environment and ensure collective stability. Given the new challenges arising this century, including the likelihood of worldwide ecological and food crises of much greater length and severity, a more integrated approach to the environment, culture and development is now essential. Rather than the extension of European standards to the country, where they are often inapplicable, it will call for intelligent support measures to help players realise visions and projects that address real situations and problems both locally and nationally. It demands greater North-South and South-South solidarity and an acknowledgement of the unique role played by farmers in managing the biosphere and feeding our populations.

In order to cope, the countries to the South of the Mediterranean must be given effective support in their strategic planning, institutional reform, capacity building and in the implementation of their policies. While this support will first be provided under bilateral partnerships, Mediterranean and Euro-Mediterranean regional cooperation could become a powerful force for collective education. Mediterranean countries have common cultural and environmental characteristics, problems and assets. One of its assets is its solar potential. The extraordinary diversity and quality of its terroirs, landscapes and culinary traditions – an essential part of Mediterranean civilisation – is another. Will it be able to take advantage of this diversity and produce a "post-modern" form of sustainable rural development? Or will its ecological and socio-economic weaknesses be accentuated until they reach breaking point?

Europe, whose destiny is bound up with that of the southern and eastern Mediterranean, has a particularly close interest in these matters. It would therefore be well advised to introduce and finance a "Mediterranean Terroir Plan", in the Union for the Mediterranean (UfM), to support innovation, mobilise local populations and players on the three shores, help restore a common sense of pride in the region, and set the Mediterranean on the path to sustainability.

Mohamed Aït Kadi and Guillaume Benoit

Mediterra 2012

The CIHEAM Governing Board, at its 122nd meeting in Paris on 18 December 2009, decided that the CIHEAM report, Mediterra, now to be published biennially, would take as its theme "The Mediterranean Diet and Regional Development".

One of the main objectives of the report would be to analyse all questions associated with the "Mediterranean Diet", which should be viewed not in purely gastronomic terms but as an integral part of Mediterranean life.

Attention should also be drawn to CIHEAM's forthcoming participation in the 8th International Congress on the Mediterranean diet, which is due to be held in Barcelona on 24 and 25 March 2010.

More information on the congress can be found at:
http://congresodietamediterranea.info

Biosecurity in the Mediterranean Basin: risks related to trade in plants and plant products

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Introduction

In the current context of globalization, movements of plant commodities (such as plants or seeds for gardening) and plant products (such as wood or grain) in international trade are increasing. This growth in trade has resulted in an increase in the numbers of pests including invasive alien species of, for instance, insects, nematodes, bacteria, fungi and plants, introduced into new areas in the past decades (see Box 1 for definitions). Some plants, imported for ornamental purposes, may also be invasive and escape when planted. Invasive alien species may cause major threats to agriculture (e.g. causing crop loss or additional costs of treatment), to the environment (e.g. by out competing native species) or to activities such as tourism, and as a result to the economy in general.

The Mediterranean Basin is particularly vulnerable because its climatic conditions potentially allow the establishment of sub-tropical and tropical species. In the context of climate change, these threats may increase. A collection of environmental treaties (e.g. the Convention on Biological Diversity, the Bern Convention) and European Directives encourage countries to take measures to control the introduction of invasive alien species and promote their eradication. Also, some international treaties (Agreement on the Application of Sanitary and Phytosanitary Measures of the World Trade Organization, International Plant Protection Convention Standards) allow States to pass legislation preventing the introduction of pests including invasive alien species, provided that the measures they require are technically justified. Pest Risk Analysis (PRA) is used as a technical tool to assess the risk that a species will enter a new territory, establish there and have negative impacts. If the risk is considered unacceptable, management measures are proposed. Most countries rely on National Plant Protection Organizations (generally within Ministries of Agriculture) to manage the implementation of such measures, which are increasingly considered part of the biosecurity legislation. The process is illustrated below with relevant examples for the Mediterranean area.

Definitions

Alien species: A species, subspecies or lower taxon, introduced outside its natural past or present distribution; includes any part, gametes, seeds, eggs, or propagules of such species that might survive and subsequently reproduce

Biosecurity: strategic and integrated approach that encompasses the policy and regulatory frameworks (including instruments and activities) that analyse and manage risks in the sectors of food safety, animal life and health, and plant life and health, including associated environmental risk. Biosecurity covers the introduction of plant pests, animal pests and diseases, and zoonoses, the introduction and release of genetically modified organisms (GMOs) and their products, and the introduction and management of invasive alien species and genotypes. *Biosecurity* is a holistic concept of direct relevance to the sustainability of agriculture, food safety, and the protection of the environment, including biodiversity.

Invasive alien species: an alien species whose introduction and/or spread threatens biological diversity.

Pest: any species, strain or biotype of plant, animal or pathogenic agent injurious to plants or plant products. [FAO, 1990; revised FAO, 1995; IPPC, 1997]

Sources: Convention on Biological Diversity, FAO, International Plant Protection Convention (IPPC).

MAI Montpellier

MAI Montpellier is leading the FLONUDEP project, which promotes industries that are active in the field of sustainable development.

The project, set up on 1 January 2010 with other French partners, consists in developing a single harmonised method for the simultaneous evaluation of a food industry, taking account of three main factors in food sustainability: environment, nutritional quality and social and economic implications.

Accordingly, life cycle analysis (LCA) will be applied for the first time to each of these factors throughout the entire process (production–processing–distribution–consumption). It will also be possible to use this method as the basis of a decision-making tool, which will have two objectives: to serve as a guide to professionals, ensuring that their industries are more efficiently organised, and as a basis for discussion between different stakeholders in the industries by providing accurate indicators at all stages in the production and distribution chain.

www.iamm.fr

How to assess biosecurity risks to plants and plant products

The European and Mediterranean Plant Protection Organization (EPPO) is an intergovernmental body in charge of cooperation in plant protection for European and Mediterranean countries, and it counts 50 Member States. EPPO has developed a tool for PRA known as the "EPPO Decision-support scheme for quarantine pests" (hereafter called the EPPO Scheme, see EPPO 2009) which can be used at the country level. PRA is a framework for organising biological and other scientific and economic information to assess risk. PRA leads to the identification of management options aiming to reduce the risk to an acceptable level. The EPPO Scheme allows the assessment of several types of pests: insects, nematodes, bacteria, viruses, plants, etc.

The EPPO scheme is composed of different sections:

Pest Risk Assessment

Pest Risk Assessment follows the logical sequence of introduction of a pest: entry, establishment, spread and invasive behaviour (assessed through impacts). As far as probability of entry is concerned, an organism can enter a new territory through intentional introduction (e.g. an invasive alien plant being imported as an ornamental species), or through unintentional or "accidental" introduction (e.g. import of palm trees infested by an insect). Any route by which the entry or spread of a pest can occur is called a "pathway". An organism which enters a new territory does not necessarily establish self-sustaining populations. Probability of establishment is then assessed by considering availability of host plants or habitats, the climatic conditions of the area under study, the characteristics of the species, etc. To assess suitability of climatic conditions, modelling software can be used, such as CLIMEX (see Sutherst *et al.*, 2004 for more details). Probability of spread by natural means (e.g. wind or water dispersal) and human activities (e.g. through movement of soil, irrigation water, footwear, machinery) are evaluated. Establishment and spread of an organism does not necessarily imply a negative impact. It is also necessary to further evaluate whether there are potential negative economic impacts. The assessment of potential economic impacts includes effects on plants (negative effect of the pest on crop yield and/or quality of cultivated plants or on control costs), environmental impacts (for example through the reduction of endangered species or major components of ecosystems) and social impacts (e.g. effects on water quality or on health). For any assessment, the degree of uncertainty is noted to ensure the transparency of the process. The overall conclusion of the pest risk assessment evaluates whether the pest represents an unacceptable risk. If so, the PRA continues with the selection of risk management options.

Pest Risk Management

Pest Risk Management explores options that can be implemented: (i) at origin or in the exporting country, (ii) at the point of entry or (iii) within the importing country or invaded area. The options are structured so that, as far as possible, the least stringent options are considered before the most expensive/disruptive ones. The methods whereby risk management options are selected differ according to whether the introduction is intentional or unintentional, the type of entry pathway, and are determined on a case by case basis. Pests intentionally introduced are often invasive alien plants imported for ornamental purposes. Measures recommended for intentional introductions are either the prohibition of imports or actions that can be taken in the importing country such as publicity (e.g. of existing regulations and lists of invasive or potentially invasive plants), labelling or marking of plants explaining the risks and appropriate actions/uses, restrictions or Codes of conduct on sale, holding, planting. For pests unintentionally introduced as contaminants, measures are classical plant health measures. Some measures are applied in the exporting countries and intend to prevent a pathway from being contaminated (e.g. specified treatment of the crop or of the consignment, establishment and maintenance of pest freedom of a crop). Some other measures are intended to detect an infestation in a consignment, such as visual inspection or removal of the pest from the consignment. The EPPO scheme also proposes specific measures for entry with human travellers and contaminated machinery. Possible measures are respectively inspection of human travellers and their luggage, campaigns to enhance public awareness, fines, and mandatory cleaning or disinfection of machinery/vehicles.

Concrete examples relevant to the Mediterranean Basin

Emerging pests in the Mediterranean area for which a PRA has been conducted by EPPO are presented below and illustrate the different threats, and magnitude of these threats, to the economy and to the environment. These species are, or should be, the object of management measures in Mediterranean countries. The full PRAs on these species with references are available on the EPPO website.

The Asian fruit fly (*Bactrocera invadens*) originates from Asia, but has had no recorded impact in its area of origin. It was reported for the first time in Kenya in 2003, and to date it has invaded 32 Sub-Saharan African countries, hence its name "invadens". Indeed, this species can fly long distances, and be transported with infested fruits. It primarily attacks mangoes, citrus, guavas and papayas, and also fruits of around 40 tropical plants (bananas, melons, etc.). The Asian fruit fly is likely to colonise new territories via international trade routes. The species is still absent from the Mediterranean Basin, but Citrus production sites in North-African countries are particularly at risk. Fruit flies are known for being formidable pests, annual management of which can cost millions of euros for an infested country. This is particularly true for the Asian fruit fly, considered to be one of the most harmful species in Africa. It causes very serious damage, which has been well documented on mango: in West Africa it can cause production losses of up to 70%. The small African mango producers who cannot afford insecticide treatments are faced with huge economic losses. Reduced supplies of mango, which is an essential dietary components in Africa, threatens food security there.

Water hyacinth (*Eichhornia crassipes*) is an aquatic plant originating from South-America. This plant is considered one of the most invasive plants. It particularly affects tropical areas, and is already present in all continents, but within European and Mediterranean countries, it is only established in Spain, Portugal, Italy and Israel. The plant has beautiful flowers and is imported and produced to be traded for ornamental purposes. It reproduces very efficiently vegetatively, can double its biomass in 1 to 3 weeks and can totally cover water surfaces. Freshwater bodies and ecosystems in the Mediterranean Basin are highly susceptible to the establishment of the species. The species is spread rapidly through human activities during maintenance of swimming areas, attached to fishing gear or to hulls, anchor lines, etc. Water hyacinth has major impacts in areas it invades: it reduces rice production, clogs irrigation canals, modifies aquatic habitats leading to losses of biodiversity, blocks hydropower generation stations and recreation areas, decreases water quality, and may increase the risk of transmission of human diseases such as malaria. Water hyacinth is expensive to control. Its removal along 75 km of the Guadana River in Spain between 2005 and 2008, for instance, cost more than 15 million euros.

Silver-leaf night shade (*Solanum elaeagnifolium*) originates from South America and is a weed of many crops: maize, cotton, potato, tomato, cereals, orchards, etc. It is considered a severe threat, and is already invasive in North Africa. The species could spread to further countries as a contaminant of a variety of commodities: seeds for sowing, grain, plants for planting accompanied by soil, etc. The plant reproduces very efficiently vegetatively, as fragments of roots as small as 0.5 cm long can regenerate. Fifteen hundred (1500) to 7200 highly viable seeds are produced per plant and can remain viable for at least 10 years. Spread is extremely efficient via livestock and manure, irrigation water, agricultural machinery and vehicles, rooted nursery plants, contaminated straw or seeds, as well as by wind over dozens of kilometres. This plant causes serious crop losses in alfalfa, cotton, sorghum, maize, groundnut, wheat and cultivated pastures, which can decrease livestock production. In Morocco, for instance, losses of up to 47% in maize and 78% in cotton have been reported. Agricultural land infested with silver-leaf night shade loses considerable rental and resale value. In Morocco, the value of infested land decreased by 25%. Following an EPPO and Food and Agriculture Organization workshop in Tunisia in 2006 on this species, a management program has been implemented for North Africa.

Trends in biosecurity in the Mediterranean Basin

Pest risk analyses are conducted every year on various species, and may lead to changes in law and in commercial regulations. The tools and processes for performing risk analyses (e. g. the schemes, the software for climatic prediction) are constantly being revised and improved. Unfortunately, they cannot evolve as fast as increases in both the products newly traded and the expanding origins of production, greatly challenging the work of risk assessors and legislators. Climate change is predicted to increase temperatures in the Mediterranean by 4°C by 2100, and to decrease rainfall by 10% to 40%, with more rain in winter, and less in summer with a resulting increase in droughts (Karas, 2000). These conditions might favour the establishment of new pests of sub-tropical and tropical origin that so far are not able to thrive in Mediterranean countries due to cold winters. Some species may increase their invasiveness. Identifying which new species will spread because of climate change remains an extremely difficult exercise, but modelling water hyacinth's potential distribution under a climate change scenario clearly extends the range of the species in the Mediterranean Basin (Kriticos and Brunel, in preparation). A study performed on traded ornamental aquatic plants also highlights that emerging invasive alien plants are a particular threat to the Mediterranean Basin and Macaronesia because of the similarity of forecast climatic conditions with the tropical regions they originate from (Brunel, 2009).

The introduction of new invasive alien species will have detrimental consequences on agricultural production and food security. Indeed, the increase in the number and prevalence of pests and disease will directly impact crop production, already threatened by water shortages. Furthermore, while livestock production will suffer from desertification, the spread of unpalatable rangeland weeds will also decrease the productivity of pastures. The increased frequency of water shortages and decline in water quality due to increased droughts will be reinforced by evapotranspiration caused by aquatic invasive alien plants, as it is already the case for the water hyacinth (Lalana *et al*, 1987). Additionally, the permanent cover on water surface provides suitable habitats for the development of diseases such as malaria and schistosomiasis (bilharzia) (Harley *et al*. 1996), the incidence and extent of which will also be increased by higher temperatures. Negative impacts on biodiversity are also expected. Many valuable habitats are at risk due to the inability of species to cope with new climatic conditions. This is particularly true for Mediterranean wetlands whose waterfowls and fisheries may be lost. Aquatic invasive alien plants would make those losses worse by invading wetland habitats and competing with indigenous species, thus transforming the habitat.

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Sarah Brunel and Eladio Fernandez-Galiano

MAI Zaragoza

A crash course for professionals: "Adaptive Management of Mediterranean Forest Ecosystems to Climate Change", organised by MAI Zaragoza, will be held from 10 to 15 May 2010.

The first signs of climate change are already becoming apparent from the ecosystem functions of the Mediterranean forests. The change will have adverse effects not just for the trees but for all plant and animal populations and for ecological processes. It will also impact on resources, goods and services related to the ecosystems, the most critical of which is water.

In the circumstances, adaptive management measures seek to make forests and the populations dependent on them less vulnerable to the effects of climate change. In so doing they may also help to protect water and soil resources and biodiversity.

The course will therefore address all these questions and provide participants with the means to understand the issues and take appropriate decisions.

More information at:
www.iamz.ciheam.org

Interview

Alparslan Basarik
Rural development policy adviser, Turkish Union of Chambers of Agriculture (TZOB), www.tzob.org.tr

Q - To what extent are farmers concerned with climate change in Turkey?

The agricultural sector is vital to food security, poverty reduction and sustainable development and is directly vulnerable to the negative effects of climate change. However, solutions that might reduce these effects to a minimum are also to be found within this sector.

As the world population continues to grow, there is a corresponding increase in the need for food products. Changes in temperature and rainfall levels, which may be part of a broader trend, have a negative effect on agricultural production, reducing output and hence the amount of food available. Our farmers, who are in the front line of this fight against the elements, recognise that they are best placed to find solutions to the problems because their work brings them into direct contact with the main causes.

As we all know, output levels in the agricultural sector are largely dependent on the weather. Our farmers take whatever steps are necessary to mitigate the negative effects of climate change and ensure that production continues. They also endeavour to help counter the effects of climate change by taking a more responsive approach involving agricultural practices that make more effective use of natural resources. Agricultural work must be carried out in accordance with sound environmental principles. It is essential to preserve natural resources, follow good agricultural practice, manage resources sustainably and take an environmentally friendly approach to agricultural and forestry work. In recent years, education and awareness raising programmes on such issues as climate change, effective water use and food security have become increasingly prominent in our country. In this connection, our farmers have been offered low-interest loans as an incentive to adopt pressure irrigation systems. They have become increasingly interested in this type of project and use of pressure irrigation systems has become much more widespread.

Q - What do you think of the Copenhagen negotiations on climate change?

Climate change is one of the most serious problems facing mankind. Failure to deal with it will have particularly catastrophic effects on the poorest countries and populations. In order to protect and support vulnerable communities and small farmers, who will be among the first and most severely affected by climate change, it will be necessary to implement realistic and permanent policies and promote worldwide cooperation and coordination.

The Union of Turkish Chambers of Agriculture (TZOB) has been closely following the climate change negotiations held in Copenhagen between 7 and 18 December 2009. Unfortunately, the discussion did not lead to an effective agreement. As we know, if we are to avoid the worst effects of climate change, global warming should not exceed 2°C. The "Copenhagen Accord", which was issued at the end of the Copenhagen Negotiations but is not legally binding, recognised the scientific view that the increase in global temperature should be below this level and that deep cuts in global greenhouse gas emissions were therefore required. However, no specific level was given for cuts in greenhouse gas emission and countries will be left to decide for themselves.

Countries should set aside conflict of interests and see climate change as a global problem with global causes and effects. They should take action in accordance with an internationally agreed plan, according to their responsibilities and their capabilities. Signatories to the Copenhagen Accord must be persuaded to accept it as a legally binding agreement as soon as possible. Agriculture has an important part to play in any strategy of adaptation to climate change and we must bear in mind that it is not the problem but part of the solution. Any solutions must therefore focus on agriculture.

CIHEAM Activities Report 2007-2009

In keeping with practice followed over the past few years, CIHEAM recently published its Activities Report for the period 2007-2009, which provides an overview of work by the four MAIs and the General Secretariat in the fields of education, research, publication and cooperation.

The activities report is also available in electronic format and can be downloaded from the CIHEAM website:

www.ciheam.org

Q – What has TZOB done to help farmers adapt to climate change?

Policy on crop and livestock production must take full account of the negative effects of climate change if food security is to be maintained. TZOB has been following the policy-making process in this area and advising the administrations and institutions concerned. It is also important to develop agricultural practices that counter the negative effects of climate change on water resources and ensure that agricultural production is sustainable. In order to prevent increased salinity in regions where climate change is likely to lead to higher temperatures, farmers training programmes have been made expanded to include projects on precautionary measures such as soil cultivation, drainage and irrigation techniques.

Like those of many developed countries, the 727 chambers of agriculture that make up the Union provide services for farmers: training, research, publication, etc. To ensure that they derive maximum benefit from the financial aid programmes offered by the state, the European Union and the United Nations, training seminars are held at our chambers of agriculture and our farmers are given help and encouragement in preparing projects. Training courses on the effects of climate change, modern irrigation techniques, biodiversity, and other subjects are currently available in various regions. Within the framework of a United Nations joint programme, our chambers are working on such projects as the "*Grants programme for adaptation to climate change in the Seyhan River Basin"*, "Development of a Civil Society Dialogue between the EU and Turkey" and a follow up project entitled "Civil Society Dialogue – II: Fisheries and Agriculture". The Union has signed a protocol with the Ministry of Agriculture and Rural Affairs on training for farmers in such areas as water and soil management, modern agriculture and production techniques, and good agricultural practices. Preparations for the implementation of the project are in progress.

Q - How can we cooperate at Mediterranean level to counter the negative impacts of climate change? Is the TZOB currently involved in any cooperative ventures in this area?

The Mediterranean basin is among the regions that will be particularly hard hit by climate change on account of water shortage. Governments must increase the amounts allocated for protection of water resources in the region and loaned to farmers as an incentive to improve irrigation methods. Furthermore, R&D work in the region must be stepped up so that new drought and salinity resistant plant species can be developed and widely cultivated. Universities, governments and non-governmental organisations must work together on concrete projects.

The TZOB has been a member of the International Federation of Agricultural Producers (IFAP) since 1972 and it plays an active role on IFAP's Mediterranean Committee. At a meeting of IFAP's Mediterranean Committee in November 2008, all participating countries pooled their experiences and practices in the fields of food safety, food security and climate change, which were the main items on the agenda.

Members of the Committee and the European Commission announced the setting up of a thematic programme devoted to food security in IFAP's Mediterranean member countries, which would comprise various joint projects. Studies would be carried out to determine how these projects should be developed. While they were being implemented, it would be possible to set up a communications network, so that the experiences of non-governmental organizations in different countries could be pooled, and organise seminars and workshops, where NGO representatives, decisions makers, producers and researchers could meet, improve their understanding of the issues, conduct studies on climate change in accordance with the strategy defined, and benefit from the experiences gained in different countries.

Interview by the CIHEAM General Secretariat

MAI Bari

CIHEAM-MAI Bari is leading a cooperation project in Kosovo, which is designed to improve plant production and bring it into line with European standards.

The aim of the project is to assist the Kosovan Ministry of Agriculture, Forests and Rural Development in the task of upgrading the capabilities of its plant production services. In practical terms it is intended to help the departments responsible for bringing regulations and standards on agricultural production into line with those prevailing in Europe thanks to integrated and organic methods.

The project will involve working groups comprising national and international experts, training programmes, field trials and an awareness-raising campaign, which will run throughout the duration of the project.

The general objective is to contribute to Kosovo's economic development by expanding income generating activities in the agricultural sector.

www.iamb.org

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Agenda

3 - 6 May 2010 – Antioch (Turkey)
III International Symposium on the loquat, organised by the University of Mustafa Kemal, Antakya/Hatay, and the ISHS, dedicated to the latest scientific developments (information).

5 - 7 May 2010 – Brussels (Belgium)
EGEA VI, Conference on the social and health benefits of a balanced diet: the role of fruit and vegetables, organised by Aprifel (information)

23-25 May 2010 – Taormina (Italy)
International Workshop "Advances in statistical hydrology" organised by the University of Catania (information)

25-27 May 2010 – Casablanca (Morocco)
International conference "People, forests and the environment coexisting in harmony" organised by Sylva-Monde (information)

8 June 2010 – London (United Kingdom)
The International Grains Council is organising its annual conference (information).

28 June – 1 July 2010 – Montpellier (France)
Symposium "Innovation and sustainable development in agriculture and food", organised by Cirad, Inra and Montpellier SupAgro (information)

19-24 July 2010 – Barcelona (Spain)
WOCMES, World Congress for Middle Eastern Studies, organised by IEMed (information)

22- 27 August 2010 – Lisbon (Portugal)
28th International horticultural congress organised by the ISHS, the APH and the SECH, on "Science and horticulture for people" (information)

CIHEAM website

Recent publications

CIHEAM Analytical Notes

- *Agricultural trade liberalisation. Access to the European market for Mediterranean fruits and vegetables*, Charlotte Emlinger, No 55, February 2009.

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- Summary of the 04/2009 edition of the review, December 2009.

CIHEAM Watch Letter

- Watch Letter No 11, "Agriculture, fisheries and rural development in the Mediterranean islands", autumn 2009.

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- *Nutritional and foraging ecology of sheep and goats*, T.G. Papachristou, Z.M. Parissi, H. Ben Salem, P. Morand-Fehr (eds), Options Méditerranéennes, Series A, No 85, Zaragoza, CIHEAM / FAO / Nagref, 2009.

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CIHEAM Website and Observatory

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The Watch Letter

Every quarter CIHEAM issues its Watch Letter in English and French.

The next issue will be published in May 2010 and will be devoted to food, nutrition and health in the Mediterranean Region.

To receive the Watch Letter, contact:
observatoire@ciheam.org