Blue Plan Notes
Environment and Development in the Mediterranean
N° 12 July 2009

Mediterranean agriculture: toward adaptation to climate change

The Mediterranean basin is one of the most vulnerable regions to the foreseen impacts of climate change. Agriculture will be one of the most seriously affected economic sectors, while the countries of the Southern and Eastern rims of the Mediterranean are likely to be the most severely hit. On local level, the capacity for resilience of the environment and populations seems to be the keyword of the medium-term adaptive solutions. On regional level, increasing food dependence and disintegration of agricultural societies and economies are two challenges which call for a further strengthening of Mediterranean cooperation around the agricultural issue.

Knowledge about, and scenarios for Mediterranean agriculture

Under the impetus of the scientific community, the impacts of climate change have come to be considered in the light of the interactions between society's various sectors. The differences between the models, the high uncertainty levels, or the error margins continue, nevertheless, to hamper both the quantification and the regionalisation of the forecasts.

For the Mediterranean region, the scenarios of the IPCC, as outlined in the Panel's 4th Report, foresee for the time frame 2100 the following developments: (Fig. 1):

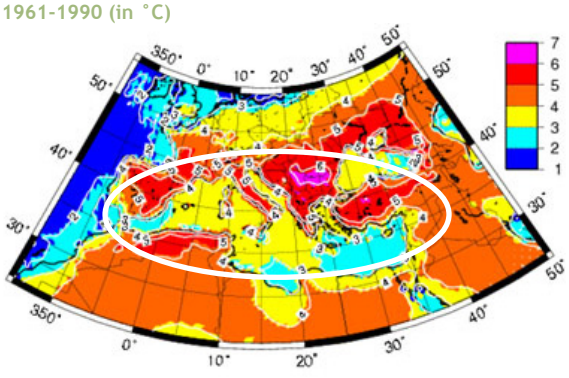
- A rise in air temperature ranging between 2,2 C° and 5,1 C°,
- A significant decrease in rainfall in the range of -4 to -27 %,
- An increase in the frequency of extreme events under the form of heat waves, droughts or floods,
- A sea level rise in the order of 35 cm by the end of the century, if not more

Roughly speaking, this global warming would give rise to several types of impacts: on natural resources, on production—in quantitative as well as in qualitative terms—, on upstream sectors—by affecting the consumption of inputs—, on downstream sectors—by affecting the quality of products—and on rural areas. As regards agricultural production, simulation tools help test strategies of adaptation to environmental change. The results of these simulations lead to the conclusion that there will be a generally negative impact on agriculture and a high vulnerability of developing countries in the vicinity of arid and semi-arid areas.

The scenarios remain, however, ambiguous as to the weak intensity of the impacts in case of a modest global warming in initial phase. Climate change related risks for agriculture cannot be downplayed, no matter the adaptive solutions envisioned, for the consideration of critical factors in the models is still questionable.

The chief factors relate to natural resources. Basically, carbon fertilisation resulting from an increase in CO_2 atmospheric concentration could have a positive impact on yields only under non restrictive water conditions, which implies the availability of additional water resources

Figure 1: Surface air temperature variability in summer 2070-2099 vs. 1961-1990 (in °C)



Source: Somot et al., 2007

and the corresponding financing of maintenance and infrastructure.

Then, regarding the other factor—that relate to agricultural policies—, the idea according to which the most underprivileged countries could mitigate their agricultural loss by giving preference to imports of foodstuffs, over domestic production, has been seriously questioned by the food crisis of 2008 and must now be qualified.

Finally, given the prospective analysis of the agricultural productions under the impact of climate change, and observing that the anthropogenic effects on the environment are actually worrying, it may be considered that climate change will exacerbate the major impacts already observed.

Major environmental constraints

The climate change impacts on the Mediterranean environment will relate particularly to:

➤ altering the water cycle, a key issue pertaining to the region's sustainable development,

➤ degradation of agricultural land and decrease in soil fertility,

➤ erosion of biological diversity, displacement of bioclimatic stages and parasitic and health hazards.

Less water availability

The irrigated areas of Mediterranean countries have doubled up within 40 years, thus exceeding 26 million hectares in 2005, that is over 21% of the crop land. Over this same period, irrigated areas have reported a steady increase.

During the second half of the XXth century, intensification was accompanied by a recent objective of reduction of inputs, water saving and enhancement of the efficiency of irrigated systems as required by production objectives. The Southern and Eastern Mediterranean Countries (SEMCs) foresee structural water deficits, while the Northern Mediterranean Countries (NMCs) foresee an increase, in the range of 19% to 35%, of major water stress areas by 2070. The soil moisture rate having been to a large extent maintained artificially over the past few decades by recourse to irrigation, one should fear, in return, a decrease in water reserve of the soils most sensitive to drying up cycles.

Maintaining fertility

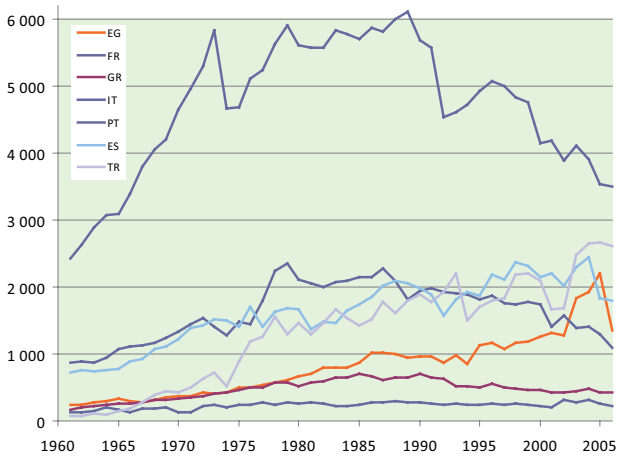
The production volumes of the main Mediterranean crops have multiplied by 3 for cereals, by 2.5 for vegetables and by 5 for citrus fruits over the period 1961-2007. At the same time, fertilizer consumption also increased. Egypt and Turkey thus exceeded the consumption rates of some Southern European countries during the 2nd half of the XXth century (Fig. 2).

A portion of crop land now has to contend, however, with a recent process of gradual loss of productivity due, inter alia, to a decrease in soil fertility. Over the past twenty years, the annual increase rates of the yields of the main Mediterranean crops have dropped by a half, for cereals, and by 20%, for vegetables. In Europe, no correlation could be established as yet between the global warming of recent decades and the crops yield levels.

For the decades to come, the models applied to Southern Mediterranean Countries (SMCs) reveal, in connection with climate change, a 30% drop in Moroccan cereal production for the time frame 2030[1], as well as average yield reductions in the range of 5.7% to 14%, for Algeria. In its national report to the UNFCCC, Egypt predicts a drop in rice production by 11% for the time frame 2020-2050.

The increase of CO_2 in the air might, initially and under satisfactory water conditions, induce a greater availability of nutrients and boost production. However, in fine, the soil's organic matter loss, thus induced, would give rise to additional needs for inputs in the short term.

Figure 2 : Fertiliser consumption of some Mediterranean countries[2], 1961-2005 (in thousand Tons)



Source: Plan Bleu 2008, according to FAO and WDI

The effects of extreme temperatures on phenologic stages are also likely to have a negative impact on the inputs/land productivity correlation, which only an extension of the cropland could compensate.

Limited lands, vulnerable soils

The degradation of farmland by erosion, loss of microorganisms, salinisation, desertification, etc—within a context of climate change—constitutes a threat for all Mediterranean countries. The European countries are developing a project of coordinated response, via a draft framework directive on soil protection which is likely to be issued shortly, thus consolidating the Water Directive and the Nitrate Directive.

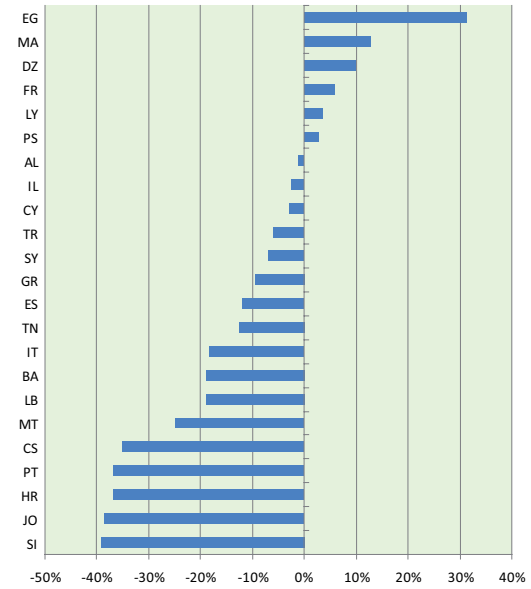
The phenomenon of desertification is not the only one constituting a threat for farmland; however, as its scope and intensity are insufficiently evaluated, it remains indiscernible from erosion and urbanisation (Fig. 3).

Arable land per capita in the Mediterranean has decreased by a half since the 1960s, and this, despite a rising food demand which stretches farming to marginal land, regardless of global warming.

Alongside with this, the overall food dependence of the region is on the increase. The search for productive land at acceptable cost led Egypt in 2008 to turn to new partners for lease of farmland or massive cereal imports. This approach which consists in securing supply does not exempt one—in view of the environmental exigencies—from sustaining agriculture in the areas of arid countries at grips with major constraints.

Rangelands, in particular, extend over a large portion of Mediterranean rural areas (mountains, arid plateaus). Permanent meadows and pastures accounted for 80%,

Figure 3: (Net) Loss of arable land between1980 and 2005 (in %)



Source: WDI

73%, 70%, 60% and 50% of the total farmland area in Algeria, Jordan, Morocco, Syria and Tunisia in 2005, respectively. (Fig. 4).

Searching for ecosystems' new balance

Forest areas are experiencing still strong pressures in the Southern and Eastern Mediterranean Countries (SEMCs), and this, due to overexploitation of firewood, land clearing and overgrazing, even though the situation is in process of stabilisation at several locations.

The high resilience of Mediterranean woodland ecosystems, under the stable climate conditions of the past centuries, has allowed their restoration to their previous status within a few decades. However, in a context of rapid global warming, the slowness of the colonization phenomena of a few taxonomic groups and lack of knowledge of the adaptive response of biodiversity give reason to believe that the extinction of species is not merely an anecdotal phenomenon.

The evaluation of the impacts of climate change on carbon trapping by wooded areas, on botanic composition and on the biodiversity of woodland, meadows and pastures, as well as on the feed value of the produced fodder, requires additional works. It is, however, estimated that a global warming of 1°C would translate into a displacement of vegetation by around 180 km to the North or around 150 m in altitude, together with an alteration of the areas of distribution of pathogenic species and their vectors.

There can be no doubt, under such conditions, that the agro-sylvo-pastoral activities will, in their turn, be affected by global warming. The latter are particularly important as an instrument of resilience of the natural environment. They participate in maintaining the forest stands in the SEMCs, contribute in minimising fire starts, provide services and produce externalities. More broadly, they open up tremendous research-development prospects.

Finally, the production systems of the SEMCs present features that are worth revisiting with regard to pest control and climate adaptation issues: diversity of wild and domestic varieties, large potential of native, ancient and rustic varieties (stability of yield level over time, disease resistance), as well as several agricultural systems: closed, short channels, mixed and "cooperative" systems...

Responses and adaptation

Maintaining and pushing forward family farming in the Mediterranean

Over a half of the rural population of most SEMCs is agricultural. This stood at over 45 million people in 2005 for the agricultural giants: Egypt and Turkey. Unlike in the Northern Mediterranean Countries (NMCs), this rural population will continue to rise significantly into 2020.

Agriculture is one of the worst remunerated sectors, but it remains—according to the World Bank development report for 2008—four times more efficient in poverty reduction than the other economic sectors. Besides, it is the sector which offers the most significant means of additional subsistence and climate and economic risk management, and this, based on the diversification of household incomes which it allows. Farms of less than 10 ha account for over 80% of the total number in most Mediterranean countries (Fig 5).

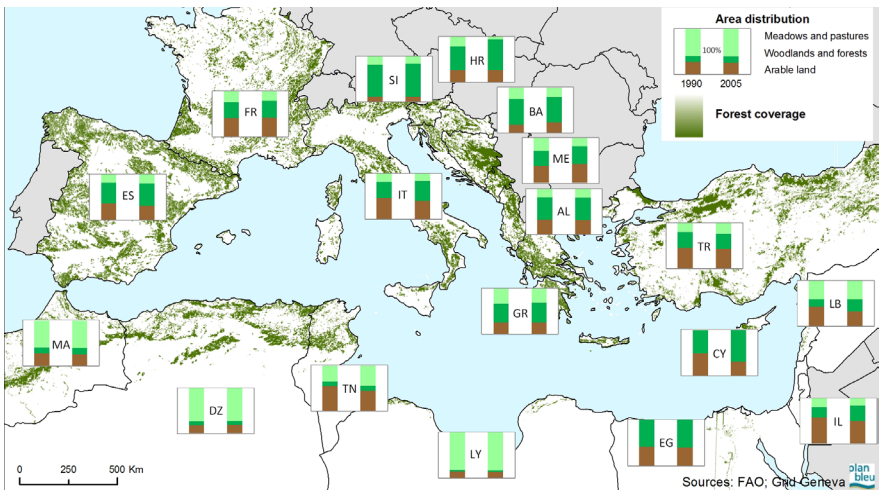
This family agriculture is one of the strengths of the rural environment in view of the social, production and territorial planning and occupancy that it provides. Besides, it constitutes a diversification factor in matter of securing the supply of local markets.

The same applies to pastoralism, considered as an alternative for sustaining the populations living on marginal agriculture, and likely to meet the rise in urban demand on meat products.

Policies challenged

The recent food crisis has highlighted the failure to give priority to agriculture—apart from export structures—in the economies of Mediterranean

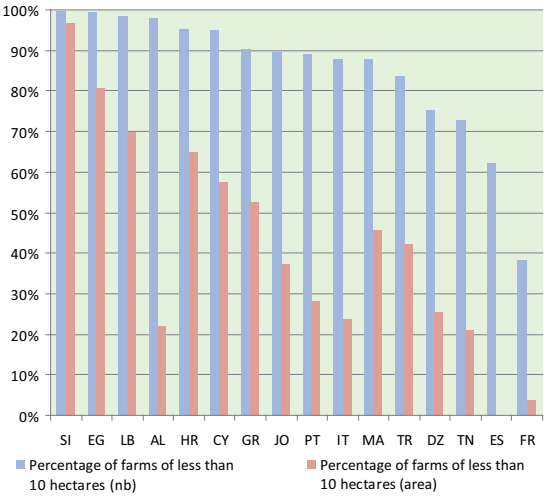
Figure 4: Relative portion occupied by woodland, farmland and pastureland in the Mediterranean in 1990 and 2005 (in %)



Source: Plan Bleu 2008, according to FAO and WDI

countries. It is advisable today to emphasize again the production function of agriculture, to restore security of supply and to re-examine the issues of marketing and infrastructures, knowing that the Mediterranean middle class gets supplied for the major part on international markets.

Figure 5: Percentage of farms of less than 10 hectares in the Mediterranean (last year available)



Source: Faostat statistics division, 2008

Global warming is likely to make the arid character of Mediterranean countries even more marked. These areas have been exploited by the populations for centuries. Their degradation is steeped in time and attests a strong resistance to an increase in anthropogenic pressures. The state of these environments is the outcome of permanent adaptation mechanisms of millennia-old populations and of the capacity of resilience of the environment for agricultural and pastoral activities.

There is room for technological progress, but this will not be enough to curb the expected impacts of global warming, nor would it justify pursuing the business as usual scenario in the Mediterranean. The technological adaptation potential—be it of varietal modification, evolution of patterns, enhancement of irrigation efficiency and pest control, or refinement of weather forecasting in the short term—is considered as scarcely sufficient to offset the demographic growth expected for the end of the XXIst century.

Moreover, the socio-economic adaptation capacities remain quite inadequate, since the time periods are estimated as 3 years for cultivars, and as several decades for major water infrastructures.

It is necessary to enlist political and technical responses, such as

- Facilitate adaptation of agriculture via R&D, training and community organisation;
- "Secure" rangelands and ensure access to resources;
- Grant status to farmers and bring them on board in institutional representation;
- Identify critical forest habitat areas and organise production;
- Conduct national inventories of domestic and wild animal and plant genetic resources and their uses;
- Set up continuous and long term weather and hydrographic observation systems;
- Ensure availability of indicator sets pertaining to climate change…

Addressing at once the capacities of resilience of the natural environment and of the societies living therein constitutes the veritable challenge that needs to be taken up with a view to ensuring the conservation of natural resources and sustaining human activities. The development of national climate change adaptation strategies may provide a facilitating framework, especially when operated within a regional logical framework.

(1) Cropwat model applied to winter cereal crops under the scenarios of the 3rd report.
(2) MED countries: Albania, Algeria, Bosnia-Herzegovina, Croatia, Cyprus, Egypt, France, Greece, Israel, Italy, Lebanon, Libya, Malta, Morocco, Palestinian Territories, Serbia-and-Montenegro, Slovenia, Spain, Syria, Tunisia, Turkey

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