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LOCAL ENVIRONMENTS, SUSTAINABILITY AND GLOBAL TRADES: THEORETICAL ISSUES

LAND DEGRADATION, CONSERVATION AND GLOBALIZATION: A MEDITERRANEAN PERSPECTIVE

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ABSTRACT

The era of globalization poses new challenges to the sustainable use of soil and water as rapid population growth, expansion of urban areas and creation of new markets, both local and afar, elevate production demand and expectations on the fragile soils. One of the main objectives of the Concerted Action has been to co-ordinate research efforts on the sustainable use of soil and water at the interface between urbanization, agriculture and tourism. But how have existing attempts to manage soil and water resources faired? The paper explores the conflicts between the control of land use for the sustainable use of soil and water and the pressure for land use change exerted by opportunities in the globalizing economy. Promoting sustainable use of soil and water is a difficult task in the Mediterranean environments as it requires a sound basis for the scientific judgement of sustainability, alternatives to market controls on land use decisions and effective dissemination of appropriate measures and technologies.

1. INTRODUCTION

A central challenge of the Concerted Action, within which the Rabat symposium was organised, is the identification of how information from the environmental sciences can assist in the development of sustainable futures. In particular there are concerns about how the economic and environmental transformations in the Mediterranean region may impact on the sustainable use of soil and water resources. At first sight it would appear to be an uncomplicated issue. Land degradation (including soil erosion and decline in fertility) has been acknowledged as a problem throughout the history of agriculture in the region. Most (though by no means all) researchers, institutions and governments express concern about the long-term impact of agricultural activities on the management of soil and water resources. Within this context of tacit recognition of a potential environmental problem, one might imagine that the task of establishing the magnitude, extent and processes of soil erosion would be straightforward and that the performance of measures to combat the negative effects of erosion might have been evaluated and appraised. But the evaluation of the status of soil erosion across the Mediterranean and of the success of conservation measures is not undemanding and this short paper aims to examine why.

The Concerted Action has focussed on interactions between urbanization and agriculture. There is a conflict between the need to control land use as a vehicle for the sustainable use of soil and water and the pressure for land use change exerted by opportunities in the globalizing economy. There is a burgeoning literature on the globalization process which draws some attention to environmental impacts, but curiously the relationship between globalization and the evolution and adaptation of environmental policy does not appear to be well represented in the literature. Questions about the performance and resilience of soil and water conservation policies has seldom been addressed beyond the local scale. In exploring the area of conflict between land use and land degradation, the paper will address three related issues: whether soil erosion is a real problem; how soil conservation measures have performed in a globalizing context; and options and strategies for sustainable futures. Encouragement for sustainable land use in the Mediterranean needs to be based on the interrelated resources of soil and water and acknowledgement that land degradation comprises many types of change in soil properties of which the physical removal of soil by erosion processes is only one. However, for the purposes of this concise discussion, soil erosion processes are the main topic.

2. IS THERE REALLY A SOIL EROSION PROBLEM?

The title of the section is borrowed from a chapter heading in the influential book by Piers Blaikie (1985): *The Political Economy of Soil Erosion in Developing Countries*. It is important to consider the contexts in which the term “problem” is applied to what ostensibly appear environmental processes.

There are different meanings of problem for different actors, dependent on scale and fundamentally shaped by political and economic factors. At this point it is necessary to consider the nature of the soil erosion problems, the economics of soil loss and the scale at which soil erosion and conservation are evaluated and associated decision-making takes place. This leads to questions about whether the information that can be provided by environmental science is necessarily useful in problem solution.

From a scientific perspective, soil erosion is usually considered an environmental issue. Identification of the occurrence of soil loss can lead to soil erosion becoming an object of interest in its own right and inspire investigation into the nature of processes and controlling factors. Much technical knowledge about conservation measures has been developed in this manner. Secondly, soil erosion can be treated as a social issue in situations where farmers recognise that it is occurring and accommodate action into farming processes. The wide range of ancient indigenous soil and water conservation structures, many of which are evident in the Mediterranean testify to the long-term implicit recognition of soil erosion as a consequence of agricultural activity. Recognition that land degradation is caused by interaction between land use practice, the inherent characteristics of soil and vegetation and the erosive energy of water and/or wind provides a basis for land use planning. The fact that, in some circumstances, land use management proceeds with inadequate attention to the maintenance of soil productivity is indicative of soil erosion as a political-economic issue. The basis of Blaikie's (1985) thesis is that the political-economic context within which land-users operate will determine the perception of erosion hazard and the reaction to it. Clearly there is a set of complex circumstances that influence land use decisions and management practices. Globalization imposes a further layer of complexity as the use of local resources responds to rapidly changing and often distant market controls. In these environmental policy circumstances the long-term sustainability of soil and water resources may be difficult to devise and implement.

Recognition of the political-economic context in which soil erosion occurs is often overlooked in commentaries about the preservation of natural resources. Consider the statement below that has been extracted from an FAO website (the statement itself is not dated and may have been written several years ago, though it was added to the website in 1997).

“Man must attempt to control his physical environment. Above all he must control the accelerated erosion caused by his own misguided activities and stamp out abuse of humanity's basic source of wealth the natural soil cover” (Ahmad, *undated*).

Such a statement is very unforgiving and is typical of the ecocentric stance adopted by agencies when discussing erosion at a general level. The blame is directed at the human race as a whole but implicitly the guilt is attributed to the land users - those who work the soil with “misguided activity” and “abuse”. There are many reasons for making high impact statements in reports, not least for impressing politicians, international agencies and research funding bodies of the need to support further investigation. Prominence attached to arguments of inappropriate past land use is evident in recent reviews of land degradation problems in Tunisia (Steen, 1998), Turkey (Evrendilek and Ertekin, 2002) and Jordan (Khresat *et al.*, 1998). But is such an approach helpful or even correct? Stocking (1995) has drawn attention to the often conflicting statements about global rates of soil loss or desertification that are supposed to startle governments into action. A problem with an overstated ecocentric attitude to soil erosion is that it implies that soil resources are priceless. The fact that soil and water are vital to life cannot be disputed but its relevance to land use management and decision making at the local scale is largely irrelevant. Seckler (1987) attributes this to a lack of distinction between the total and marginal value of a resource. To a land user, the short-term benefits of conserving soil and water may not justify the costs involved. In other words, the marginal costs of soil loss are accepted. Difficulties arise as the cumulative impact of soil loss over many years accelerates declining fertility. Globalization is significant in this context because external influences can reduce environmental constraints that may have traditionally limited the exploitation of soil and water resources. This has been illustrated for an earlier Concerted Action workshop (Higgitt, 2001) by an example from the desert margin of Jordan. There have been profound changes in population-environment dynamics in the twentieth century, which have transformed the traditional relationship between the local population and the local environment (as a source of accessible resources). It is argued that this cultural-historical process has diluted the implicit responsibility for the maintenance of the environment.

Approaches to the elucidation of soil erosion dynamics and to decisions on land management are both constrained by spatial and temporal scale. Furthermore, scale is an essential ingredient in explanation as inappropriate interpolation or extrapolation can yield meaningless results. A recent example concerns the estimated average rate of soil erosion in Europe as proposed by Pimental *et al.* (1995). Boardman (1998)

has demonstrated the tortuous and bogus ancestry of this value which originates from a series of small scale plot experiments in Belgium undertaken as part of a PhD study but ends up being quoted as an average rate for a continental area. Such extrapolation is both misleading and inaccurate. Though published data on global, regional or national soil erosion inventories may motivate government agencies to enact policy or distribute resources, overgeneralization and exaggeration inherent in large scale audits can be counterproductive in the USA, for example, there have been high profile papers claiming that the problem is massively exaggerated (Crosson, 1995; Trimble and Crosson, 2000).

While politicians are more likely to focus on big numbers at large scales, many recent advances have been made in examining patch dynamics and the small-scale spatial and temporal variability of plant-soil interactions. In the semi-arid environments of the Mediterranean vegetation clumps generate spatial heterogeneity which affects short-term redistribution of water and sediment (Puigdefabregas *et al.*, 1999). These dynamic relationships at patch scale are sensitive to disturbance and/or change in climatic conditions and are a precursor to successful modelling at larger scales. Assessing soil degradation status is therefore an expensive task and requires the appropriate use of limited data. Indicative soil properties can provide some information at local scales and might include A-horizon thickness, soil depth, organic carbon content (Olsen *et al.*, 1994), microbial activity (Pascual *et al.*, 2000), measures of soil biodiversity (Le Floch *et al.*, 1998), aggregate stability (Cammeraat and Imeson, 1998; Boix-Fayos *et al.*, 2001) or geochemical indicators, such as environmental radionuclides (Higgitt, 1995). Alternatively, summary information for larger areas can be gained through large scale mapping from aerial photographs and satellite images (Hill *et al.*, 1995; Seixas, 2000), from analysis of river sediment loads (Ozturk, 1996) and from the sedimentary archives preserved in lakes and reservoirs. There is clearly an issue of representativeness in the information that can be interrogated. Fundamentally, the scale and precision at which the scientific information can be provided may not match the unit of account used for decision making, be it a parcel, farm management plan or regional assessment. The costs and benefits of soil conservation need to be taken into account. Practitioners in Northern Europe have discovered that the on-site costs of soil erosion, in terms of loss of fertility of the soil are fractional compared to the off-site costs caused by flooding and pollution of aquatic ecosystems. There is some evidence to suggest that in the Mediterranean region the off-site impacts of soil erosion on the environment are moving up the agenda, especially on the European margin.

The discussion of the construction and availability of data raises some issues of scientific responsibility. These ideas have been explored by Stocking (1995) in a frank and critical manner. Though it can be argued that the technical solutions to erosion problems, many of which have been enhanced by recent research, are seldom enough basis for a successful conservation program. It therefore follows that there is responsibility on scientists to work more closely with planners, agencies and stakeholders to deliver reliable and timely data and to appreciate the socio-economic and cultural context of the locality. Initiatives such as the Concerted Action that explicitly aim to enmesh disciplines can be seen as a positive move towards this goal. However, the “situatedness” of the researcher should not be overlooked as this will partially determine the objectives, such as the requirement to publish results.

3. SOIL CONSERVATION IN THE MEDITERRANEAN

Having noted some of the difficulties of articulating the nature of land degradation and its assessment, the next aim is to evaluate the success of soil conservation measures across the Mediterranean and whether their implementation has been adversely impacted by globalization. At the outset it was noted that the literature linking environmental policy with globalization is limited and an attempt to summarise soil conservation status in the region indicates why. Obtaining information about the implementation and evaluation of soil conservation beyond small scale pilot studies is difficult. In part this reflects a “grey literature” of information in interim reports and documents written for agencies, which outweighs evaluations published in journals and books. Around the Mediterranean, attention to land degradation and desertification is highly variable, as illustrated in Table 1. The table compiles search statistics from on-line journal catalogues. Not surprisingly there is a greater volume of literature from the north shore countries. In the south published articles containing information about soil erosion or soil conservation are relatively few although the volume of published soil science is often impressive. It is clear from the lack of information in the open literature that a thorough investigation of the status of soil conservation across Mediterranean countries is extremely difficult, let alone an assessment of whether policies and procedures to protect soil and water resources are managing to compete against land use changes induced by globalization.

However, many of the issues facing the promotion of sustainable use of soil and water can be

addressed through a critique of recent examples from the region, from a consideration of national environmental priorities at one end of the spectrum, towards consideration of indigenous knowledge and community participation at the other. One example of the policy significance of land degradation can be interpreted from documentation of the EU Cohesion Fund. Funding is available to Greece, Portugal, Spain and Ireland for environmental, infrastructure and transport development, within which the environment dimension is manifested by direct investment in infrastructure (such as water supply) and by protection of natural and cultural heritage. The reports of the allocation of Cohesion Fund support towards environmental projects in Spain and Portugal (EU DG XVI, 1999a,b) is very much focused on water pollution and gives no mention to the sustainable use of soil and water.

Table 1. Number of research articles in international journals by country.

	land degradation	desertification	soil	soil erosion	soil conservation*
N Africa					
Morocco	6	10	112	8	1
Algeria	1	4	36	2	1
Tunisia	3	5	68	6	0
Libya	0	0	13	0	0
Egypt	0	3	245	4	0
Middle East					
Turkey	1	3	229	2	1
Syria	2	2	126	4	1
Jordan	1	5	145	3	1
Lebanon	1	1	16	1	1
Israel	2	12	428	15	0
Europe					
Greece	4	12	315	14	3
Italy	7	2	608	24	6
Spain	28	36	1176	80	9
Portugal	3	4	170	12	1

(Notes: Compilation used Web of Science (5700 science and 1725 social science journals, 1981-2002) for occurrence of search term in title/abstract. * also searched term "soil and water conservation").

It appears that measures to reduce soil erosion are not among the highest priorities for governments seeking EU funding for environmental initiatives. At the same time, land use management can be very sensitive to EU subsidies. Simulation of on-site and off-site impacts of soil erosion and flooding for different land use scenarios in Alora Region, Spain, demonstrate the sensitivity of the landscape to land use change, especially concerning olive oil production (Schoorl and Veldkamp, 2001). The EU subsidy for olive oil is worth more than 2 billion euros per year, but is not formulated with respect to environmental considerations (de Graaf and Eppink, 1999). Research directed at evaluating land use controls on soil degradation (mainly through the EU MEDALUS programme) indicate that there is high spatial heterogeneity, such that conservation measures need to be targeted for specific sites (Kirkby *et al.*, 1998; Puigdefabregas *et al.*, 1999). Similar subsidy-related impacts have been demonstrated in parts of Greece where satellite imagery reveals an extension of overgrazing related to the introduction of EU subsidies (Hill *et al.*, 1998). Linking the allocation of subsidies to farm scale conservation plans offers some prospect though the track record of incorporating micro-management (farms) with macro-economics (agricultural policy) is not auspicious.

At a national scale, some information about the status of land degradation can be derived from land capability assessments. In Turkey, The General Directorate of Rural Services produced land capability assessments in 1978 and 1996. Comparing the two time frames demonstrates the rapid consumption of agricultural land through urban expansion, at a rate of 9000 ha per year (Cangir *et al.*, 2000). Land capability assessment includes indicators of erosion as a measure of sustainability but, as a result of the rapid audit process, the information is understandably subjective. Many authors have attempted to produce statistics for the extent of erosion in a region, nation or content but in practice such data are often

disputed. Viewing the process from the perspective of a national government, it would seem that land capability assessment gives some basis for strategic land use planning and Cangir *et al.* (2000) go so far as to propose an ideal land use pattern (Table 2). The logic is appealing but the practicalities of enforcing such zoning would seem too challenging, not to mention contrary to notions of involving local stake-holders into the planning and decision making process.

Table 2. Ideal land use pattern for conditions in Turkey (after Cangir *et al.*, 2000).

Land Capability Class	Agriculture	Forestry	Wilderness	Urban / Infrastructure
I	80	15	3	2
II	70	25	3	2
III	60	30	5	5
IV	55	35	5	5
V	50	40	5	5
VI	20	55	20	5
VII	0	60	40	<1
VIII	0	20	80	<1

Moving to North Africa, desertification has become a major political issue and the emphasis of research and development projects has tended towards improving the efficiency of irrigation techniques and use of agricultural water in general. In Morocco, several FAO sponsored programmes have been implemented to monitor and diagnose better use of marginal water (WCA, 2002). Soil salinization has been the aspect of land degradation of greatest concern, while the off-site impacts of agricultural activity, particularly nitrogen pollution have come under recent consideration. Some optimism is found in reports evaluating traditional agriculture. For example, Barrow and Hicham (2000) report that some village communities in the western High Atlas are innovating and developing supportive social capital while other communities are faring less well. Intensification of agriculture in the Rif Mountains has led to deforestation and fears of widespread land degradation though recent reviews suggest that there is little evidence of declining soil productivity (Funnell and Parish, 1995; Moore *et al.*, 1998). In Tunisia, Baban et al (1999) provide positive examples for the Tunisian environmental programme. Participatory activity is essential in these local scale initiatives. An interesting example has been provided from the uplands of Lebanon (Zurayk *et al.*, 2001), where traditional allocation of lands through planning authorities has often resulted in poor take-up of directives, especially in tribal lands. Participatory research here demonstrates that farmers have extensive indigenous knowledge about soil conditions (though not conventional quantitifiable knowledge) and a working definition of land degradation. Though farmers can identify action that may exacerbate soil erosion they are able to rationalise land use decisions, which are principally determined by land tenure arrangements.

4. EMERGING CHALLENGES FOR THE 21ST CENTURY

The brief review of the identification and evaluation of measures to mitigate soil erosion across the Mediterranean Region show that although the general essence of the problem is acknowledged by governments, there is limited evidence for coherent policy of implementation. Not only does the process of globalization have the potential to accelerate the rate of land use change, but the environmental priorities also shift over time. For the most part, the traditional concern of scientists examining soil erosion has been the on-site impacts of declining soil productivity or salinization associated with irrigation processes. In Northern Europe, where the on-site impacts are rather less than the off-site impacts on aquatic ecosystems, most attention has been turned downstream. There is some evidence from the literature to indicate that off-site impacts of sediment-based pollution have begun to be recognised as significant problems in the countries of the northern Mediterranean and are currently becoming a focus of R&D programmes in the countries of the southern shore. It is likely that control of off-site impacts is likely to increase in importance in regional, national or EU target standards.

More recent concerns about climate change and biodiversity will also become more prominent in attitudes towards the sustainability of soil and water resources (e.g. Feddema and Freire, 2001). Just as soil degradation in the semi-arid margins of the Mediterranean is sensitive to land use changes, so climatic variability is also very significant. Indeed it is often difficult to separate the relative significance of climate from land use as drivers of soil erosion. Related to climate change, the role of restoring degraded

soils to enhance carbon sequestration will become more significant as a means of mitigating the greenhouse effect (Lal, 2000). Potentially, governments can offset carbon storage in soils against permitted CO_2 emissions, providing a further stimulus for encouraging soil conservation.

5. ENHANCING SOIL CONSERVATION

Scientific and technical research has enabled controls on soil erosion processes and soil productivity to be evaluated. Within the semi-arid environment of the Mediterranean, the enhancement of techniques to estimate rates of erosion and their significance for both on-site soil productivity and off-site impacts on pollution are needed to strengthen the available data. Soil-plant interactions are a particularly important area where better understanding of environmental controls are required. Yet no matter how good the basis of the scientific research, greater integration between scientists, land users and policy makers is required. This is not a new message. As Blaikie (1985) identified, land using practices are economic activities arising from political-economic relations. By definition, conservation policies must affect political-economic relations and cannot therefore be introduced in a manner that assumes neutrality in the state apparatus. Not only is there an onus for scientists to consider more critically the nature of information required by policy makers, but there is also a requirement for policy makers to consider conservation measures within the wider issues of patterns of power and economic and political interest. If anything, the globalization process means that the political economic context within which land use decisions will be made will become more volatile as agricultural production systems react to the import of cheap food from commercial growers, shifts of labour from urban to rural areas and to financial incentives of structural adjustment programmes or focussed funding from national or overseas sources.

Just as scientists have increasingly drawn attention to the ecological transition of Mediterranean environments to explain plant assemblages and consequent plant-soil interactions, so too is the socio-economic history of land use important in understanding the constraints and opportunities for local communities to respond to environmental targets (e.g. Marathianou *et al.*, 2000). Some of the papers summarised in this discussion have indicated variability in the success of community based programmes. For many producers in the Mediterranean, it seems unlikely that best management practices for sustainability will arise without suitable incentives (or in some cases viable alternatives). Experience in the USA (Napier, 1990) has shown that economic incentive and a certain degree of coercion are necessary to encourage conservation-minded practices. Demonstration of conservation agriculture in Mediterranean environments (e.g. Prinz *et al.*, 1994; Mrabet, 2000) is required but so too are suitable incentives to encourage its adoption and extension. Environmental Services schemes reward farmers for using land in a sustainable way (essentially payment for creating wider environmental benefits), where criteria are measured against soil benchmark indicators. On the European side of the Mediterranean, and within the context of over-production within the EU, there is some scope for incorporating targeted environmental measures into subsidy reforms. To the south of the Mediterranean, where agricultural output is a major contributor to GDP, the flexibility for developing such initiatives is less tough, it might be encouraged through EU co-operation programmes. For all Mediterranean environments there would be a need to improve the empirical basis upon which soil benchmark indicators could be evaluated.

6. SUMMARY

Globalization has many impacts on land use decisions which may be detrimental to the management of soils in the Mediterranean region. Existing research methodologies have tended to polarize the relationship between physical (scientific-technical) and human (political-economic) factors in a manner that has become unhelpful to the solution of environmental issues. Though there remain many research questions about the resilience of Mediterranean ecosystems and soils and concerning the development of conservation agriculture techniques, the input of science into the policy making arena needs more attention. The assumption that scientific recommendations are somehow politically neutral is unfounded and there is a need to boost integration between scientists, policy makers and stake-holders.

The challenges facing the Mediterranean are significant. Rapid urbanization places more demands on the use of soil and water resources while the opportunities and impacts of globalization strictly influence land use practices. Information on soil erosion dynamics for the Mediterranean is at best patchy and an evaluation of the implementation and success of conservation practices hampered by the lack of information in the open literature. The empirical basis upon which the transformation to sustainable use of land can be measured is therefore weakly developed. Add to this the changing perceptions of environmental priorities, in particular concerns about carbon sequestration, soil biodiversity and pollution

of aquatic ecosystems and the emphasis of conservation policies will need to adapt. Climate change provides further uncertainty. It could be concluded that the delivery of sustainable land use is too complicated and unwieldy to deliver at a national or regional scale. However, there are some success stories from smaller scale projects which offer hope that environmental concerns could be augmented within future policy review.

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