Book of Abstracts

International Conference on Ecohydrology and Climate Change

Tomar, Portugal, 15th - 17th September, 2011

Organization:
Polytechnic Institute of Tomar, Mathematical Department of Business School
Évora University, Institute of Mediterranean Agrarian and Environmental Sciences (ICAAM)
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Soil degradation and Soil quality: Soil functions and Land Use

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Processes resulting in soil degradation are by now generally well known after decades of research and so are management measures needed to avoid this. However, lack of an effective communication tool, such as a clear and transparent measure for soil quality, has hampered the creation of a feeling of urgency in society when dealing with soil degradation and its effects. The seven soil functions, proposed by the EU in its Soil Protection Strategy of 2006, may be helpful to define quality measures as will be illustrated for function 1, expressing water-limited biomass production as a ratio of potential production. Communication is also likely to benefit from linking soil functions to the concept of ecosystem services which gains prominence in policy circles. Thus, soil expertise can be more effectively linked to the policy arena. Soil functions should not only be defined for actual but also for potential conditions which are most relevant when considering ecodynamics as a function of climate change. Then, scenario analysis by modelling, considering the effects of alternative forms of land use, is needed. Here soil science faces the risk that others use soil databases and pedotransfer functions for their models bypassing soil expertise. Soil scientists should therefore close the knowledge chain proving the relevance of soil research. Even though the advantages of introducing certain forms of land use to avoid soil degradation can often be well demonstrated, nothing may happen in practice because of political, social, or economic constraints. A plea will therefore be made for active engagement of at least some soil scientists in implementation practices to ensure that real-life examples of effective soil management in terms of avoiding soil degradation can be demonstrated.

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Global Change and Geopolitics of Natural Resources

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In the last five millennia, the global climate system has been relatively stable. But, when climate changes significantly, or the environmental conditions degrade to the point in which necessary resources are not available, the tensions experienced by societies may lead them to a breaking point. Europe and the rest of the World are in a period of transition: a global financial crisis, a global energy crisis, a global food crisis, new centres of power and leadership emerging outside of Europe. In this context, Global Change is a process that is producing increasing pressures on society, making sustainability the biggest challenge for the society of the twenty-first century.

Sustainability is an open and multidimensional concept, which stimulates many different individual and collective, public or private, actors to seek a sustainable balance between production, consumption and preservation and regeneration of human and natural resources. The pursuit of sustainability, as a process of social change, requires different actors to cooperate, it generates different types of conflicts, and forces significant changes in terms of cultural values, in the production and consumption models, and in the governance systems (Lourenço and Machado, 2005).

Therefore, Global Change has an important geopolitical dimension, which results mainly from the fact that the consequences of environmental change are neither equal nor equitable between regions or countries (Barnett, 2007), and it is becoming increasingly evident that Global Change has a potential to disrupt the capacity of political, social and economic systems to adapt to change.

When analysing national security issues, stability is a main objective. Maintaining the stability within and between nations is often a means of avoiding large-scale military conflicts. Today, the capacity of the Earth (ecosystems and social, economic and cultural systems) to support human activities is being largely exceeded, creating an unstable situation that, in some regions, may be critical.

In the framework of conflict analysis, Global Change should be considered in terms of the nature and extent of the environmental stress it produces. This environmental stress is the result of two main factors: the scarcity of renewable natural resources; and the degradation of the quality of renewable natural resources resulting from increased human interaction with ecosystems. This interaction makes it increasingly more difficult to distinguish between natural and anthropogenic environmental changes. Unsurprisingly,
these two factors are strongly interconnected: envi-
ronmental degradation may worsen the scarcity
and tensions over the distribution and access to
resources, while the scarcity of a natural resource
can degrade its quality by overexploitation (Lietz-
mann and Vest, 1999).

The analysis of the relationship between envi-
ronmental stress and conflict must take into
account that environmental stress interacts with
political, social, and economic factors, and that
this evolves through several stages before conflict
arises. The main consequences of environmental
stress (poverty, food insecurity, the spread of
disease conditions, migration or refugee movements
and disruption of social and political institutions)
can, in a given adverse socio-economic and poli-
tical context, contribute to conflicts, which in a
receptive manner can also lead to greater envi-
ronmental stress.

Similar levels of environmental stress may have
different consequences on the level of conflict in-
tensity. Thus, to evaluate the potential for conflict
associated with environmental stress, it becomes
necessary to analyze the socio-economic and poli-
tical context. In countries with strong governments
and which are socially cohesive, even tense dis-
putes can be solved peacefully. However, in coun-
tries with fragile governments or with weak support
basis, the lack of resources is often a significant fac-
ctor for internal or external conflict and instability.

Although, the competition for resources does
not immediately trigger violent conflict, and no re-
cent wars have been waged solely because of na-
tural resources, there are a number of evidences
that degradation of drinking water, loss of stable
land, decline in food production and increase in
the frequency of environmental disasters can lead
to massive economic losses and large migrations,
thus generating tension and conflict.

In fact, conflicts resulting from migration are
triggered by voluntary or forced displacement and
are based on internal or cross-border migra-
tions. The voluntary migration can be induced by
structural changes such as persistent droughts,
fruits, and soil erosion (desertification). Forced
displacement is often associated with large indus-
trial projects, mining, construction of dams and
forestation plans.

In the absence of empirical evidence con-
cerning the more alarming scenarios of Homer-Dixon
(2001) and Michael Klare (2002) who brooded
an increasing likelihood of violent conflict or war
among states because of natural resources, it is
settled that nowadays, the depletion and degrada-
tion of natural resources is a fundamental issue in
the framework of global security. Therefore, the
way in which scarce resources can instigate con-
flict or foster peaceful cooperation is still an open
question that needs to be considered as part of the
New Governance for Sustainability.

References:

sity Press.

Keywords:
- Global Change, Natural Resources, Geopolitics, Conflicts, Sustainability, Security

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Resistance, resilience and community dynamics in fluvial ecosystems disturbed by contrasting hydrologic conditions: The case of Mediterranean-climate streams

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Ecological disturbances are defined by their physical effect and/or by their impact on the biota. Such disturbances may modify habitat structure, conditions and resources to the disadvantage of pre-disturbance resident biota, killing organisms or threatening their well-being and, in so doing, modifying community organization. Most natural disturbances are non-catastrophic (i.e. some resident biota survive) and act as strong evolutionary-selective forces.

We review how stream communities respond to natural contrasting hydrologic disturbances typical of Mediterranean-climate streams (MCE: Mediterranean denotes Mediterranean basin only). Globally, there are five Mediterranean-climate regions (med-regions): Mediterranean Basin and parts of coastal California, Chile, South Africa and Australia. They are characterized by a seasonal precipitation pattern of a water surplus in winter and strong water deficit in summer. Rainfall amounts vary among these regions, being lowest in the semi-arid ones (annual average < 500 mm). Rainfall also varies among years, ranging from extremely wet to extremely dry years, which alternate inter-annually in unpredictable succession. This precipitation pattern produces the MCE seasonal, sequential, contrasting hydrologic disturbances in the form of flooding and desiccation.

Floods are discrete pulse events, abruptly affecting habitat condition and community structure; whereas droughts are often ramp-shaped events that gradually intensify as desiccation and water drawdown progresses. However, once flow connectivity is disrupted, the drying impact on communities isolated in pools may be abrupt.

Most fluvial ecosystems experience natural hydrologic changes of high or low flows emanating from flooding and desiccation. In MCE, differences in precipitation combined with varying successions of wet and dry years result in temporal and spatial variability of water permanence, ranging from perennial, through intermittent, to quas-ephemeral flow. Manifestation of these contrasting flow disturbances is greatest in the more arid Mediterranean regions due to high desiccation pressure and low water permanence.

During evolution, the biota of disturbed ecosystems (such as MCE) acquires adaptive traits that allow their populations to their environment. Some organisms in affected sites may die off and their populations be decimated; while others may endure a disturbance or avoid it. Organisms avoiding disturbance may be displaced from a disturbed site (e.g. washed downstream by floods and survive), or use behavioral and life-history adaptations for a timely move to more protected sites, within or outside their resident ecosystem (internal or external refuges). Endurance and avoidance responses are generally recognizable as different forms of resistance to environmental stressors.