

COMMENTARY

# ‘Full’ world versus ‘empty’ world paradigm at the time of globalisation

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## Abstract

The Mediterranean region is characterised by a high diversity mainly due to the integration between natural (land heterogeneity) and human (stewardship) processes. Cultural landscapes are the results of such coevolutionary processes. A better understanding of the mechanisms that have assured along the millennia, the maintenance of biological as well as ecological processes seems of extreme importance for our future survival. In North America, a frontier mentality persists in the cultural mindset and rich biodiversity is associated only with remote areas, reflecting a model of an empty world in which human development is completely isolated from the natural (wild) processes. This vision is in contrast with the full world vision of the Mediterranean dwellings. Plasticity, adaptation to disturbance, and the persisting of biological refugia can be considered the most relevant factors responsible for the Mediterranean dynamics. These factors are rare or impossible to find in the North America context from which the dominance of the economic capital over the natural and cultural ones is a very popular model exported worldwide. In this commentary the full world paradigm is presented as an extension of the concept of resilience and ascendancy to propose a new grammar that incorporates self-organisation of natural and human dominated systems into a process of diffuse globalisation of economics and human behaviour.

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## 1. Introduction

Biodiversity exists at different levels of biological organisation, from genes to landscapes (Noss,

1990; Angermeier and Karr, 1994; Farina, 2000) and is unevenly distributed across the Earth (Myers, 1990). At present time, biodiversity is declining at an alarming speed (Pimm et al., 1995), with unprecedented effects on ecological complexity and specifically affecting the quality of our life (Naeem et al., 1994). However, it appears that some regions that have experienced long-term

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human intervention, like the Mediterranean basin, still preserve high values of biodiversity (Myers et al., 2000). Indeed there has never been a time since the glacial period when the Mediterranean has not experienced human occupation (Di Castri, 1981; Blondel and Aronson, 1999). Even as the glaciers receded, humans colonized, but simultaneously with other species. The fact that biodiversity may, in some circumstances, coexist with intensive human activity gives a glimmer of optimism regarding the future of our planet (Balmford et al., 2001), and has previously pointed out (Daly and Ehrlich, 1992) is important to link population processes, sustainability and the earth's carrying-capacity.

In this commentary, we offer a view of biodiversity and human activity, based on a comparison between Mediterranean and a North American perspective. We point out the differences between the two, in terms of ecosystem and ecoregion studies and the aim to explain the differences in terms of plasticity, disturbance and refugia. We conclude by discussing the challenge of globalisation within the framework of the conservation of biodiversity.

### *1.1. High biodiversity correlates*

This is a dilemma when we try to analyse the 'genuine' reasons for Mediterranean biodiversity. One hypothesis emphasises the species richness in terms of climatic conditions (a collection of highly diversified regional and local microclimatic regimes, with a variety of substrates in which living organisms may undergo evolutionary processes and genetic differentiation). Multiple processes, created and driven by such local conditions, depend mainly on the extreme richness of the environmental conditions, coupled with the effect of seasonal changes. A second hypothesis points out the influence of ecological processes on the patterns of human settlement. Local conditions determined where humans initially settled, and subsequent adaptation to these environmental conditions helped them to persist in the area and differentiate (at least socially) from the people in the adjacent area. This hypothesis emanates from the human use of resources and from the way

humanity in the Mediterranean shares resources with other organisms, albeit under a continued disturbance regime (Rundel, 1998).

Both hypotheses can find supporting evidence in existing data and should not be viewed as alternative hypotheses, but rather as complementary ecological driving forces. It is our opinion that the hot-spots for biodiversity in the Mediterranean basin are a consequence of an integration of natural and anthropogenic processes. Developing these hypotheses is one of the goals of this paper; however, to interpret our proposed scenarios it is important to develop some ideas regarding how biodiversity has been maintained in the Mediterranean region over the millennia. This may also serve to develop new perspectives on how to conserve biodiversity in the future, offering an alternative to simply chronicling the reduction of this important component of ecosystems.

## **2. The Mediterranean paradigm**

We know that, at ecotones, the number of species is higher than in the surrounding environments (Leopold, 1933; Risser, 1993; Hansen et al., 1992). This effect has been well documented on several occasions for plants and animals at the scale of the landscape. Moving to a larger 'ecological' scale like a biome or ecoregion, this paradigm can be usefully utilised to explain the higher diversity of species. In these latter cases, many species can be found only at such an ecotone. Furthermore, the ecotone represents an area in which evolutionary processes are in action (Di Castri et al., 1988).

The Mediterranean region can be observed at least at two different scales: one (broad) scale in which the region appears as a bridge between Europe and Africa, and a second (finer) scale in which it is considered as a mosaic of geomorphic and climatic patches, finely linked to each other (Lepart and Debussche, 1992). At one broad scale human populations have integrated low frequency components of climatic change by long-term migration and recolonisation. Such migratory movements have had dramatic effects on the sociopolitical geography of the Mediterranean

region (e.g., the barbarian invasion at the end of the Roman Empire), but their frequency has been low, allowing the systems to adapt to the new regime of disturbance by human use. In contrast, smaller-scale abiotic fluctuations were integrated by cyclic migrations (transhumance). The fine-grained mosaic of ecosystems corresponds to the case in which neighbouring watersheds may be managed differently resulting in different species assemblages, yielding greater regional diversity. The use of ecotopes as environmental (landscape) units in capturing natural diversity along with the cultural diversity is more than a hypothesis (Vos and Stortelder, 1992; Naveh and Lieberman, 1994) and it leads to a new vision of diversity maintenance. Our hypotheses imply a strong overlap between human history and ecosystem processes, leading to the paradigm of the cultural landscapes. This paradigm is based on the assumption that, in the past, human populations have locally established tight linkages with their environment by feedback mechanisms able to ensure a certain type of sustainability. Within this paradigm, the ecological mosaic appears very reasonable. The high contrast between the different patches that compose such a mosaic generates a high diversity of living forms. Such mechanisms have been the object of great interest among ecologists and today the high value of such landscapes have been recognised by agencies such as UNESCO and IUCN (van Droste et al., 1995).

### 3. The North American paradigm

High biodiversity in North America is generally observed in areas with relatively low human impact, particularly in mountains, wetlands, riparian zones, and ecotones. Conversely, several areas with low human population have low diversity, either due to climatic constraints, or to high human influence (e.g., monoculture croplands). Biodiversity conservation efforts are concentrated in areas of minimal human influence. As a legacy of colonization by Europeans, a frontier mentality still persists in the cultural mindset of North Americans, where wilderness is viewed as a hostile resource to be dominated and exploited (Nash,

1986; Turner, 1980). However, another concept has developed along side the exploitative viewpoint. In the tradition of Henry David Thoreau and John Muir, wilderness is viewed as an aesthetic and spiritual ideal (Nash, 1986; Oeschlaeger, 1991). This view informs the designation of protected areas in regions far from human settlements (e.g., Yellowstone National Park, USA; Pinacates World Biosphere Preserve, Mexico). As human pressure on these areas increases, managers fight to preserve both biodiversity and the cultural value of wilderness.

The perception of an ‘empty’ world, when in fact North America is almost ‘full’, brings both problems and solutions. There is a tension between people who continue to operate solely from the ‘empty’ world concept that has led to exploration and conquest. The latter are tailored by exploitation/extraction of diversity. There is now a growing recognition that some land must be maintained for current and future diversity. The latter attitude has led to the set aside of lands at several administrative scales. New federal parks are being established. Federal agencies are reconsidering the way they manage land on federal lands. State and provincial agencies are developing buy-back and exemption programs to increase critical habitat. In addition, local groups are developing land trusts and conservation easements (Wright, 1993). In contrast to the Mediterranean, patterns of biodiversity in North America after colonization are hardly a result of a long period of co-adaptation with human cultures. Colonization and settlement of the frontier has depleted biodiversity. There is evidence that, prior to colonization, high biodiversity existed in close proximity with humans in some areas and remains where traditional agricultural practices persist (Nabhan et al., 1982).

### 4. Population density and hot-spots

High biodiversity can coexist with high population density (Balmford et al., 2001). This has in the past been true for Mediterranean type ecosystems around the world (Myers et al., 2000). This is less true in North America where, with few exceptions, biodiversity is concentrated away from human

populations. Colonization does not inevitably lead to a loss of biodiversity. According to Cincotta et al. (2000), human density and biodiversity hot spots are often found in the same location. Perth, Western Australia, (colonized 200 years ago) is an example of an area where a dense population coexists with natural areas of high biodiversity. Perth may be able to maintain this relationship because it is relatively isolated from other metropolitan areas. Similar situations are present in North America in cities like Tucson and Orlando. However, it is important to relate population density and biodiversity hot-spots to the impact of industrialisation processes in North America with respect to a more agrarian based Mediterranean economy and try to quantify this impact at both temporal and spatial scales.

Cities in general have a very large 'ecological footprint' in the modern world (Wackernal and Rees, 1996; in Odum, 2001). Probably there has never been a time in history when a large city has been integrated into the system. It is, however, possible that large cities have been isolated (functionally encapsulated) in the past and, therefore, prevented from seriously changing the function of the systems. Today, this is not the case and cities are, to a large extent, driving the use of resources through development (Farina, 2000). In the past, there were two functional systems, cities and their surroundings, and the countryside. The two systems functioned separately. Cities were sinks for services, provided by the surrounding countryside. Today the cities, markets and industries are the drivers of systems that were formerly separate (rural, cultural) (Barrett et al., 1999). Three crucial factors seem to play a relevant role to explain the permanence of high biodiversity in the Mediterranean region: plasticity, disturbance and refugia.

#### 4.1. Plasticity

Plasticity is a characteristic of the Mediterranean ecosystem (Perevolotsky and Seligman, 1998), where continual change in human and natural stressors can be incorporated into the system without apparent loss of ecological complexity. Thus the system may evolve to different configurations while maintaining biodiversity and

the services provided to humans. In such a system, services that the system cannot provide are not needed, i.e., the carrying capacity of the system is not surpassed. This does not mean that the system will maintain the same set of biologically diverse organisms, but it has the capacity to modify its structure, for instance, by the coalescence of communities (Thompson et al., 2001). This indicates an adaptation of the system that incorporates humans over time in homeorhetic fashion. There is little indication that the North American system has had sufficient time to develop such plasticity.

#### 4.2. Disturbance

Disturbance in the Mediterranean is culturally informed and results in a fine scale heterogeneity that provides habitat for many small organisms (Naveh, 1998). In North America, in contrast, disturbance tends to be very much larger in spatial scale and may displace entire ecosystems (e.g., monocultural agriculture replacing native grassland). Disturbance in North America has also occurred over a much shorter time span than in the Mediterranean, resulting in modifications in system function that may not be easily restored. Despite this fact, we have the lesson learned from the Mount St. Helens eruption, in which 600 km<sup>2</sup> were devastated on 18 May 1980. This event transformed homogenous landscape into a patchy landscape mosaic, housing many species with complex relationships (Lovett, 2000; Franklin and MacMahon, 2000).

#### 4.3. Refugia

Despite the long tenure of humans in the Mediterranean, we do not believe that the ecosystem has been completely modified. Assuming this hypothesis is correct, we note that unproductive pieces of land, hard to manipulate, persist across the Mediterranean. These sites may be cliffs, mountain slopes, ponds, swamps, sacred forest or simply rocky-bare soils. These 'islands' have played a fundamental role as ecological oases or refugia for many species. Often, fragmentation by human activity reduces habitats to small, isolated patches that may be refugia for biodiversity.

Neglected areas, those not immediately useful economically, may also function as refugia. These refugia can be considered as a bank for biodiversity, but may not be self-maintaining systems. Refugia may be too small to function on their own or may be surrounded by unrelated systems that constrain critical functions like their capacity for self-organization. Refugia, nonetheless, remain an important resource for both the Mediterranean and North American systems and around the world. The philosophy that has created the biosphere reserves and national parks has been implicitly based on the concept of refugia (see also Margules and Pressey, 2000).

## 5. The challenge of globalisation

The large-scale disturbance regimes that are common in North America are beginning to replicate as the world becomes more economically connected. Thus, systems which have been stable in the past may now be subjected to dramatic and irreversible changes, involving both natural and cultural processes (Laurance et al., 2001). This change is a response to an increased emphasis on economic systems, to the detriment of cultural (Wuethrich, 2000) and natural systems that should provide a check upon each other. Maximising economic capital, without the control of natural and cultural capitals, could exhaust non-renewable energy in the short term, use dangerous technologies as well as technologies dangerously, and cause an immoral and unequal distribution of goods and services. This results in humans moving far from natural processes. In this way both cultural and natural capital are being depleted and their role in controlling economic capital is reduced (Costanza et al., 1997; Barrett and Farina, 2000; Farina, 2000). The proposed analysis using the environmental Kuznets curve (EKC-analysis) as proponents of economic globalisation has been demonstrated to have deficiencies and limitations (Max-Neef, 1995; Tisdell, 2001,) and should not be used as guideline for implementing economic-environmental policy.

The sustainability viewpoint proposed by Costanza (1991) and the concept of resilience proposed

by Holling (1973) are interesting departure points from which to try to develop a new grammar that can cross the boundaries between human activities, economic development, diversity and complexity in socio-natural systems. A new complex systems approach to biodiversity at the time of globalisation is necessary as depicted in the cartoon in Fig. 1. Ulanowicz (1980, 1986) has suggested that the emergence of an ecological hierarchy in ecosystems organization is a consequence of the genealogical hierarchy intrinsic to ecosystems. Organization and structure in living systems from a phenomenological approach (Varela, 1979) suggest that biological processes can be regarded autonomous of physical constraints thus the importance of acquired knowledge of the organism from experience can be regarded as a reflection of ontogeny. These different views strongly suggest that we need to consider the role of knowledge from a cultural and historical experience as an integral part for understanding the complex dynamics in socio-natural systems. Ulanowicz (1997) proposed the concept of ascendancy as a possible way to try to quantify not only ecosystems status but also the behaviour of economic communities. Turning the question to biodiversity: how can we propose a new outlook that can untangle the complex dynamics underlying functional biodiversity in socio-natural systems?

## 6. Discussion and conclusion

We need to try to understand the processes that regulate to a larger extent the historical dynamics in socio-natural systems seeing functional biodiversity as an organisational agent that mutually changes its dynamics. At the ecosystems level, we need to understand further if for example species-area curves (SAR) and relative species abundance can be regarded as a multifractal landscape in order to untangle the scaling laws that can explain community organization from local-regional to landscape spatial scales (Borda-de-Água, et al., 2002). We need to pay more attention on how self-organization and self-similarity (Solé and Manrubia, 1995a,b; Kaufman, 1993) can be incorporated in our view of the evolution of socio-natural

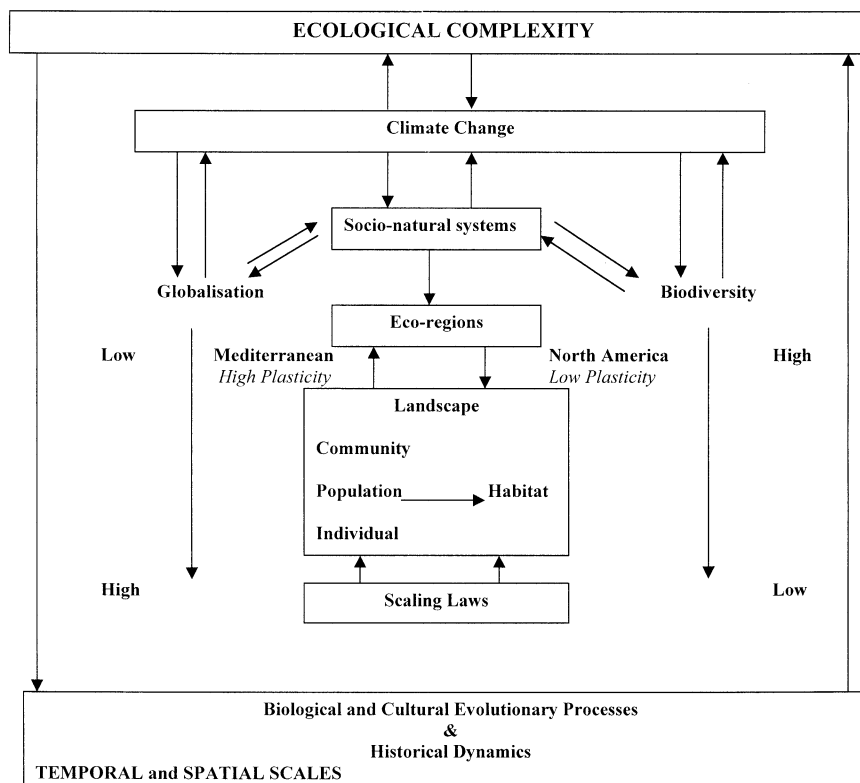


Fig. 1. This oversimplified cartoon of a socio-natural systems dynamics highlight some of the relationships between ecological complexity, climate change, biodiversity and globalisation for the two examples of the ‘full world’ Mediterranean paradigm and the ‘empty world’ of the North America paradigm. The low and high axes at the left and right of the diagram indicate the metrics of globalisation and biodiversity, respectively. The time and spatial scales box at the bottom of the cartoon serves as a reminder to show that biological and cultural evolutionary processes and historical dynamics can be regarded as the time scale at which crucial factors seem to play a relevant role to explain the permanence of high biodiversity at different spatial scales.

systems in the world. In this respect the proposed idea of a ‘full world’ needs to embrace all these views to make a synthesis of the existing information and try to understand the underlying non-linearity of its dynamics. We need to consider not only the ecosystems dynamics per se, but also the historical changes in the evolution of the relationship between nature and culture (ARCHAEO-MEDES, 1998; van der Leeuw and Baudet-Michel, 1997) not as separate entities but as connected socio-natural information networks within the scenario of the emerging role of climate change in our culture.

In conclusion, concepts presented for the Mediterranean region are based on the idea of a ‘full’ world in which humans are an integral part of the

system (Odum, 2001), conversely North Americans perceive their world as empty. The ‘empty’ world viewpoint is inappropriate when human development approaches the carrying capacity of a system. Since we are already reaching the global carrying capacity for human development, the North American paradigm is an inappropriate guide for the future, anywhere in the world. Globalisation, despite its short-term economic advantages, is not ecologically sustainable when it implies that the same standards will be applied everywhere. Such globalisation will reduce diversity and the capacity of natural and cultural systems. However, from both viewpoints, we learn lessons based on long and short-term human use of the environment. From each, we need to extract



guidelines to develop new scenarios, based on a world where a partnership between humans and nature can be fully realised. Ultimately globalisation decreases the ‘degrees of freedom’ in the society, therefore, narrowing the choice and diversity of services, products necessary to restore and maintain a healthy environment.

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