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Transdisciplinary Challenges for Sustainable Management of Mediterranean Landscapes in the Global Information Society

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Abstract

The present chaotic transformation from the industrial to the global information society is accelerating the ecological, social and economic unsustainability. The rapidly growing unsustainable, fossil energy powered urban-industrial technosphere and their detrimental impacts on nature and human well-being are threatening the solar energy powered natural and seminatural biosphere landscapes and their vital ecosystem services. A sustainability revolution is therefore urgently needed, requiring a shift from the „fossil age" to the „solar age" of a new world economy, coupled with more sustainable lifestyles and consumption patterns. The sustainable future of viable multifunctional biosphere landscapes of the Mediterranean Region and elsewhere and their biological and cultural richness can only be ensured by a post-industrial symbiosis between nature and human society. For this purpose a mindset shift of scientists and professionals from narrow disciplinarity to transdisciplinarity is necessary, dealing with holistic land use planning and management, in close cooperation with land users and stakeholders. To conserve and restore the rapidly vanishing and degrading Mediterranean uplands and highest biological ecological and cultural landscape ecodiversity, their dynamic homeorhetic flow equilibrium, has to be maintained by continuing or simulating all anthropogenic processes of grazing, browsing by wild and domesticated ungulates. Catastrophic wildfires can be prevented only by active fire and fuel management, converting highly inflammable pine forests and dense shrub thickets into floristically enriched, multi- layered open woodlands and recreation forests.

Keywords:

chaotic ecological and socio-economic transformation; sustainability revolution, homeorhetic flow equilibrium; Mediterranean uplands conservation and restoration; fire and fuel management

1 Introduction

The object of this essay is to discuss some of the major transdisciplinary challenges, facing the global information society, for landscape ecologists, conservationists, restorationists, stakeholders and decision makers on land use in Mediterranean uplands. The theoretical premises on which this paper is based are of general relevance, and the principles for dynamic conservation management are applicable for most other semi-natural perturbation dependant landscapes on all continents.

2 The Chaotic Transdormation of Human Society towards the Global Information Age

Human society is presently undergoing a crucial transformation from the industrial to the post-industrial global information age. The ensuing closely interwoven rapid changes,embrace all spheres of human life and their biological-ecological,social-cultural, economic, technological and political spheres. The changes are driven by the rapid development of worldwide computer networks of information, reinforced by cellular telephones, allowing a rapid economic built-up expansion and globalization.

However, in spite of the great advances in science and technology, the emerging global information society has not been able to resolve the deep ecological crisis yet that was created in the last century, caused by rapid population growth and urbanization and coupled with the intensive consumption of fossil fuels, agricultural products, forest products and fresh water supplies. On the contrary, current globalization has not only expanded this ecological crisis from the industrial countries to a world wide scales, it has also accelerated the pace of undesirable and irrevocable changes of global warming and their threatening catastrophic outcomes. At the same time, the promises of the new global economy have not been realized. The present world-wide economic crisis, accompanied by much more expensive basic food prices are widening further the social and economic gap between the world's richest 1 billion people and its poorest 1 billion.

According to a recent survey by the World Bank. reported in the Israeli „Haaretz" newspaper in June 2009, a wave of social and political unrest could undermine the stability of the poorest countries if the industrialized G-20 countries will not come immediately to their rescue. In the developing countries, hundred of thousands have already lost their jobs without any social security for unemployment. They will return to live beyond the threshold of poverty, joining the poorest billion trapped at subsistence level and even to hunger and starvation. The poorest countries and the poorest parts of the society are also the major victims of ecological disasters, becoming more severe and frequent because of global warming, such as flooding, hurricanes, typhoons as well as desertification. Originating on the Wall Street Bank failures, the present economic crisis reveals the fragility and unsustainability of the ruling so-called „free global market" economy, driven by unrestrained economic growth and fed by greediness, short sightness and ignorance.

According to the findings, reported by the Global Footprint Network (Global Footprint Network 2008) our demand surpasses also nature's budget and humanity has consumed all the new resources the planet produced in 2008. We are in the ecological equivalent of deficit depending, drawing down our resource stocks – in essence, borrowing from the future. The above-mentioned recent bank failures in the United States have shown what happens when debt and spending get out of control. We are seeing signs of similarly disastrous consequences from our ecological overspending. Climate change, shrinking forests, declining biodiversity and current world food shortages are all results of the fact that we are demanding more from nature than it can supply.

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As described lucidly by the world renowned systems scientist and planner, Ervin Laszlo (2008), this **„Macroshift"** transformation is a chaotic process, driven by economic, sociological, and ecological unsustainability, in which four major phases can be distinguished:

(1) The **trigger phase** of gradual but ongoing change, chiefly by technological innovations.

(2) The **transformation phase** of more rapid built up, characterized by a higher level of production, faster population growth, and accompanied by greater social complexity and growing impact on the social and natural environment.

(3) The **critical chaos phase** in which the changed social and environmental relations put pressures on established culture, honored values, ethics and world-views, so that the society becomes chaotic. It exhibits a subtle order that is extremely sensitive to fluctuation and nothing continues in the same way as it did before, everything „bifurcating „ into rapid, previously unforeseen change. The outcome of these bifurcations will be determined by the evolution of the dominant culture, how the people's values, views and ethics respond to change, the way how its developmental trajectory forks of, either to the fourth phase of breakdown or breakthrough.

(4a) The **breakdown phase**, in which a critical mass of people in society is either resistant to change or changes too slowly and the institutions are too rigid for the urgently need transformation, needed to overcome unmanageable ecological and social stresses. The social order is exposed to a series of crisis that soon degenerate into conflict and violence - together with the total irreversible degradation of the natural environment-namely its open landscapes.

(4b) The **breakthrough phase** in which the mind-sets of a critical mass of people is shifting the culture of society towards a better adapted mode of improved social order, governed by more adapted values, world views and ethics, leading to sustainability of our total Human Ecosystem, integrating humans with their total environment, namely their urban –industrial, rural, natural and semi-natural landscapes.

These four Macroshift phases are shown in Figure 1.

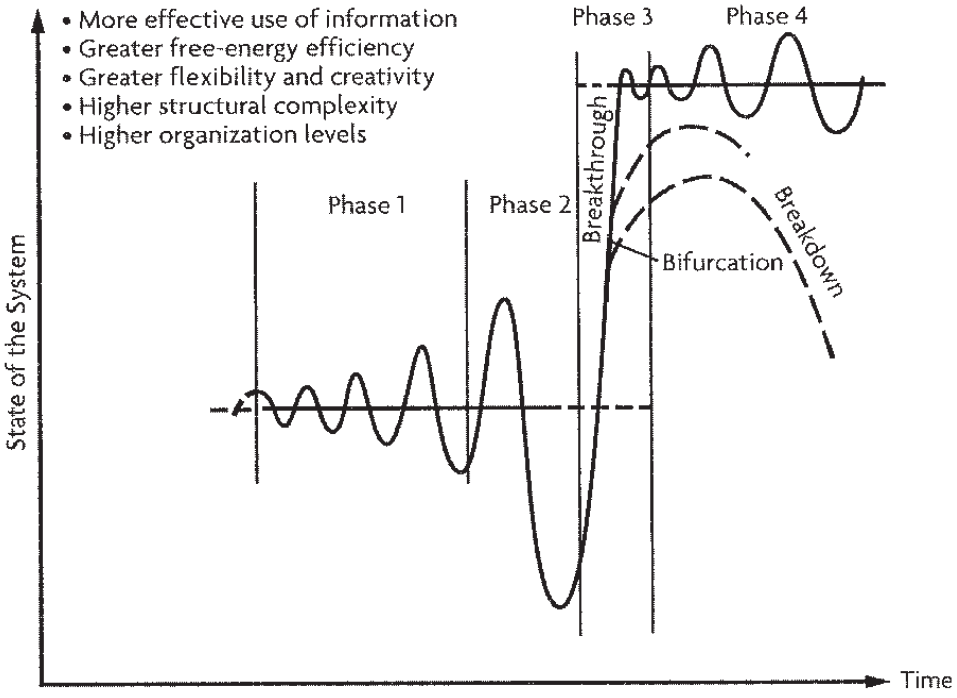

Figure 1: The four phases of a Macroshift (Laszlo 2008).

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We are now in the critical chaos phase, in which the presently accelerating severe ecological, cultural and socio- economic crisis of our Total Human System leaves human society little time for the choice of navigating this transition from the threatening breakdown to a breakthrough towards a sustainable world. Such a breakthrough is a „chaos point", during which any input or influence on the system, however small, can replace existing trends by new trends and processes. This can be achieved only by an urgently needed, ecological, socio-economic and cultural and technological *„sustainability revolution"*, leading to the sustainable future of nature and human life on Earth.

This sustainability revolution requires a shift from the „fossil age" to the „solar age" of a new world economy, based on the limitless output of the sun as the non-polluting and renewable energy source. It demands a shift from depletion of natural resources to their more efficient and wiser sustainable use, by recycling and reducing throughflows of material and energy and their adverse impacts on human and landscape health. However, this revolution will not be achieved merely by the widespread adoption of technological innovations of regenerative and recycling methods and their efficient utilization towards a shift to solar and other non-polluting renewable sources of energy. As Laszlo (2008) has shown lucudly, this Macroshift must be part of a cultural , consciuoness evolutionary proricess, leading to more sustainable lifestyles and consumption patterns. By caring for nature and even unvesting in nature and its conservation, it should result in the creation of a post industrial symbiosis between nature and human society (Naveh 2007).

3 Multifunctional Biosphere Landscapes - the Basis for the New Symbiotic Relations Between Nature and the Global Information Society

In practical terms this means converting the presently antagonistic relations between the rapidly expanding, human-made, rural, suburban and urban-industrial technosphere landscapes and the rapidly vanishing natural and seminatural forests, shrublands, woodlands, grasslands, and wetlands into mutual benefit win-win relations. This can be achieved only by realizing the vital importance of all these natural and semi-natural landscapes for the conservation of nature and for human life and well-being.

As explained in detail in my recently published anthology (Naveh 2007), these **multifunctional biosphere landscapes** are the spatial and functional matrix for all wild – that means spontaneously developing and reproducing - plants and animals on which future organismic evolution depends. Figure 2 shows the differences between the solar-powered biosphere and the fossil energy powered technosphere landscapes.

In contrast to the technosphere landscapers which are functioning as unsustainable throughput systems, biosphere landscapes are sustainable regenerative and recycling systems in which the solar energy is derived through photosynthesis and the material flow is channeled through conversion, distribution, and assimilation. Most biosphere landscapes have retained the capacity to organize themselves in a coherent way by maintaining their structural integrity in a process of continuous self-renewal in their live creating processes, increasing thereby their internal negentropy, order and information and ensuring further biological evolution.

On the other hand, technosphere landscapes lack entirely these self-organizing and regenerative capacities. Their high outputs of entropy, waste and pollution together with that of the high-chemical input of agro-industrial landscapes

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are endangering the future of biosphere landscapes and human health.

Without the need for additional inputs of materials and fossil fuel, biosphere landscapes provide free ecological, sociological and economic goods and services. These are also the most efficient non-polluting and cheapest antidotes against the multitude of psychological and physical stresses of the global information society. From the point of view of human land uses, their most important functions are their capacities for biological and geophysical production and protection, and for carrying, filtering, buffering, storing and regulating the flows of energy, matter, and information. At the same time, they also provide aesthetic, cultural, spiritual and re-creative values for our physical health and mental well-being. According to Daily (1997), these „ecosystem services" include the purification of air and water; mitigation of floods and droughts; detoxification and decomposition of wastes; generation and renewal of soil and soil fertility; pollination of crops and natural vegetation; control of the vast majority of potential agricultural pests; dispersal of seeds and translocation of nutrients; maintenance of biodiversity, from which humanity has derived key elements of its agricultural, medicinal, and industrial enterprise; protection from the sun's harmful UV rays; partial stabilization of climate; moderation of temperature extremes and the force of winds and waves; support of diverse human cultures; and provision of aesthetic beauty and intellectual stimulation that lift the human spirit.

Of special significance for the information society in this context, is the *„restorative experience of nature"* after *„direct attention fatigue"* caused by continuos and intensive mental work (Kaplan 1995) such as performed by High Tech-workers spending many hours in creative work behind the computer (Naveh 2003; Naveh 2007). Only when carrying out all these functions to their fullest potentials on a sustained basis, we can consider these biosphere landscapes as healthy, stable and attractive multi-functional and multi beneficial life-supporting and even life-saving natural systems.

Although these services are essential to human societies, their continued existence has been taken for granted. Never before have human actions so threatened their provision. Because these services are not traded

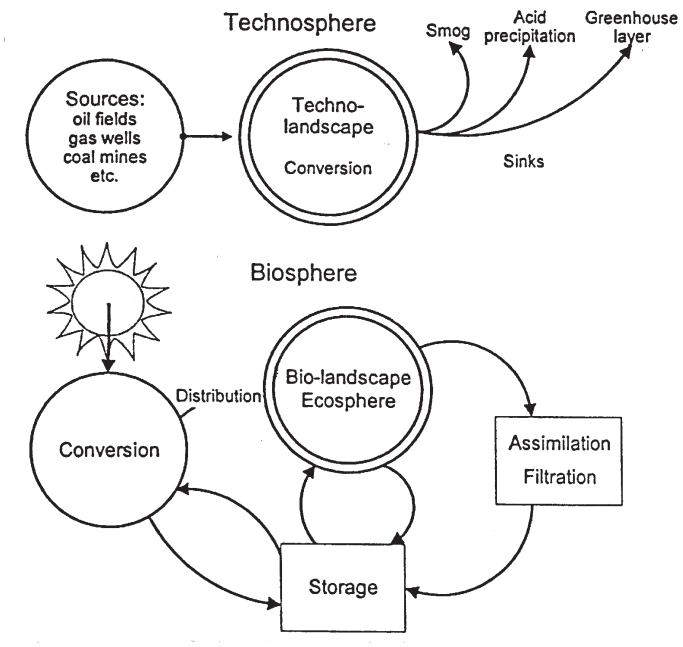

Figure 2: Biosphere landscapes as sustainable regenerative systems and technosphere landscapes as unsustainable throughput systems.

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in economic markets, society has no feedback mechanisms to signal changes in their supply or in the deterioration of underlying ecological systems that generate them. Their vital importance is often recognized only after these „free ecosystems services" have been lost, as was the case following the Hurricane Katrina disaster in New Orleans (Chambers et al. 2007).

In recent years, and especially after the publication of the important Millennium Assessment report MA (2005) for human welfare, there is a growing tendency to incorporate the multifunctional services and goods and their material monetary „hard" values and intangible non-monetary „soft" values in the decision making process for land uses. Wherever this is implemented, it could be recognized as an important step towards the realization of the above-mentioned symbiotic relations between nature and human society. Thus, for instance, China is investing over 700 billion yuan in ecosystem services payments in the current decade (Liu et al. 2008). This is well reflected in the special January 2009 issue of „Frontiers in Ecology and Environment" Vol.7,devoted to ecosystem services – with the objective to identify and quantify the resources and processes that nature provides to people for the creation of a credible, replicable, reliable and sustainable framework for landscape planning, conservation management and decision making.

That all these efforts are **transdisciplinary challenges** has been clearly shown in this issue by the report on the initiatives of „Nature Capital Project", as implemented in Hawaii (Daily et al. 2009). This is a partnership between Stanford University, The Nature Conservancy and World Wildlife Fund, helping to integrate ecosystem services into everyday decision making around the world by turning the evaluation of ecosystem services into effective policy and financial mechanisms (www.naturecapitalptoject.org). In this respect some advances have been achieved up-to-now with major tangible biophysical and ecological production functions and their monetary benefits. However, a key challenge remains to also include the intangible „soft" non-monetary cultural, aesthetic , scientific , spiritual, religious and psychotherapeutic values. These have intrinsic values, that means non-instrumental and non - economic **existence values for their own sake** and, most important , they ensure the future evolution of life on earth, which is priceless. In this way, they contribute significantly to our physical, mental and cultural well-being and thereby to the quality of life.

However, the capacity of these regenerative biosphere systems to continue producing all these vital free services, is severely endangered by the unsustainable technosphere throughput systems and their increasing output of entropy, waste and pollution having far-reaching adverse effects on humans and nature. As mentioned above, we are also faced with the problem that all these free production, protection and regulating services of nature are taken for granted and that in actual land use policies and practices only those „hard" functions which ensure marketable economic returns are taken into account without realizing that all these functions are interdependent. By neglecting the „soft" functions, the „hard" functions will be lost also sooner or later. This is especially the case in the Mediterranean Region.

4 Mediterranean Biosphere Landscapes as Dynamic Human Perturbation-Dependent Homeorhetic Flow Systems

Before dealing with the present accelerating degradation of Mediterranean biosphere landscapes and their sustainable conservation management and restoration, a full comprehension of the thermodynamic behavior as human-perturbation-dependent systems is essential. As outlined in more detail elsewhere (Naveh 1991; 1998; 2007; Naveh & Lieberman 1994), all these semi-natural and agro-silvo-pastoral landscapes, in the Mediterranean as well in as most others biomes, behave like *dissipative structures*, senso Prigogine (1976). They are maintained and stabilized only by permanently interchanging energy and entropy with their environment. Driven by positive feedbacks of environmental and internal fluctuations, they move to new intermediate states that generate conditions of renewal of

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higher internal entropy production, while undergoing short- and long-term cyclic fluctuations. These fluctuations are caused by natural and human perturbations Thus they are far from a homeostatic so-called „climax" equilibrium stage. We assume that in the Mediterranean, such cyclical perturbations have been introduced already in Middle Pleistocene by wildfires and by the Paleolithic food gatherer-hunters (Naveh 2007; Naveh & Carmel 2004). For many thousand years, these cyclic anthropogenic perturbations have been continued with much greater intensity by rotational grazing, browsing, cutting and coppicing regimes, together with cultivation and other traditional land uses. Superimposed on the seasonal and annual climatic fluctuations, their resulting defoliation pressures were incorporated into the landscape at different spatio-temporal scales. This resulted in the establishment of a human-maintained and dynamic long- and short-term flow equilibrium or *homeorhesis* (from the Greek, meaning preserving the flow) between the tree, shrub, herb, and grass layers and the cultural artifacts of forests, woodlands, shrublands and grasslands.

In homeorhesis, the system does not return to a stable state as in homeostatic „climax" systems, but moves along the same trajectory of change, as long as these cyclic perturbations are continued with similar intensities and frequencies (Waddington 1975). In this manner, these perturbation-dependent systems have acquired long-term adaptive resilience and evolutionary metastability.

Wherever moderate, traditional defoliation pressures have maintained open, grassy patches for light demanding herbaceous plants, including also highly ornamental geophytes, we found in our studies a very high floristic and structural diversity. But where these pressures have ceased, either for the sake of nature protection or as a result of land abandonment, or where they had been intensified, both floristic and structural diversity had been reduced considerably (Naveh 1998a; Naveh & Whittaker 1979). These findings have been corroborated on a much larger scale by Noy-Meir and Kaplan (1991). Their practical implications have become an integrative part of dynamic conservation management in Israel (Perevolotsky 2005).

In all these Mediterranean uplands, the disruption of the dynamic homeorhetic flow equilibrium is the result of *neotechnological landscape degradation*. It is characterized by the unfortunate combination of the cessation of human agro-silvo-pastoral activities and disturbance processes, following depopulation on one hand, and on the other hand, by the rapid and careless shift from diversified and stable traditional agriculture to large-scale agro-industrial farming, coupled with indiscriminate planting of dense monocultures of‘ highly inflammable pine trees. Therefore, we conclude that high biological and cultural biodiversity or *„total landscape ecodiversity"* and their combined and closely coupled biological, ecological, cultural and socio-economic functions and values can only be ensured by the maintenance of dynamic homeorhetic flow equilibrium on both micro-and macro-scales.

For this reason it should be realized that neo-technological landscape degradation and despoliation cannot be prevented simply by protective measures and by the cessation of human influences. On the contrary, maximum attainable biodiversity, within a fine-grained matrix of ecological heterogeneity patterns, fulfilling all above-mentioned functions, requires the perpetuation, simulation, and/or restoration of all natural and cultural patterns and processes, including grazing and browsing by wild and domesticated ungulates. If this is not anymore economically feasible, the vital defoliation pressures have to be simulated by mechanical or other, ecologically sound means.

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5 Accelerating Degredation of the Mediterranean Landscape in the Emerging Global Information Society

As described in more detail elsewhere (Naveh & Lieberman 1994), and updated in the concluding chapter of the anthology (Naveh 2007), these accelerating threatening trends of landscape degradation are a major part of the global environmental crisis. It is operating in the Mediterranean Basin as a vicious cycle of mutually amplifying and destabilizing feedbacks of exponentional growth of populations and their needs for open land, coupled with the traditional and modern land use pressures and, especially, by rapidly growing tourism. These pressures are combined with synergistic processes of greater intensity of traditional and modern agricultural land uses and urban-industrial expansion on one hand, and depopulation and land abandonment on the other. In a more recent survey of the neo-technological impoverishment of the open Mediterranean landscape at the end of the twentieth century (Naveh 1998b; Naveh 2007), I showed that the most pessimistic sceneries predicted by The Blue Plan of the United Nations Environmental Program (UNEP, 1988) have become true. This is especially the case of the heavy urban-industrial and tourist pressures in the coming twenty years of this region, and their negative impacts on these landscapes and on the environmental quality at large, and especially in the coastal zone.

Since then, these pressures have increased even more. Unfortunately, the same is true for my warnings (Naveh 1995) that any increase in climatic stress will further aggravate the process of overall landscape degradation.

In spite of several positive regional and national initiatives, reported by Vogiatzakis et al. (2008) in their important anthology on Mediterranean island landscapes, the quality of the environment and of the open landscape in all countries around the Mediterranean Basin has further deteriorated. Most threatening are the consequences of global climate changes also in this region and especially in the more arid parts. We are experiencing now, not only severe drought spells with higher than average temperatures in the winter and higher frequency in the summer, but also an alarming increase in the frequency of extreme and even catastrophic meteorological events, including unpredictable windstorms, and very heavy convectional rainfall intensities. Therefore, we are faced with a period of increasing uncertainty in spatial and temporal climatic trends with synergistic detrimental and sometimes even catastrophic ecological effects. As a result, also the present water crisis in the drier parts of the Mediterranean has become even more severe as predicted.

According to a recent report by the Israel Ministry of Environmental Protection, reported by Z. Rinat in the Israeli newspaper „Haaretz“, on the 6th August 2008, there will be a reduction in rainfall by 10 % and until 2050 by 20%. This means for Israel a reduction of 25 % of the amount of water available. At the same time the water requirement for irrigation, industrial and human uses will increase by 20 % in Israel. A similar deficit can be expected also in other semi-arid Mediterranean countries and regions, which could be further increased by an additional 20 % during the long tourist season.

These climatic stresses are further enhancing brush encroachment in abandoned and neglected forests and maquis, thus encouraging their floristic impoverishment and resulting in accelerated and widespread decline of the unique biological, ecological, and cultural ecodiversity of the Mediterranean, distinguished as one of the world‘s „biodiversity hotspots“ (Myers et al. 2000). The creeping forest die-back, caused chiefly by pests, disease and their synergetic interaction with photochemical air pollutants on *Pinus halepensis* (Naveh et al. 1981), has further increased the accumulation of dry fuel. This resulted in even greater inflammability and higher temperatures and destructive power of the many wildfires raging in all Mediterranean forests and shrublands.

However, we have not yet closed this vicious cycle. Because of its high solar radiation potentials, the Mediterranean Basin has not only high photochemical air pollutants activity. It is also rich in sclerophyllous and

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aromatic woody plants, emitting biogenic volatile organic compounds under heat stress. *Pinus pinea* and most probably all other Mediterranean pine species, as well as eucalyptus trees, are emitting high amounts of terpenes. These volatile organic emissions play apparently a key role not only in their high inflammability but further increase also the threats of air pollutants by favoring the formation of ozone, organic particles and volatile hydrocarbons (Seufert 2000, personal communication).

In all the above–cited papers I have warned, unfortunately in vain, that if no efficient preventive measures will be taken in time, these hot fires could become even more devastating with progressing air pollution and climate stresses. I stressed that their prevention should not only be piecemeal measures but part of a holistic, sustainable landscape planning, management, conservation and restoration.

6 Discussion and Conclusions

In view of the exponential speed and extension of the Mediterranean landscape degradation processes in the emerging global information society, the unique co-evolutionary biological and cultural richness of Mediterranean uplands and their intrinsic and instrumental values are gravely endangered. The severe threats of global climate changes and their synergistic couplings with land degradation and desertification are an additional compelling reason to double our efforts in order to conserve and restore the health, integrity and eco-diversity of as many as possible of these most valuable landscapes. This would be the best insurance policy, It would ensure sufficient landscape connectivity, and counter further fragmentizing, homogenizing, pollution and scenic despoliation, and it would provide options for sustainable life supporting and other vital ecosystem and landscape functions and keystone species, and afford best chances for the survival of rich biotic communities and their further evolution. To face these challenges and ensure the future of viable Mediterranean biosphere landscapes, there is urgent need for a radical change towards more sustainable conservation and management practices.

All international and local initiatives and conservation projects and advanced research methods, such as those suggested by Papanastasis and Chouvardas (2005) and Perevolotsky (2005) for integrative landscape ecological management practices, will have sufficient impact to prevent further landscape degradation only if they will strive towards new, post-industrial symbiotic relations between nature and its biosphere landscapes and the emerging global information society, as part of the above-mentioned sustainability revolution in the Mediterranean Basin.

At this crucial phase of the transition from the industrial to the post-industrial global information age, we must realize that all Mediterranean biosphere landscapes are an integral part of the above described global chaotic evolutionary process of our total Mediterranean Human Ecosystem. This has reached a critical stage of a destabilizing shift towards a chaos point or so-called *„bifurcation"* from a metastable attractor point to non-linear and chaotic ones. Whether this bifurcation will lead to further evolution or to further creeping decline until final total collapse, will depend almost entirely on the decisions and behavior of human society and their decision makers on all levels.

It should become obvious to all environmentally engaged and concerned scientists that the present crisis demands very different ways of thinking and acting to those which they have been prepared by most of their teachers in the universities and in their professional career. In order to fulfill a meaningful role in this social and ecological sustainability revolution, their science cannot remain just another branch of those disciplines following blindly and faithfully all the conventional outdated mechanistic and reductionistic paradigms and preaching a positivistic human-detached so-called "objective" science.

Our main challenge is to respond together with all those dealing with sustainable land use planning and development to the demands of the emergent global information society by taking an active role in steering this

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Macroshift towards such an all embracing sustainability revolution, ensuring healthy and attractive landscapes. This will demand from all concerned environmental scientists and especially those dealing with land use planning and management, conservation and restoration, a mind shift from narrow disciplinary approaches to transdisciplinary systems of thinking and acting.

The term *transdisciplinarity* implies an overarching scientific and practical approach, transcending and crossing disciplines and professions, aiming together towards a common systems goal. This does not mean that by adopting such a transdisciplinary shift, landscape scientists have to neglect their own unique disciplinary expertise, gained from different fields of knowledge, and fused together by dealing with the land as a whole. Rather they will have to share it not only with other scientist, such as economists, anthropologists, environmental psychologists, sociologists, historians and philosophers, but also with all those dealing in their professional practice with land management and use, as well as with the decision makers and stakeholders of these landscapes. This can be achieved with the help of an ongoing interactive dialogue, leading to closely interwoven cooperation between many fields of knowledge and expertise.

As outlined lucidly by Lieberman (2005), the need for such a transdisciplinarity concept for landscape study, research and education is more urgent and critical than ever. It is the only alternative to deal in more efficient ways with the complex interactions between natural and human systems in these landscapes, to prevent their accelerating biological and cultural degradation, and to safeguard and create sustainable productive and attractive landscapes for the emerging information society.

To cope comprehensively with the complexity of landscapes as an integrative part of the complex network of interactions between nature and modem life, landscape scientists have to bridge the gaps between the natural sciences, the social sciences, the arts and humanities, joining forces with concerned, environmentally and ecological oriented scientists from all abovementioned fields in co-active landscape studies They will have to deal with all relevant human-ecological aspects, concerning the people living, using, perceiving and shaping these landscapes. They have to consider not only the material and economic needs of people, but also their spiritual needs, wants, and aspirations of all stake holders involved. For this purpose, biosphere landscapes should not merely be viewed as a source for our materialistic satisfaction, but also as a source of enlightenment and enjoyment, as well as a source of mental health (Naveh 2007).

As outlined above, in our perturbation-dependent Mediterranean natural and semi-natural landscapes, total landscape ecodiversity is determined by the maintenance of a dynamic homeorhetic flow equilibrium between the tree-shrub-grass cover. Therefore, we can ensure the continuation of all vital ecological processes and their dynamic flow equilibrium and evolutionary metastability in all these Mediterranean biosphere landscapes, only by dynamic conservation and restoration management.

A first vital step towards this goal will be the establishment of new, better balanced and complementary relations between healthier, more livable and attractive technosphere landscapes and their "hinterland" of viable and diverse biosphere landscapes and of productive and sustainable agricultural landscapes, on which human well beings depend. Among one of the most urgent tasks will be to ensure the instrumental and non-instrumental live supporting functions of *„keystone biosphere landscapes"* and especially their potentials to act as a biological filter and living sponge, absorbing the emissions from the technosphere. This requires the restoration, reclamation and rehabilitation of damaged landscapes, the revitalization of wetlands, rivers, lakes and their embankments, the creation of living corridors and viable urban biosphere islands, together with dynamic conservation management of nature parks and reserves.

One, if not the most important and urgent tasks to achieve this goal and to prevent at the same time catastrophic fire outbreaks, is an integrated fire, fuel and landscape management. This should incorporate fire prevention through public and professional education and environmental management; preplanned and ins-

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talled fuel reducing systems; efficient fire danger and weather forecast, facilitating quick detection and fast initial combined ground and air attacks. Such precautions and measures for efficient prevention were apparently lacking completely in the recent most catastrophic wildfires in summer 2007 in Greece. Instead of relying on the foresters, the Greek government left fire prevention and extinction solely in the hands of inexperienced and not sufficiently familiar with fforests, urban fire extinction technicians (Papanastasis 2008, personal communication).

Conservation and restoration strategies should be aimed towards the conversion of dense, monotonous, species-poor, and highly flammable tree and tall shrub thickets into park-like mosaics of more or less open woodlands with many floristically enriched grassy patches. On marginal Mediterranean uplands, afforestation strategies should be diverted entirely from planting commercial, monospecies conifer and eucalyptus plantations to the establishment of multi-species and multi-beneficial park-like, multi- layered forests.

Most recently, Ray Benayas et al. (2008) presented successful examples in Spain of creating „woodland islets to reconcile ecological restoration, conservation, and agricultural land use" by combining active restoration with passive restoration of natural regeneration. These woodlands could be designed and used as recreational parks, releasing the pressures on nature reserves. They could serve also the urgently need for the creation of special „climate stress refuges", with promising hardy, drought-and pollutant-resistant ecotypes of trees and shrubs from the drier Mediterranean biomes and ecotones, which I recommended already in 1995 (Naveh 1995).

Ultimately, the success of such a holistic landscape planning and management policy will depend on the creation of awareness and understanding for the value of these landscapes and their ecodiversity, concern about their future and motivation for active involvement in conservation activities. In many Mediterranean countries, this is most probably the greatest difficulty to overcome. In some of these, the clashing demands of traditional users of Mediterranean uplands, the modern private and public „developers", and the classical conservationist-protectionist „fundamentalists" have led to a special version of the mediterranean „tragedy of the commons" (Hardin 1968). In this, each side seeks to maximize its own profit or institutional interest, regardless of the fate of the „common" of the open landscapes as a whole. Lack of public awareness, understanding, and motivation is favoring options which are short termed (from election to election) and money earning (for those supported by the most powerful political pressure group) and therefore also the most harmful and irreversible.

One way to help overcoming these obstacles are more effective communication tools. These should be used in order to transform the „semantic" information, expressed in words and figures in scientific publications, reports, and lectures into „pragmatic", usable information which leads to action through its feedback on the receiver. These will be effective only if their contents could reach all those who care for, those who live from and those who deal with these landscapes at all levels of decision making. One efficient tool could be the **„Green Books for Landscape Conservation (GBLC)"**. We developed these first as „Redbooks of Threatened Landscapes" (Naveh 1993) within the framework of the Working Group for Landscape Conservation as part of the IUCN Commission of Environmental Strategy and Planning (CESP). Resolution 19.40 of the General Assembly at Buenos Aires in 1994 mandated the work of our group, based on the pilot study of the first Green Book that has been carried out in West Crete (Grove et al. 1993).

In contrast to the IUCN Red Data Books for endangered plants and animals, dealing only with the abstract taxonomic species level, these Green Books deal with the concrete space/time defined landscape scale. These range from the smallest mappable landscape ecotope to regional landscape scales of 200-400 squared km. It is on this terrain level that decisions on land uses and conservation measures are made, determining the fate of plant and animal populations, and of all other landscape values and functions.

The threats to such tangible and familiar landscape units

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have much more meaning and public appeal than threats to species or to spatially vaguely defined and even intangible ecosystems. This is even more the case, if Green Books are presenting relevant information not only on endangered natural assets but also on all other crucial issues and perils to cultural, socio-economical, historical and scenic landscape assets, comprising the total landscape ecodiversity. In contrast to the Species Red Data Books, and to the common type of land studies and surveys, these GBLCs are recommending alternative and more sustainable land use practices and conservation strategies, including zoning and protecting for each specific landscape unit within the regional landscape systems.

In order to avoid the „top-down" syndrome of conservation plans prepared by experts and imposed by administrators, efforts should be made for maximum involvement of the local populations from the early planning stages. With the help of such open dialogue and by approaching conservation „from the roots", their fullest comprehension and cooperation should be ensured. They should demonstrate above all, how demands to safeguard intrinsic biological and cultural „soft" landscape values can be reconciled with controlled utilization of „hard" values, which are vital for the sustainable socio-economic advancement of human society.

To raise awareness of the dangers to these landscapes and apprehension about their future, comprehension of the complex problems and their best solutions, and motivation for active involvement in their realization, these Green Books should not be only descriptive but anticipatory. This could be achieved with the help of different optional scenarios on the fate of these landscapes units under alternative land use options. However, although based on advanced scientific methods, this information should be presented to the planner, land manager and user, the political decision maker and the public at large in clear nontechnical language with ample illustration by maps, figures and photos.

In contrast to the fate of most scientific reports, which are filed away, GBLCs should be used as a practical background document for planning, policy and management guidelines, usable by professionals, politicians and the public. They should serve not only as a first database and dynamic landscape model, but lay out the foundations for a long-term impact evaluation and forecasting tool.

In contrast to „Environmental Impact Statements" GBLCs should be active and positive initiatives to change already prevailing undesirable trends and to prevent their continuation with the help of innovative, holistic, long-term and multi-beneficial planning and management strategies on regional landscape scales.Further Green book studies of threatened landscape, were carried out in the Mediterranean Region and elsewhere (Green & Vos 2001), but together with the cessation of this IUCN Commission and its Working Groups, this important initiative ceased, but now it is more urgently needed as ever.

At the same time, it must be realized that the effective prevention of further disastrous increase in greenhouse gases and pollutants and all other detrimental, irreversible anthropogenic impacts will be possible only by a substantial reduction of wasteful production and consumption in the industrial countries and by drastically curbing the population explosion in developing countries. This will be determined not only by political and economical considerations but chiefly by socio-cultural, scientific and ethical decisions.

In concluding, the fate of all these natural and semi-natural landscapes as well as all those human-made and maintained technosphere landscapes rely entirely on the decisions of human society. Therefore the sustainable future of our Total Human Ecosystem will be determined by human behavior, driven by our conscious, vision and political willpower to convert the run-away destabilizing feedbacks by cultural regulating through legal and institutional stabilizing inputs. Their actual implementation will, hopefully, lead to the urgently demanded breakthrough. If we, as citizens, land owners, users and stakeholders, foresters, managers, researchers and political decision makers have made our choice in favor of a break-through instead of a breakdown then we have to combat all these threats and ensure the sustainable future, health and integrity of our Mediterranean landscapes with the help of ecological knowledge, ecological wisdom and ecological ethics.

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