PREFACE

Biodiversity encompasses genes, species, ecosystems and their relative abundance. International awareness of the need to conserve biodiversity has been growing steadily since the first "Earth Summit" in 1992. The development of ecological networks can connect the fragmented habitats of wild animals, stem biodiversity loss, and promote dispersal and genetic exchanges of wild species. In this book, the authors present current research in the study of biodiversity conservation including the theory and practice of ecological networks to conserve biodiversity; sustainable utilization and conservation of indigenous Western Cape medicinal plants; biodiversity change and sustainable development; biodiversity management in the Brazilian Atlantic Forest; and agricultural water management inside the North African oasis.

Chapter 1 - The aim of this book chapter is to 1) describe biodiversity conservation, 2) review theory and practice of ecological networks, 3) explain new approaches based on GIS-modelling, and 4) introduce case examples of ecological networks. Biodiversity is a term that encompasses genes, species, ecosystems and their relative abundance. International awareness of the need to conserve biodiversity has been growing steadily since the first "Earth Summit" in Rio de Janeiro in 1992. Moreover, the 10th meeting of the Conference of the Parties to the Convention on Biological Diversity (CBD-COP10) was held at Nagoya of Japan in 2010. Ecological networks are based on landscape ecological principles and consist of core areas, corridor zones, and buffer zones. The development of ecological networks can connect the fragmented habitats of wild animals, stem the biodiversity loss, and promote dispersal and genetic exchanges of wild species. Developing ecological networks in European countries is strongly influenced by the American approach of greenway planning. The process is characterized as three steps: 1) to designate territories to function as an ecological compensation to the territories that are heavily exploited, 2) to make a linkage of these compensative territories by zones with coherent land management, and 3) to allocate sufficient space to create compensation and linkages. As new techniques to design ecological networks, we introduce approaches based on GIS-modelling. GIS (Geographic Information System) is defined as "a system for capturing, storing, checking, manipulating, analysing and displaying data which are spatially referenced to the Earth." In order to designate the priory areas of animal habitat, effective approach is to model species geographic distribution. Species distribution models are built based on associations between environmental variables and known species' occurrence records to identify environmental conditions within which populations can be maintained. After identifying priority areas, connectivity and linkage should be analyzed. In such case, least-cost modelling with GIS is considered useful. The least-cost modelling is one of the GIS analytical methods to estimate the connectivity of the landscape matrix. This type of modelling is based on the configuration of resistance or friction maps in raster format, e.g. how difficult or easy for animals to move a specific object or land cover types. Generally, it is referred to "cost surfaces" in GIS literature. Finally, we describe a variety of case examples of ecological networks in the world: Europe, North America, and Asia.

Chapter 2 - The informal medicinal plant trade has been extrapolated for South Africa but the highly biodiverse Western Cape has been previously disregarded. The Cape Floristic Region (CFR) and the fynbos biome are both facets of South African materia medica that have received little scholarly attention. Recntly it has become apparent that Cape bush doctors dominate the use and trade of medicinal plants in this biodiversity hotspot. Bush doctors are leaders of a flourishing Rastafari phenomenon that incorporates sociopolitical and religious beliefs with traditional KhoiSan healing techniques. This chapter details the contemporary collection and trade of medicinal plants by Cape bush doctors and outlines the scope for sustainable utilization and conservation of indigenous Western Cape medicinal plants.

Inventories of 39 of an estimated 200 bush doctors reveal utilization of 137 plants, animals and minerals collected for medicinal purposes. This plant species richness represents relatively low richness when compared to other herbal market surveys. This is surprising considering the incredible biodiversity of the Cape. The results insinuate that the range of available Western Cape medicinal plants, estimated at 533, have not been fully exploited due to the emergent nature of this ethnomedicine. The 33 common species gathered by over a quarter of bush doctors suggest homogeneity among inventories that share an even distribution of ethnospecies. Prioritized conservation lists for medicinal plant species were compiled including plants that are phylogenetically distinct, on the South African Red Data List (20) and endemic to the fynbos biome.

Chapter 3 - There are concerns that loss of biodiversity may eventually result in economic development becoming unsustainable. This view is reflected, for instance, in the Millennium Economic Assessment (2005) and in the Economics of Ecosystems and Biodiversity (TEEB) Study which was designed 'to draw attention to the global economic benefits of biodiversity and to highlight the growing costs of biodiversity loss and ecosystem degradation' http://teebweb.org/. An output from the latter project includes the book *The Economics of Ecosystems and Biodiversity: Ecological and Economic Foundations*.

The stock of biodiversity represents partly a natural and partly a man-made resource, and as a whole, is an asset or form of capital because of the valuable ecosystem services which it supplies to humankind. Nevertheless, not all elements of biodiversity are valuable from a human perspective: some elements such as pests, those causing diseases, and 'hostile' ecosystems have negative value. For example, although the complete eradication of the organism causing smallpox would reduce biodiversity, other things held constant, it is a valuable reduction in the stock of biodiversity from a human perspective.

Chapter 4 - Climate change poses a major threat to tropical biodiversity. This chapter examines the potential threat to two of Thailand's key forested areas - the southern peninsula and the north - using the maximum entropy (Maxent) model. In the south, according to the Hadley CM3 B2a scenario, mean temperature will rise by 2.1°C from 2000 to 2100 and annual precipitation will decrease by 178 mm. Model simulations indicate that similar numbers of species will gain and lose suitable habitat areas. In the north, mean temperature will rise by 1.4°C from 2000 to 2050 and annual precipitation will decrease by only 71 mm. As in the south, similar numbers of species are expected to gain and lose suitable habitat areas, with evergreen species benefiting particularly. To maximize species resilience we recommend increasing the area of forest under conservation by expanding existing protected areas or establishing new ones.

Chapter 5 - The Brazilian Atlantic forest is a hotspot of biodiversity, characterized by high species richness, level of endemism and danger of extinction. The remnants of this biome stand in the most populated and developed region of the country and their conservation is in constant conflict with strategies of development. Our study was developed in the State of Espírito Santo, in the municipalities of Linhares and Sooretama. Located at the north of Rio Doce, it was one of the last regions of the Atlantic forest to be deforested, and forest fragmentation took place mostly after 1950. Our purpose were: 1) characterize the evolution of the forest fragmentation in this region, the present situation of its remnants, and the main strategies, conflicts and potentials for conservation; 2) evaluate the conservation value of the forest fragments based on a study of the community of a group of insects: the community of Blattaria; 3) integrate these information to propose guidelines to resolve potential conflicts based on positive and non conflictual conservation recommendations. The landscape of Linhares and Sooretama is dominated by plantations, among which can be found two large reserves and fragments of diverse sizes, shapes and degrees of disturbance. Only in Sooretama there are 213 fragments, which, with the Sooretama Biological Reserve, cover 44% of the municipality area. Similarly to the reserves, the fragments were preserved by the imposition of the law and due to the interest of people of keeping the forest as a reserve of value. Fragments are used for several purposes, being submitted to strong disturbances that could lead to their massive disappearance in a near future. The analysis of the community of Blattaria showed that the number of species shared among sites is very low (between 22.9% and 39.6%), with a high number of species found only in single fragments and nowhere else; the richness per area in small fragments is not smaller than in large reserves; habitat diversity is stronger than the effect of area *per se*. These results show that even after more than 50 years of fragmentation and isolation, the situation of the biodiversity in this region is not lost: small and very disturbed fragments still shelter important biodiversity of insects, and can be of extreme interest for composing a set of remnants that maximizes the number of species to be protected. Based on it, the management and conservation of the biodiversity should first of all include the fragments, and for this reason should be conceived in the landscape or regional scale. At this scale, fragments should be envisaged in a management plan, in which restrictions and possible uses are explicitly established. In such a context, the choice of priority fragments should be done taking in account the landscape diversity: it should include fragments from different hydrographic basin, soil types, vegetation *facies*, as well as the diversity of use.

Chapter 6 - In this chapter I am presenting a methodology and basic equations permitting to establish models to monitor water, nutrient and salt distribution in the oasis soil under different irrigation system, to determine the best oasis architecture for an efficient use of resources, to estimate the amount of water really needed by plants and the oasis productivity, to test the efficiency of irrigation and drainage network, to detect the eventual diseases that can attack the three vegetable stories, to predict plant species distribution, to search indicators for environmental planning and ecosystem risk analysis. Finally, a method to scale up or extrapolate results from one stand to all the region have been evoked and a case study have been presented.