

PREFACE

In recent decades, there has been an increased need to understand ecosystems in order to be able to manage them for conservation and sustainable use. Yet examples of how research directly supports conservation are rare. This book examines the impact of disturbance, specifically habitat fragmentation and forest harvesting in national parks. This book also presents the results of observations of bulk deposition and its physico-chemical properties in national parks in Poland and tries to identify tendencies of change in its composition. In addition, research on Uganda's forest and savanna parks are reviewed, stimulating thinking about what kind of research is of value in guiding conservation actions. Over the past several decades, a highly polarized debate has emerged in the conservation literature about whether national parks in lesser developed countries should follow the "Yellowstone model" of strict protection or whether new types of national park should be developed. The authors of this book assess the U.S. national park experience and ways in which to balance people's needs and desires with nature protection in national parks. Other chapters in this book examine the abundance and diversity of vertebrate fauna in national parks in India, the roles of rhodolith beds and their impact in the marine national parks of the Gulf of California management, the impacts of multiple or extreme storms on national seashores, and the impact of invasive plant species on biodiversity and ecological integrity of national parks.

Chapter 1 - The importance of Kibale medium altitude tropical moist forest to the conservation of epiphyte biodiversity is partly due to its large area, proximity to Congo basin refuge and fairly high species diversity. The epiphyte diversity and factors determining their diversity and distribution in the forest canopy environment in Kibale National Park are discussed.

The tree species associations identified by Cluster Analysis and Principal Component Analysis (PCA) reveal low similarity between and within sites in Kibale National Park. The two main forest types based on tree species are the mixed forests in the central and north part and the climax forest in the south.

There are 5 families, 13 genera and 22 fern species with non significant influence by basal area. Common families are Aspleniaceae and Polypodiaceae. Most species preferred light humus substrate. Most species preferred the base and mid branch zones of their hosts. Selective logging appears to have led to the decline in the species richness and change in the composition of the epiphytic ferns 28 years after logging.

There are 57 orchid species dominated by genera *Polystachya*, *Bulbophyllum*, *Tridactyle*, *Angraecum* and *Diaphananthe* with non significant influence by basal area. There is no

significant difference in the number of orchid species between the logged and un-logged forests. Most species occur in the light humus substrate. Epiphytic orchids are characterised by host preference discussed. The general pattern of the vertical distribution of epiphytes is that of an increase from the tree base to branch zones and thereafter a decline to the top branch zone. The canopy epiphyte community is different from that of the trunk.

Hemi epiphytes had 13 families, 13 genera with 24 species dominated family Moraceae. The most common *Ficus* species is *F. sasibarica* and *F. conracii* with no influence of basal area, while the herbaceous facultative epiphytes have *Rhipsalis baccifera*, *Peperomia manni* and *P. tetraphylla* that increase significantly with the host basal area.

Ficus species and the herbaceous facultative epiphytes prefer the base branch and the mid branch zones of the host trees characterized by a narrow range of vertical distribution in both the logged and un-logged forests. Most species are found in the light and heavy humus types of substrate. Logged forests have more hemi-epiphytes and the herbaceous facultative epiphytes than the un-logged ones.

Chapter 2 - The Wielkopolski National Park is a valuable fragment of nature not only from the national perspective; it is also an element of the European Ecological Network Nature 2000. For 20 years now the Ecological Station of Adam Mickiewicz University located there has been conducting systematic studies and monitoring of both, biotic and abiotic elements of the environment. One of the major threats to this area is pollution reaching the substratum in precipitation. The chapter presents the results of observations of bulk deposition and its physico-chemical properties, and tries to identify tendencies of change in its composition. It was found that over the study period the pH of precipitation tended to grow systematically. The year with the lowest figure was 1994 with the annual weighted mean pH of 3.92. In turn, the year with the lowest acidification was 2006 with a mean pH of 4.80. The predominant acid-forming ions were sulphates, with a maximum concentration even exceeding 40 mg dm^{-3} . Sulphate deposition was noted to show a downward tendency with time. It was found that due to intensification of transport in the vicinity and through the Park, mean concentrations of nitrates were on the increase, causing a change in the composition structure of precipitation. Some interesting data reveal fluoride ions, which are especially dangerous because of their specific character; their maximum concentration in bulk precipitation can reach 0.41 mg dm^{-3} . Bulk precipitation measurements are accompanied by observations of throughfall, which show a substantial deposition of acid-forming ions. The electric conductivity of throughfall (with a mean of $77\text{--}150 \text{ }\mu\text{S cm}^{-1}$) varies much more widely than in open-terrain precipitation (with a mean of $30\text{--}40 \text{ }\mu\text{S cm}^{-1}$). The deposition of cations has been stable over the recent years and stays around 40 meq m^{-2} . Still, the research shows higher deposition levels of acid-forming compounds in the Wielkopolski National Park than in Poland's and Europe's (EMEP) lowland stations monitoring background pollution.

Chapter 3 - In recent years, international conservation scholars and practitioners have largely dismissed the U.S. national park experience, often termed the "Yellowstone model," as being too protectionist and exclusionary, and therefore irrelevant and even detrimental to park management and policy in lesser developed countries. A review of the U.S. national park experience finds, however, that U.S. parks are perhaps most notable for the way that they have adapted to broader economic, social, cultural, and political demands to become an enduring feature of U.S. culture, while at the same time becoming keystones of biological diversity conservation in a process that I call conservation syncretism. The U.S. experience

suggests that there is no easy, perfectly harmonious balance between protecting park ecosystems and meeting the needs of people, but that both can be pursued concurrently. U.S. parks are an imperfect response to diverse human demands, but the process of responding to these demands has produced many different types of national parks and management strategies. The 125 years of U.S. experience in balancing people's needs and desires with nature protection in national parks holds useful lessons for international conservation. Specifically: (1) regardless of the nature of their management, it is important that national parks become valued by people from a broad spectrum of society; (2) a combination of advocacy groups, broad public input, and professional and scientific park management all can work together, even in the absence of formal collaborative processes, to shape a strong and enduring conservation system, (3) socially valued conservation takes time to evolve, and must simultaneously reflect and lead societal values; and (4) there is no easy answer to fundamental conflicts between biodiversity maintenance and human needs; these must be worked out in the combined crucibles of negotiation and adaptive management.

Chapter 4 - National Seashores are federally designated coastal systems that have natural and recreational significance. Along the Atlantic Seaboard and in the Gulf of Mexico, the National Seashores are dynamic barrier islands and spits that are migrating landward (transgressing) within sea level rise. This migration occurs during hurricanes and tropical storms that produce elevated water levels and large waves, capable of eroding the beachface and causing overwash and barrier breaching. The impact of a storm on a barrier island or spit depends on the extent and height of foredune development relative to the elevation of the storm surge. The transfer of sediment to the backbarrier in washover fans is the primary mechanism through which barriers transgress and is responsible for significant damage to and even loss of park infrastructure. The ability of coastal dunes to control the rate and timing of transgression and protect the capital outlay of a park depends on ability of dunes to redevelop in height and extent following storms from sediment delivered from the beach or washover fans by the wind. National Seashores that are impacted by frequent storms tend to have a low profile that is vulnerable to washover and inundation over a wider range of storms. A low frequency of storms or a large supply of sediment from offshore or alongshore allows for larger dunes to develop soon after a storm, thereby limiting the potential for washover. A change in the rate of sea level rise or the frequency of extreme storms may lead to a loss of system resiliency and the development of smaller discontinuous dunes that promote more rapid transgression and shoreline erosion. Using the Gulf Islands National Seashore as a model of a park recently impacted by multiple storms in quick succession, it is shown how park infrastructure and even visitor access to sensitive beach and dune systems can reinforce change and limit post-storm recovery.

Chapter 5 - Plant introduction in national parks occurs on a regular and constant basis. There are various mechanisms for such introductions going from visitors' activities such as camping and hiking to past historical disturbance before the creation of a park. In all cases, the challenges remain the same: can we predict and understand the impacts of invasive species on biodiversity and ecological integrity. What are the mechanisms that influence their rate of invasion or their control? With globalization and climate change, these impacts on the ecological integrity of a park can become more severe threatening the long term ecosystem services and functions that it provides. This review examines the historical and current states of plant invasions in national parks of Atlantic Canada and their potential impacts on their ecosystems and ecological integrity. Previous inventories of invasive plant species, analyses

of changes in previously disturbed or managed habitats now included in the parks and studies on the mechanisms of plant establishment are combined to draw a picture of what has been done and what remains to be done in order to protect the ecological integrity of the parks. Through examples from my own research activities and others, challenges will be discussed and how they may in the long term influence management. Potential strategies and implications of these challenges are presented. Considering that the rate of species invasions is accelerating in the world, what can be done to reduce this trend in the national parks?

Chapter 6 - The National Park of Doñana in Spain contains the most important wetlands in this country due to the richness in both vegetation and fauna. Life there is heavily conditioned by the water level in the marsh (locally named "marisma").

It is known that the wetlands are considered as a desertification indicator and a climate change index. The marshes within Doñana National Park have a wide extension (roughly 50,000 Ha) and a smooth, flat topography (elevation ranges between 0.8 and 1.8 meters above sea level).

Every year, more than 35,000Ha of *marisma* change from being flooded in the wet season to being completely dry in summer. The evolution of both vegetation and fauna (migratory birds in particular) depends on this annual flooding-drying cycle.

Several human activities during the second part of the XX century were carried out in order to control seasonal flooding, and to make the interior of the National Park (N.P.) independent from stream contributions, the Guadalquivir River and sea tides.

In 1998, other emergency actions were carried out in order to avoid the Park contamination by a toxic waste (mud with a high content of heavy metals) that reached the Park after the failure of the Aznalcollar mining waste pool.

In the frame of the National Park preservation project, known as Doñana 2005, several actions were designed, including the reversal of some hydraulic works. There was a certain concern about the impact of these measures as the ecosystem balance in this wetland is very complex. The numerical techniques (hydrodynamic modeling of the water flow in the marshes) appeared as a convenient way to simulate the present situation and the intended changes.

As water is very sensitive to small gradients, it is mandatory to know the territory in detail and the elevations in particular, as accurately as possible. The Laser Scanning (LIDAR) was used in an aerial survey in 2002, because it is the most powerful technique to build the best DTM (Digital Terrain Models) available today. To georeference the data acquired (hundred millions of points), a geodetic reference frame was established as well as a Geoidal model.

The main goal of this chapter is to explain how geodesy, geomatics engineering and hydraulics engineering can collaborate in the simulation of different scenarios. This will contribute in the management of Doñana marshes, which is quite a complex ecosystem, and in the decision making about the re-conditioning works, currently in process.

Chapter 7 - Afrotropical forest ecosystems remain largely unknown in time when biodiversity is greatly threatened by deforestation. This leads to a situation where management decisions in protected areas are rarely based on data representative of that area. The main objective of this chapter is to discuss how different factors influence lepidopteran larval communities on a constant leaf resource, *Neoboutonia macrocalyx* Pax. tree, within and around Kibale National Park, Uganda. The focus of this chapter is on disturbance, specifically

habitat fragmentation and forest harvesting. Seasonality of lepidopteran larval community is also examined to understand factors that influence the leaf feeding herbivores.

Both habitat fragmentation and selective logging seem to have negative influence on larval community. This is likely due to the differences in microclimate and tree community composition, although the food resource, fresh leaf production, was constant throughout the year. Remarkable seasonal variation was found in larval abundance, species richness, and community composition. Variation in species richness and diversity is related to the flowering of *N. macrocalyx* and rainfall. Similarly, flowering correlates with larval abundance as does mean monthly minimum temperature. This chapter shows that humans can have negative and long-lasting impact on herbivorous insects. It underlines the importance of the timing of biodiversity assessments and demonstrates that the management decision to let Kibale Forest regenerate naturally has not been correct solution in regard to herbivorous insect fauna.

Chapter 8 - Sal forests are covering 32% of forest land of Bangladesh and are one of the three major forest resources beside the tropical evergreen and coastal forests. The two National Parks Madhupur and Bhawal comprise most of the Sal forests in Bangladesh. This study examined a comparative analysis of plant species richness, pattern of diversity, forest structure and regeneration of the core areas of these two national parks, which are located in the same agro-ecological zone. In total 129 plant species were identified in the Madhupur National Park where, 43 plant species in the Bhawal National Park. The diversity index and evenness for mature trees, saplings, seedlings, shrubs, climbers and herbs were higher in Madhupur, whereas the concentration of dominance was higher in Bhawal National Park. The dominant species, Sal (*Shorea robusta*) tended to be more dominant over its natural associates in Bhawal compared to Madhupur National Park. The diameter and height class distributions revealed that the Madhupur National Park had a wider range with a mixture of very young to giant trees, where the Bhawal National Park was lacking giant trees. From the results of the study it can be concluded that the core areas of these two National Parks warrant more protection from human interventions. Protection measures and eco-development activities are needed in order to reduce the anthropogenic pressures on the natural resources of the parks and to meet the livelihood requirements of the local inhabitants.

Chapter 9 - Rhodolith beds are free-living coralline red algae that are widely distributed worldwide. They are one of the critical habitats for biodiversity conservation and sustainable fisheries in European, Australian and New Zealand waters. As part of the OSPAR region they are under a high level of monitoring because the high sensitivity of changes ranging from fisheries impact to global warming. However, there are other regions in the world in where rhodolith beds are commonly found as The Gulf of California (Eastern Pacific). High biodiversity, species under special protection (IUCN, Mexican red list) and fisheries species are common elements in rhodolith beds. However, although these macroalgal habitats seem to be common in some Marine Protected Areas of the gulf, there are currently relatively few studies highlighting its importance as critical habitat for monitoring. The present report evaluates the advantages to monitor rhodolith beds and their impact in the Marine National Parks of the Gulf of California management.

Chapter 10 - Here we reports the abundance and diversity of vertebrate fauna in Ranthambhore National Park in Rajasthan. The objective of the study was to assess the abundance and diversity of different group of vertebrate fauna. This area is located at the junction of the rolling Vindhya and craggy Aravalli Hills. Surveys were conducted using previously established scientific sampling methods. Total of 239 species of vertebrates were

recorded, which include Amphibians (5), Reptiles (38), Fishes (16), Birds (149) and Mammals (31). The high species richness and diversity of different vertebrates recorded during the study period is due to the diverse vegetation types and microhabitats. The diversity of fauna is rich in the Ranthambhore National Park compare with other ecosystems. Major conservation problems and issues were discussed in this paper.

Chapter 11 - In recent decades, there has been an increased need to understand ecosystems in order to be able to manage them for conservation and sustainable use. Yet examples of how research directly supports conservation are rare. We reviewed publications based on studies in Uganda's National Parks from the 1950s to the present day with a view to making the findings more relevant for park management and to summarize the lessons that have been learned for conservation. Our reviews reference over 200 publications for the savanna parks and over 300 for forest parks. Many examples exist where research has improved park management. For example, research in the savanna parks led to changes in management of animal populations in the 1960s and resulted in the culling of hippos and elephants. Fire management plans were developed based on research that measured the impacts of different burning regimes. In forests, management of concessions now demands that seed trees are left in each hectare of forest as a result of research that showed mahogany trees rarely fruit below 50 cm DBH and studies of ape ecology have led to recommendations for the establishment of ape tourism sites in several forests in Uganda. We conclude that to make research more relevant to immediate conservation needs researchers should work closely with protected area authorities to plan their research. On their part, protected area managers and policy makers should endeavor to implement research recommendations.