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ABBREVIATIONS

AVHRR: Advanced Very High Resolution Radiometer
BCP: Bird census period
EI: Electivity Index
ETM+: Enhanced Thematic Mapper Plus
GIS: Geographic Information Systems
GPS: Global Positioning System
NDVI: Normalized Difference Vegetation Index
NOAA: National Oceanic and Atmospheric Administration
PCA: Principal component analysis
PSC: Point-Stop Counts
RS: Remote sensing
SNP: Serengeti National Park
TANAPA: Tanzania National Park authority
WGS: World Geodetic System

1. Introduction

Over 10 % (1186 species) of the bird species in the world are threatened with extinction in the near future, almost all of them due to habitat change or loss by man (BIRDLIFE INTERNATIONAL 2000). Likewise, 1130 mammals, 296 reptiles, 146 amphibians and 5611 plants have been identified as endangered species (IUCN 2000). The destruction of natural habitat is the major factor contributing to the global species extinction event (for example COLLAR and STUART 1985, GROOMBRIDGE 1992, BIBBY 1995). The increasing loss of biodiversity has centred on conducting inventories and monitoring species and habitats, especially in identifying areas of high species richness, threatened species and species of restricted or local distribution (for example COLLAR and STUART 1988, ICBP 1992, STATTERSFIELD et al. 1998, HEATH et al. 2000). In 1992 the UNCED-Conference in Rio de Janeiro pointed out the need for monitoring the environment, leading to the Convention on Biological Diversity (UNITED NATIONS 1992) and the Agenda 21. Article 7 of the Convention on Biological Diversity deals with identification and monitoring, which are to be undertaken with sampling and other techniques. New methodologies with a view to undertaking systematic sampling and evaluation of the components of biological diversity are to be developed (Article 15 b of Agenda 21).

While the number of identified threatened species has increased dramatically, a huge gap in knowledge of ecosystems and their fauna and flora remains. Distribution, status and ecology of species are mostly unknown in many countries, as is the degree they are endangered. In view of the immense unknown ecosystems in the world, a great number of which are located in developing countries, conventional survey and mapping methods cannot deliver the necessary information in a timely and cost-effective fashion. Nature conservation will require large volumes of Remote Sensing (RS) data if the quality of planning is to improve. With RS technology, we may be able to make real progress in understanding why more species occur in some places than in others and in identifying the most critical places that must be protected to preserve the maximum number of species into the 22nd century and beyond (STOMS and ESTES 1993). As current air photos are often not available, satellite images are the sole source of data for many regions of the world.

Fortunately, computer technology has improved enormously in the last years, mainly processing time, storage requirements as well as programme features and possibilities. Concurrent declining costs of computer hardware have favoured the design of new techniques for special data processing and combining remotely sensed information with other extensive data sources.

In the last 20 years Geographic Information Systems (GIS) have been widely accepted and used as a tool for a host of applications in planning processes, in storing, analysing and maintaining data. Ground survey information together with RS imagery by using GIS techniques offers a huge potential for quick identification of areas of high biodiversity.

The approach of this study is to combine the potential of bird data, GIS and satellite-based RS in view of using these components to monitor the environment. After defining the terms monitoring and habitat in chapter 1.1, chapter 1.2 to 1.4 mainly focus on the potential using GIS, bird and satellite data. Chapter 1.5 continues with a detailed literature review of previous studies, which used GIS, bird and satellite image data to focus attention on issues considered to be the most important for effective use of the three components. Therefore, the main characteristics, especially methodology, satellites image analysis, bird census, scale and accuracy requirements were analysed and compared. Chapter 1.6 focuses on weaknesses of these studies and specifies objectives for the present study corresponding to the weaknesses.

1.1. Definition of monitoring and habitat

As the two terms *monitoring* and *habitat* are widely used in this study precise definitions are given in the following.

1.1.1. Monitoring

Monitoring has become more and more important in assessing nature and its natural and human-induced changes (BISCHOFF 2000). It is a very important information-tool for decision-making in conservation policy (BISCHOFF and DRÖSCHMEISTER 2000). The term *monitoring* has been defined by several authors (for example FURNESS et al. 1993, HELLAWELL 1991, MAAS 1999, PEITHMANN 1996). DRÖSCHMEISTER (2000) favours the following definition of HELLAWELL (1991), as it is the most useful and the most unambiguous one: “Monitoring - Intermittent (regular or irregular) surveillance carried out in order to ascertain the extent of compliance with a predetermined standard or the degree of deviation from an expected norm”.

HELLAWELL (1991) gives three reasons for monitoring:

1. assessing the effectiveness of policy or legislation
2. regulatory (performance or audit function)
3. detecting incipient change (‘early warning’).

The latter is of greatest interest to ecologists and conservationists. Further information, aims, strategies, techniques and programmes on monitoring can be found for example in BISCHOFF and DRÖSCHMEISTER (2000), BLASCHKE (1999), FURNESS and GREENWOOD (1993), GOLDSMITH (1991) and SPELLERBERG (1991).