1. INTRODUCTION

Biodiversity is one of the most important resources for mankind. It is the essential basis for the functioning of natural ecosystems. When considering the major advances of technologies in modern molecular biology, the potential of biodiversity for the development of especially medicines and increased food production is immense. Since the endorsement of the Convention on Biological Diversity in Rio de Janeiro in 1992, Biodiversity and related topics have become, justifiably, of crucial interest not only to science but also to politics. Yet, scientific knowledge on basic data concerning species numbers appears surprisingly low (Barthlott *et al.* 1999).

Trends in the development and expansion of the human population have led to a loss of biodiversity, which seems to be increasing at an alarming rate. Changes in biodiversity influence the composition of species, which again changes and usually limits the possibilities for land-use due to less productive ecosystems or a general degradation of abiotic resources such as soil. Because changes in biodiversity mostly occur gradually, the degradation process often progresses unnoticed for a long time. Even in Namibia, where the economy is almost entirely based on natural resources, the decline in terrestrial biodiversity has only consciously been recorded from about 1940. A gradual but steady decline of productivity of agricultural rangelands eventually forced several landowners to seek alternative means of income (Brown 1996, Volk 1966a).

The history of pastoral land use in Africa started about 8000 to 10000 years ago in the north-east, from where it gradually progressed southwards to reach southern Africa about 2000 years ago (BIOTA 2000). In Namibia, intensive grazing systems were first established during the 18th and 19th century (BIOTA 2000, Volk 1966a). Volk (1966a) attributed widespread vegetation degradation on Namibian rangelands to rangeland management. He described the main agents changing the structure and composition of vegetation in Namibia as fire and grazing. As fire was already in the 1960's seen as unfortunate and prevented as far as possible, the impact of it on Namibian Rangelands was relatively small. Grazing, on the contrary, had a much more pronounced effect, even if this only became apparent much later. Before the country was divided into farms, grazing was dependent on available surface water and rangelands were thus only subjected to short, irregular but intensive grazing, which probably did not influence the species composition over the long term. With the creation of farms, the supply of water was secured with boreholes and watering points, while the farms were fenced as single units. Nomadic grazing was replaced with permanent grazing (Standweide). Grazing intensities were relatively high (per unit area), but because farms were not subdivided, grazing was also very selective. This modus of grazing probably caused the most severe damage to rangelands in Namibia - palatable grasses were decimated, bush densities and erosion rates increased (Brown 1996, Volk 1966a, Strohbach & Austermühle in prep, Walter 1954). Only from the late 1940's on, the concept of rotational grazing was introduced to deal with the lower productivity of the veld (Volk 1966a).

In southern Africa, the opportunity thus exists to investigate relatively young states of a shift in species composition. With the expected continued population growth as well as an expansion of intensive anthropogenic land-use, it is the type of land-use itself that can be regarded, apart from climatic changes, as the main causative factor of an often-irreversible change in biodiversity.

In recent years several programs addressing global changes and their effects on natural ecosystems and -resources have been initiated based on growing concern about accelerated change and loss in global biodiversity, e.g. ILTER (International Long-Term Ecological Research Program) and UNCBD (United Nations Convention on Biological Diversity). Up to date, however, biodiversity studies only played a marginal role in these programs, as existing studies are usually isolated case studies, which are difficult to extrapolate (Jürgens & Strohbach 2000).

BIOTA (BIOdiversity monitoring Transect Analysis in Africa) was initiated in 2000/2001 to monitor changes in biodiversity, taking ecosystematic, biological and socio-economic processes into account. A thorough knowledge of the dynamics of these processes is the first aim of this multi-disciplinary endeavour, enabling the conceptualisation of practical and sustainable management guidelines for rangelands; i.e. the latter should be both socio-economically realistic, as well as scientifically validated (Jürgens & Strohbach 2000). The standardisation of methods as such is further regarded an important feature of BIOTA, as biodiversity studies in the light of global change cannot and should not be conceptualised as isolated case studies (Jürgens & Strohbach 2000, Westfall *et al.* 1996). In a first attempt to reach an ambitious goal, BIOTA started off studying biodiversity and documenting its changes in species composition on a strip transect along a climatic (rainfall) gradient throughout Africa, the basic assumption here being that overall biodiversity as well as land-use are strongly dependent on climatic- and vegetation zones. The approximate position of this strip-transect for southern Africa is shown in Figure 1.

The design of any project dealing with biodiversity and related issues is faced with the reality that only an estimated 8.5% of all species in existence is known, with even less being known about their distribution (Barthlott *et al.* 1999). Of the entire spectrum of biodiversity, vascular plants remain the most appropriate group of organism for a depiction of terrestrial diversity. There exists a relatively good knowledge base on plants, but more importantly, plants as primary producers are fundamental to all terrestrial ecosystems and their overall biodiversity (Mueller-Dombois & Ellenberg 1974). Further, through its composition, structure and functional characteristics vegetation provides a multitude of habitats for other organisms (Jürgens & Strohbach 2000). It is therefore understandable that the characterisation of vegetation types and their dynamics are a major part of the BIOTA project. The main emphasis of vegetation studies carried out by BIOTA are the documentation, classification and mapping of vegetation along the transect, in close co-operation with remote sensing techniques. Further, vegetation dynamics are monitored on permanently marked "biodiversity observatories". Research of other disciplines also focuses on the observatory area, viz.: soil analyses, characterisation of fungi, lichens and biological soil crusts, functional zoodiversity, socio-economic aspects, impact of land-use as well as the development of predictive modelling.

Vegetation can be defined as a mosaic of plant communities in the landscape. Communities again are associations of plant species that are capable of successfully competing with one another within the confines of a particular combination of environmental features (Küchler 1988). Vegetation reacts noticeably to environmental stresses, these being natural or man-induced, which can be detected in a change of known species associations (and species abundance) within a plant community. Mapping single plant communities can become rather problematic: environmental variations will lead to an infinite number of variations of plant associations. Apart from characterising communities, similar communities should, for practical purposes, be grouped into manageable units. The aim of the vegetation map of the transect is the creation of a database with relevé data which can be used for future reference (Strohbach 2001), similar to the "Veld Types of South Africa" as characterised by Acocks (1988). Acocks defines a veld type as " a unit of vegetation whose range of variation is small enough to permit the whole of it to have the same farming potentialities". Thus, mapping veld types rather than communities, while having a thorough understanding of an area's phytodiversity and its ecological requirements can be regarded as a valuable tool in the management and monitoring of natural resources (Mueller-Dombois & Ellenberg 1974, Jürgens & Strohbach 2000, Strohbach 2001).

Environmental planning can only be sustainable and adhere to sound conservation principles if it is based on a high standard of ecological data (Bredenkamp 2001). The health of an ecosystem can only be assess once the "complete picture" is known - it does not only help to look at the presence of a few dominant and desirable species while a more sensitive rare species, which may be an indicator species, disappears due to unchecked disturbances. Present vegetation maps for Namibia are at present, however, little more than just a list of dominant species (Giess 1971, Dept. Agricultural Technical Services 1979, Strohbach 2001), which does not help in assessing or managing rangelands.

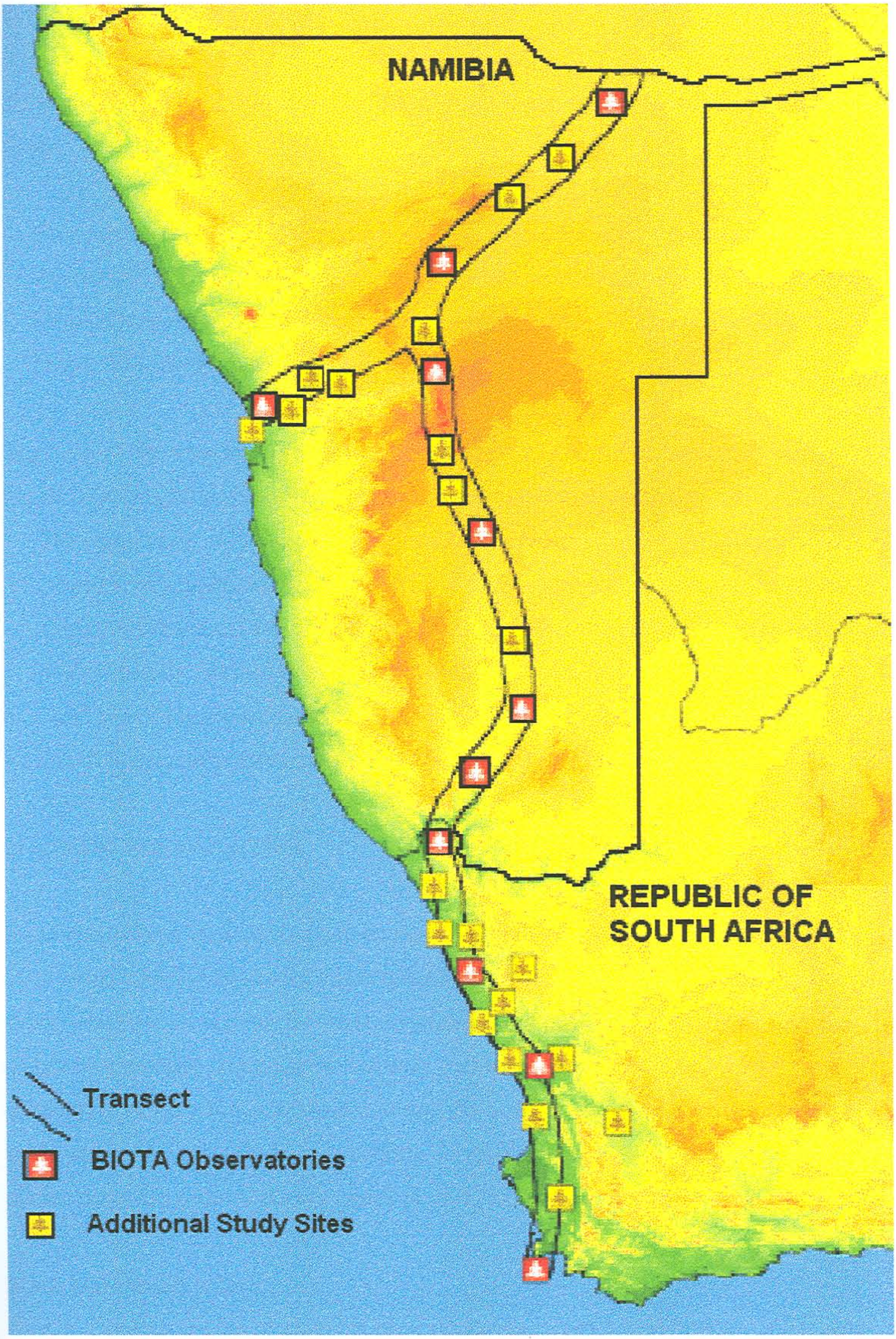

Figure 1: Position of Transects and Observatories of the overall Project BIOTA Southern Africa.