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# **The BIOTA Observatories in Africa:** A standardized framework for

## large-scale environmental monitoring





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#### Introduction

One main challenge for biodiversity research on a regional or global scale is to guarantee comparability of biodiversity assessment through

standardization in sampling design and methodology.

Such a standardized design should (i) allow the comparability of data sets in space and time, (ii) facilitate interdisciplinary analyses, (iii) allow spatial scaling up and numerical modelling and (iv) facilitate the implementation of a continental or global network of biodiversity observatories.

In order to meet these requirements, the BIOTA Biodiversity Observatories were developed and tested in the framework of the BIOTA Project.

### **Sampling Design**

A BIOTA Observatory encompasses an area of 1 km<sup>2</sup> (1000 m × 1000 m), which is subdivided into one hundred hectare plots (100 m x 100 m). To avoid interferences, different sampling areas are allocated to the different disciplines. The sampling of the vegetation takes place on nested plots of 100 m<sup>2</sup>, 1000 m<sup>2</sup>, and 10,000  $m^2$  (see Figure 1).

The number of hectare plots to be sampled may depend on discipline and research question. Accordingly, a hierarchical ranking of the hectare plots with a stratified-random procedure was employed. This allows for different sampling intensities, but at the same time ensures that all disciplines conduct their intensive monitoring on the same hectare plots.



In close vicinity of each BIOTA Observatory an automatic weather station is installed to be able to relate the collected data to climatic parameters of the actual region (see Figure 4).

Figure 1: Schematic layout of a BIOTA Observatory and arrangement of different sampling areas within one of the hectare plots.



Figure 2+3: Fenceline contrast between two Observatory pairs in Figure 4: Para-Ecologist at an Figure 5+6: The Observatories Gellap Ost (left) and Duruchaus Namibia (left: Narais / Duruchaus, right: Gellap Ost / Nabaos) automatic weather station in (right) in Namibia the Richtersveld, South Africa



#### Implementation

BIOTA Observatories with this design have been installed along climatic, landuse and landscape gradients in Southern Africa (BIOTA Southern Africa), West Africa (BIOTA West), and Morocco (BIOTA) Maroc). Over a period of nine years (2001-2009), field and remote sensing data on overall 45 Observatories were sampled by scientists from approx. 50 African and German institutions, representing various disciplines (i.e. botany, zoology, mycology, microbiology, lichenology, soil science, climatology and socio-economy).

In areas with differing landuse types (e.g. different grazing intensities), two or more BIOTA Observatories are situated close to each other to cover the landuse effect (see Figure 2+3).

Besides fulfilling above mentioned requirements, the BIOTA Observatories contribute to the long-term biodiversity monitoring obligation of the host countries as required from countries that signed the Convention on Biological Diversity (CBD) and provide infrastructure and baseline data for ecological research projects.

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