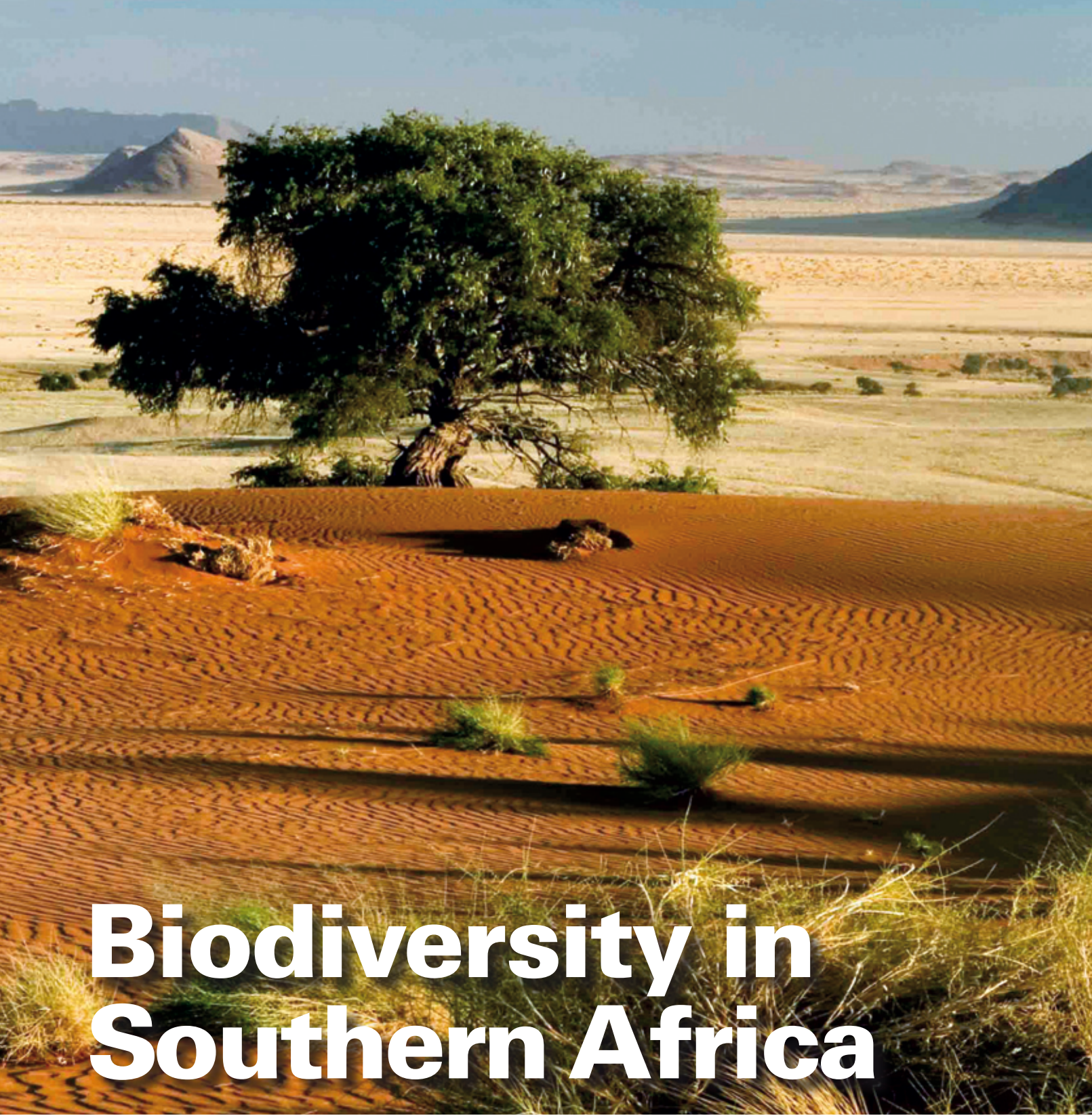

Biodiversity in Southern Africa

Vol. 1

Patterns at Local Scale
The BIOTA Observatories

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Cover photograph: Under harsh desert conditions a large Camelthorn (*Acacia erioloba*) is surviving at the eastern edge of the large Namib dunefield (Dieprivier), with view of the escarpment in the distance.
Photo: Torsten Heydenreich, Rostock/Germany.
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Article I.3

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BIOTA's contribution to global biodiversity monitoring and standardisation— in the past, at present, and in the future

Norbert Jürgens

The production of a book that summarises nearly a decade of BIOTA research is a good reason to also re-consider the value of the established observation network. What has been the contribution of the BIOTA observation network in the past, what lessons have we learnt and what is the road ahead of us?

Proving a concept

When BIOTA started to set up the first long-term observation sites, there was no comparable project worldwide. BIOTA established a standardised and coherent observation system at a large number of sites across the African continent (see Fig. 1 on page XX), within an ecosystem context, including a number of organismic groups and integrating measurements of important drivers i.e. weather and landuse. There were also a number of experiments, especially within the context of restoration and ecophysiological research, which added to the monitoring component at the observation sites. Until today, we are not aware of any project with a similar depth and breadth regarding biodiversity monitoring. Therefore, BIOTA played the role of a flagship project for DIVERSITAS INTERNATIONAL with its bioDISCOVERY core project and for the Biodiversity Observation Network (GEO BON) within GEOSS.

In addition, the implementation of BIOTA's Observatory network played a very motivating role for the scientific communities and for NGOs within the subregion. The fact that one project set up a network of standardised observation sites and, thereby went beyond the never-ending discussion about how the implementation of a long-term observation scheme can be harmonised within different scientific paradigms, made a huge difference for the scientific networks. It has even proven that such a large, ambitious objective is indeed possible! As a consequence, many new observation activities were initiated or at least discussed. For example, there were numerous discussions about the extension of the BIOTA observation transects into other countries cooperating within the ELTOSA network (Environmental Long-Term Observation network of Southern Africa). For Phase II of the BIOTA project, Namibia explicitly asked for the establishment of west-east transects, which subsequently ran from Walvis Bay to the Kalahari (compare Chapter II.1). In addition, researchers from outside BIOTA started to use BIOTA Observatories for additional monitoring activities.

Secondly, the continuous monitoring activity at the BIOTA Observatories that have been presented and discussed at international scientific fora, provided important information for the discussion regarding the extent and speed of environmental changes especially land degradation and loss of biodiversity. The value of such a spatial network of standardised observation sites is very obvious and relevant for decision-making. For example, the results of the botanical monitoring activities at the Observatories from the Cape to the Kavango, from the Namib coast to the Kalahari shows a cumulative increase in species number and cover during the last decade, probably mainly caused by above-average rainfall at the majority of the Observatories (see Article III.3.8, Fig. 8). This observation of a present "recovery" of the vegetation during a full decade is a very important message. This message might allow many local farmers to understand the projected climate change rather as a sign for the need for long-term adaptation and to a lesser degree as an instant Armageddon, which can only be escaped by immediate emigration to other regions.

Thirdly, the observation system facilitated a strong involvement of local rural communities into monitoring and research activities (see Article III.8.2 for some examples). This was even further enhanced with the full-time employment and training of members of local landuser communities as para-ecologists at several of the BIOTA observation sites (see Article III.8.3 for further details). The para-ecologists were involved in regular biodiversity monitoring and socio-ecological research activities. Through their work they understood the research aims, processes, and results and could thus help to facilitate the process of sharing the research findings with the landusers and other stakeholders. The integration of local knowledge into the scientific findings through mutual learning between researchers and para-ecologists also improved the applicability of the research results.

Today

Today, the BIOTA observation system is well organised, the monitoring methods have been improved based on field experience, and various steps of quality control have been set up, based on lessons learnt during the first years. The following lessons are worthwhile sharing.

1. Good biodiversity monitoring requires good taxonomic training and knowledge. As monitoring work needs to be repeated regularly (in our case, annually), it is rather an excep-

tion that plants for instance are found in good ecological condition, or in flower or with fruits, which then enables the identification of the species and replacement of former nicknames by proper scientific names.

2. It can therefore not be recommended to run a long-term monitoring activity with students, even PhD students, replacing each other every three or four years. Permanent staff with academic or even merely practical on-the-job training, supervised by a senior scientist, is the better solution. This is particularly true for vegetation monitoring, which requires identification of most of the plants at the site. Each change of staff requires a new process of learning species concepts and the identification of species in their different states of development and damage. During this learning phase, errors are inevitable. It requires a large effort on quality control, including additional field trips to verify preliminary identification, regarding past records.

3. As a response to the two above-mentioned problems, the project tried to ease the identification of the high diversity of plants. In countries with a long scientific tradition there are comprehensive identification keys for the flora of the whole country. However, country-wide keys like this are missing for Africa. Therefore, the project compiled large numbers of photographs well suited for fast identification in the field. More than 12000 images showing more than 1500 species are available at www.southernafricanplants.net (see also Article III.8.6). These numbers are rapidly growing and this collection represents the best botanical photo guide of the region.

4. Individual-based monitoring of plant populations is far more sensitive and reliable than monitoring based on cover estimates. For individual based monitoring the youngest development states need to be clearly discriminated from established states. In many climates with a defined unfavourable season this normally means that individuals, which have germinated during the most recent favourable season, need to be separated from those that are somewhat older and have survived the unfavourable season. Depending on the date of recording within the year, this may mean that only individuals that survived at least one unfavourable season (drought or winter), which normally is easily apparent, will be recorded.

5. While fixed-site monitoring is feasible for plants, it is more challenging when related to zoological taxa, due to the more unpredictable activity patterns of animals. In other cases the high number of species found in traps (such as during the good rainfall years between 2000 and 2009) can consume all available human-power in collecting, sorting, and identifying specimens from the field. In contrast, the observation of e.g. numbers of ant nest or active termite mounds is more feasible.

6. It may be reasonable to focus the work on specific functional types or guilds, which may be suitable as indicators, depending on the research goals and the desired temporal resolution. For example, it is very obvious that annual plant species in arid regions show a very specific response to timing, amount, and temporal pattern of rainfalls within one season. In contrast, for long-term trends, it may be more important to monitor only perennial aboveground species.

Future

It is well possible that the present favourable trend in climate and biodiversity response may turn into a decline in future. Then, it will be very important to use the BIOTA observation data as an early warning system. Hopefully, it will be possible to distinguish between various potential causes, be they related to climate, landuse, biological invasions, diseases, pollution, or other influences.

Therefore, and based on the public statement by Minister Schavan that she will not allow such an important project to be stopped, the botanical teams at the NBRI Windhoek and the team at the Biocentre Klein Flottbek of the University of Hamburg have made a commitment to continue the annual monitoring, albeit not at all Observatories every year, after the end of BMBF funding in April 2010.

At the same time, we are trying to find new funding in order to maintain the existing observation system and to expand these activities into new countries and regions. Whether such funding will be provided and from which institution for which part of Africa, cannot be foreseen today.