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The role of GBIF and other new technologies in conservation and monitoring biodiversity change

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Ecological baselines and monitoring ecological change

Long-term studies in the Serengeti ecosystem highlight their value in understanding ecosystem dynamics. In Serengeti, we used both natural and anthropogenic disturbances as experiments to understand how the system functioned. The main perturbation that provided insight to the system dynamics was the change in the wildebeest population. The complex ecosystem behavior involving slow and rapid change, and multiple states only became apparent over a period of several decades.

1. Ecosystems involve events at different spatial scales, from large-scale migrations to small-scale mosaics of burns, and both need to be maintained. Conservation needs to take into account infrequent and unpredictable events, such as floods, fire and droughts, long-term trends and oscillations. Management should plan on the time scale of those events (30-80 years in this system). In particular, management should not be aimed at maintaining the *status quo*.
2. Both natural and anthropogenic disturbances were invaluable in providing insight into mechanisms of ecosystem regulation and stability. Systems can be self-regulating by either food or predation, and culling is not necessarily required for this reason.
3. The ecosystem can occur in multiple states. Some of these can be natural but others can be artifacts of anthropogenic disturbances. There is no *a priori* need to control and maintain only one natural state.
4. Conservation outside protected areas must be able to distinguish between natural change and direct human-induced change. To do this protected areas are useful because they act as the ecological baseline where human-induced change is kept to a minimum.

Guy Midgley, South African National Biodiversity Institute	**Projecting and monitoring climate change impacts on terrestrial biodiversity: Roles for GBIF**
	Species responses to regional and local climatic changes have provided rich information to begin assessing the vulnerability of natural ecosystems to this emerging global threat. Continuous collection of historical records of plant phenologies, for example, provided some of the earliest evidence of directional responses of the natural world to apparent anthropogenic impacts of regional temperatures. More recently, recorded shifts in species' geographic ranges have further supported inferences of significant change based on records of air temperature and other physical environmental characteristics. A small number of extinctions attributable to climate change have raised the relevance of long term monitoring and observation even further, and developments in "joint attribution" (the observation of a species response statistically attributable to an observed or modeled climate shift) have placed such monitoring on a stronger footing. None of these critical insights would have been possible without systematic observation – but even more might have been possible, especially in the southern Hemisphere and specifically in Africa, if the appropriate framework for repeated species observations had been in place. Nonetheless, the wealth of information on species distributions currently dormant in herbaria and other types of species geographical records could unlock significant understanding of biodiversity trends in response to recent and ongoing climate change. Furthermore, enhancement of species geographic information is sorely needed to improve bioclimatic niche-based models of species response to climate change. In this paper I will discuss the value and some potential uses of species and community-level information for vulnerability analyses of terrestrial biodiversity under anthropogenic climate change.

David Obura, Coral Reef Degradation in the Indian Ocean (CORDIO)	**Applying new technologies to the monitoring of coral reefs**
	Biodiversity change in the tropical marine ecosystems of East Africa is accelerating with the increasing complexity and interactions between natural and anthropogenic environmental changes, and their cross-scale interactions from local to global levels. Monitoring and documenting impacts to biodiversity now requires accessing a range of datasets and tools, which are increasingly being driven through internet and digital technology media. This presentation will illustrate how understanding the impacts of global warming on coral reefs relies on a range of old and new technologies, including remotely sensed information on the atmosphere and oceans, *in-situ* field based monitoring and local to regional biodiversity and biogeographic data. The growth of multi-disciplinary networks of researchers and managers interested in specific issues, such as coral reef management, is highlighting the increasing integration that is possible with new communication technologies and that can be supported by new biodiversity resources. Gaps in accessibility to and use of information that affects African scientists and policy development will be highlighted, and recommendations made for improving these. Finally, the need to orient products to facilitating specific outcomes in research and/or management-related areas is highlighted, to contribute positively to halting negative changes in the distribution and abundance of species.
Emma Archer, University of Witwatersrand	**Biodiversity conservation and sustainable rural livelihoods in a marginal environment: A case study from dryland South Africa**
	Ninety-one percent of South Africa can be categorized as drylands under the United Nations Convention to Combat Desertification (UNCCD) classification, including arid, semi-arid and dry sub-humid zones. These areas include biodiversity hotspots, with high numbers of endemic species - identified as conservation priorities by the South African national government and key conservation institutions such as Conservation International. Such areas are, in addition, frequently the home of individuals and communities seeking to pursue sustainable rural livelihoods under harsh (and changing) conditions. While broad conservation initiatives have, in the past, tended to regard biodiversity conservation and sustainable rural livelihoods as mutually exclusive within the same geographic area; farmers, scientists and conservation practitioners are increasingly realizing that the two efforts may, in fact, complement and support one another. A case study from western semi-arid South Africa demonstrates how farmers, scientists and conservation practitioners may work together to collect data and share information around biodiversity conservation and the pursuit of livelihoods in a harsh and marginal environment. Ideally, ground surveyed data and local knowledge collected through these partnerships should be integrated with globally available biodiversity information (such as that obtained via GBIF) to simultaneously support both activities as it improves our understanding of the importance of agricultural biodiversity in building resilient livelihoods and farming systems under conditions of climate risk.

Stella Simiyu, Secretariat, Convention on Biological Diversity	**Implementing the Global Strategy for Plant Conservation in Africa: The role of GBIF**
	The Convention on Biological Diversity has adopted the 2010 target "*significantly reduce the rate of loss of biodiversity by 2010*" to which the Global Strategy for Plant Conservation (GSPC) with sixteen outcome targets to be met by 2010 is closely linked. The first three targets of the strategy focus on understanding and documenting plant diversity. They aim to generate a widely accessible working list of all known plant species; develop a preliminary assessment of the conservation status of all known plant species at national, regional and international level and also develop models with protocols for plant conservation and sustainable use, based on research and practical experience. The baseline data generated is essential for achieving the other targets related to in situ conservation (targets 4-5), sustainable use (targets 6,12), ex situ conservation (targets 7-9), trade (target 11), invasive species management planning (target 10) indigenous knowledge (target 13) education, capacity building and networking (target 14,15, 16). GBIF, through its programmes, has provided strategic support to facilitate the implementation of the GSPC especially through its seed funding. However, in Africa, GSPC implementation has been severely constrained by lack of baseline data at national level since the bulk of taxonomic resources and data are held outside the continent. The countries are often constrained in accessing these datasets due to lack of technological capability and skilled manpower. The GBIF portal therefore offers an excellent platform for the fast tracking data access, yet, to date, there has been only limited engagement with GBIF within Africa. This presentation seeks to highlight potential opportunities, review some of the challenges and recommend some possible actions to enhance uptake of new technologies in Africa.

Martin Sharman, European Commission Directorate General for Research	**Biodiversity data acquisition and assessment after the MEA: How GBIF and GEOSS will benefit Africa**
	Slowing and finally stopping biodiversity loss is the greatest intellectual, social, economic and behavioural challenge that humanity has ever faced. The survival of our cultures, if not our species, depends on finding ways to slow and stop the loss. The issue is urgent - we must draw on lessons learned to move rapidly forward. In some cases, rapid and effective action in the field and in implementing or developing workable legislation can be based on what is already known and understood. In too many cases, however, our knowledge is fragmentary or even absent. The Group on Earth Observations is a world-wide effort to provide a framework within which to assemble environmental data that can be used to underpin planet-wide sustainability -- the Global Earth Observation System of Systems (GEOSS). How might GEOSS draw on GBIF to benefit Africa and other regions? To make use of environmental and biodiversity data, the users of both GBIF and GEOSS need access to huge datasets, which implies major advances in biodiversity informatics to discover and exploit links between taxonomic, ecological, species, genetic, molecular, economic and social data. In parallel, significant effort will be needed in one of GBIF's key tasks -- the digitisation and validation of existing data, including taxonomic synonyms and geo-referencing of observations and specimens. GEOSS might learn lessons from GBIF concerning the problem of developing and implementing common protocols and agreed standards for the construction of and access to biodiversity-related databases, to issues of confidentiality and property rights to data, and protocols for data access and use. Advances made in all these fields will depend on collaboration between scientists, software engineers and practitioners all over the world. African institutions should be both major contributors to and beneficiaries of the developments.

Gavin Maneveldt and Richard Knight, University of the Western Cape	**Biodiversity conservation: Its current status in South Africa and the way forward**
	Just over a year ago, toward the end of January 2005, the world's scientists and government representatives met collectively and officially at the first Conference on Biodiversity, Science and Governance. This gathering formed part of the ongoing global effort to curb the loss of biodiversity by 2010 and ensure the long-term conservation and sustainable use of our biological diversity. Moreover, the conference was intended as an intervention to sensitise public opinion about scientific and social issues connected to biodiversity. The greatest concern expressed at this conference, was the fact that we are still losing species at an unprecedented rate: the current species extinction rate is estimated to exceed the 'natural' rate by 100 to 1,000 times. Yet, most global citizens are only vaguely aware of the problem. The *Convention on Biological Diversity* states that we should be conserving 10% of our land surfaces, and 20% of our coastlines. Despite being a relatively young democracy, South Africa is well on its way to achieving the millennium goals set at the Johannesburg Summit, currently conserving ~6% of it terrestrial surfaces and ~18% of its coastline in formal protected areas. While this appears impressive, a number of shortcomings exist, particularly with regard to the protection of sensitive and coastal ecosystems, and more importantly, how to conserve, or provide conservation status to the remaining 90% and 80% of our terrestrial surfaces and coastlines respectively. One of the methods to obtain and understand biodiversity issues, and to convey their importance to society, is though the use of biodiversity Web Map Services. This provides for the distribution of current biodiversity information and an ability to integrate local or desktop information as well as to distribute combinations of these information layers to third parties through map views.
Ed February, University of Cape Town	**The potential role for GBIF in developing management policies in African national parks**
	The classical paradigm in ecology is the "equilibrium paradigm" consonant with the cultural metaphor "balance of nature". This paradigm suggests that if a system is conserved and isolated from direct human interference such a system will maintain itself in the desirable state (climax state) for which it was conserved. More recently, conservation biologists have shifted their way of thinking to emphasise process rather than a single point. Along with this understanding of succession in vegetation change is an understanding of the biodiversity of the region under consideration. GBIF allows for a better understanding of biodiversity with limited resources. The developing world can thus embrace this new understanding for biodiversity conservation which includes humans as agents for disturbance in ecological systems. This talk will focus on the changes in philosophy of conservation in South Africa and the potential role for GBIF in conservation management in South Africa.