Proposal of S03a for the work in phase III

(a) Name of proposing person(s):

Dr. Elisabeth Uhlmann  
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and  
PD Dr. Reinhard Berndt,  
ETH Zürich, Switzerland

(b) Title of project:

Biodiversity and population dynamics of Glomeromycota in south-western Africa

(c) Regional focus and limits:

A focus is placed on the arid regions in the winter- and summer rainfall areas, especially Gellap Ost and Nabaos in the Nama Karoo as well as Remhoogte and Paulshoek (and adjoining areas) in the Succulent Karoo.

(d) Please explain how your proposal would contribute to our 5 overarching themes of BIOTA:

Our proposal will contribute to all overarching themes:
To theme 1, *Natural Dynamics in space and time*, by continued sampling that reveals the inter-annual variation of the spore community, the dynamics of mycorrhizal infection of plant roots as well as the variation of the spore community depending on the plant community. This enables differentiation of the natural variation from human-induced variation.

To theme 2, *Understanding natural processes of change*, by comparing sites in the summer rainfall area to sites in the winter rainfall area, the influence timing of rainfall has on species communities is investigated. This enables predictions of changes in the arbuscular mycorrhizal community for sites that are likely to come under the influence of summer rainfall should the current climate change continue.

To theme 3, *Understanding human use, values and impact in space and time*, by investigating the mechanism by which overgrazing increases the species richness of arbuscular mycorrhizal fungi in the winter rainfall area. Understanding why species richness is increased and defining the threshold where species richness again decreases allows the setting of more rational grazing thresholds.

To theme 4, *Interventions (tools, techniques, instruments) for sustainable use of biodiversity and biodiversity management*, by using the exclosure sites, the length of time required for regeneration of the spore community can be investigated. Thus, recommendations for resting periods of pasture can be given.
To theme 5, *Inform policy on local, national, and international level*, by making results of the biodiversity study public awareness for hidden diversity and its influence on the grazing value of a given site is raised.

**(e) Proposed co-operating partners:**

Dr. Nicky Allsopp, ARC-Animal and Forage Production

**(f) Key questions:**

Results obtained in phase I and II show major differences of the summer- and winter rainfall areas with respect to their reaction to overgrazing: plants at overgrazed sites in the summer rainfall area support fewer mycorrhizae (although they belong to usually mycorrhizal plant families), but overall, soils at overgrazed sites do not contain fewer mycorrhizal spores and species than sites with moderate grazing. In contrast to that, the dominant plants at overgrazed sites in the winter rainfall area support fewer mycorrhizae, presumably because they belong to plant families that are predominantly non-mycorrhizal. Nevertheless, the soils at these sites contain more spores and more species than soils from moderately grazed sites.

- Clarifying the influence of intact sites on heavily utilised sites where plants do not support mycorrhizae: is there an input of spores?
- How far does the potential spore input reach – i.e. which sites require augmentation with spores for regeneration?
- How long does it take the sites to revert to normal arbuscular mycorrhizal communities – i.e. how long are the resting periods required for regeneration from overgrazing?
- What role do mycorrhizas play in controlling vegetation distribution along the Namaqualand/Bushmanland ecotone where mycotrophic C4 grass communities meet non-mycorrhizal succulent shrub communities?

**(g) Key activities:**

- Assessment of the spore community and of the arbuscular mycorrhizal community inhabiting plant roots to complete time-series investigations.
- Collecting soil and root samples in transects leading from intact sites into heavily utilised areas to clarify the input of spores from sites under moderate grazing.
- Collecting of soil and root samples at sites excluded from grazing to assess the regeneration potential of overgrazed sites.
- Collecting soil and root samples along the Namaqualand/Bushmanland ecotone