Vegetation dynamics following human-induced disturbances in the Succulent Karoo

Natural vegetation recovery processes in the Succulent Karoo are slow and impacts of human disturbances such as ploughing remain visible for decades if not centuries. Many attempts at restoration have failed because the system’s dynamics were poorly understood. Therefore, if we wish to mitigate human-induced vegetation changes, we have to understand the pathways and possible endpoints or states in the community development process. The ultimate test of how well we understand vegetation dynamics is whether we are able to reconstruct a complex self-sustaining system, that provides the essential ecosystem services, from its parts (Jordan et al. 1987).

The study will comprise three principal themes:

1. Investigating the pathways and possible endpoints of natural recovery of the vegetation after human-induced disturbances. This will be done by studying the vegetation dynamics on:
   - abandoned fields of different ages since abandonment (comparisons are to be made between communal areas, commercial farms and conservation areas);
   - in exclosures that have been erected in the 1970s and 2000s where grazing by large herbivores has been excluded after a history of severe grazing; and
   - after the removal of livestock, but with utilization of the vegetation by wildlife.

2. Outcomes of previous attempts at range reinforcement will be evaluated. Such an analysis should identify factors that have contributed towards the success of the intervention or alternatively have led to their failure. In this regard Prof WA van Niekerk of the Department of Animal and Wildlife Sciences, University of Pretoria, will collaborate. The hypothesis that Atriplex nummularia produces allelochemicals that prevent the return of indigenous species will also be investigated.

3. Providing a theoretical framework for restoration efforts based on an analysis of the previous two themes. Such a framework should incorporate the possible effect of global climate change.

Besides a floristic approach, an analysis of functional traits will be done. The identification of functional groups will be used to simplify community complexity.

Regional focus and limits:

Succulent Karoo (Namaqualand – Springbok-Kamieskroon area)
Contribution to overarching themes:

The project relies on data on *natural dynamics in space and time* (theme 1) although the origin of the data will not be from Observatories. The core of the proposal will be to analyse the data in such a way as to *understand natural processes of change* (theme 2). Because the driving forces to be examined are human-induced, *understanding human use, value and impact in space and time* (theme 3) is an integral part of the project. Knowledge and insight derived from the first three themes can then be used to evaluate previous restoration efforts and to make recommendations for future restoration projects. In this way the *interventions (strategies, tools, techniques) for sustainable use of biodiversity and biodiversity management* (theme 4) will be addressed.

Proposed co-operating partners:

WA van Niekerk, Department of Animal and wildlife Sciences, University of Pretoria
The restoration aspect will need coordination with other teams in the Succulent Karoo

Key questions (a few):
- How does land-use (communal, commercial, conservational) affect the pathway of natural recovery? (Investigation in terms of diversity of species, dominance, diversity of functional traits, biomass.)
- Does *Atriplex nummularia* produce allelochemicals that prevent the return of indigenous species?
- What is the role of *Galenia africana* in the recovery process?
- How can our understanding of the natural recovery processes after human-induced disturbances guide our planning for successful restoration projects?