Edaphic habitat islands in quartz fields of South Africa: A model system for Island Biogeography?

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Conophytum calculus sub. calculus

Background

Habitat islands share fundamental characteristics with true oceanic islands (e.g. isolated areas regarding species distribution). But to which degree are both systems comparable?

As habitat islands are not surrounded by water, the matrix in between can strongly vary in terms of type and permeability for different species.

We therefore plan to include different island variables:

- Island size
- Isolation (Geographic and Environmental)
- Topography
- Habitat heterogeneity
- Matrix quality

Combined approach by including:

- Remote Sensing Techniques
- Community Ecology
- Island Biogeography

Oophytum oviforme

Project & Objectives

Remote Sensing:

- ✓ Classification of different habitat types within the quartz islands based on satellite images.
- ✓ Ground truth validation of habitat classes by first field survey (April 2019).
- ✓ 10 different habitat classes according to topographic variables defined.
- ✓ Defining the quartz island size and geographic isolation.

Classify matrix types. Compare classification based on two satellite images of different seasons.

Community Ecology:

Sampling of floristic communities within the different habitat types on the quartz islands. (Field survey 08-10.2019)

Sampling of functional trait richness within the different habitat types. (Field survey 2020)

Drivers of assembly processes of the quartz field flora along steep environmental gradients (community scale)?

What is the relative contribution of habitat islands at the quartz fields to different scales of diversity (landscape scale)?

Island Biogeography:

Characterize quartz island by island size, isolation, habitat heterogeneity and matrix type.

Characterize quartz island and different habitat types according to species richness, trait richness, endemic richness and % endemism.

How isolated are the different habitat types regarding geographic distance and matrix permeability?

Do quartz island characteristics explain plant diversity, plant traits and niche characteristics (island scale)?

Study Area

Succulent Karoo, Western Cape South Africa: Quartz fields in the Knersvlakte Nature Reserve

Quartz islands: different size, different geographic and environmental isolation, different habitat heterogeneity
Different amounts of quartz pebbles

Photos: Pia Eibes

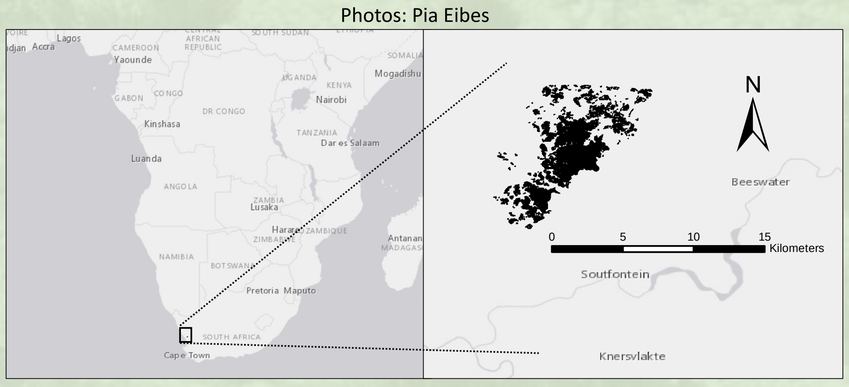

Fig. 1: Map of the Study Area in the Knersvlakte Nature Reserve, Western Cape, South Africa. Photos above show the characteristic landscape with differently colored quartz-gravel surface.

Flora & Habitat Types

Flora:
Biodiversity Hotspot Quartz fields in the Succulent Karoo matrix

High percentage of dwarf succulent shrubs, mostly from the family Aizoaceae (Asteraceae and Crassulaceae) (Schmiedel 2002)

About 140 plant taxa in southern Africa are quartz island endemics, mostly locally endemic (Schmiedel & Jürgens 2004)

Argyroderma crateriforme
Crassula deceptor
Conophytum calculus
Conophytum subfenestratum
Antimima solida

Photos: Ute Schmiedel

Fig. 2: Some characteristic dwarf succulents of the Aizoacea and Crassulaceae families

Habitat types:
Shallow soils, high salinity and stone content → edaphically dry habitats with special microclimate (Schmiedel 2002)
Habitat diversity within quartz islands is driven by a small-scale mosaic of distinct soil (Schmiedel et al. 2015)

Literature:
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Photos: Ute Schmiedel, Pia Eibes
Paintings: Pia Eibes

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