Looking over the experimental site at Elandsberg Private Nature Reserve. In the foreground is a ploughed pasture and in the background, the dark green renosterveld vegetation is visible. Photo: Cornelia Krug.

The Renosterveld Restoration Project

Understanding and restoring West Coast renosterveld

by **Cornelia B. Krug,** Conservation Ecology Department, University of Stellenbosch

Renosterveld is one of the most threatened habitat types in the Cape Floral Kingdom with less than 10% of its original extent remaining. As it is generally associated with fertile soils, where there was once lowland renosterveld we now find wheatfields, vineyards, pastures, olive groves and fruit orchards. The natural remnants are restricted to the koppies (in West Coast renosterveld in the Boland and Swartland) or to steep slopes (in South Coast renosterveld, mainly on the Agulhas Plain). Remnants are further threatened by invasive alien plants, by fertilizers (which benefit alien grasses) and pesticides from the surrounding agricultural areas. Genetic exchange between the fragmented remnants is limited, and smaller populations of plants and animals inhabiting fragments are more likely to become extinct.

But it is not all doom and gloom. Many farmers take an interest in the natural vegetation on their property (as Sue Winter of the Botanical Society has documented in her recent research) and there is an increased demand to revert abandoned or marginal lands to indigenous vegetation for game farming and ecotourism – the flower display in renosterveld in spring is spectacular.

The Project and the people

There is a general lack of understanding of renosterveld ecology, so it is difficult to inform interested farmers about how to restore their natural renosterveld vegetation. Because of this shortcoming, Sue Milton of the Conservation Ecology Department of the University of Stellenbosch, with her experience in the field of restoration and rehabilitation, initiated the Renosterveld Restoration Project. Funded by the Table Mountain Fund of WWF-SA, the project aims to understand what aspects of renosterveld ecology are important for restoration, and will try out different restoration strategies in order to provide guidelines for farmers who want to achieve fast recovery of renosterveld on their lands.

Experience shows that natural vegetation usually recovers slowly on abandoned fields, and with this in mind we embarked on the project. The main study site is located on the farm Bartholomeusklip at the foot of the Elandskloof Mountains north of Wellington. Here the late Dale Parker and his wife Elizabeth established a private nature reserve in 1973, initially intended to save the endangered geometric tortoise *Psammobates geometricus*. Dale Parker, a great conservationist, warmly welcomed researchers on his property, among them the students working on the Renosterveld Restoration Project. Bartholomeusklip not only encompasses one of the largest remaining patches of West Coast renosterveld (1 600 ha), but also stocks a number of game species, among them eland, red hartebeest, plains zebra and bontebok. This allows for a glimpse back in time when large herds of game, including the extinct blue antelope and quagga, roamed the Western Cape.

Four graduate students and one researcher are working on different aspects of renosterveld ecology and restoration within the Renosterveld Restoration Project, and another, Ndafuda Shiponeni, completed her M.Sc. on seed dispersal in renosterveld earlier this year (see her article in the March

ABOVE: Natural renosterveld vegetation opposite the experimental site. Photo: S. J. Milton.

LEFT: A burned renosterbos *Elytropappus rhinocerotis* is all that is left after a plot was burned for restoration trials. Photo: Cornelia Krug.

2003 *Veld & Flora*). Benjamin Walton is investigating plant species composition and floral diversity to understand the role of fire and grazing in vegetation succession in renosterveld. Nicola Farley is making monthly observation of the use of various habitats by game species, while I study the small mammals (such as the four-striped field mouse, pygmy mouse or musk shrew) that use the old fields, and burned, grazed and spared renosterveld vegetation fragments in this area. Graduate student, Donald Iponga Midoko, is conducting experiments to improve our understanding of renosterveld vegetation recovery on old fields. He is monitoring the influence of grazing and grass on the growth and survival of indigenous shrub species that he has introduced, as well as testing restoration strategies by examining the survival of indigenous species after burning, brush cutting and herbicide application. Doctoral student, Rainer Krug, is collating all the field data collected by his colleagues (and gleaned from publications) into an ecological model to understand the processes that lead to renosterveld restoration. He has essentially turned his computer in a virtual study site, conducting and monitoring simulated experiments that would otherwise take generations to conduct.

Funding from the National Research Foundation has extended renosterveld research and is supporting a number of students investigating various other aspects of renosterveld ecology. Ian Newton (University of the Western Cape) has recently completed a map of all remaining renosterveld fragments on the West Coast using satellite images, Gwen Raitt and Suretha van Rooyen (University of Stellenbosch) have been sampling vegetation in burned, grazed and protected areas to reveal the effects of disturbance on the indigenous rooigras *Themeda triandra* and unwanted grasses from Europe. Habitat studies by Chavoux Luyt from the University of Stellenbosch will provide guidelines for use of fire for habitat management for the renosterveld specialist antelope, the bontebok. Ruther Parker (University of Cape Town) in collaboration with Mark Botha (BotSoc), is investigating potential incentives for landowners to conserve renosterveld remnants as most renosterveld is on privately owned land and conservation management can be costly to the land-owner.

Renosterveld ecology

By looking at seed dispersal, monitoring plant survival and the responses of plants and animals to certain disturbances (like fire and grazing), we learn about processes shaping this ecosystem. It is often assumed, as renosterveld is closely related to fynbos, that fire is one of the main driving factors, but is this true? What role did the large herbivores play? Has renosterveld always been dominated by asteraceous shrubs, as we see it today, or was it once a grassland with shrubs instead of acacia trees? What do the results tell us so far?

Ndafuda's results (in *Veld & Flora* 89(1), 32-33) show that most of the species found in West Coast Renosterveld are adapted to dispersal by wind or in the dung of large herbivores, while in fynbos most species are adapted to dispersal after fire or by ants. The seeds of the shrubs and tussock grasses are equipped with plumes to be carried by the wind, whereas some geophytes produce large round seeds that tumble on the ground, and the grasses and forb species (woody plants found in grasslands) have seeds that survive the passage in the gut of large herbivores. These seeds are then deposited with 'fertilizer', giving them a good chance to establish successfully. Many of the bulbous species found in renosterveld have bulbils (small bulbs surrounding the larger main bulb) that break off and disperse when the main bulb is disturbed – pulled down by molerats, dug up by porcupines or disturbed by hooves. Other geophytes found in renosterveld, like amaryllids, flower after fire and carry seeds in flower heads that tumble over bare ground (see *Veld & Flora* 82(2), 70-71), while various *Iris* and *Oxalis* species have seeds that fall or jump from the flower heads and do not appear to rely on wind or animals for dispersal.

In his shrub transplanting experiments Donald Iponga Midoko found that the renosterveld shrub species he planted grew better in patches where grazing animals reduced grass cover, as this limited competition for the growing plants. Seedlings of the wild

LEFT: Project members Rainer Krug, Donald Iponga Midoko and Ndafuda Shiponeni discussing the experimental set up for the herbivory/grass competition project. The cage protects the plants from being grazed, and grass competition is excluded by regularly weeding the plot.
Photo: Cornelia Krug.

olive, in contrast, were damaged by antelope which browsed their leaves and stems, and grew best in areas were they were surrounded by grasses. In renosterveld, olives are restricted to heuweltjies (extinct termitaria) where the soil is nutrient enriched, and plants grow in high densities. Therefore, the species must be able to withstand competition from other plants. Shrub growth is greater when the grass is removed by grazing, or, in this case, by weeding.

We therefore assume that seedlings of shrub species establish in patches opened up by grazing, or trampling, and where there is very little competition from other species. Fire might also create openings but at this stage of the research we cannot say which species establish in the plant communities after fire, and what influence grazing has on the establishment of plant species.

The game species present at the study site are mainly grazers or mixed feeders (animals that both graze and browse). The grazers, like Burchell's zebra and the red hartebeest, favour the old fields, which can be likened to natural grazing lawns made up from *Cynodon dactylon*, or kweek grass. Natural grazing lawns are created by the animals through dung deposits, which contain grass seeds, and on wallow sites.

The animals return, over and over again, to these patches, and as shrub species are susceptible to competition from grasses, the lawn patches keep growing in diameter. Eland, a mixed feeder, is found on the old fields and in the natural renosterveld vegetation. By browsing on the shrub species, eland also create gaps in the shrubby vegetation, where grazing lawns can develop.

Restoring renosterveld

By documenting plant and animal species and community response to disturbances, like fire or grazing, we learn which are the 'appropriate disturbances' to kick-start the restoration process on an abandoned field or in a degraded piece of natural veld. The study on seed dispersal has shown that, despite seed movement by animals and wind, seeds of only a few species return naturally. After years of agricultural use, the soil's seed bank is also severely depleted. Moreover, competition by grasses or alien vegetation prevents many of the germinating seeds from establishing. Therefore, large-scale restoration trials, where patches of abandoned field are burned, mowed or treated with herbicides, and where seeds of renosterveld species are sown, were conducted. The results provide insight on what the farmer can do to 'kick-start' their restoration of indigenous vegetation.

Knowledge of which plant and animal species are associated with the different disturbance regimes helps the farmer, for example, game farming requires extensive patches of lawn grass within the shrubby vegetation, or if a farmer wants to encourage geophyte species, small patches underneath the shrubby vegetation need to be kept open and grass patches limited.

From the simulation experiments we learn what size a patches of natural vegetation should be in order to supply the surrounding vegetation with enough seeds to ensure the establishment of natural vegetation, and how plants influence each other during seedling establishment. Every day, individual projects yield new and interesting results, so watch out for more information on the Renosterveld Restoration Project.

Further reading

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The author

Dr C.B. (Connie) Krug is a postdoctoral researcher at the Conservation Ecology Department at the University of Stellenbosch, and has been co-ordinating the Renosterveld Restoration Project since 2001. She is a member of the Renosterveld Forum Committee that organizes workshops and meetings on renosterveld.
For more information on the Renosterveld Restoration Project, please contact her at ckrug@sun.ac.za.