From this: the main kaolin pit with dense alien trees in the background...

RESTORING FYNBOS THE ECOLOGICAL WAY

*by **Patricia Holmes**, Cape Ecological Services*

Ecosystem restoration projects are becoming an increasingly important part of biodiversity conservation as continuing human population growth ultimately results in the loss of natural ecosystems, either directly through the development of land, or indirectly through inappropriate land-use practice. Restoration has become an essential tool for improving ecosystem functioning, minimizing biodiversity losses and increasing the connectivity in nature reserve networks.

Ecological restoration takes into account the regeneration methods, composition and functioning of the native ecosystem. It aims to recreate a sustainable indigenous community by maximizing natural regeneration from *in situ* seed banks or broadcast seed, with minimal post-sowing intervention. By contrast, a labour-intensive horticultural approach to restoration involves mass species' plantings, and is much more expensive. Nevertheless, there are important applications of the horticultural approach, for example, in projects that aim to augment populations of endangered species.

Ecological restoration implies more than the re-vegetation of a site with indigenous species. In order to recreate a native ecosystem that is sustainable in the long-term, key linkages among organisms and ecosystem processes need to be re-established. Focusing on the indigenous vegetation is a good start, but the survival of plant species (and the maintenance of plant biodiversity) in the long-term will depend on the relevant pollinators and seed dispersal agents being present in the ecosystem. The ability of some animals to re-colonize the restoration site will depend upon a number of extrinsic factors, such as the proximity to and size of neighbouring indigenous vegetation remnants, and the presence of corridors linking these remnants.

Each ecosystem is different, with its own suite of biological attributes. Knowledge of these attributes is essential before embarking upon an ecological restoration programme. For example, in the Cape Floristic Kingdom, Afromontane forest ecosystems are found in fire-free sites, and forest species do not require fire for germination. Establishing appropriate pioneer vegetation and attracting frugivorous birds are key processes in forest restoration. On the other hand, fynbos ecosystems are fire-prone and seed germination is stimulated by fire from soil-stored seeds. Likewise, different ecological conditions and biological attributes characterize dune thicket and renosterveld ecosystems.

Ecological guidelines for restoring fynbos

Here are some of the key ecological factors to consider in restoring fynbos vegetation.

- Many species have long-lived seeds, bulbs or corms in the soil that can survive a few decades in the dormant state. Topsoil is therefore the most critical resource for natural regeneration from local origin. It must be stored and managed with careful stockpiling, to maximize seed viability.
- In natural vegetation, fynbos species recruit only after fire. Thus in order to maximize natural regeneration it will be necessary to burn the site, or create conditions that mimic the effects of fire, to trigger germination. The most important treatment is to expose bare topsoil and sown seed to the high daily temperature fluctuations attained in autumn (March-April), before the winter rains commence. Smoke has also been found to stimulate germination in many fynbos species and seed could be smoke-treated before sowing. Fynbos vegetation is renowned for its high diversity, the result of a high turnover in species between different habitats and landscapes. For this reason it is extremely important to collect plant material at nearby, similar sites. Moving seeds even a few kilometres could jeopardize local gene pools, for example through hybridization between a local species and a close relative from another habitat.

How does one plan the ecological restoration of a site?

First of all one should assess what has transformed the site in the first place. Was it encroachment by alien plants, or was there also some disturbance such as frequent burning or ploughing that may have depleted indigenous seed banks? Once the level of transformation has been ascertained, the appropriate actions may be planned and implemented.

A good example is an ecological restoration project undertaken after three decades of alien invasion and open cast mining on the Cape Peninsula. At first sight, the ecological restoration of the kaolin mine site might have appeared to be impossible. A dense stand of alien trees (predominantly pines, hakeas and eucalypts, the oldest of which were 35 years) had excluded the indigenous fynbos vegetation for years before mining operations began. Trees were removed and the topsoil bulldozed and stockpiled, as part of mine site preparation. As the site had been invaded for only about three decades, it was predicted that fynbos propagules would be present in the topsoil, so the sown mix contained local seed of species that do not store seeds in the soil, such as sugarbushes, conebushes and Bruniaceae. Seed was sown in autumn and recruitment, both from the soil and sown seed, resulted in a diverse, structurally representative fynbos community. A total of 142 indigenous species was recorded at the 0.3 hectare site, of which 70% originated from the topsoil.

On-going management includes alien follow-up control. In three years, many native birds, frogs and invertebrates have returned to the site and most plant species have set seed. Regular monitoring of the site will enable under-represented components to be identified. These may be re-introduced after a subsequent fire. In order to maintain diversity, fynbos vegetation should be burnt on a 15-30 year cycle. Continued monitoring will reveal whether the restored ecosystem is fully functional and sustainable in the long-term.

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For more information, and a flow diagram on how to plan restoration of fynbos, please contact the author at tel/fax (021) 712 7816 or e-mail <prebelo@mweb.co.za>.

...to this: three years later, the site supports a representative proteoid fynbos community.