The lost fynbos of Tokai Park

by **Anthony Hitchcock**, Nursery and Threatened Plants Programme Manager, Kirstenbosch National Botanical Garden, **Carly Cowell**, Regional Ecologist, Cape Research Centre, South African National Parks and **Tony Rebelo**, Threatened Species Research Unit, South African National Biodiversity Institute

ABOVE: Paul and Liz Johnston, Anthony Hitchcock, Eric Harley and Tony Norton with the *Erica verticillata* plants that were successfully restored to the Prinskasteel wetland in Tokai. Photo: Tony Rebelo.

The restoration of Tokai represents one of our last opportunities to link ecological processes from Table Mountain to the Cape Flats, as well as to rehabilitate a sustainable area of critically endangered Cape Flats Sand Fynbos.

The biggest threat to our natural vegetation today is habitat destruction. It is crucial to the restoration of threatened species that we secure natural habitats for their survival. The alternative is keeping small collections in botanical gardens, such as Kirstenbosch, or as vacuum-packed seeds in temperature-controlled vaults, such as at the Millennium Seed Bank at Wakehurst Place in England. The problem with these is that a single event could destroy a collection: a power failure, lack of watering over a weekend, an accidental application of herbicide instead of insecticide or a thermostat malfunctioning. An inexpensive valve or a misreading of a label could wipe out an entire collection of irreplaceable plants and animals.

It is far more efficient to restore a patch of veld and return the threatened species to their natural environments where they can interact and evolve with their pollinators, dispersers, predators and physical environment. At least that way the species can track and adapt to climate change and other environmental changes which they would not be able to do as domesticated pot plants or as seeds maladapted to local conditions by being decades beyond their environmental expiry date. It also means that thousands of plants can be grown, rather than a dozen or so in a tight space in a botanical garden, thus allowing the development of robust gene banks that are capable of dealing with variation and change in the environment.

Restoration is however fraught with challenges. The more an area has been transformed the more difficult it is to restore it. Restoration of old farm lands, for instance, is problematic as the soil structure has been destroyed and the indigenous seed banks lost. Areas invaded by alien plants are easier to restore as often the soil is still intact, although if the invasions have been prolonged, the indigenous seed banks may have died. In pine plantations where the seed banks have not yet been lost, restoration can occur by just removing the pines and clearing the debris with a burn. Fire is essential for fynbos restoration. It not only clears the debris, but also sterilizes the soil, eliminating pathogens and predators, and cues the seeds to germinate after the following rain.

Habitat restoration is thus multi-factorial. It includes restoring the soil structure, clearing alien invasive species, burning to stimulate regeneration, restoring the balance of fauna, flora and fungi, and allowing the ecosystem to take over and restore itself. The primary objective of restoration is definitely not gardening. Instead it is to kick-start the ecosystem to look after itself with minimum further intervention.

Research has shown that after three generations of invasion, seed banks are lost. The shorter-lived seed banks are lost early, but at three generations the bulk of the species have gone. Among the first to disappear are the dominant and most prominent species – those that store their seeds on the plant and release them after a fire – like the charismatic sugarbushes, conebushes and brunias. These species will need to be returned to restore functioning ecosystems.

The animal communities are easier as the majority of them will return when the plants are restored, assuming that some natural habitat remains not too far away. These are essential for pollination, control of more vigorous plants and animals, and a myriad of interactions which fine-tune ecosystems allowing them to deliver their services.

Restoration at Tokai

The Tokai section of the Table Mountain National Park, fortunately, appears to have been rescued in time. Tokai is at the third generation cusp – rescued at the final cycle while the last of the seed bank is still intact. We are also very fortunate in having a comprehensive plant species list from a neighbouring farm, Bergvliet, collected by William Purcell from 1915 –1919, so we have a reasonable idea of species that might have occurred in the area. Furthermore, Sybil Morris, a resident of Tokai, has been monitoring plants regenerating under the pines and in clearings, so that we have a good list of species that have survived in the plantations.

The restoration of plant species at Tokai is therefore primarily that of encouraging the seed banks to germinate. To this end a restoration burn is essential. However, we know that the serotinous species do not have a seed bank and will thus have to be re-introduced. This is best done by sowing seeds onto the postfire environment before the first rains. We suspect that re-sprouting species, which tend to have small seed banks, will require augmentation as very few seeds will survive to germinate. We also know that the alien seed banks (like the Australian wattles) will be large and alien control is therefore essential.

The restoration at Tokai thus requires the co-ordination of the tree fellers to minimize damage and clear the area in time for an autumn fire, the fire teams to burn before the first autumn rains, and the alien teams to clear the emergent weeds. At the same time horticulturalists need to collect seeds for release and sowing after the fire and to prepare cuttings for planting when sufficient rains have fallen.

There is only one problem with this scenario. In the hundred years since Purcell compiled his list, many species have become threatened with extinction, mainly due to habitat loss. In fact, 35 of these species are listed as threatened on the Red List, with three extinct in the wild. Obviously the extinct and most threatened species top the list for re-introduction to Tokai, provided that they don't have emergent seed banks. To this end Purcell's list was compared to the existing plants, the Red List, known flowering (two months later, for seed) and growth (two months earlier, for cuttings) times, and – using herbarium and Red List monitoring records – the nearest surviving population that might be a source for seeds or propagation material. In some cases, the nearest (and last!) surviving populations may be as far away as Somerset West, as is the Shy Watsonia (*Watsonia humilis*) with a conservation status of Critically Endangered, or Rondeberg up the West Coast in the case of the Slack Buchu (*Agathosma glabrata*) which is Endangered.

Tokai is the only ecologically viable conservation area of Sand Fynbos in the southern suburbs. Other areas exist, but are too small to survive without intensive management. Consequently the area is the major potential restoration site for other highly threatened species. A list of fifty of the most threatened species from the Cape Flats has been compiled for potential restoration.

Process and timing

Species are collected as seeds or cuttings, and germinated or rooted at the Kirstenbosch nursery. These are 'grown-on' in small bags or 'unigrow' plugs and kept separate from other collections in the nursery. Unigrow plugs are hard, narrow plastic sleeves that allow deep root growth in minimal growing medium. The healthy root systems ensure rapid growth. The narrow plugs minimize soil disturbance, reducing the possibility of introducing weeds, alien soil animals and soil diseases. The plugs are sterilized and re-used. It is essential to time the collection and regulate the growing so that the time in the nursery – where

BELOW: Friend of Tokai Park volunteer, Eric Harley, planting a Mountain Dahlia (*Liparia splendens* var. *splendens*). Photo: SANBI.

RIGHT: Waiting for the rain. Sarah-Leigh Hutchinson, FRD restoration intern at SANBI and James Forsyth, Friends of Constantia Valley Green Belt in the area where the plantations were cleared and burned. All that was needed was some autumn rain, but unfortunately, the autumn and winter of 2011 was exceptionally dry. Photo: Tony Rebelo.

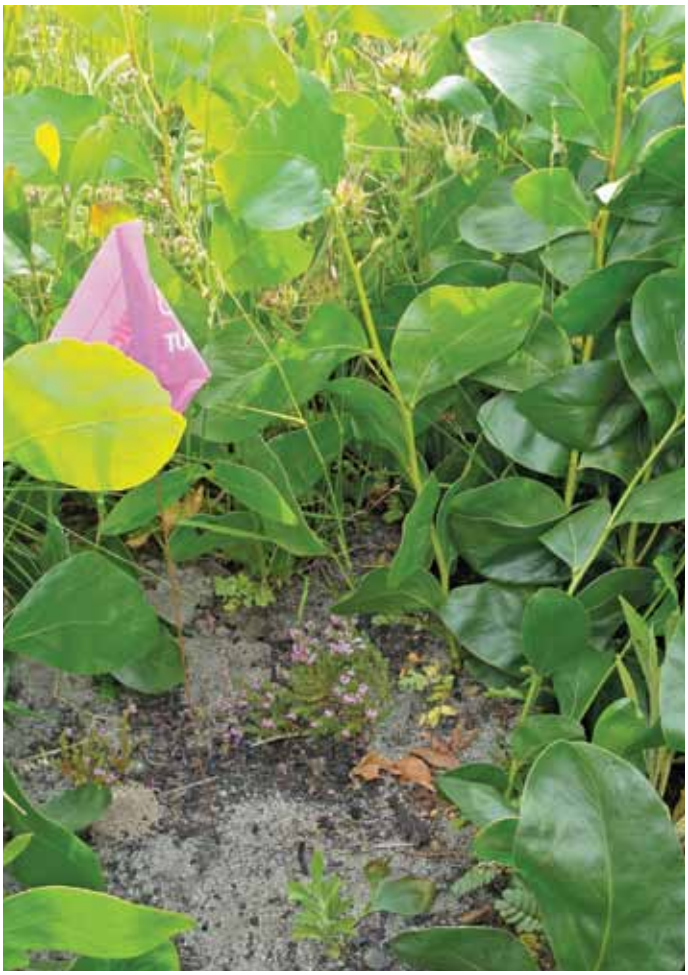
diseases and hybridization may occur – is kept to a minimum. Plants must be ready for planting by winter, with a window for planting till mid July, after which plants will not establish before the onset of the summer drought.

2011 was the fourth year of restoration planting at Tokai. An area of 25 ha, the biggest area to be restored since restoration began, had been clear-felled and burnt on schedule. Although the first fire was almost put out by rain, the rains then dried up. Seeds of serotinous species were sown in April, but despite the anticipation, winter did not arrive. By late July the end of the planting window was approaching, and there was no choice but to plant out the cuttings and hope for the best. Some thousand plants, including two species Extinct in the Wild, four Critically Endangered (CR), one Endangered (EN) and three Vulnerable (VU) were planted, most of these being wetland species.

The problem with planting threatened species out is that one does not know where exactly the plants will survive. This is not helped by the area having been under plantation so that wetlands had been sucked dry and their extent therefore unknown. The lack of rains did not help either, as the water tables did not rise and thus there were no clues to where the wetlands might be. Plants are planted in a grid over the entire suitable restoration area. The grid is needed to facilitate monitoring as the purpose is to establish where plants will survive within the restoration area. This will allow the second-year planting (the last one, as afterwards competition with established plants results in very low survival) in 2012 to focus on areas where survival was acceptable.

BELOW: The Kenilworth Heath (*Erica turgida)* which is Extinct in the Wild, flowering beautifully amid a mass of alien Golden Wattles. Photo: Louise Nurrish.

RIGHT: Spraying fungal spores for the Port Jackson. The spores are dispersed by a dry air blower using talc powder as a carrier medium. GPS was used to ensure an even coverage of the site and to monitor progress. Photo: Tony Rebelo.



The weather was not ideal with temperatures in the mid-twenties and the soils almost dry; having not had any rain for weeks. Proteaceae were planted early in July by the Friends of Tokai Park and SANBI's Threatened Species Unit over the entire area, but especially near the paths. The wetland species were planted later in July by a team of Kirstenbosch horticulturists, nurserymen and the Protea Garden team assisted by the Friends of Tokai Park, the Kirstenbosch Plant Recorder and the Threatened Species Unit, in what is known as the 'Lost Wetland'. The initial signs are positive. Although winter rains were poor, the spring rains have been regular, if a bit scanty. Many of the plants are showing active growth and very few have been lost. The real test is to see whether they will survive the summer.

Challenges (another word for problems!)

Historically people walked anywhere in the pine plantations. In planning the conservation area of the Tokai Park, through open stakeholder engagement, it was decided that a core area would be established to allow animals such as Grysbok to survive. Paths along one quarter of the canal were closed to allow waterbirds and animals (including the Cape Clawless Otter) refuge. The path system was routed around this core to link the shaded walkways that surround the fynbos area. Although path closure has been marked with signage and logs placed across the paths, certain users persist in following these paths and even remove the logs. The Table Mountain National Park appeals to these users to keep off the closed paths as they disturb the animals that are shy of dogs and people and the paths spread alien plants into the fynbos

ABOVE LEFT: Thinleaf Selago (*Pseudoselago spuria*) and Wild Storksbill (*Pelargonium cucullatum*) vie with Port Jackson to establish. We are hoping the Port Jacksons are infected with the fungus and will die. Monitoring the plots will establish whether the experiment is a success or not, but if successful it should drastically cut the effort and cost of alien removal. Photo: Tony Rebelo.

LEFT: Rampant Garden Route Ragwort (*Senecio pterophora)* plants threatening to shade out new restoration plantings.

TOP: The Kenilworth Heath (*Erica turgida*) was eliminated in the 1970s from the wild. Tokai Park is one of a handful of suitable sites where the species can grow.

ABOVE: A Critically Endangered male Cape Flats Conebush (*Leucadendron levisanus)* in full flower. Photos: Louise Nurrish.

area. It also hampers the restoration efforts undertaken by Kirstenbosch and Table Mountain National Park to bring back the lost fynbos of Tokai Park. Recent restoration plantings along the Prinskasteel canal have been trampled by horses and some dog walkers have trampled and killed restored plants, upsetting the stream system that negatively affects the breeding of frogs and insects. Table Mountain National Park, Kirstenbosch and the conservation community ask that people using the Tokai Park do so responsibly and with respect to the natural environment in which they find themselves.

Another factor that affects the success of restoration includes the rampant re-growth of some pioneer species – both indigenous, such as Wild Storksbill (*Pelargonium cucullatum*), and alien, such as Garden Route Ragwort (*Senecio pterophorus*) – weeds that can smother the young plants if not managed effectively. A major concern is the mass germination of alien Port Jackson (*Acacia saligna*) seedlings which were not adequately controlled under the plantation and have established large, local seed banks. They are currently small, but will become a problem if allowed to grow unchecked over the next few months. Together with Alan Wood of the Plant Protection Research Institute, Table Mountain National Park and SANBI are experimenting with spraying the area with large numbers of the fungal spores that cause cancerous galls on Port Jackson. If the experiment is a success it will greatly reduce the effort and costs of clearing this alien species, as well as reduce the need to bring herbicides into the restored areas.

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WHAT DOES THAT MEAN?

cues In germination, the stimuli used by the seed to begin germinating. Typically in fynbos this includes a combination of rainfall, minimum night temperature and maximum day temperature, as well as smoke, pH changes and other cues.

pathogens Disease-producing agents, usually a virus, bacterium, fungus or another micro-organism.

Red List The Red List of South African Plants provides up to date information on the national conservation status of South Africa's indigenous plants, using the internationally-standardized IUCN Red List criteria. Visit the website http://redlist.sanbi.org/.

serotinous Serotiny is an adaptation in which seeds are stored safely on the plant, and usually released - in fynbos - after a fire when plants are killed. It is a rare strategy, even in fynbos 98% of plant species release and disperse their seeds the moment they are ripe.