GUIDELINES FOR THE REHABILITATION OF DECOMMISSIONED PLANTATIONS
IN THE SOUTHERN CAPE

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1. INTRODUCTION
Most of the SAFCOL plantations in the southern Cape consist of pines trees and are situated near or on the lower slopes of the Outeniqua and Tsitsikamma mountains. They were established primarily in areas of Wet Mountain Fynbos and to a much lesser extent Afromontane Forest. Several of these plantations are economically non-viable and are likely to be decommission for other land use practices. This report provides guidelines for the rehabilitation of decommissioned plantations to indigenous fynbos or forest vegetation, and is based on information obtained from Messrs. J. Vlok and D. van Eden (Ecological consultants, pers comm.) and Vlok (1987).

2. REHABILITATION PROCEDURES
The procedure required to rehabilitate plantations depends on whether the plantations were established in fynbos or forest environments and secondly whether they were planted with pine or gum trees.

2.1. WET MOUNTAIN FYNbos AREAS
Wet Mountain Fynbos on the southern slopes of the Outeniqua and Tsitsikamma Mountains has a substantial component of serotinous species, such as Protea mundii, P. nerifolia, Leucadendron eucalyptifolium and Berzelia intermedia. Because serotinous species retain their seeds in the flower heads for prolonged periods, these flower heads can readily be used to replenish depleted seed stocks in plantations. Therefore, they play an important role in the recommended rehabilitation procedure.

2.1.1. Pine plantations or compartments (with few or no blue gum and acacia trees).
In plantations, where the indigenous growth consists mainly of wet mountain fynbos species, the recommended procedure for rehabilitation after clear felling is as follows:
1. All stumps of alien acacia and gum species should be treated with the herbicide ‘Timbrel’ and seedlings and coppice with ‘Garlon’. Where a spray is used a hood should be fitted to the nozzle to reduce herbicide contamination of non-target areas. Some 4 - 6 months after this treatment all stumps of these alien species that are readily accessible from existing roads should be removed (using bulldozers if necessary).
2. Stumps of felled pine trees need not be sprayed with herbicide and should be left in the ground to decay.

3. Branches and litter remaining after clear felling should be loosely stacked wind rows not exceeding a width of 3 m and a height of 2 m.

4. The gap between the wind-rows should be at least 5 m wide.

5. These wind-rows should then be burnt: (a) between 6 to 18 months after the clear felling of the plantation, and then (b) only 1 - 2 days after a light rain to reduce the intensity of the burn and resulting denaturing of the soil. Furthermore, the rows should be burnt one at a time.

A well-executed burn will kill most (up to 95 %) of the residual pine seeds and many of the deleterious pathogens and fungi in the plantation. Moreover, it will also stimulate the germination of seeds of alien acacias (such as blackwood and black wattle), thus facilitating the planning and execution of alien control work.

6. Between 6 and 12 months after this burn intensive alien eradication work should be undertaken. Seedling of pine trees should be hand pulled, while living stumps and seedling of blue gums and acacias should be sprayed with herbicide. After this operation very few residual and viable pine seeds should remain in the plantation. However, in situations where large infestations of acacias were present in or close to the plantations, additional follow-up work should be done annually for the next one to three years, depending on the numbers of alien seedlings present.

7. Only if the soil in the plantation is badly compacted should it be ripped or ploughed, otherwise it should be left undisturbed.

8. The residual seed stock of indigenous plants in the plantation should be supplemented by harvesting seed (flower) bearing branches (30 – 50 cm in length) of serotinous species from neighbouring fynbos areas and scattering them over the rehabilitation site.

9. The recommended procedure is as follows:
   - The habitat from which the seed material is collected should correspond with that of the plantation to be rehabilitated. For example plant material from a wet south facing slope should not be used to seed dry north facing slope.
   - The branches or stems used for seeding purposes should be collected, transported and scattered in the target area within 24 hours of harvesting to prevent substantial seed loss.
• Branches or stems should be cut in 30 – 50 cm lengths and spread in rows some 50 cm wide and 50 cm apart from each other.

• The plant material should be scattered such that there is approximately one seed head (flower) per square metre and the rows of seeding material are less than 10 cm in height (so that they do not provide a refuge for insects and rodents).

Furthermore, the seeding material should be collected from fynbos stands that:

• Correspond to that likely to be found in the plantation.

• Are mature and where the Proteaceae have flowered at least three times.

• Have a high number of serotinous species (e.g. Protea- spp., Leucadendron- spp. Berzelia-spp. and Erica sessiliflora).

• Have already experienced their main seed production season (usually November to March in serotinous species).

In terms of overall recovery one should aim at having on average of at least 10 indigenous plants per square metre after the first year.

2.1.2. Gum or acacia (blackwood) plantations or compartments.

Many Australian gum and acacia trees are allelopathic and release chemicals that inhibit the growth of other plant species and microbial organisms in the soil. This phenomenon complicates the rehabilitation procedure. The most effective, but very expensive, method is to poison and remove all trees stumps, while the cheaper and less potent method is to leave the poisoned stumps in the ground to decay. The former method is outlined below.

1. All stumps of alien acacia and gum species should be treated with the herbicide ‘Timbrel’ and seedlings and coppice with ‘Garlon’. Where a spray is used a hood should be fitted to the nozzle to reduce herbicide contamination of non-target areas. Some 4 - 6 months after this treatment all stumps of these alien species should be removed (using bulldozers if necessary) and sent to pulp mill or burnt in an area where the soil will be denatured.

2. The smaller branches and litter should be stacked in rows and burnt (see section 2.1.1.3-5.).

3. The soil in the plantation should then be ripped to a depth of 10 – 15 cm to loosen and aerate it.
4. Natural microbes must be introduced into the soil using products such as 'Effective microbes'.

5. On steep gradients ripping should be done along contour lines and fast growing grass species should be cultivated to stabilize the loosened soil. The species and treatment used depends on the soils and gradients present and an expert should supervise this task. Wooden logs may also be used to help stabilize the ground. The logs should be 1,0 - 1,2 m in length and secured to ground in a staggered formation, but having an overlap of some 10 cm.

6. Supplementation of the seed bank of indigenous fynbos species should be done as described in section 2.1.1.8 -9., but the amount of seeding material used should be doubled.

2.2. **Mesic Mountain Fynbos Areas**

On the drier and often sandier coastal plateau south the Outeniqua and Tsitsikamma mountains (such as at Rondevlei) the indigenous fynbos is characterized by an abundance of *Erica* species and few serotinous ones.

2.2.1. & 2. *Pine and gum plantations or compartments*.

The method is the similar as that outlined in sections 2.1.1. for pine plantations and 2.1.2. for gum plantations. However, seed bearing branches of the appropriate *Erica* species, rather than serotinous species, should be harvested and scattered in the plantations.

2.3. **Indigenous Forest Areas**

The indigenous Afromontane forests in the southern Cape are restricted to areas that are moist throughout the year and protected from fires.

2.3.1. *Pine plantations or compartments*

The recommended procedure to rehabilitate pine plantations that are found in very moist areas and have a strong growth of indigenous forest or pioneer species is as follows:

1. All stumps of alien acacia and gum species that readily accessible from existing roads or track should be removed and stacked in rows. The remaining stumps and seedling of these species should be sprayed with herbicide.

2. Stumps of the pine trees need not be sprayed with herbicide and should be left in the ground to decay.
3. The branches and litter remaining after clear felling should not be burnt, but preferably be left in place. However, if they form a dense layer that obstructs indigenous plant growth, some of the branches and litter may be stacked in rows and then left to decay.

4. The soil should not be ripped or ploughed.

5. Alien plant eradication work should be done some two years after felling.

6. In general the indigenous seed stock within the plantation need not be supplemented and the plantation should be left to rehabilitate by itself.

2.3.1. Gum plantations or compartments

The recommended procedure is as outlined in section 2.1.2.1-6. However substantial numbers of seeds (ca. 15 / m²) or seedling (ca. 5 / m³) of pioneer trees (such as *Virgilia oroboides*, *Halleria lucida* and *Rhamnus prinoides*) and forest trees should be planted to enhance the rehabilitation process.

2.4. Unwanted roads

Roads where the soil is compacted should be ripped to a depth of 10 – 15 cm. On steep gradients ripping should be done along contour lines and the ground stabilized in a manner described in section 2.1.2. 5-6)

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