PYRAMID VALLEY - A PROPOSAL FOR THE RESTORATION OF THE ORIGINAL SWAMP MARGIN VEGETATION

D.A. Norton[1]

Background

Pyramid Valley Swamp, with its rich lake sediments containing the remains of many extinct bird species (especially moas), is one of the more interesting protected natural areas in New Zealand. The area of greatest scientific interest lies in the base of Pyramid Valley and consists of a swamp, usually inundated with water, with a narrow marginal zone fenced from stock, surrounding this. Adjacent limestone bluffs are not considered here, although they are of considerable scenic and archaeological interest. In recent years, Pyramid Valley swamp has been fenced from surrounding farmland and protected by a QEII National Trust covenant. The QEII trust advisory management committee, which includes the landowner, have indicated an interest in seeing some of the original (pre-human) vegetation re-established around the swamp. This report provides guide-lines for such a restoration project.

Objectives and constraints

For any restoration programme to be successful it needs to be carefully planned, to have long-term guide-lines, and secure resources, to ensure that any work undertaken is sustained in later years.

The primary objective of this restoration programme is to re-establish plant communities representative of those occurring at the site prior to human impact on the area. The pre-human vegetation datum is based on the macrofossil reconstruction of Burrows (1988) for 3500 years ago. It is important to realize that it will never be possible to recreate communities identical to those existing in the past because of changing environmental conditions (especially climate). Moreover, an incomplete fossil record precludes our knowing comprehensively the composition of those communities. However, it should be possible to establish plant assemblages containing many of the plant species present in pre-human times including in particular the physiognomic dominants. Furthermore, the establishment and dominance of some species (e.g. *Prumnopitys taxifolia*) will be a long-term goal, but it should be possible to establish a reasonable vegetation cover within a 5-10 year period (cf Rangiora Matawai Park project).

---

[1] School of Forestry, University of Canterbury, Private Bag, Christchurch

Given the scientific significance of the area, two important constraints need to be placed on any planting.

1. That only species that have been reliably identified as occurring at the site (see Burrows 1988; Appendix 2) be planted, at least initially* .
2. That plant material used for restoration come from plants growing within the ecological district (Waikari) or region (Lowry) (see Timmins et al. 1987 for a comparable example).

The Present Environment

Three main landform units can be recognized within the fenced area; the main swamp with calcareous and organic sediments (about 0.8 ha), a marginal area of poorly drained ground but lacking the deep sediments of the main swamp, and better drained slopes above this (rendzina soils derived from limestone parent material). The total area being considered is about 1.8 ha.

No official climate stations occur close to Pyramid Valley, the nearest being Balmoral (20 km north) and Waipara (15 km east). Annual rainfall at these stations is 658 mm and 729 mm respectively. Mean January temperature is 16.3 °C & 17.5 °C and June temperature 4.9 °C & 6.3 °C respectively. Average daily temperature range is 11.0 °C at Waipara and 12.3 °C at Balmoral. 38.3 days of air frost occur on average at Waipara and 79.1 at Balmoral. Balmoral has on average 118.3 days of ground frosts. Extreme recorded minimum temperatures are -13.3°C and -8.8°C respectively for Balmoral and Waipara. Snowfall occurs on average 1.5 days each year at Waipara and 3.6 days at Balmoral. The local microclimate at Pyramid Valley will undoubtably differ from these stations, especially with respect to temperature patterns, although rainfall is likely to be about 700 mm. The enclosed nature of the swamp is likely to result in pronounced temperature inversions occurring in winter. Strong gusty northwest winds are likely to occur, particularly in summer, and could result in soil moisture shortages on the well-drained slopes around the swamp.

The present vegetation of the site consists largely of rank grass- and rushland. Two main species groupings occur. In the wetter areas, *Ranunculus scleratus, Juncus articulatus, Eleocharis acuta, Nasturtium microphyllum, Glyceria* sp and *Agrostis stolonifera* are the dominant species, while *Dactylis glomerata, Festuca rubra* and *Rumex obtusifolius* are dominant on the drier ground. This rank

* However, the future possibility of planting species not recorded from the site should not be excluded. For example, this site could provide a suitable refuge for wetland species rare and endangered in the area.

growth is a direct consequence of grazing cessation some years ago. Control of these plants during establishment of the indigenous plantings will obviously form an integral part of management of the area. Very little of the pre-human vegetation remains at the site, a few plants of *Eleocharis acuta* and some heavily browsed *Carex secta* just outside the fenced area being perhaps the most distinctive. Both *Phormium tenax* and *Cordyline australis* have been planted at the site. A full list of extant plant species is included in Appendix 1, comprising 26 species of which seven are indigenous (but the two planted species are probably not of local origin).

Restoration Programme; A Preliminary Outline

Three general principles underlie the restoration programme proposed here.

1. Initial efforts should be directed towards establishing a vigorous cover of indigenous plants in order to assist in suppressing the rank grass and rush sward, and to modify microclimate conditions sufficiently to promote the survival of other indigenous plants. The plants used at this stage need not be plants that are likely to be dominant in the anticipated 'mature' communities.
2. Cluster planting with woody species should be used as much as possible in order to assist survivorship chances.
3. Nature should be allowed to play a dominant role in determining the final floristic composition of the communities, although this may result in plant assemblages not initially expected from the incomplete fossil record.

Restoration should aim to develop two main plant communities, one on the poorly drained area close to the swamp (the swamp margin) and the second on the better drained ground beyond this. There is no intention to plant the swamp itself. Indeed this would be contrary to the approved broad management plan and so the swamp *per se* is not discussed further here. The possibility of the adjacent plantings leading to a drying out of the swamp should, however, be watched.

On the poorly drained flat and hummocky ground closest to the swamp, sedge and rush species (*Carex, Baumea, Eleocharis*), *Blechnum* spp* and *Phormium tenax* are likely to have dominated the pre-human flora. Given the ease with which some of these species can be divided and transplanted, initial planting should concentrate on them, especially *Carex secta* and *Phormium tenax*,

* Although *Blechnum* species have not been recorded by Burrows (1988) they were almost certainly present (probably *B. penna-marina* and either *B. minus* or *B.* 'mountain').

and possibly *Baumea rubiginosa*. Great care will be needed to ensure that extant native plants like *Eleocharis* are not eliminated. *Carex* and *Phormium* should provide rapid early cover and help suppress the rank growth presently dominant. Once the *Carex* and *Phormium* are established, some of the typical wetland shrub species can be established (e.g. *Cordyline australis, Coprosma* spp, *Leptospermum scoparium* and *Myrsine divaricata*). These need not be in great numbers, but rather should be planted in small clusters of 5-10 plants (plant spacing within clusters of 1-1.5 m). The densities of clusters should increase towards the outer edge of this zone as typically occurs around less modified wetlands. At a later stage it should be possible to expand plants like *Eleocharis* and to introduce other wetland plants (e.g. *Potamogeton cheesemanii*).

In the better-drained areas, initial planting should aim to obtain a good woody cover (c.f. Rangiora Matawai Park). A range of species should be planted in mixed clusters in order to provide self protection. *Leptospermum scoparium, Coprosma* spp* , *Olearia virgata, Corokia cotoneaster, Plagianthus regius* and *Cordyline australis* are likely to be the most useful initially. However, there is no reason why plants like *Carpodetus serratus, Hoheria angustifolia, Prumnopitys taxifolia* and *Pennantia corymbosa* could not also be tried at the start, especially in the middle of clusters. A greater survival rate may, however, occur if they are left for a few years before planting. For the initial plantings, plant spacing within clusters should be 1-1.5 m and cluster spacing about 10 m. The initial plantings would need to be reinforced over a period of years to ensure a good woody cover is obtained. Once these plants have become established, introduction of further plants can follow as material and suitable planting sites become available.

It would not be advisable to plant climbers (*Rubus, Muehlenbeckia* and *Clematis*) until the woody plant cover is successfully established, perhaps not for at least ten years.

Because the planted area is going to be isolated in a rural environment, it is important to develop a good buffer for wind shelter around the periphery of the planted area. *Cordyline australis, Leptospermum scoparium* and *Phormium tenax* would probably be useful for this purpose.

I believe that given the 'semi-natural' rather than 'garden' nature of Pyramid Valley, the plantings should not be viewed as a botanical

---

* Could include *Coprosma rotundifolia, C. propinqua, C.* aff. *parviflora,* and *C. robusta* or *C. lucida* (whichever occurs in the area).

garden requiring regular attention. Rather, I would like to see 'nature' being given a chance to sort things out itself in order to determine the final floristic composition of the planted areas.

Control of unwanted 'weedy' plants will form an integral part of management of Pyramid Valley swamp, at least initially. Some chemical control may be needed with the initial establishment of woody species. However, an environmentally more attractive proposition may be to graze the area heavily shortly before planting and use manual control methods after this. Subsequent growth of the plantings may then be sufficient to keep the rank grass and rush sward suppressed. However, the possibility of woody weeds (e.g. *Sambucus nigra*) establishing at a later date should not be overlooked.

A final point with this proposal is the need for the advisory committee to keep good records of both the overall management activities undertaken, and the source of planted material and its subsequent development at the site. This will provide valuable information for future planting into the site and may also assist other restoration projects in the future.

Management Work

Most of the work will need to be undertaken voluntarily or the costs involved in this project will be prohibitive. Much of the collection of plant material could be undertaken during Canterbury Botanical Society field trips to the area. Some propagation can also be undertaken by Society members. However, because of the large amount of material required, it may be necessary to negotiate an arrangement with one/some commercial nurseryman to assist with this. The possibility of the Department of Conservation supplying plants surplus to their requirements should also be investigated. Initial planting should be undertaken by experienced people, but local school groups could play an important role in weeding and later mass plantings. Detailed monitoring and supervision of work and monitoring of plant progress will, however, need to be undertaken by the management committee.

References

Burrows, C.J. 1988. Moa browsing: Evidence from the Pyramid Valley mire. In; Rudge, M.R. (ed), **Moas, Mammals and Man.** New Zealand Ecological Society, Wellington, (in press).

Moar, N.T. 1970. A new pollen diagram from Pyramid Valley Swamp. **Records of the Canterbury Museum 8,** 455-461.

Timmins, S.M., Atkinson, I.A.E. and Ogle, C.C. 1987. Conservation opportunities on a highly modified island. Mana Island, Wellington, New Zealand. **New Zealand Journal of Ecology 10,** 57-65.

SPECIES LIST

(indigenous species marked *)

Achillea millefolium
Agrostis stolonifera
Anthoxanthum odoratum
*Carex secta** (just outside fenced area)
Cirsium arvense
Cirsium vulgare
*Cordyline australis** (planted)
*Coprosma propinqua** (on rock)
Cynosorus cristatus
Dactylis glomerata
*Eleocharis acuta**
Festuca rubra
Glyceria sp
Holcus lanatus
*Hydrocotyle novae-zeelandiae**
Juncus articulatus
*Muehlenbeckia complexa** (on rock)
Nasturtium microphyllum
Plantago lanceolata
*Phormium tenax** (planted)
Populus nigra (Lombardy form)
Ranunculus scleratus (on mud)
Rumex obtusifolius
Sambucus nigra
Taraxacum officinale
Trifolium fragiferum

Species that have been recorded as macrofossils from the Pyramid Valley swamp by Burrows (1988) and Moar (1970).

Baumea sp (*rubiginosa*)
Carex cf *foresteri* (Moar 1970)
Carex cf *lucida* (Moar 1970)
Carex secta
Carmichaelia sp
Carpodetus serratus
Clematis sp (*foetida*)
Coprosma rotundifolia
Coprosma spp
Cordyline australis
Corokia cotoneaster
Elaeocarpus hookerianus
Hoheria sp (*angustifolia*)
Leptospermum scoparium
Lophomyrtus obcordata
Melicope simplex
Muehlenbeckia australis
Muehlenbeckia complexa
Myoporum laetum
Myrsine divaricata
Olearia virgata
Pennantia corymbosa
Phormium tenax
Phyllocladus alpinus
Plagianthus regius
Potamogeton cheesemanii (Moar 1970)
Prumnopitys taxifolia
Pseudopanax ferox
Rubus schmidelioides
Rubus squarrosus
Tetrapathea tetrandra
Teucridium parvifolium