

BANKSIDE — A NEW SCIENTIFIC RESERVE ON THE CANTERBURY PLAINS

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SUMMARY: Current surveys, encouraged by the New Zealand Ecological Society, are showing that a surprising number of native communities still survive on the Canterbury Plains, though in modified form. In 1969 a small area of scrub and grassland with undisturbed soils near Bankside was secured for a scientific reserve — the first of its kind on the Plains. A brief description is given.

LOCATION

Bankside Reserve — a fenced rectangular block of about seven acres — lies between the Selwyn and Rakaia Rivers, and about four miles south-east of Bankside (Fig. 1). A "paper" road, Knyvett Road, forms its eastern boundary and provides legal access from Heslerton Road. Other boundaries adjoin farmland held under one title. The altitude is 220 feet above mean sea level.

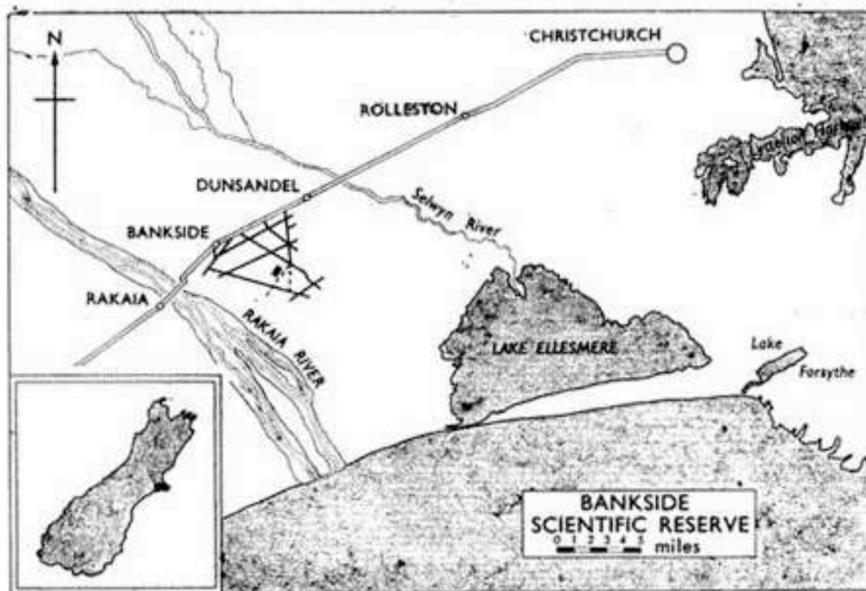


FIGURE 1. *Locality map*

GEOLOGY AND TOPOGRAPHY

The reserve is underlain by greywacke fan gravels of the Springston Formation, at one time thought to be of glacial origin (Suggate, 1958), but now interpreted "as an aggradation deposit consequent upon rising Postglacial sea level." (Suggate, 1963). This fan or floodplain, formed mainly by the Rakaia and Selwyn rivers, lies between the younger Postglacial gravels and the older late glacial gravels of the Burnham Formation.

The surface of the flood plain, which corresponds in age with the Halkett Surface overlying Springston gravels in the Waimakariri sector, has a characteristic, braided channel relief; sand ridges and low, stable sand-dunes, old abandoned stream channels, stony ridges and flattish stony plains are all represented.

The reserve includes a section of one of the tallest sand-dunes, a prominent stream channel, and various stony plains and ridges, thus representing a fair cross-section of the local land surface. An old established water-race passes through the south-east corner providing an artificial habitat of further interest.

SOILS AND CLIMATE

Ward *et al.* (1964) describe the soils, climate and agriculture of this region in detail. Briefly, soils are mapped as Eyre very stony sandy loams (8c) with many small areas of dune soils; (it should be noted, however, that on Sheet 1, Ward *et al.* (1964), the map unit covering the area including the reserve is incorrectly labelled 8a — Eyre stony silt loam). Within the reserve the Eyre shallow loams and stony loams are confined to stony plains and ridges; whereas the deeper, fine sandy loams of the stable sand-dunes belong to the Paparua series (E. J. B. Cutler, pers. comm.).

The work of Cox and Mead (1963), supported by radiocarbon dates, suggests that these soils developed on a surface between 3,000 and 6,000 years old.

The free-draining Eyre soils are especially drought-prone and very low in nutrients. Paparua soils, on the other hand, retain soil moisture better and generally have a higher content of nutrients (Table 1). However, the most important single factor limiting plant growth on both soils is inadequate moisture during critical periods.

TABLE 1. *Chemistry of Eyre-Paparua soils (condensed from Ward et al. 1964)*

Soil	Depth in.	pH	Citric sol. P mg.%	C/N ratio	C.E.C. %me.	T.E.B. %me.	Base satn.
Eyre v.st.	0-7	5.4	4	14	10.5	3.2	30
Sa. loam	10-15	5.5	16	—	8.2	1.5	13
Paparua	0-7	6.0	6	8	11.1	6.6	60
Sa. loam	10-16	6.2	12	—	5.4	2.6	49

The reserve lies within the subhumid climatic zone and is subject to drying north-west winds, frequent frosts and summer drought. Although fairly evenly distributed, annual rainfall is not likely to exceed an average of 26in.

HISTORY

This area, like most of the Canterbury Plains, was modified by fire in Polynesian times and was probably affected by earlier, natural fires (Cox and Mead, 1963; Molloy, 1968). Subsoils contain subfossil charcoal of kanuka (*Leptospermum ericoides*) which indicates that this soil complex was dominated by kanuka scrub. By applying the chronology established elsewhere (Cox and Mead, 1963), it can be assumed that this occurred at least 1,000 years ago, and probably throughout Post-glacial times.

Scrub and grassland covered the region during the early part of European settlement, with grassland dominating. This is well documented on *Black Map 51*, "North Bank of Rakaia", signed by H. Cridland 1863-65, and deposited in the Christchurch files of the New Zealand Department of Lands and Survey. Good remnants survive today despite modification by periodic burning and grazing during the last century or more. Ward *et al.* (1964) record patches of matagouri (*Discaria toumatou*), manuka, tussock and danthonia in their soil survey of this region.

Hitherto, the native scrub and grassland of the Canterbury Plains have been poorly documented. Early botanical writers such as Haast, Armstrong, Cockayne, and Wall concluded that it had all disappeared or was strongly modified. Their accounts are largely reconstructions based on a few early records, modified remnants and riverbed successions. The last three writers mention patches of scrub in various places on the Plains without actually describing them. Cockayne's discussion of "South Island manuka shrubland" of the "North-eastern" and "Eastern" districts, in fact, provides an approximate descrip-

tion of kanuka scrub at Bankside (Cockayne, 1928, p. 193).

Contemporary botanists have largely neglected the Plains, though Connor and MacRae (1968) have described a phase of *Notodanthonia clavata* grassland, an induced community, at Te Pirita on the high Plains.

Until it was subdivided and sold in 1968, this land had always been used as grazing for dry sheep. Originally it was part of Run 108, "Heslerton", one of the early Canterbury runs, which was taken up in 1853 and covered nearly 20,000 acres (Acland, 1946). Like many runs on the Plains "Heslerton" was subdivided into smaller holdings during the 1870s and 1880s. But the farming pattern did not change significantly. Holdings were still relatively large with individual paddocks containing 200-650 acres.

The present owners of the surrounding farmland are developing the remaining "native country" rapidly, erecting new subdivision fences, yards and buildings, and cultivating or overdrilling large tracts of grassland and scrub.

VEGETATION

Four communities are found in the area with transitions, in places abrupt, in others gradual, depending on site tolerance or degree of modification, or both. The reserve includes all four and although it does not match the very best examples of some, it is nevertheless, the best compromise under the circumstances. The following brief description applies to the communities in the area as a whole.

Kanuka scrub

This community consists of small, isolated clumps and large patches several acres in area, chiefly on Eyre soils (Fig. 2). It is dominated by reddish and green forms of kanuka of mixed age and density, ranging from scattered seedlings through plants 2-4 ft. tall, to occasional shrubs 12-15 ft. tall. It has regenerated freely after periodic fires; the last about 15-20 years ago and one about 40 years ago. These estimates are approximate only and based on a few ring counts. Other shrubs are rare. *Cyathodes juniperina* and an occasional, suppressed plant of manuka (*Leptospermum scoparium*) are present. Both have probably decreased in numbers with burning and grazing, and, with manuka, "blight" *Eriococcus* spp. as well.

In the least disturbed patches the ground layer is rich in bryophytes, lichens and the larger fungi. At the base of large kanuka shrubs are deep cushions of *Hypnum cupressiforme*. Kanuka seems to be spreading into both grassland communities judging by the number of seedlings and young plants throughout.



FIGURE 2. *Danthonia* grassland in foreground merging into short-tussock grassland and kanuka scrub. An oblique view across the reserve from near the gate.

Short-tussock grassland

This community is restricted entirely to Paparua soils and is the characteristic vegetation of stable sand-dunes and abandoned channels with deep, fine sediments (Figs. 2 and 3). It is dominated by fescue tussock (*Festuca novae-zelandiae*) and contains many other herbaceous plants and numerous seedlings of *Carmichaelia*. As a closed community it resembles the kind of grassland usually found on pastoral run country at higher altitudes.

Here and there an occasional plant of matagouri, heavily browsed native broom (*Carmichaelia robusta* and probably *C. violacea*), or a small clump of kanuka, break the apparent uniformity of this grassland. A feature of the community is the extremely patchy distribution of many species.

Danthonia grassland

Several phases of turf grassland dominated by danthonia (*Notodanthonia clavata*), with scattered shrubs of native broom and matagouri are also conspicuous (Figs. 2 and 3). The latter are from 1–3 ft. tall, appear to be even-aged (about 40 years) and lack vigour. No seedling matagouri were found.

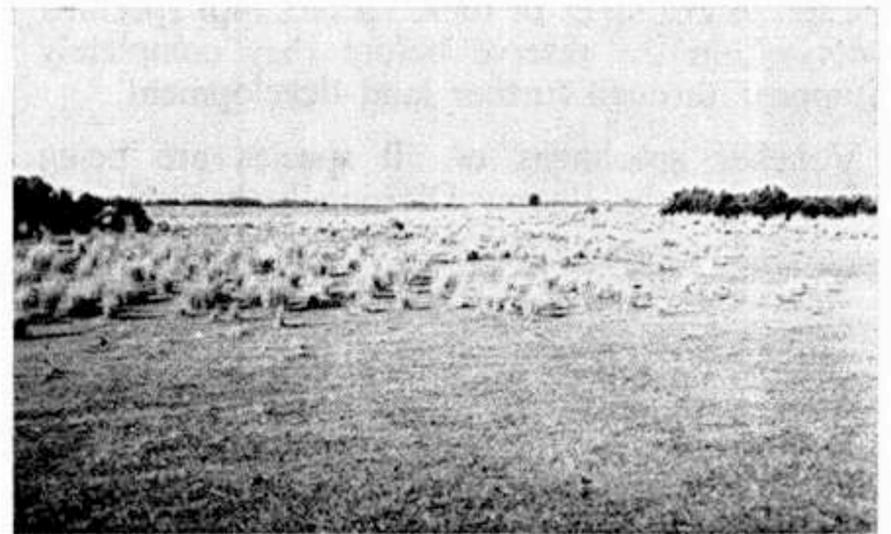


FIGURE 3. *Danthonia* grassland merging into short-tussock grassland with patches of kanuka. Southern end of reserve; looking towards Banks Peninsula, view slightly to right of Figure 2.

Water-race community

This artificial community consists of both native and adventive species, ranging from submerged aquatics to normal terrestrial species favoured by the increased soil moisture. Such water-races are a feature of the Canterbury Plains and help to extend the distribution of otherwise restricted species.

FLORA

A list of species is appended. For the vascular plants it is reasonably complete, but further studies will undoubtedly extend the list of bryophytes and lichens. Fungi have not been surveyed.

Features of this list are:

- (1) the surprisingly large number of native species; 76 species representing 60 genera.
- (2) among these, the number that are rarely, or perhaps never previously, found on the Canterbury Plains, e.g. *Iphigenia novae-zelandiae*, *Carmichaelia monroi*, *Raoulia subsericea*, *Scirpus caligenis*, *Stackhousia minima*.
- (3) the relatively low number and proportion of adventive species; all widespread in tussock grasslands, except the 16 species restricted to the water-race.

Native plants recorded outside the reserve but not seen within are indicated on the list, in all nine species. It is possible that some may appear in future years, but it would be worthwhile to

transplant examples of these species into specified plots within the reserve before they completely disappear through further land development.

Voucher specimens of all species are being collected for the Botany Division herbarium.

FAUNA

At one time rabbits (*Oryctolagus cuniculus*) and hares (*Lepus europaeus*) were abundant in this area and contributed to the modification of the vegetation. At present their numbers are low and under control.

The common mouse (*Mus musculus*) and at least one species of skink (*Leiopisma*) have been seen in the reserve. The following birds frequent the area: fantail (*Rhipidura fuliginosa*), harrier (*Circus approximans*), skylark (*Alauda arvensis*), starling (*Sturnus vulgaris*) and hedge sparrow (*Prunella modularis*). At least one species of finch nests in the short kanuka.

DISCUSSION

The Bankside Reserve is of particular interest since it appears to be the last substantial remnant of primitive scrub and grassland on surfaces of its precise age group on the Canterbury Plains. It is a relic in the strict sense and one in danger of destruction by encroaching land development. The Eyre-Paparua soil complex alone covers 260,000 acres in the South Island, of which 240,000 acres occur in Canterbury. The uncultivated site at Bankside thus provides a basic reference for one of the Plain's largest soil groups, together with its soil flora and fauna.

Reserves of this nature are comparatively new and no doubt many problems of management will arise. For example, experience has shown that the structure and composition of these communities may change once burning ceases and grazing animals are excluded. If the existing communities are to be maintained, it may be desirable to introduce a policy of infrequent grazing and, perhaps, controlled burning to parts of the reserve. However, providing no new disturbance arises, they should remain indefinitely and provide a full record of Postglacial soil development and a history of the vegetation.

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REFERENCES

- ACLAND, L. G. D. 1946. *The early Canterbury runs*. (Revised edition.) Whitcombe and Tombs Ltd., Christchurch.
- COCKAYNE, L. 1928 *The vegetation of New Zealand*. In *Die vegetation der Erde XIV*. Engelmann, Leipzig. (2nd Edition.)
- CONNOR, H. E., and MACRAE, A. H. 1968. Montane and subalpine tussock grasslands in Canterbury. In *The natural history of Canterbury*. (G. A. Knox Edit.) A. H. and A. W. Reed, Wellington.
- COX, J. E., and MEAD, C. B. 1963. Soil evidence relating to post-glacial climate on the Canterbury Plains. *Proc. N. Z. Ecol. Soc.* 10: 28-38.
- MOLLOY, B. P. J. 1968. Recent history of the vegetation. In *The natural history of Canterbury*. (G. A. Knox Edit.) A. H. and A. W. Reed, Wellington.
- SUGGATE, R. P. 1958. Late quaternary deposits of the Christchurch metropolitan area. *N.Z. J. Geol. Geophys.* 1: 103-122.
- SUGGATE, R. P. 1963. The fan surfaces of the central Canterbury Plain. *N.Z. J. Geol. Geophys.* 6: 281-287.
- WARD, W. T.; HARRIS, C. S., and SCHAPPER, H. P. 1964. Soils and agriculture of Ellesmere County Canterbury, New Zealand. *N.Z. Soil Bur. Bull.* 21.

APPENDIX — SPECIES LIST

Vascular plants:

- W *Acaena ovina**
- S - - *Aciphylla subflabellata*†
- SD - *Agropyron scabrum*
- D - *Agrostis tenuis**
- KSD - *Aira caryophyllea**
- W *Alopecurus geniculatus**
- KSD - *Anthoxanthum odoratum**
- D - *Aphanes microcarpa**
- D - *Bromus mollis**
- W *Callitriche* sp.
- SD - *Carex breviculmis*
- SD - *C. colensoi*
- W *C. inversa*†
- W *C. virgata*
- D - *Carmichaelia monroi*
- KSD - *C. robusta*
- SD - *C. violacea*(?)
- S - - *Celmisia gracilentata* agg.
- W *Centella uniflora*
- SD - *Cerastium holosteoides**
- D - *Cirsium vulgare**
- D - *Colobanthus brevisepalus*†

-- D --	<i>Coprosma petriei</i> var. <i>petriei</i> †	-- D --	<i>Pteridium aquilinum</i> var. <i>esculentum</i> †
KSD --	<i>Cotula perpusilla</i>	- S --	<i>Pterostylis mutica</i>
-- D --	<i>Cotula</i> (minitooth")	- SD --	<i>Pyrrhanthera exigua</i>
- SD --	<i>Craspedia uniflora</i> var. <i>uniflora</i>	- S --	<i>Ranunculus lappaceus</i> agg.
KSD --	<i>Cyathodes fraseri</i>	--- W	<i>R. cheesemanii</i> (?)
K ---	<i>C. juniperina</i> †	-- D --	<i>Raoulia australis</i>
KSD --	<i>Deyeuxia avenoides</i>	- S --	<i>R. hookeri</i>
KSD --	<i>Dichelachne crinita</i>	- SD --	<i>R. monroi</i>
KSD --	<i>Dichondra repens</i>	- S --	<i>R. subsericea</i>
- SD --	<i>Dichondra brevifolia</i>	KSD --	<i>Rumex acetosella</i> *
- SD --	<i>Discaria toumatou</i>	--- W	<i>Sagina procumbens</i> *
--- W	<i>Eleocharis acuta</i>	--- W	<i>Scirpus caligenis</i>
--- W	<i>Elodea canadensis</i> *	--- W	<i>S. setaceus</i> *
--- W	<i>Epilobium komarovianum</i>	- S --	<i>Scleranthus brockiei</i>
-- D --	<i>E. tenuipes</i> (?)	- SD --	<i>S. uniflorus</i>
-- D --	<i>Erodium circuitarium</i> *	- S --	<i>Stackhousia minima</i>
- S --	<i>Festuca novae-zelandiae</i>	KS --	<i>Thelmyitra longifolia</i>
--- W	<i>F. rubra</i> var. <i>commutata</i> *	-- D --	<i>Tillaea sieberiana</i>
- SD --	<i>Geranium sessiliflorum</i> agg.	- SD --	<i>Trifolium arvense</i> *
--- W	<i>Glossostigma elatinoides</i>	- SD --	<i>T. dubium</i> *
--- W	<i>Glyceria declinata</i> *	-- D --	<i>T. glomeratum</i> *
KSD --	<i>Gnaphalium collinum</i> agg.	KSD --	<i>T. repens</i> *
--- W	<i>G. japonicum</i>	-- DW	<i>T. subteraneum</i> *
-- D --	<i>Gypsophila australis</i> *	--- W	<i>Triglochin striata</i> var. <i>filifolium</i>
- S --	<i>Haloragis depressa</i>	KSD --	<i>Viola cunninghamii</i>
- SD --	<i>Helichrysum filicaule</i>	-- D --	<i>Vittadinia australis</i> †
-- D --	<i>Hieracium pilosella</i> *	-- D --	<i>Vulpia bromoides</i> *
KSD --	<i>Hydrocotyle novae-zelandiae</i> var. <i>montana</i>	-- D --	<i>Wahlenbergia gracilis</i>
KSD --	<i>Hypericum gramineum</i>	Bryophytes:	
- SD --	<i>Hypochaeris glabra</i> *		<i>Bryum truncorum</i>
KSD --	<i>H. radicata</i> *		<i>Breutelia affinis</i>
--- W	<i>Hypsela rivalis</i>		<i>Campylopus introflexus</i>
-- D --	<i>Iphigenia novae-zelandiae</i>		<i>Ceratodon purpureus</i>
--- W	<i>Juncus articulatus</i> *		<i>Hypnum cupressiforme</i>
--- W	<i>J. bufonius</i> *		<i>Polytrichum juniperinum</i>
--- W	<i>J. filicaulis</i> *		<i>Rhacomitrium lanuginosum</i>
--- W	<i>J. tenuis</i> *		<i>Tortriquetella papillata</i>
- SD --	<i>Lagenophora petiolata</i> †		<i>Tortula muralis</i>
--- W	<i>Leontodon taraxacoides</i> *	Lichens	
KSD --	<i>Leptospermum ericoides</i>		<i>Acarospora</i>
K ---	<i>L. scoparium</i> †		<i>Buellia</i> (2 spp.)
--- W	<i>Lilaeopsis</i> sp.		<i>Candelariella</i>
--- W	<i>Lolium perenne</i> *		<i>Cladonia aggregata</i>
--- W	<i>Lotus pedunculatus</i> *		<i>Cladonia</i> (4 spp.)
- SD --	<i>Luzula rufa</i> var. <i>albicomans</i>		<i>Diploschistes</i>
- S --	<i>Mentha cunninghamii</i>		<i>Graphis</i>
-- D --	<i>Muehlenbeckia axillaris</i>		<i>Lecanora</i>
-- D --	<i>M. ephedroides</i>		<i>Lecidea</i> (6 spp.)
- S --	<i>Microseris scapigera</i>		<i>Lepraria</i>
- S --	<i>Microtis unifolia</i>		<i>Parmelia</i> (5 spp.)
--- W	<i>Myosotis caespitosa</i> *		<i>Perforaria</i>
--- W	<i>Myriophyllum propinquum</i>		<i>Physcia stellaris</i>
- SD --	<i>Nertera setulosa</i>		<i>Ramalina ecklonii</i>
KSD --	<i>Notodanthonia clavata</i>		<i>R. ecklonii</i> var. <i>sublinearis</i>
- S --	<i>Ophioglossum coriaceum</i>		<i>R. geniculata</i>
- S --	<i>Oreomyrrhis rigida</i>		<i>R. leiodea</i> var. <i>condensata</i>
- SD --	<i>Oxalis corniculata</i>		<i>Ramalina</i> sp.
-- D --	<i>Pelargonium inodorum</i> †		<i>Sticta</i> (2 spp.)
--- W	<i>Plantago lanceolata</i> *		<i>Teloschistes chrysophthalmus</i>
--- W	<i>Poa pratensis</i> *		<i>T. velifer</i>
--- W	<i>Potamogeton cheesemanii</i>		<i>Usnea</i> (2 spp.)
- S --	<i>Prasophyllum colensoi</i>		<i>Xanthoria parietina</i>
--- W	<i>Pratia angulata</i>		<i>X. parietina</i> var. <i>ectanea</i>

K=Kanuka scrub; S=short-tussock grassland; D=danthonia grassland; W=water-race;
 *=adventive species; †=species growing in the area but not recorded from the reserve.