Current research with introduced trees in the South Island high country

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Background

The New Zealand Forest Research Institute Ltd (NZFRI) has been researching tree growth in the high country for almost 40 years. Much of the effort, particularly in the early years, was directed at inventories, and 'condition and trend' surveys of native forest, scrub and grasslands (Holloway, 1969). Until the late 70s the focus of research with introduced species was soil rehabilitation and erosion control using trees, shrubs and herbaceous species (particularly legumes) in headwater catchments above 900 m (Ledgard and Baker, 1988). The central base for this research was in the headwaters of Broken River, in the Craigieburn Range. Over recent years research has been directed at mid-elevation (500-700 m) drier sites, particularly where *Hieracium* and rabbits are limiting pastoral production. Here the aim is primarily to improve soils, but it also involves research on the biological potential and management systems for improving the productivity of farmlands.

Major NZFRI research sites

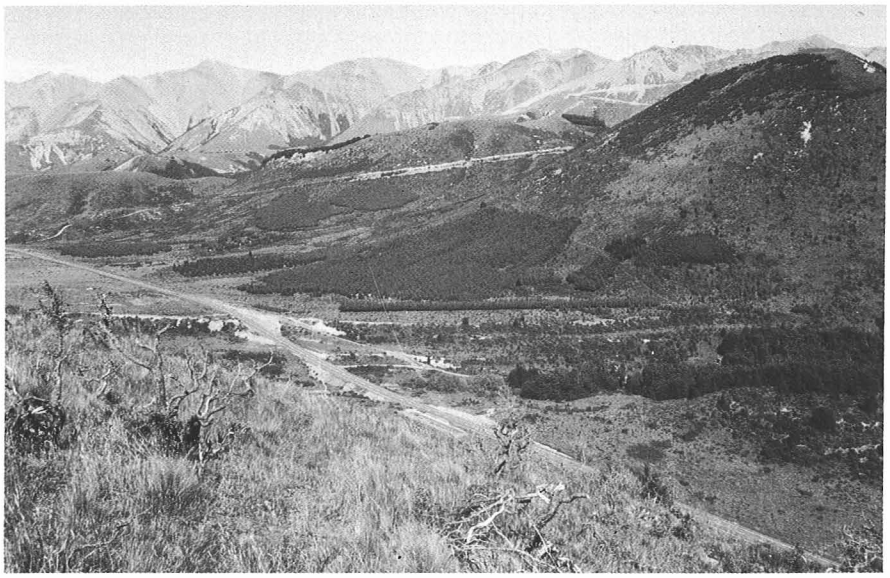
A 1982/83 survey of introduced forest trees in the Canterbury high country found rainfall to be the main determinant of growth (Ledgard and Belton, 1986). The dominating influence of rainfall and the practical necessity of concentrating activities in core research areas has effectively concentrated recent research at three sites.

The wettest site (1200 mm) remains in the Craigieburn Range and contains trials dating back over 30 years; the most recent plantings (1979) were on Flockhill Station and involved 15 ha of predominantly Corsican and ponderosa pine (*Pinus nigra* and *P. ponderosa*) and Douglas fir (*Pseudotsuga menziesii*) in which biomass and silvicultural trials are currently being established.

The moist site (800 mm) is on Ribbonwood Station near Lake Ohau where trials were first established in 1978. Over 50 ha of trial plantings have now been planted comprising mostly Douglas fir and Corsican, ponderosa and Bishop's pine (*Pinus muricata*) plus a demonstration block involving 24 species.

The dry site (550 mm) has only recently been established on Balmoral Station near Lake Tekapo. There, major trials involving over 30 ha are aimed at species choice, soil rehabilitation, and agroforestry and silvicultural options.

In addition, from 1978 to 1991 NZFRI undertook detailed research on tree species and designs for sheltering irrigated pasture at AgResearch's Tara Hills high-country research station near Omarama (Ledgard and Baker, 1992).



NZ Forest Research Institute's 'wet' (1200+ mm rainfall) high-country forestry trial site on the eastern slopes of the Craigieburn Range. Most trials were planted in 1978-80.

Current NZFRI research

NZFRI's current research with introduced trees is financed almost solely by Government's Public Good Science Fund (PGSF) and is carried out under three programmes. The first is titled "High country sustainability with trees" and concentrates on integrated research looking at the use of trees (and associated herbaceous legumes), particularly in low rainfall areas, for soil conservation, improvement

NZ Forest Research Institute's 'moist' (800 mm rainfall) high-country forestry trial site on Ribbonwood Station near Lake Ohau. Trials in foreground planted in 1983/84.

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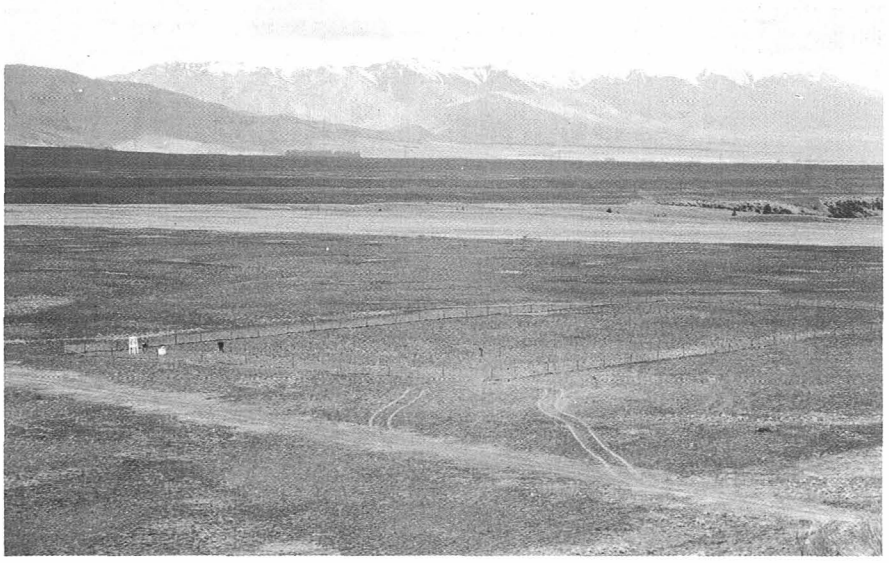
and land rehabilitation, emphasising multi-purpose utilisation options and their on-site and off-site impacts relative to long-term sustainability. Objectives specifically address fundamental questions concerning species choice, propagation, and establishment techniques, total biomass production under different management regimes, soils, nutrient cycling, water use, wilding spread and biodiversity. Collaborative assistance with this research is being offered by AgResearch and Landcare Crown Research Institutes.

Many of the trials established by NZFRI have wood production potential. These aspects are covered in the second programme "Silviculture of plantation trees" where, under the objective "Silviculture and modelling of conifers for snow-prone sites" researchers are investigating stem growth, yield and response to a range of silvicultural treatments with the ultimate aim to predict growth rate and quality relative to species, site and silviculture.

The third programme is titled "Planning for rural environments" and aims to develop multi-disciplinary planning methods for evaluating the social and economic effects of land-use changes involving forestry and agriculture, using the Mackenzie Basin as the study area (See Evison, page 38). In 1992/93 a major survey of 80 Mackenzie Basin 'stakeholders' tested their visual acceptance of a range of land-use options as depicted by computer-generated landscape images. The social and economic effects of the preferred options will be modelled. The major collaborators with this work are Lincoln University (Department of Landscape Architecture and the Agribusiness and Economic Research Unit), Landcare Research Ltd (Land Resources), and the Rabbit and Land Management Programme and independent researchers Lindsay Saunders and Taylor Baines and Associates.

The recent interest in high-country forestry, particularly in the Mackenzie Basin, has prompted concern by Electricorp about the effect of large-scale forestry on water yields for hydro-electricity generation. While there is considerable experience in New Zealand with modelling water balance for radiata pine forests in high-rainfall areas, few measurements have been made at sites with low rainfall and with other species. At Ribbonwood Station it is planned to measure water movement in individual tree stems and to relate this to weather conditions throughout the year. Measurements in sapwood cross-sectional area in roots, stems and branches will be used to scale the flow measurements to stand transpiration for Douglas fir. This research will be in collaboration with canopy measurements and water balance modelling in a separate NZFRI programme, "Sustainable forestry".

Current (1993/94) Government funding for the above research amounts to the equivalent of two person-years for the first two programmes with a further two for the rural planning programme.



NZ Forest Research Institute's 'dry' (550 mm rainfall) high country forestry trial site on Balmoral Station near Lake Tekapo. Over 50,000 trees planted here in 1993.

Other research

NZFRI carries out the bulk of research with introduced woody species in the high country. The other major contributor to woody species research is Landcare, in particular Dr Barry Wills who is based at Alexandra. Dr Wills' trials (Wills, 1984) have included woody tree species such as the acacias and mountain mahogany (*Cercocarpus montanus*), but most success has been with forage species such as the evergreen woody shrubs *Altriplex halimus* (Mediterranean saltbush), bluebush (*Kochia prostrata*) and tree lucerne (*Chamaecytisus palmensis*) and the evergreen subshrubs such as the hairy Canary clover, *Dorycnium hirsutum*. This research continues under Landcare's programme "Alternative trees for sustainable systems".

References

Holloway, J.T. 1969: The role of the Protection Forestry Branch, Forest Research Institute, in the high country. Tussock Grasslands & Mountain Lands Institute, Review No. 16: 33-44.

Ledgard, N.J., G.C. Baker, 1988: Mountainland forestry – 30 years' research in the Craigieburn Range, New Zealand. New Zealand Forest Research Institute Bulletin No 146: 64 pp.

Ledgard, N.J., M.C. Belton, 1986: Exotic trees in the Canterbury high country. NZ J1 of For Sci 15(3): 298-323.

Ledgard, N.J., G.C. Baker, 1992: Tara Hills High Country Research Station, Omarama: Tree shelter trials for irrigated pasture. FRI Contract Report FWE 92/11 (for MAF): pp 54.

Wills, B.J. 1984: Alternative plant species for revegetation and soil conservation in the tussock grasslands of New Zealand. Tussock Grasslands & Mountain Lands Institute, Review No 42: 49-58.

Resource Technology '94

Resource Technology '94, to be held at the University of Melbourne, September 26-30, 1994, aims to assist both resource managers and researchers by exploring new opportunities for using technology such as GIS, GPS, soft photogrammetry, decision support systems, remote sensing and visualisation in the broad field of resource management. In addition the meeting will present examples of a wide range of applications of these technologies, focusing strongly on our own corner of the world.

The NZ Forest Research Institute is one of the Chairs of the meeting, along with the University of Melbourne office of Geographic Data Coordination, CSIRO Division of Wildlife and Ecology, and the Resource Technology Institute, USA.

Applications included are forestry, agriculture, mining, water resources, wildlife and parks, rehabilitation, cultural resources, global change, national data coordination, salinity, biodiversity and sustainable development.

Further information and registration of interest forms can be obtained by contacting Gordon Hosking, NZFRI, Private Bag 3020, Rotorua, phone: 07 347-5521, fax: 07 347-5333.