

Many outstanding landscapes are focused on the intermontane basins and valleys and reflect, to a large extent, communities of interest, and provide a focus for identity. Protected landscapes could represent a way of mediating between competing land uses (such as forestry and nature conservation) in these areas by overcoming some of the institutional barriers which currently exist to integrated land-use planning and management for the high country.

## CONCLUSIONS

Forestry can provide a viable economic land-use option for parts of the high country which, in conjunction with other land-use options, may assist in reducing land degradation in some areas. However, climatic limitations mean that commercial forestry is unlikely to locate in semi-arid areas where degradation is most pronounced.

The potential impacts of forestry on the outstanding natural and cultural values of the high country mean that forestry proposals should not proceed without careful assessment of their environmental effects. Plantation forestry should be designed, sited and managed to fit in with the landscape and prevent impacts on important plant and animal communities, adjacent lands and waterbodies. Forestry should be avoided where it is likely to impact on visually-sensitive areas or significant natural or cultural values.

Current institutional arrangements for resource management in the high country may not adequately meet the challenges to landscape planning posed by afforestation. A protected landscapes approach may represent the best method for integrating forestry with other land uses within those parts of the high country which have been identified as having special significance.

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# High-country pastoralism – 'The King is Not Dead'

D. Scott\*

## INTRODUCTION

Pastoral agriculture from the South Island high country was one of the foundations of New Zealand, and has been an important component of its economy for most of its history. Pastoral runs in New Zealand presently make up about 20% of the land area; they carry about 5% of the national stock and 3-8% of New Zealand net farm income, depending on how fine wool is selling. That there are some present difficulties is admitted, but to put it in perspective, the present debate on the high country, on decreasing vegetation stature, decreasing nutrients, and decreasing productivity, is very similar to the debate at the turn of the century in the North Island following forest clearance. The difference is that the North Island squandered their resources in 30 to 50 years whereas the high country has spun that out to a century and a half. The answer may be the same in both instances – fertiliser.

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## PRODUCTION POTENTIALS

The tussock grasslands were grasslands because they were either too cold or too dry to support continuous forest cover. Originally there was probably a larger shrub component. While forests may have been more extensive in the warmer interglacial period prior to the tenth century, it is unlikely that they ever extended into the central basins, which are now the problem areas. Log remains and isolated stands which have persisted should probably be regarded as relics from that earlier warmer period, rather than an indication of general forest suitability during the colder period from the tenth to the present century. Trees have probably become generally more suitable with the temperature warming since the turn of this century.

My view is that the potential organic matter production of a site is determined more by environmental conditions than by species per se. The four most important environmental factors for pastoral purposes are soil moisture, temperature, soil fertility and the interaction of grazing and

plant growing points. By reviewing nearly a century of trial work we have been able to rate the potential pasture productivity of most high-country sites together with the most suitable species for a range of management options. These range from less than a tonne of dry matter production per year on unimproved short tussock on shallow soils to our top measurement of 22 tonnes per year on some of the deep loess soils with fertiliser and irrigation. With a conservative conversion of one tonne of dry matter per stock unit (su) this leads to potential carrying capacities in the range of 0.5-20 su/ha/yr.

If potential primary production is determined by environment not species, then trees have no inherent superiority over other plant forms. This view seems to be at variance with empirical data and I am not sure whether the concept is wrong, or whether there are methodological or conceptual differences in our measurements of primary production of pastures and trees.

Also in the gradient from productive and benign environments to the more extreme environments, primary production becomes more concentrated in cellulose and hemi-cellulose products as compared to saccharides and starch. This trend limits production options. Cellulose and hemi-cellulose production can either be used directly, as in forestry, or in pastoralism after break down by the stomach microbial fermentation process of ruminant-like animals into usable fibres or meat.

## PASTORALISM

Pastoralism can probably operate over a greater range of environments than forestry and has a wide range of potential output rates depending on site and inputs (particularly fertiliser). Pastoralism in the high country has and can operate at three levels: extensive, semi-extensive and semi-intensive.

Initially extensive pastoralism was based exclusively on native species, of which the most dominant elements were the tall and short tussocks. The initial impression of these was of dense luxuriant grasslands. Tall tussock extending into the moister lowlands, while short tussock dominated the drier central basins. What was not appreciated initially was that they were not like grasslands in other parts of the world, but more like trees: slow-growing perennials with large quantities of dead biomass above ground and small intrinsic growth rates hidden in a large biomass. The second feature that quickly became apparent was that while mature dominant tussocks, with the exception of blue tussock, were largely unpalatable to stock, their early regrowth following burn-



Integration of shelterbelts protecting hay paddocks, Godley Peaks Station, Lake Tekapo.



ing was palatable. This led to fire being used as an efficient management tool. Over time short tussock replaced tall tussock at the lower altitudes, the proportion of smaller inter-tussock species increased and a number of overseas species established themselves. Stock feed came principally from these inter-tussock species and the regrowth from fired tussock, rather than from the mature tussocks. On this basis stock numbers increased rapidly and reached a maximum around the 1880s. Thereafter numbers decreased steadily on all unimproved land. Few entirely extensive pastoral properties remain and probably most of them are in financial difficulty.

The decrease in stock-carrying capacity on the extensive areas was masked by the advent of fertiliser use and oversowing in the high country, principally after World War II, at the start of the semi-extensive stage. Sulphur and phosphorus

fertiliser and legume oversowing produced a five-fold increase in production. The fertiliser requirements vary along the rainfall gradient from as little as 20-40 kg S/ha/yr in the very dry zone, to 50-200 kg/ha/yr sulphur superphosphate in the mid-rainfall zone, to the generally unaffordable 200-1000 kg/ha/yr superphosphate in the high-rainfall areas. It is currently estimated that about 20% of high-country runs have been developed in some form and that those areas now carry about 80% of the stock. This semi-extensive development has been dominated by the success of introduced legumes and by some continuing difficulty with high-producing grasses as compared to the adventive browntop and sweet vernal. While markedly increasing carrying capacity, the effect of the dominance of legume-based pastures has been a tendency to increase the disparity between summer and winter feed supply, with the conse-

quent trend over the last two decades of the development of special purpose cultivated, fertilised, and often irrigated blocks, for the purpose of supplying winter feed. My guess is that probably half of such properties are financially viable, and half in trouble, with mortgage and other interest costs being the big millstone.

The development of smaller, special purpose pastures based on fertiliser, closer stock management and species to utilise those changed conditions, could be the start of the semi-intensive stage. This involves subdividing land into its smallest landscape units and managing or developing them for specific feed periods throughout the year. Most of the technology already exists and there are already a few examples where the extensive areas of development within some runs have been divided into farms-within-farms, each with their own flocks, management and budgets. For those that have managed the costs of initial development, the system seems viable and sustainable. Such development will naturally focus on the more responsive soils, creating a need for increased flexibility to re-align property boundaries to make greater use of the better sites and forgo pastoral use of other areas. While the trends will be driven primarily by economics, the main factors

will be soil fertility and fertiliser inputs.

One of the justifications of tussocks in pastoralism is as shelter from wind, and to a lesser extent temperature. This may be as shelter for other plant species; agricultural trials have shown greater survival of oversown legumes close to tussocks in the drier zones (though not in the higher rainfall). Folk wisdom also highlights tussock as stock shelter, particularly during lambing. Tussocks are considered desirable on winter blocks as points of access to the lower vegetation following snowfall or as maintenance feed in extreme conditions. Probably the main justification of tussocks is as shelter from wind soil erosion by raising the general zero-plane for wind velocities. Such shelter has assisted in the accumulation of soils in the past, and decreased its loss in the current era. However, other species could equally provide such shelter effects; perennial lupin, tall oat grass, shrubs and trees are candidates.

#### INTEGRATION OF FORESTRY WITH PASTORALISM

Between the two extremes of total exclusion of forestry to full commercial forestry there are the intermediate states of tree shelter belts, block forestry, agroforestry, biomass harvesting, palatable feed banks, and savannah grasslands. In each case

there has to be decision on what is the prime use for allocation of costs and benefits. In particular, for timber production, there is the strong interaction between tree density and branching for clear wood production and hence value.

Forestry, as distinct from growing of trees, is not an option for all of the high country. Commercial forestry has its best potential in the 800-1500 mm rainfall zone with preference for topography that does not limit ultimate extraction. Forestry in other areas has to be supported by other reasons. In that sense pastoralism, in using the foraging ability of ruminants, is applicable to a greater range of sites than forestry. Also, in the nutrient depletion debate, it is not clear whether trees can exploit minerals in a different rooting layer or merely mobilise organic matter calcium.

Wind is a characteristic feature of the New Zealand climate. Trees as shelter belts for soil conservation or animal shelter are for agriculture advantage and have to be assessed and costed primarily in those terms, with any timber products a bonus. There is much folklore, but very little hard data, on the value of shelter belts in the high country pastoral context. Full shelter belt protection of cultivated paddocks for hay or special purpose pas-

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tures is fully justifiable with row spacing to give adequate protection of these better soils. However, with shelter being effective for only 15 to 30 tree heights, it is questionable whether the cost could be justified for a sufficient frequency of shelter belts to reduce the ground level wind flow effectively over the large areas of the high country. There is also some dilemma in where to place trees for stock shelter purposes. Sheep, particularly Merinos, tend to graze into the wind. It is only in severe storm conditions, which presumably are the ones we are trying to protect against, that they will move down wind. Such rare conditions, particularly during shearing, are probably better accommodated by the block planting or agroforestry options.

The block planting of timber woodlots within current pastoral runs seems the most viable of the forestry options, with the land holders choosing the ratio that best suits them, and working into that ratio over time. The advantage is that each activity is given its own best management, with a good deal of complementarity in labour requirements. The costs and benefits of this option are primarily in production forestry terms. The high country, like other more extreme environments, is limited to a few products, and the vagaries in the return from those products. Forestry adds a second significant product from those environments and, from a strictly pastoral perspective, is very resilient in that it can be capitalised over a longer time frame. As the last decade has shown, forestry blocks sown in earlier decades for

no particular financial budgeting reasons were the saviour of many runs during the current down-turn of wool prices.

Agroforestry, or the grazing of stock beneath relatively wide-spaced trees, is an attractive concept. In practice it is difficult to achieve because of the slightly different requirements of the two products. There are very few good high-country examples and these are generally on partly developed pastures rather than undeveloped tussock or *Hieracium* land. The time that the block is out of pastoralism, while trees get above grazing damage height, is probably longer in the high country than in other areas. However, this could be an advantage for establishing some of the slower-growing, but more persistent legumes, like caucasian clover. One of the claimed advantages of agroforestry is the apparent greater growth of pasture in proximity to trees, interpreted as additional nutrients from litter fall. Until detailed measurements are made, this should be interpreted with caution; as grasses and herbs tend to etiolate under low light conditions, so that even though they look taller they have less bulk than pasture in the open. Both a forestry block and an agroforestry block are excellent stock storm shelter. The cost and benefits of this option would have to be shared in some manner between forestry and pastoralism budgets.

The concept of a savanna type grassland with stock grazing below widely-spaced single or groups of trees does not have any demonstrable New Zealand high-country example, though it is

approximated in some of our shrublands. The concept is mainly aesthetic, though with justification that with sufficient density the trees would raise the zero plane for wind effects, forage is provided if a suitable species is found, nitrogen fixation occurs if a suitable legume tree species can be found, and sun or wind shelter for stock is provided. On the last topic, observation on stock preferences should be interpreted with caution. Animal behaviour studies suggest that a large object like a tree, shrub, rock or water trough may be serving as a social aggregation point rather than its functional interpretation. For instance, in another context it was found that the removal of water troughs from paddocks resulted in disappearance of animal tracks, more uniform utilisation of pasture, and the reduction in transfer of nutrients into stock camps. There are instances of farmers removing shelter belts or trees as they had become the loci of stock diseases like blood poisoning.

The concept of a forage bank of palatable trees, pods or seeds is attractive but has no demonstrated high-country example. With the extensive literature on the effects of deer on our native forests, there is probably a case for considering native species in this context. There are some feed bank examples for shrubs. At present the most suitable tree species seem to be tagasaste, but only on the mid-slope thermal belt in the high country.

All the forestry examples have been interpreted in terms of clear wood or pole production in which length, form, and knotting are important considerations and where the branching of trees in an open habitat is a disadvantage. The same limitations do not apply to fuel wood production. This remains an option for trees grown for other reasons, though the size of the market will limit its widespread application. Should biomass harvesting for power or alternative fuel production ever become an economic option, then the large areas of presently degraded lands of the central basins could take on additional significance as their topography would be suitable for easy machine operation. The species for such an enterprise would certainly be different from timber species. For mechanical harvesting there would probably be an advantage in a large shrub or small tree. To commit a pastoral heresy, there are already potentially perfect species in the form of gorse or broom!

I believe it is wrong to consider forestry as a solution to the rabbit and *Hieracium* problems. Rabbits are primarily a problem in the very low rainfall zone, *Hieracium* in the mid rainfall, with the forestry option having its optimum in the mid to high rainfall zone. The rabbit and *Hieracium* problems are linked in the



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sense that they both require low vegetation. Thus the two problems tend to increase in unison, though unfortunately removal of one is unlikely to result in a decrease of the other – at least in the short term. One only has to observe establishing plantations to see that early stages, before the tree canopy closes, can become prime *Hieracium* and rabbit environments.

## DISCUSSION

In discussing high-country options one should remember two quirks of human nature. One is that distant fields seem greener. The other is our tendency to overstate a case. War game theory says that if you know nothing about an option then you should play for minimum losses on your part, and it is only when you know everything about an option that you play for maximum gains. In practice, as the new boy on the block, forestry should perhaps be saying that it “is no worse than pastoralism”, rather than claiming the earth. In essence, an element of caution is needed in considering new options.

The long-term trends seem to indicate that natural clothing fibres are decreasing in value, and wood cellulose is increasing – though as yet these figures have not come from a suitably independent source to assume their impartiality. These changes have to be reflected in allowable use of land.

As outlined above, the advantage of pastoralism is that potentials and limitations are largely known, and that most of the infrastructure is in place. The economics of pastoralism will be largely determined by commodity prices (principally wool), as compared to environmental, labour and capital costs. However, pastoralism will have to change towards fertiliser use and the semi-intensive to make it sustainable in terms of nutrient use.

With the changing economics, and as indicated by support for the Mackenzie District Council scheme change, forestry should now be on an equal footing with pastoralism as an allowable land-use option, and let preference and economics determine which is the best mix. As indicated above, the preferable option is likely to be woodlots of varying sizes as part of pastoral farming.

However, probably the main requirement for the high country is the increased consideration of non-primary production uses, e.g. tourism, recreational, or lifestyle blocks. All the options will require some freeing up of land laws to allow subdivision for particular uses, or as a way of trading into the various options.

# Report on Forestry Corporation of New Zealand

A.P. Thomson

Peter Olsen's account of the Council's discussions with the forestry Corporation is full of interest. It portrays the Corporation as a responsible organisation with a firm commitment to what (in its view at least) is the long-term interests of New Zealand. This we knew already; it has been evident in various articles and statements made by the Chief Executive in recent years. But it was reassuring to have confirmation.

The article, however, did not deal adequately with the matters raised in the motion passed (by 26 votes to 21) at the last Annual General Meeting. True there was for the first time a statement on Douglas fir age classes and there were somewhat generalised statements on rotation lengths, the emphasis on radiata clearwood, a reduction in the Douglas fir cut, the restocking of Douglas fir and the varying levels of the radiata annual yield. What we were not told were the actual past and present and the projected future levels of the radiata cut, and likewise of the cuts of Douglas fir and other species. One cannot see that this is commercially sensitive information. It was stated that there was no evidence of any alarming trend that would jeopardise sustainability of the forest resource **quality**. What does this mean? And what are the trends, alarming or otherwise? And are there any other trends which would jeopardise the sustainability of the forest quality? We were not told. Finally we were given no answers at all to the main question raised which was how the Corporation's harvesting and marketing policies affect future yields.

The report concludes with the statement that “it is the Council's view that no further investigation is merited, particularly in the light of recent statements on FCNZ's future”. As Institute members we elected a Council and one must accept their considered view. For this reason I do not wish to press the matter in greater detail; Institute members may read the comments and make their own interpretation as to whether the Council has acted fully and fairly on the AGM motion.

The different matter which I will raise is how the Institute has handled this very important question. There have been what appear to be unnecessary delays. I am informed that the Minutes of the AGM were distributed to local sections within one month. This was useless as some local sections did not pass the information on to

members. The August issue of NZ Forestry did not deal with the motion at all except for a reference in one letter to the Editor. The last issue of the journal does not quote the wording of the motion passed. It was thought that the Institute would appoint a small select sub-committee to talk to the Corporation but three months passed and the matter was then handled by a full Council meeting with Corporation staff. The President and the Council apparently failed to recognise the urgency of this matter.

Before proposing the AGM motion I had had a letter from the Hon Wyatt Creech, Minister of State Owned Enterprises, a copy of which had been sent to the President. The letter said *inter alia*: “You ask if it is possible for members of the public to have easy access to details of FCNZ's forest policy, given that FCNZ is a publicly owned company. As a state-owned enterprise, FCNZ is required to observe the accountability requirements of the State Owned Enterprises Act 1986. It is also subject to the Official Information Act 1982. These statutory provisions oblige FCNZ to make more information publicly available than its commercial competitors. In general FCNZ is willing to make available information which is not commercially sensitive. If you have any questions concerning FCNZ's forest policy, you should write directly to the company.”

More recently in a post-election statement quoted in The Evening Post Wyatt Creech said: “The Government is not considering, nor has it ever considered, selling the Forestry Corporation or its biggest forest at Kaingaroa.”

The good tenor of the earlier letter gave me the impetus to propose the AGM motion; the letter seems to have been ignored by both the Institute and Mr Cullinane. One may ask why? One must further ask why the Corporation was not prepared to submit to the process of analysing how its harvesting and marketing policies affect the future supply of wood. If the Corporation's view is, as it appears, in contradiction with the Ministerial statement, why did the Institute not take this up?

The most disturbing statement in Peter Olsen's report reads as follows: “Comments from members and correspondence in the August 1993 journal indicate a degree of discomfort in the Institute being