

THE CLASSIFICATION OF LAND ACCORDING TO DEGREE OF RABBIT INFESTATION IN CENTRAL OTAGO

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Abstract

The European rabbit (*Oryctolagus cuniculus*) introduced into New Zealand in the 1830s, has consistently flourished in Central Otago, the upper Waitaki, and inland Marlborough, all areas of mediterranean climate. It has proved difficult to manage in these habitats.

The 'rabbit problem' is largely confined to 105,000 ha of low producing land mostly in semi arid areas of Central Otago. No field scale modifications of the natural habitat have been successful in limiting rabbit numbers. The costs of control exceed the revenue from the land and continued public funding for control operations appears necessary.

A system for classifying land according to the degree of rabbit proneness is described. Soil survey and land classification information for Central Otago is related to the distribution and density of rabbits. This information can be used as a basis for defining rabbit carrying capacity and consequent land use constraints and management needs.

It is concluded that the natural rabbit carrying capacity of land can be defined by reference to soil survey information and cultural modification to the natural vegetation.

Classification of land according to rabbit proneness is proposed as a means of identifying the need for, and allocation of, public funding for rabbit management.

Keywords: Rabbit habitat, rabbit proneness, use of rabbit prone land.

INTRODUCTION

In New Zealand, populations of European rabbit, of west mediterranean origin, have been (or still are) high in Central Otago, the upper Waitaki and inland Marlborough where the climate is mediterranean in character.

In this paper soil survey and associated information for Central Otago is related to the distribution and density of rabbits, as a basis for defining the rabbit carrying capacity of land (i.e. rabbit proneness).

The ultimate size of rabbit populations is a function of productivity and survival rates. In habitats typical of Central Otago about 25 young/adult female are born over a five months breeding season (Fraser, 1985). In contrast rabbits in lowland wetter habitats produce 45-50 young/adult female over an eight to nine month breeding season (Gibb *et al.* 1985, Williams and Robson 1985). However, survival rates differ markedly. In lowland areas there is very high juvenile mortality and populations in these areas are generally stable. In contrast, rabbits in Central Otago habitats have much lower mortality of young since predation from cats, ferrets and hawks does not have a great impact in Central Otago because young rabbits (the main prey) are only available for a few months of the year and there is little alternative prey.

The concept of defining rabbit habitats in New Zealand is not new. Bull (1956), Howard (1959) and Gibb *et al.* (1969) all discussed the features of favourable rabbit habitats and the impact of soil, climate and land use on rabbit numbers. Relating the distribution and density of wildlife species to land/habitat classification systems is widely used as a basis for developing management and conservation policies and practices (e.g. Rogers 1981).

METHODS

To assist control operations, rabbit populations have been regularly monitored in the Maniototo, Hawkdun and Alexandra districts since 1980. Transects are counted from a motor cycle at night using a spotlight and the rabbits seen in each

kilometre recorded. As far as practicable the same observer records each route each time and counting is done only when weather conditions are fine and calm. In this study, records from 41 count routes were analysed, covering 501 kilometres over land predominantly within areas requiring regular rabbit control.

Each count route was marked on the appropriate land **resource** inventory worksheets (National Water and Soil Conservation Organisation 1979). Information on parent material, soils, slope, erosion, vegetation and land use capability for each count sector (one kilometre) within each count route were recorded in a computer file along with rabbit numbers for each sector.

The rabbit population information was summarised as the mean of the maximum number recorded (as an expression of rabbit proneness) for a particular element of the land inventory unit (vegetation, soils **etc.**). Confidence in the results was increased by including only records where there were more than five of a particular land inventory unit. This was done to minimise the possibility of control operations greatly influencing populations.

As a general measure of the variable quality of habitats for rabbits in Central Otago, rabbit count data was related to soil survey information for the region (N.Z. Soil Bureau, 1968) expressed as soil sets. As the great majority of the soils of the South Island are zonal (where climate and vegetation are the major influences on soil formation) it was postulated that soil sets will reflect variations in habitats for rabbits.

RESULTS

Rabbit counts showed marked variations according to the soil sets (Table 1).

Some soil sets (notably **Conroy**, **Conroy Hill**, **Alexandra**, **Blackstone**, **Blackstone Hill**, **Arrow**) and soils where bare rock is dominant, create a habitat that can sustain high numbers of rabbits. Conversely, other soil sets (**Becks**, **Cluden**, **Matarae**, **Matarae Hill**) even though they are within similar areas to those supporting numerous rabbits, do not appear to create such a favourable environment/habitat.

The numbers of rabbits, when related to the classes of dominant vegetation recorded on the land resources inventory worksheets, also follow a clear pattern (Table 2).

On the basis of the relationship between rabbit densities and soil sets all land in the study area was **categorised** into five convenient classes of rabbit proneness. These were defined as: extreme, high, moderate, low, and negligible and were derived from examination of the range of the maximum numbers of rabbits recorded. An exponential scale ($y = e^x$) doubling at each step was used to separate the classes according to the range in rabbit numbers (ie negligible = <5, low = 5-10, moderate = 10-20, high = 20-40, extreme = > 40) as shown in Figure 1.

The approximate proportions of land in the South Island denoted extreme, high, moderate etc., were derived from general soil survey information and are estimated to be: extreme < 1%, high 5%, moderate 13%, low 41%, negligible 41%. Most of the extreme and high classes are located in Central Otago and the upper Waitaki with small areas in the upper Awatere and upper Clarence.

DISCUSSION

In accord with other studies (Bull 1956, Williams 1977, Gibbet *a/l.* 1969, Williams 1963) high producing pasture, and land above 900 m (snow tussock grassland) and forests in the study area seem to provide unfavourable habitats for rabbits when compared with the **semi-arid** areas of unimproved grassland or herbfield. Rogers (1981), working in Southern France and Spain, also found that floristically rich low

Table 1: Rabbit numbers and soil sets.

Soil Group	Soil Set	n	mx	cv
Brown-Grey Earths				
- Subxerous				
	- on terrace lands and fans			
	1 Lowburn	10	4.1	59.8
	1a Drybread	20	2.7	97.8
	2a Pigburn	15	9.7	66.9
	- on rolling lands and hills			
	4 Conroy	42	26.2	112.9
	4H Conroy Hill	118	50.4	109.4
	4d Becks	7	11.9	75.3
	- on steepplands			
	5 Alexandra	48	70.3	76.4
Yellow-Grey Earths				
- Dry-subhygrous				
	- on terrace lands and fans			
	6c Oturehua	10	15.0	65.2
	- on rolling lands and hills			
	8 Cluden	10	4.1	73.9
	9 Blackstone	46	63.1	160.7
	9H Blackstone Hill	37	32.1	140.3
	9d Matarae	16	12.2	36.1
	9dH Matarae Hill	11	10.9	56.7
	- on steepplands			
	10 Arrow	8	33.4	115.3
- Dry-hygrous				
	23f Naseby	30	5.6	91.6
Recent Soils				
	- on flood plains and young fans			
	94 Fraser	10	17.0	176.1
Soils with bare rock dominant				
		14	67.9	54.0

n = number of sites, all with >5 records.

mx = mean of maximum rabbit numbers recorded per km.

cv = coefficient of variation $[(sd/mx) \times 100]$

Table 2: Rabbit numbers and vegetation.

Dominant vegetation class	n	mx	cv
High producing pasture	26	13.4	137.5
Low producing or native grassland	254	24.3	126.6
Short tussock grassland	112	56.4	157.9
Snow tussock grassland	8	6.0	119.1
Exotic forest	11	3.6	63.7
Semi-arid herbfield associations	88	60.4	63.6

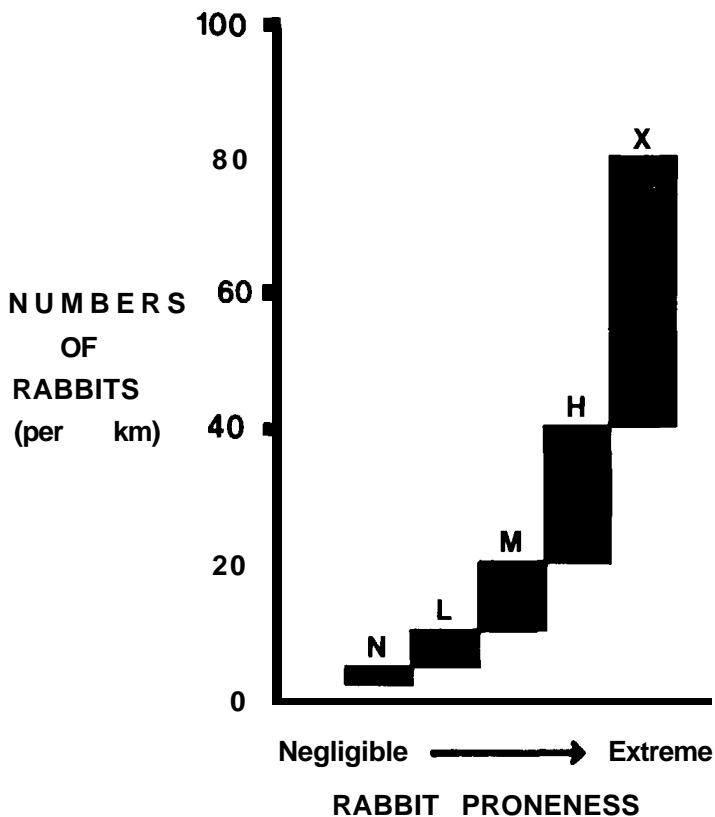
n = number of sites, all with >5 records.

mx = mean of maximum rabbit numbers recorded per km.

cv = coefficient of variation $[(sd/mx) \times 100]$

grassland was favoured by rabbits particularly where juxtaposed with suitable refuges for burrowing or general cover.

In Central Otago, the soils with high numbers of rabbits (e.g. **Conroy Hill**) are in a semi arid environment with a low producing grassland cover, often depleted, and with sparse fescue tussocks and areas of scrub. All have rocky outcrops and are free draining. Sheet erosion is widespread. Conversely, soils supporting fewer rabbits are deeper, usually with a more dense fescue tussock grassland or an improved pasture. Rocky outcrops are few and scrub is less prevalent. It is plausible to assume that these sites are either cultivated or **oversown** and topdressed thus constituting habitats where rabbits have lower survival rates.



NB: N = negligible, L = low, M = medium, H = high, X = extreme

Figure 1: Relationship between rabbit numbers and rabbit proneness.

Man-induced desertification of parts of Central Otago through the impact of fire, sheep and rabbits has been described by Petrie (1912) and Mather (1982). In spite of a long history of endeavour (reviewed by Douglas 1974), there have been few, if any, techniques successfully developed to alter the present rabbit prone habitats to ones that might be unfavourable.

Both rabbits and sheep are capable of reducing herbage in arid areas to less than 20 kg/ha, although when occupying the same areas they consume different vegetation components. Sheep tend to have a greater impact on shrubs in the presence of rabbits. Such interrelationships between grazing animals are clearly important components of land use in areas favoured by rabbits. The rabbit management value of destocking rabbit prone land, to foster natural regeneration of cover to a stage where the habitat is unfavourable to rabbits, is yet to be evaluated.

On the east coast plains of the South Island, the vegetation has been largely modified to high producing pasture. All the evidence from this study and others in New Zealand (Bull 1956, Howard 1959, Williams 1977, Gibb et al. 1969) points to a permanent change in the pastoral habitat being sufficient to reduce its quality for rabbits (and thus numbers). Hence, much of the land which is historically moderately

rabbit prone is, for as long as it sustains high producing pasture, in a low rabbit prone category. It is unfortunate that much of the extremely and highly rabbit prone land is incapable of sustaining high producing pasture.

The agricultural production from the rabbit prone land of Central Otago (and analogous areas in the upper Waitaki, Marlborough etc.) is currently limited to extensive pastoralism. The pastoral revenue and costs of rabbit control are shown in Figure 2.

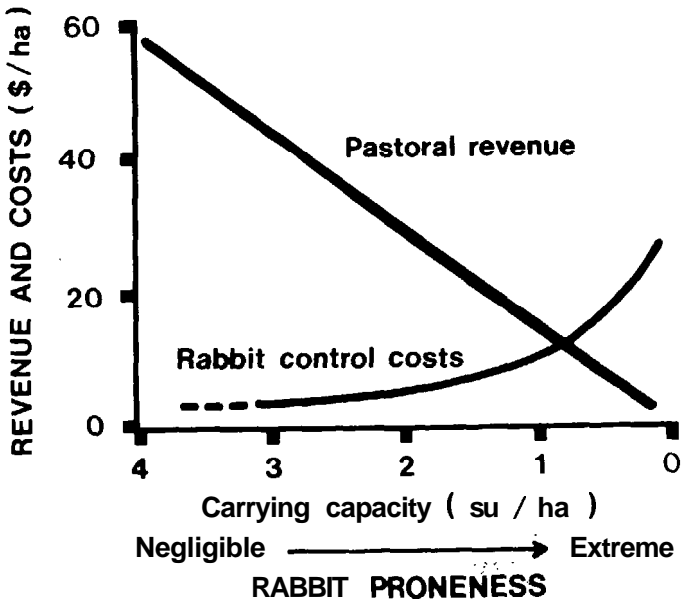


Figure 2: Relationship between the pastoral revenue, rabbit control costs and rabbit prone ness.

The essential point is that within the rabbit prone land of Central Otago rabbit control costs substantially exceed the revenue from the extremely rabbit prone (and low producing) land. Annual control costs in excess of \$20/ha have been reported for the Alexandra district (Kerr et al. 1983). Conversely, highly productive land incurs few control costs.

Recent government policy statements indicate a phased reduction (from \$6.2 m in 1985/86) in taxpayer input into pest destruction funding (Butcher 1986). It follows that deployment of any available government funds should be directed to areas of greatest need.

As the costs of pest management are concentrated on the low producing rabbit prone land, any case for financial support from general taxpayers will need to be based on criteria other than the protection of agricultural production. It is submitted that Government funding should be directed towards the protection of the land (rather than the protection of production). Bearing in mind the substantial difference between revenue earned by the individual farmer utilising extremely rabbit prone land and the high cost of rabbit control, the alternative uses, if any, to which that land can be put to avoid those high costs becomes an issue. Similarly, it is of major significance that less expensive methods of pest management are developed. It is no

wonder that affected land occupiers see myxomatosis as a potentially less costly alternative to the present techniques of pest management.

In the absence of more cost efficient rabbit management, control operations require continued funding from general taxation, unless the community sees merit in precipitating the abandoning of extremely rabbit prone land to rabbits. This support should be directed only to areas of need.

It is suggested that classification of land for rabbit proneness is a valid approach to identifying the location of areas with a need for public investment in rabbit control. Similarly this information could be used to equitably rate land occupiers for their share of the cost of rabbit management.

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