Propp No. 2468

WHAT'S NEW IN FOREST RESEARCH

No. 126 1984

Deer Control and Vegetation Response on Stewart Island

Views of the vegetation in a permanent plot located in partial dieback forest at Starling Head, Stewart Island, before (*upper photo*) and after a poisoning trial which significantly reduced the numbers of white-tailed deer. The photographs were taken in November 1979 and September 1982 from the same point in the plot, but are not of identical views.

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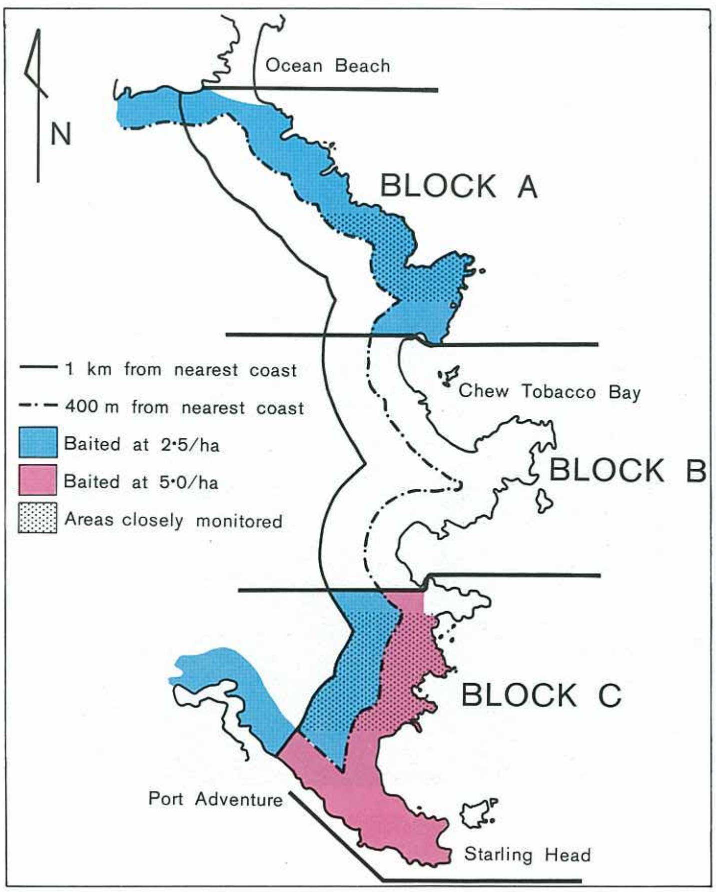
Over the last decade severe mortality has occurred in the rata/kamahi forests along the north and east coasts of Stewart Island. Regrowth in the areas affected, which often extend 100 m and more inland, is poor, and the forest cover is gradually being replaced by grasses, sedges, and ferns.

Preliminary investigations indicated that the numbers of white-tailed deer and brush-tailed possums were much higher in these coastal areas than further inland. Based on experience elsewhere in New Zealand, it was thought that browsing by these animals might be a possible cause of the dieback and/or lack of regrowth. However, an inspection of the vegetation on Bench Island, an island close to Stewart Island but free of deer and possums, showed that dieback was occurring there too (*see* "What's New in Forest Research" No. 78). Although the primary cause of the dieback is now attributed to climatic factors, the comparative study did indicate that browsing, particularly by deer, was retarding forest regrowth after dieback.

During 1979–80 various research projects were initiated by FRI to clarify the role of white-tailed deer in forest replacement where coastal dieback had occurred. Because hunting has proved to be an inefficient means of controlling the numbers of white-tailed deer in forested areas, a poisoning trial was also undertaken and its effectiveness monitored.



Map of the east coast of Stewart Island showing the location of the three study blocks and the areas where poisoned baits were laid.

Effect of deer on forest regeneration

White-tailed deer were introduced on to Stewart Island in 1905. They are now present throughout the forested parts of the Island, but densities are highest near the coast. The intensity of browsing in these coastal areas has significantly affected the composition of the understorey vegetation: few plant species known to be palatable to deer can be found within the browse range of these animals, although they still occur as epiphytes. The scarcity of favoured species has led deer to browse less palatable species, such as muttonbird scrub (*Senecio reinoldii*) and treeferns (*Dicksonia squarrosa*), and the regrowth of canopy and many understorey species is now suppressed. As a result of the opening-up of the understorey, plant species such as the sedges *Carex solandri* and *C. appressa* and the ferns *Paesia scaberula* and *Histiopteris incisa*, which are not palatable to deer, are increasing in density and may, in time, become the dominant vegetation cover.

Poisoning trial

Although recreational hunting and commercial venison recovery have helped to control deer numbers, these activities have not been intense enough to halt present vegetation trends. During February and March 1981 a poisoning trial using natural baits was carried out, both to assess the effectiveness of the method in case the large-scale control of deer proves necessary, and to monitor and compare vegetation changes under conditions of controlled and uncontrolled deer numbers.

The trial took place on the east coast of the Island (*see* map), using a Carbopol-based gel loaded with 10% Compound 1080 (sodium fluoracetate) poison. Non-toxic field trials had shown that, of the formulations available, this had the best combination of acceptance by deer, weathering properties, and unattractiveness to non-target animals. About 0.15 – 0.25 gm of the gel was applied to about 20 leaves on each of the natural baits (broken-off branches of broadleaf (*Griselinia littoralis*) placed upright in the ground). Baits were laid out across Blocks A and C along lines 150 m apart, with three or four baits every 100 m (2.5 baits/ha). Initially an area extending from the coast to 400 m inland was poisoned. Two weeks later baits were again laid in Block C, but this time over an area from the coast to 1 km inland. About 2600 baits were used — 770 in Block A and 1830 in Block C.

Assessment of poisoning operation

Poison method assessment: The type of bait used, its toxic loading, and the field layout all proved suitable for reducing the numbers of white-tailed deer. Comparisons of bird populations in the untreated block and Block C showed that the poison laid for the deer had no effect on numbers or behaviour, and no signs of other non-target species being poisoned were found.

Most baits remained toxic for between 15 and 30 days, with a few lasting much longer: when the untouched baits were removed in late June, 2% were found to have enough gel left on them to kill a deer. There was generally a surplus of baits in both poison blocks in the initial trial, only 46% of the baits laid in Block A and 32% of the baits in Block C being taken. In the second treatment of Block C only 4% of the baits laid were taken, most of these being located more than 600 m inland in the area not covered by the initial trial.

The majority of deer poisoned were killed within 2 weeks of the bait being laid, although at least two of the six carcasses found in late June were of animals which had died in the previous 2 weeks. Since all these six deer were male it is more likely that they moved into the poisoned areas during the rut than were "permanent residents" newly exposed to the baits.

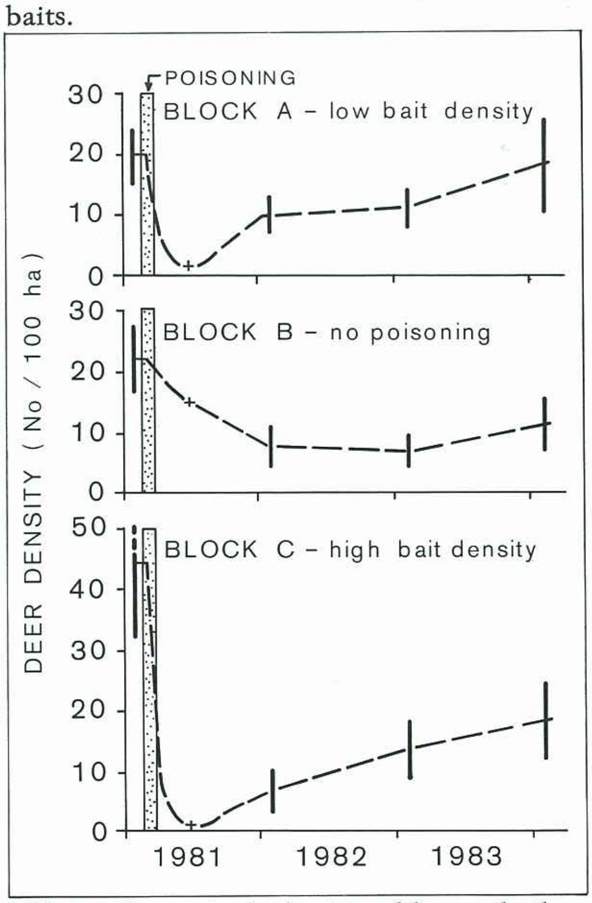
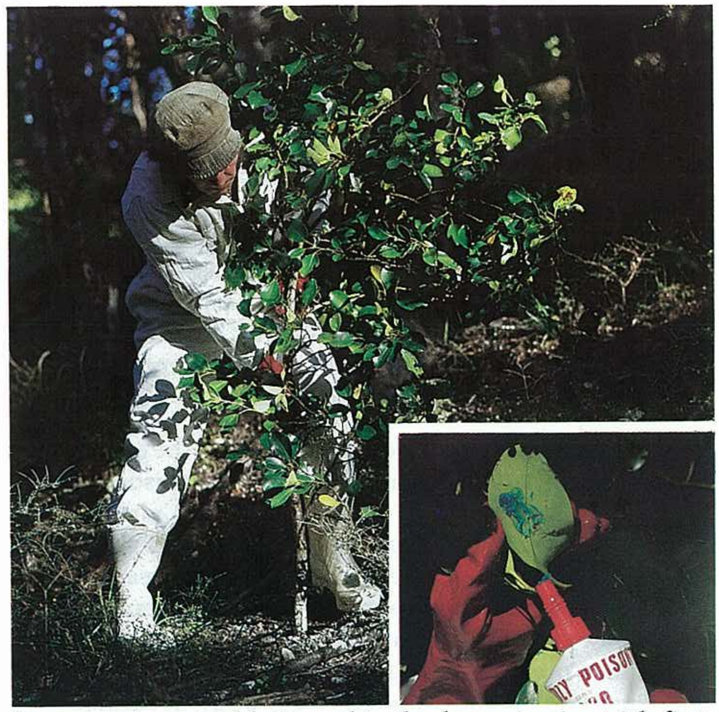


FIG. 1 — Changes in the densities of deer on the three blocks since the poisoning trial, as estimated from deer pellet surveys. The vertical lines are 95% confidence limits of the estimates.



Preparing the natural baits used in the deer poisoning trial: first, broken-off branches of broadleaf are placed in the ground, then (*inset*) sufficient Compound 1080 poison to kill an average-sized deer is applied in a gel form to the underside of some of the leaves. (Ilam AE/q 3708, 3705)

Control effectiveness: Based on comparisons of pellet densities before and after the control operation, over 90% of the deer present in both Blocks A and C at the time of poisoning were killed (*see* Fig. 1). In addition, deer numbers in Block B, which was not poisoned, were reduced by 30%, probably because deer from this block moved into the adjacent blocks as part of their normal range, and were then poisoned: 10 carcasses were in fact found in Block B. It is estimated that approximately 400 animals were poisoned, although only 240 carcasses were found — 81 in or adjacent to Block A and 159 around Block C. The higher tally for Block C is considered more a reflection of the higher initial density of deer and greater search intensity in this area than a higher percentage kill. Males and females of all ages were represented in this total, and in proportions which suggest that the poisoning was non-selective.

Subsequent checks for fresh animal sign showed that deer numbers remained very low in the poisoned blocks throughout the first winter. However, a re-sorting in the ranges of the surviving deer occurred the following spring, and 1 year after the poisoning trial the densities of deer in both the treated and untreated blocks were at a similar, low level. Probably about half of the new deer in the poisoned blocks would have moved in from Block B, while the others would have come from forested areas further inland. Pellet counts indicate that, 3 years after the poison operation, the total number of deer in the three blocks is about 60% that of the pre-poisoning level.

Vegetation response

During the summer of 1979/80, 64 permanent vegetation plots, 18 of which were fenced to exclude deer, were established within the coastal and adjacent forest areas of Blocks B and C to monitor the effect on the vegetation of a reduction in deer numbers. These plots are spread over all the vegetation associations present, and equally between the poison and control blocks. Each plot is 400 m² and contains 24 subplots, totalling 18 m², for recording seedling numbers and point-intercept scores.

A remeasurement of all the plots at the end of 1981, less than a year after the deer poisoning operation, showed that changes had already occurred in the vegetation. The plots most affected were those established in areas of partial dieback where the generally open canopy allows light through to the ground layer. The most obvious change on these sites was the increase in the numbers of woody seedlings over 15 cm tall — from 4764 seedlings/ha in December 1979 to 48 355 seedlings/ha in December 1981. Annual remeasurements of some of these plots show that the number of seedlings in all height classes has continued to increase, and that there has been a corresponding decline in the profusion of seedlings less than 15 cm tall because of shading and competition from the larger seedlings (*see* Table 1).

A similar, but less marked, response to the reduction in browsing pressure has occurred in the plots located in forest areas which have an intact canopy. However, because of the lower light levels reaching the forest floor, only those species able to tolerate limited light have responded.

Comparisons of the vegetation in the fenced and unfenced plots show that deer are again affecting the condition of the vegetation. The more palatable species which responded vigorously after the removal of most of the deer have already been heavily browsed, and some of the less palatable species are also being browsed. With the current increase in animal numbers, the condition of the vegetation outside the exclosures will probably soon be very similar to that prior to the poison operation.

TABLE 1 — Changes in the frequency and numbers of muttonbird scrub seedlings measured on 24 subplots within one unfenced permanent plot in the dieback forest, Port Adventure, Stewart Island, 1980–83.

Date measured	Seedling frequency <15cm	Seedling numbers 15–45cm	45–75cm	75–105cm	105–135cm	>135cm
10.1.80	92%	0	0	0	0	0
(Poison operation Feb/Mar 1981)						
15.9.81	75%	28	4	0	0	0
20.9.82	75%	50	23	5	1	0
13.9.83	67%	66	20	33	13	6

Conclusions

While the forest dieback occurring around the coasts of Stewart Island is related to climatic factors, regrowth in such areas is being severely retarded by browsing from white-tailed deer. The response of the vegetation to a reduction in deer numbers does, however, indicate that this trend could be reversed. Even though most of the response so far has come from sub-canopy species, the larger canopy species may well follow, for rata and kamahi seedlings are now appearing in some of the subplots in the fenced exclosures.

Natural bait poisoning has proved to be a practical and efficient method of substantially reducing deer numbers in these areas, but only short-term control can be achieved, since deer from adjacent untreated areas quickly move in to the controlled areas. If low deer numbers need to be maintained for longer periods, the incorporation of extensive buffer zones adjoining the poisoned area should help to minimise deer immigration. Alternatively, the extent of browsing damage could be reduced by using frequent spot-poisoning to keep the overall density of deer in an area at a low level.

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ISSN 0110–1048

PRINTED BY HOLMES PRINTING, ROTORUA, UNDER THE AUTHORITY OF P.D. HASSELBERG, GOVERNMENT PRINTER, WELLINGTON, NEW ZEALAND-1984