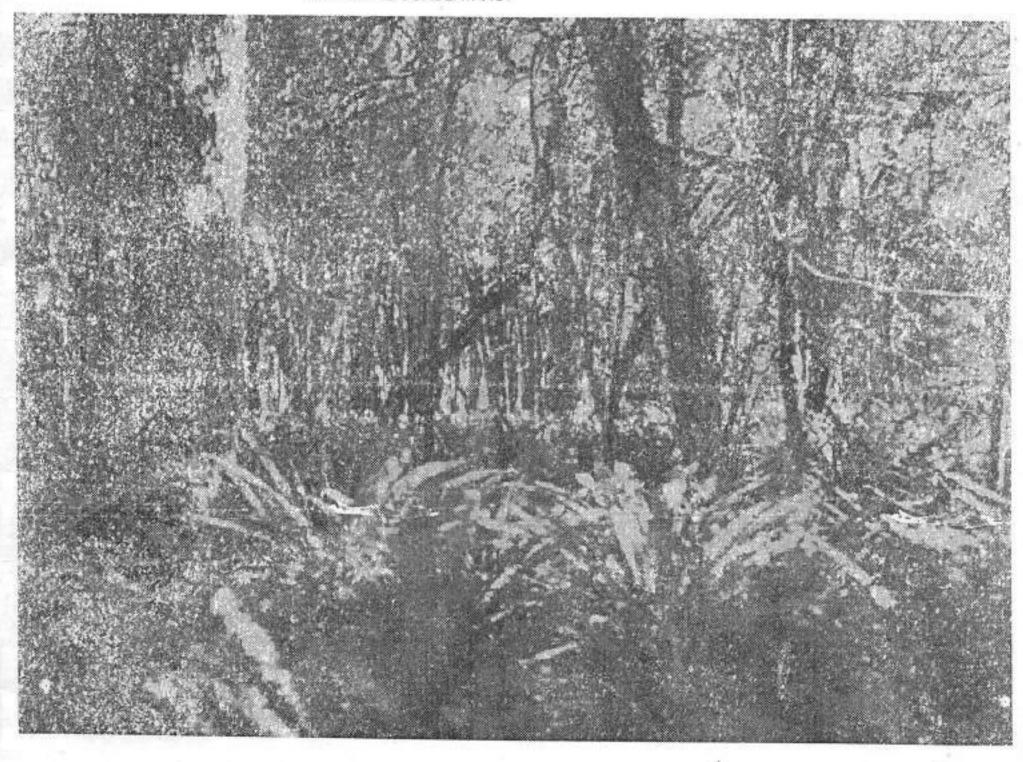
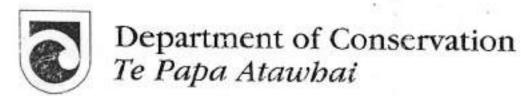
Forest Dynamics and the Influences of Browsing Mammals on Stewart Island/Rakiura

SOUTHLAND CONSERVANCY





Forest Dynamics and the Influence of Browsing Mammals on Stewart Island/Rakiura

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A. What do we already know?

Summary of background surveys, with key recommendations

WILD ANIMAL LIBERATIONS

1890

Possums

1901/02

Red deer

1905

Whitetailed deer

Some deer control between 1930 and 1952, and continued recreational hunting to date, but largely unsuccessful in controlling numbers.

SURVEYS

1909

Cockayne - botanical survey

"possums already damaging treeferns"

"Stewart Island quite unsuitable as a hunting ground" due to "trivial amount of open ground, dense character of subalpine scrub, close forest growth".

1976

Williamson - Forest and wild animal survey of northern SI.

690 recce plots, 6300 pellet presence/absence plots.

"Need to direct possum control (winter 1080) at Masons, where numbers are high".

"Whitetailed deer - need increased hunting pressure in northern and western areas."

1976

Evans & Fine - grassland survey

Little or no modification of grasslands is evident, and animal numbers

are low.

1976

Ross - Forest and wild animal survey, southern SI, coastal. 254 recce

plots, 2218 pellet presence/absence plots on 34 transects.

1977

Ross cont... Recommended further research to determine roles played by relevant factors in destruction of coastal forest, and focus survey from Paterson Inlet to Lords River - all phases of dieback are

present.

1979

Cuddihy - exclosures established. Data on NIVS for 1984 measures for 3 paired exclosures at Yankee, 3 pairs at Chew Tobacco, 1 pair at

Mason Bay.

1982

Cuddihy - wild animal survey - southern SI, coastal and inland sections. Remeasure of Ross' survey, with additional lines inland. 78 recces - no report. Unknown number of pellet counts - presence/ absence and point distance.

Deer densities much higher in south (424 groups/ha) than in north (40.2 groups/ha). Possum numbers also much higher in south (relative density 18.9) than north (2.9).

Recommendations:

Deer densities be reduced in those high density areas identified by this report, to achieve a balance between the density of deer and the maintenance of a healthy regenerating vegetative cover.

In those areas identified as containing unacceptably high possum densities a permanent reduction is required, perhaps by publicising those areas and encouraging commercial hunters into them.

1982

Slater - wild animal survey, northern SI. 5094 pellet plots along 52 transects. Point-distance and presence absence.

"Animal densities very low and compatible with forest health. With increased recreational hunting, adequate control is being achieved."

They said remeasure in 1986 - this was not done.

1982 Woolmore - regeneration survey in cutover forest of North Arm and Maroi Beach - "kamahi is evenly distributed throughout and is steadily regenerating".

1983

Sanson - Proposal for Freshwater Ecological District. "Unique natural vegetation and its inherent fragility"

1983

Cuddihy - northern forest survey: 24 permanent plots in cutover forest and canopy gaps to determine deer impacts. Established 1976, remeasured 1981, 85-6.

Conclusions and recommendations

- 1. The influence of browsing mammals is slight to moderate and targeted on preferred species.
- In all situations the regeneration of major canopy and sub-canopy species is adequate and under the present conditions no canopy replacement problems are foreseen.
- 3. So long as deer and possum densities are held at or below the current levels (Slater1983), there is no need to contemplate increasing the hunting pressure.

It was recommended that these permanent plots be remeasured in 1991, at the same time as those established in 1981 were to be remeasured (Slater 1983).

1983 Slater - forest survey, northern SI. 58 permanent plots established along 13 transects. Remeasured in 1998/99.

Recommendations

 The current animal control programme, though predominantly recreational hunting, is sufficient to ensure overall forest canopy health of all associations. Of these, S4 (coastal scrub) has the poorest regeneration densities and the association should be closely monitored to detect any canopy deterioration.

Deer densities have been declining since 1975 but may still need to be lower should canopy deterioration occur.

2. Additional permanent 20 x 20 vegetation plots should be established in those forest associations sampled by less than five plots in this survey. (Do at the next remeasure unless deterioration of any of these associations is shown to be occurring in the interim period). THIS HAS NOT BEEN DONE - GULLIES, SCRUB?

An assessment of the permanent plots should be made when the pellet lines are remeasured in 1986 and a full remeasure in 1991 unless earlier remeasurement is shown to be desirable.

1984

Challies & Burrows - Deer control and vegetation response on

Stewart Island.

1080 gel bait trial - estimated 90% success.

1986

Lovelock - wild animal survey - northern SI.

Deer and possum pellet densities are low-mod throughout.

From 1976-1981, deer pellet density and possum frequency decreased. From 1981 to 1986, deer pellet density and possum frequency is sessed.

frequency increased.

1987

Stewart & Burrows - assessment of animal effects on forest regeneration, eastern SI. 46 permanent plots, 3 paired exclosures, 18 temporary exclosures, 5 plots on Bench Island. Established 1979, seedlings remeasured 1981, fully remeasured 1984.

- 1. Comparison of forest structure and regeneration on Bench and Stewart Island.
- The influence of deer on regeneration patterns.
- Brush-tailed possum exclosure plots could not determine proportion of understorey changes attributable to browsing by deer and possums.
- 4. Ecotone transects 1982, 85, 89. Dieback was not advancing further inland.

Recommendations

- Numbers of white-tailed deer need to be drastically reduced if shrub hardwoods are to be retained as a component of the forest.
- Depending on how white-tailed deer are managed over the next few years, consideration should be given to remeasurement of the permanent quadrats and permanent wire mesh exclosures (3 at Chew Tobacco Bay) in 1990 to assess regeneration. (THIS WAS DONE IN 1999-2000).

1988

Nugent & Challies - Diet and food preferences of white-tailed deer in northeastern SI.

Deer browse all the hardwood trees, but few shrubs, ferns, or podocarps (but browse index in other survey showed miro browsed,

and palatable ferns include Asplenium bulbiferum, Dicksonia squarrosa). "... the main hardwood trees will gradually die out, resulting in a substantial decline in the carrying capacity of the forest." Meurk & Wilson - Biological survey of reserves. "Intensive animal 1989 control in selected representative areas could be used to protect scientific and tramping interests alongside those of the deerstalker and opossumer." Coleman & Pekelharing - Role of possums in dying coastal forests of 1989 Stewart Island (Chew Tobacco Bay to Murrays Mistake). Pellet survey (presence/absence) and vegetation damage, using aerial photos from 1958 and 1981. Dieback present only in 1981 photos. Patrick, Rance et al. Mason Bay entomological and botanical survey. 1989 Vegetation monitoring set up at Island Hill at cessation of pastoral lease. Very high values in area. Rance & Allen - Ulva Island Plots: 8 non-standard permanent plots 1993 established to monitor impacts of rat removal. Remeasured seedlings in 1994. Standardised in 1998/99. Nugent - Possum and deer impacts at Port Pegasus. Notes from field 1993 trip. Need to keep Nobel, Pearl and Anchorage Island deer and possum free. Some deer sign seen on Noble. Possible to control 1100 ha on Broad Head peninsula. Graeme - 3 paired exclosures at Chew Tobacco Bay remeasured and 1996 written up as dissertation. Need to incorporate her results into report.

B. What did we recently measure, and how?

Objectives and methods of Stewart Island forest bealth survey, 1998-2000.

OBJECTIVES

Vegetation

- To assess changes in forest structure and composition in northern Stewart Island over approximately twenty years.
- To investigate the influences of introduced browsing animals on forest regeneration using fenced exclosure plots.
- To compare the forest structure and composition on Stewart Island with islands
 where rats, deer and possums are absent (Ulva and Codfish Islands), and where deer
 and possums are absent (Bench Island). Useing existing vegetation plots in northern
 Stewart Island, and newly established vegetation plots in southern Stewart Island.
- To assess the impact of possums on the health of kamahi (Weinmannia racemosa)
 rimu (Dacrydium cupressinum) southern rata (Metrosideros umbellata) forest in northern and southern Stewart Island, and compare with the health of forests where possums are absent (Bench, Ulva and Codfish Islands).
- To determine the extent to which tree ferns contribute to the basal area of kamahi rimu – southern rata forests of northern and southern Stewart Island and the pest-free islands.
- To determine whether, and to what extent, animal control will be necessary in northern and southern Stewart Island for:
 - the prevention of further canopy dieback
 - the regeneration of palatable species in canopy gaps.
- Design baseline vegetation monitoring data to determine the time necessary for palatable species to grow through the deer browse tier, in the presence and absence of deer and possums, using new exclosures. Using tagged seedlings inside and outside exclosures.

Animal densities

- To estimate the pellet frequency and relative density of deer (both white tailed deer Odocoileus virginianus and red deer Cervus elaphus), possums (Trichosurus vulpecula), and rats (kiore, Norway and ship rats), and the frequency of Stewart Island brown kiwi (Apteryx australis lawryi), and feral cats (Felis catus) in northern Stewart Island.
- To quantify the trends in animal pellet frequency and relative pellet abundance between 1980 and 1998 in northern Stewart Island, and 1976, 1979, 1999 in southern Stewart Island.

- To investigate the relationship between possum pellet presence and trap catch, and impacts on preferred tree species.
- To record the diversity and estimate the abundance of bird species in northern and southern Stewart Island.

METHODS

Long term permanent plots

The standard method for monitoring the health of New Zealand's forests is the 20 x 20m permanent plot method (Allen 1993). All trees are tagged individually, and their diameter measured just above the tag (which is at 135 cm from the ground). This measurement is called diameter at breast height, or "dbh". For each species on a plot, we then get a measure of "basal area", which answers the question "how much space is taken up by this species at this site?" We also use counts of individuals to measure the density of each species at a site, and estimate how many there might be per hectare.

All saplings, which are growing through to become trees, are identified by species, and counted, to give a measure of "how many stems of each species are likely to become trees at this site". These are often recorded as number per metre squared, or number per hectare.

Seedling of woody plants, and presence of ferns, grasses and herbs, are recorded in 24 understorey subplots, which are marked by pegs in the ground, and revisited over time. These allow us to see whether each woody species is likely to grow up through the understorey in the future. Woody species are recorded as numbers of individuals of each species, in different height tiers, from 15 cm up to 135 cm tall, so we can tell whether different woody species are regenerating successfully.

Northern Stewart Island: widespread plots.

Ten transects were randomly located around northern Stewart Island by New Zealand Forest Service in 1979. They cover a range of sites and are believed to be representative of the rata-kamahi-podocarp forest in northern Stewart Island. Most lines start at the coast and follow compass bearings up to the nearest ridge.

Northern Stewart Island: subjectively located plots.

Eastern Stewart Island: Chew Tobacco Bay and Port Adventure.

Southern Stewart Island: Port Pegasus.

18 new permanent plots have been established on new transects in southern Stewart Island. The data from these is yet to be analysed.

Pest-free islands

Five permanent plots were also located on Bench Island in 1979, and remeasured during the recent survey. Ten plots on Ulva Island were established to monitor the effects of rat eradication, and these were measured in the standard format in 1999. The data from these is yet to be analysed, and will be useful for setting targets for pest control on main Stewart Island.

Monitoring possum impacts on tree canopies: the "foliar browse index" technique (Payton et al. 1999)

This method is used throughout New Zealand to monitor the effectiveness of possum control, and to survey for possum damage. Individual canopy trees of possum-preferred species, are tagged and a number of different characters scored. These include:

- canopy foliage cover (an estimate of how dense the canopy looks, when you stand below the tree, using a graded scale of black on white, in 10 % classes);
- canopy dieback;
- · possum stem use (scratch marks on trunks);
- · possum browse on foliage (searched for using binoculars); and
- a measure of flowers and fruits (as these are often eaten by possums, as well as leaves).

Around northern Stewart Island, there were 6-10 foliar browse plots on each of 10 transects. Plots were centered on a corner of each permanent 20 x 20 m plot, and half way between plots along the transect lines. Also, 11 plots were established on Bench Island, and 10 on Ulva Island, where there have never been possums. These give us a useful indication of how trees of possum-preferred species could look on Stewart Island, where possum browsing is lowered in possum control areas.

Indicator species were chosen on the basis of possum palatability, and we limited sampling to those species that were relatively common. The species were: kamahi, southern rata, Hall's totara, 3-finger, marbleleaf, muttonbird scrub and broadleaf. Browse was observed on the last two species on the first trip, at Little Bungaree, but often they were not browsed, so these could be useful in future as indicators of trends in foliage cover due to factors other than possum browse. At each foliar browse plot, 1-3 individuals of every possum preferred indicator tree species present within a 20m radius of the plot centre were assessed. The closest individual(s) of each species to the plot centre was selected for assessment, except where it was difficult or impossible to see the canopy clearly.

Permanent fenced deer exclosure plots

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These use the same measurement as permanent plots, but are surrounded by a deerproof fence, to exclude deer browsing, and show what could grow on a site is deer were completely absent. Possums and rats have access to the vegetation inside, so they are really useful to show what impacts these pests might have on forest understories (a question still without a clear answer in most of New Zealand).

Estimates of relative animal density were also measured. Possum density by trap catch rates and pellet count assessments. Deer density was measured by pellet frequency.

C. What did we find?

Key findings from long term permanent plot data and estimates of relative animal density, from the Stewart Island forest health survey, 1998-2000.

TRENDS IN VEGETATION CONDITION

I. What is the general trend in canopy tree growth and mortality?

Forests of Northern Stewart Island (excluding Chew Tobacco Bay and Port Adventure) have generally increased in basal area between 1981 and 1998/99. This means that trees are getting bigger. Stem density has decreased over the last 20 years, which means that as trees increase in size, thinning of stems occurs, so fewer, larger individuals are present now than were present in the forests around the late 1970s and early 1980s.

This is typical of forests adjusting to past canopy disturbance, as stands are now maturing at the same time, after once establishing at the same time. We have not proposed any reasons for this past disturbance. Because the stand is maturing, and because of the current stage of forest development, it is not a critical time for regeneration of canopy species throughout much of Northern Stewart Island.

2. How does this compare with forests elsewhere in New Zealand?

Trees are growing and dying more slowly on Stewart Island, than has been observed in other parts of New Zealand. This is likely due to the cool climate and very low soil fertility on Stewart Island, and relates to a pattern evident throughout New Zealand, where rates of tree mortality and growth decline the further south you go.

3. What are the long-term impacts of possum browsing on canopy trees?

The permanent plot sampling recorded growth and death rates of all trees, including those most highly preferred by possums (southern rata, Hall's totara, kamahi), and those not often eaten by possums (eg Broadleaf - *Griselinia littoralis*). Overall, mortality rates of trees ³ 10cm diameter at breast height ("dbh") of possum-preferred species were similar to the average mortality rate across all species. Actually, the highest mortality rates of adult trees occurred for Broadleaf.

For kamahi, recruitment rate exceeded mortality rate - this means, currently, that regeneration of kamahi is sufficient to retain the species as a component of the forest. However, for southern rata, Hall's totara and Broadleaf, mortality rate exceed recruitment rate, which means that recruitment of these species is not currently adequate to secure these species as components of Stewart Island forests. This could be of major concern to managers in future, and these trends may be able to be altered with animal pest management.