Department of Conservation
Te Papa Atawhai

Deer pellet monitoring in two catchments in the western Ruahines

DRAFT

Wanganui Conservancy Monitoring Report 2006/06
dme ref. 'WANCO–46628'

Amy Hawcroft
July 2006

Unpublished report for
Department of Conservation
Wanganui Conservancy
74 Ingestre St
Wanganui, New Zealand

Summary

PLEASE NOTE THAT THIS REPORT IS A DRAFT AS SOME DATA COULD NOT BE LOCATED. THE REPORT WILL BE AMENDED WHEN THIS DATA IS FOUND.

This report presents results from measurement of pellet lines in two catchments in the Ruahines. The lines were measured to determine whether red deer use of the area is increasing, in response to an apparent decline in intensity of commercial venison recovery.

Fifteen lines were measured in Pohangina catchment, which is open to aerial recovery. All were measured in 1983, and ten were also measured in 2000. In the Pourangaki, which is closed to aerial recovery, 10 lines were measured. All had been measured in 1983 and 2001 but data was not available.

Pellet frequencies were low in the Pohangina and moderate in the Pourangaki. Comparison with earlier surveys shows that the density in the Pohangina may have increased, but the change is not statistically significant. Pellet frequency was higher in the Pourangaki. Raw data from earlier surveys is not available, but comparison with results given in Forest Service reports shows that current densities are comparable to those of the late 1970s and much lower than those recorded in the early 1970s.

Remeasurement of these lines in five years time will provide better information about whether deer use of the area is changing. This should be supplemented by monitoring pellet densities on established lines in other catchments and measurement of vegetation condition.

DRAFT

Acknowledgements

Thanks to John Spence and others for assistance with mapping.
Thanks to New Zealand Forest Surveys for conducting the field work and sharing observations about the area.
Thanks to Clare Veltman and Phil Mohi for comments made about this report.

Contents

Introduction 4

Aim *4*

Background *4*

The study area *4*

Past monitoring 5

Methods 6

Sample design *6*

Field work *7*

Analysis *7*

Comparison with earlier surveys 8

Results 9

Discussion 12

Future monitoring in the Ruahines *12*

Conclusion 13

Recommendations 13

Appendix 1 Technical specifications provided to field workers 16

DRAFT

Introduction

Aim

To determine whether red deer density in two catchments in the western Ruahines is increasing.

Background

This project provides information about densities of feral deer in the Ruahine range. For the past thirty years densities have been controlled by aerial hunting. Private businesses are granted concessions to hunt on land administered by the Department within specific areas and times. The wild venison is sold on national and international markets (Department of Conservation 2003).

Commercial venison recovery has declined since 2002 (Department of Conservation 2003). Implications for DOC have been discussed by Keith Briden in two briefing papers to the General Management Team.

The study area

The Ruahines are part of the axial mountain chain running through the North Island. They are rugged with sharp ridges, steep sided valleys and fast flowing rivers, formed on relatively young, shattered greywacke, with areas of limestone, sandstone and siltstone. The climate is cool and wet with high rainfall and many cloudy days (Department of Conservation 1992).

The Ruahines support many vegetation types, including alpine grasslands (*Chionochloa* species) and herb fields, sub alpine shrubs (including *Dracophyllum,*and *Brachyglottis* in the north and predominantly leatherwood in the south), high altitude forest with pahautea, pink pine and Hall's totara. Mid–altitude forest is largely beech (northern part of the range) or kamahi (below Pohangina River) dominated forests. Podocarp–broadleaved forests occasionally occur in the lower flanks (Elder 1965).

This pattern has been modified by introduced animals and localised fire and logging. Most striking was the collapse of kamahi (and some beech) forest in the southern part of the range and its replacement with small trees (horopito, rangiora, mahoe), shrubs and ferns (Department of

DRAFT

Conservation 1992). This collapse has been related to possums, ungulate browse, and other stressors such as wind damage (Rogers and Leathwick 1997).

Red deer have occupied the Ruahines since about 1900, and numbers were high by the 1920s, when forest degradation was obvious (Cunningham 1979). By 1935 deer were seen along the tops from Kereru to the Ngamoko Range (Elder 1965). High altitude scrub and old slips in the Pohangina catchment also showed evidence of severe animal damage in the early 1960s and the forest understorey at this time was also very open (Cunningham 1971).

Ungulate control began under the Internal Affairs Department in 1938 but numbers still increased from 1945 to 1962 (Elder 1965). The Forest Service undertook widespread (all catchments from Whakarekau south) shooting from helicopters in 1972–1978, which appeared to significantly reduce deer pellet density (Oaks 1983). Commercial helicopter hunting began in 1975 and also contributed to the decline in pellet density (ibid). Helicopter hunting was restricted from the Pourangaki, Mangawhakariki and Oroua catchments in 1981 (ibid).

Possums, hares, rodents and mustelids are present in the park. Goats and pigs may be present in localised areas (Department of Conservation 1992). Some possum control was carried out in the 1960s and 1970s (Cunningham 1971)

Past monitoring

The Ruahines have a long history of monitoring, both of vegetation condition and of animal abundance (refer to WANCO 35016).

Animal abundance was measured using pellet counts. Surveys took place in 1969 (southern Ruahines), 1973 (Tukituki catchment), 1974 (Kawekas and Ngaruroro), 1975 (southern Ruahines), 1978 (northwest Ruahines), 1981 (northeast Ruahines) and 1983 (entire range).

Various systems for measuring vegetation have been applied. Approximately 14 exclosure plots in the western Ruahines (constructed in the 1960s and 1970s) were relocated and photographed in 1983 and a qualitative description of the vegetation was made. Ten have been re-measured since 1997 using the method described in (Allen 1993). Beech species, which are not highly palatable to deer, show very little difference between exclosures and unfenced plots, suggesting that recruitment is possible with current deer densities. More palatable species (broadleaf, raukawa,

mahoe, coprosmas and *Pseudopanax)* tended to be more abundant in exclosures suggesting that their regeneration is inhibited. Several species (notably kamahi) that are highly palatable to deer and possums and suffered severe dieback in the 1950s and 1960s show minimal recruitment, even inside exclosures. This suggests that those species can no longer establish even in the absence of browse (Steffens and Hawcroft in preparation). However, the exclosures cover a very small part of the range and results varied greatly from plot to plot.

Data from the extensive network of unfenced permanent plots (established in the 1970s and remeasured in 1984–5) has not been formally analysed, except some in the Pohangina valley which are included in a national review (Bellingham et al. 1999) which does not provide much information about deer impacts.

Grassland transects were established in the 1960s – and partially remeasured by Cuddihy in 1975–76 – to quantify deer impacts. These were 40m long. Vegetation and pellet presence in 15cm radius plots was recorded at 40cm intervals. In 1977 these showed an increase in ground cover density and sward height - reduced deer impact.

Methods

Pellet counts are often used as an indicator of deer use. This technique allowed direct comparison with earlier measurements in the area. Pellet counts have also been recommended for estimating the relative density of possums where only coarse indicators are needed (Baddeley 1985).

Sample design

Data collection was restricted to two catchments to reduce travelling time for field workers. The Pohangina and Pourangaki catchments were selected because they represented areas open and closed to commercial hunting and had been measured relatively recently.

Lines follow a compass bearing from stream to ridge top (they are not of fixed length). The start point on the stream was determined by breaking the stream into equal sized blocks and randomly placing a line in each block (restricted random sampling).

DRAFT

In 1983, 36 lines were measured in the Pohangina Catchment and 10 were measured in the Pourangaki. In 2000, 10 lines were measured in each catchment. Slightly more resources were available in 2006 and 15 lines were measured in the Pohangina and 10 in the Pourangaki.

Field work

Data collection followed Oaks (1983). The start and end points of each line were marked with permolat and line locations were recorded in a diagram and with a GPS. Plots are located at 20m intervals along transects.

Observers recorded the presence/absence of animal pellets in a plot with radius of 1.14m (at least 1 deer pellet, meeting certain intactness criteria, other animal pellets may be recorded in any condition) and two distances: the distance from the plot centre to the nearest valid deer pellet group (more than 6 pellets) within a 3m search radius and the distance from the centre of that group to the next nearest group within a 3m search radius.

Information about habitat: slope; altitude; aspect; vegetation type and physiography were recorded, as was basic metadata – Catchment, Date, Observers, Line number, Plot number.

Data was collected in January 1983, in Febuary 2000, and in January (Pohangina) and March–April (Pourangaki). In 2006 data was collected by New Zealand Forest Surveys for a contract of $6900 exclusive of GST.

Analysis

Two kinds of data were collected: presence/absence (p/a) of deer pellets and point distance information about pellet spacing. Methods for analysis are described in (Bell 1973). The simplest measure from p/a is the proportion of plots occupied and that summary is used here.

Earlier reports have used each plot as a sample unit to calculate pellet frequency (Jenkins 1981, Oaks 1983). It is more correct to treat each transect as a sample unit (C Veltman pers. comm.) and that approach was taken here to derive a mean frequency (percentage of plots containing

DRAFT

pellets) and an estimate of error[1]. This analysis was made for recently collected data from the two catchments.

SamplePower 2.0 was used to investigate the number of lines needed to detect (i) a 10% change in the Pohangina catchment (paired t-test) and (ii) a 10% difference between the two catchments (using an independent t-test) based on the variance in the data collected in the most recent surveys.

Comparison with earlier surveys

Raw data from early surveys could not be located. Pellet frequencies were extracted from reports which quote density (James and Beaumont 1971, Cuddihy 1977) using the equation frequency = 1−e^(−density)[2].

James and Beaumont (1971) give pellet frequencies for four blocks: Oroua, Pohangina, South−East and South−West. Cuddihy (1977) presented summary data for the southern catchments only, including (on the west) Oroua, Pohangina, Opawe and Ross. Data from Makawakawa is shown for possums only.

Oak's summaries treat catchments in aggregate so 'Kawhatau' includes Pourangaki, Hikurangi and Mangawhakariki (these can no longer be lumped together because Pourangaki is closed to aerial venison recovery while the other two are open). Oroua is just Oroua, Pohangina is upper and lower Pohangina (we also treated it this way), southwest Ruahines includes Makawakawa, Ross and Opawe.

Raw data from 1983 was obtained for the Pohangina catchment only and no data from earlier surveys could be obtained.

[1] no attempt was made to account for the different numbers of plots on each line (which varied from 10 to 60)

[2] Defecation density = −log e (1−(% plots occupied)). This is calculated for each line; multiplied by a coefficient reflecting the proportion of the sample that line represents; weighted line values are added to give a total value for the block).

DRAFT

Results

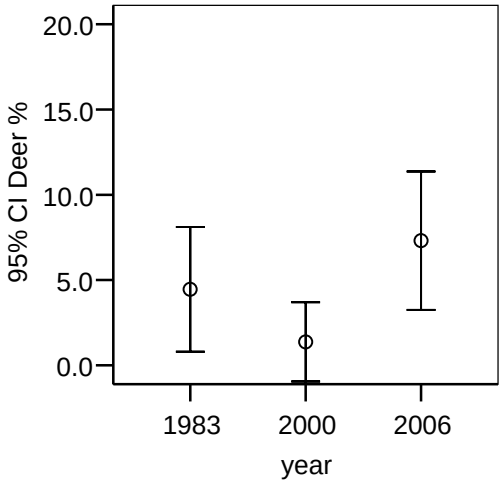

Figure 1 Frequency of deer pellets in the Pohangina Catchment (using lines measured in both 2006 and 1983 only)

The proportion of the plots that contain pellets in the Pohangina catchment dropped from an average of just under five percent to 1.4 in 2000. Frequency was higher in 2006 (7.3%).

Power analysis (paired t-test, SD = 9.5, α = 0.05, power = 0.8), indicated that repeated measurement of 15 lines would adequately detect a 10% change in average frequency, but for a smaller change many more lines would be needed (30 lines for a 5% change, nearly 200 lines to detect a 2% change).

DRAFT

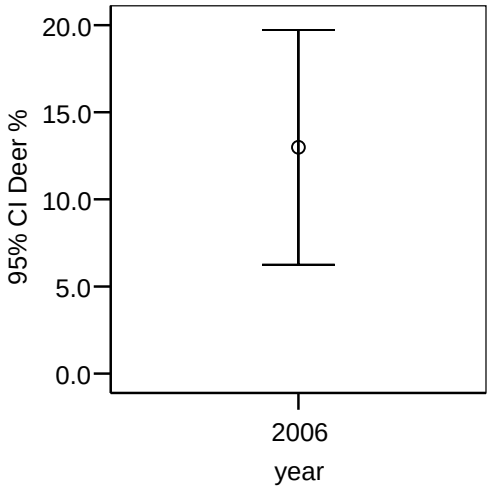

Figure 2 Frequency of deer pellets in the Pourangaki Catchment (lines measured in 2006 only)

A higher proportion of plots contained pellets in the Pourangaki (12.1%, Figure 2). This represented a large increase from 1983 (Table 2).

Power analysis to compare catchments (2 sided independent t-test, SD = 9.4, α= 0.05, power= 0.8) indicates that if ten lines were measured in each catchment then only differences of 13% or more would be identified as significant. If 15 lines were measured in each a difference of 10% could be identified (a 5% difference would require more than 50 lines per catchment).

Table 2 summarises frequency of pellets derived from all measurements conducted in the western Ruahine (note that this is a simple proportion of plots containing pellets and has no associated estimate of error).

DRAFT

Table 2 Frequency of animal pellets in the western Ruahines (% of plots measured in each year)[3]

Year	Catchment or Block	deer	possum
2006	Pourangaki	12.1	12.8
2006	Pohangina	7.4	6.1
2005	Kawhatau (tussock)	0.3	0.3
2005	Oroua (tussock)	0.7	0
2003	Makawakawa	5.8	11.9
2003	Ross	3.3	17.1
2001	Oroua	7.8	17.2
2001	Pohangina	1.0	11.3
2000	Kawhatau	data	Not found
2000	Pourangaki	data	Not found
1983	Whakarekau/Mangatera	7	21
1983	Maropea/Waikamaka	1	22
1983	Kawhatau/Pourangaki	3.8	19.9
1983	Oroua	3. 1	19.8
1983	Pohangina	2.3	16.28
1983	South West	3.4	17.18
1976	Oroua	11.0	5.8
1976	Pohangina	8.1	7.2
1976	Opawe	16.9	17.1
1976	Ross	10.9	3.0
1976	Makawakawa	.	13.5
1971	Oroua	26.3	10.7
1971	Pohangina	18	15.4
1971	South–West	43.4	15.2

[3] (simple proportion of plots containing pellets - no estimate of error).

DRAFT

Discussion

Pellet frequencies were low in the Pohangina catchment and moderate in the Pourangaki. Frequencies appear to have increased since 2000–2001 and are also higher than 1983 measurements. However frequencies are not yet as high as those recorded in the early 1970s and the contractor reported that numbers seem low relative to other sites in the central North Island (S. Husheer, pers. comm.)

Margins of error are quite large, and none of the changes described above are significant. This is probably a result of relatively small sample sizes (10–15 lines).

These results are much higher than those obtained from the tussock lines measured in 2005. In past surveys forest densities have always been higher than grassland and highest in the pahautea–broadleaf zone, and this result may reflect that. It suggests that monitoring deer density over entire catchments may be more appropriate than focussing on one habitat. Other reasons for the very low densities recorded in 2005 are discussed in (Hawcroft 2005).

Future monitoring in the Ruahines

There is a need for ongoing monitoring of the deer population and the vegetation in the Ruahines.

The exclosure plots have provided some information about the state of the forest, but conclusions drawn from that small sample should be verified by wider scale monitoring such as re–measurement of the unfenced forest plots. There has been interest in the condition of red beech and pahautea, two canopy species which are perceived to have limited regeneration in parts of the Ruahines and in other central North Island sites (Peltzer et al. 2003). The poor condition of these forests in the Kawhatau and Pohangina catchments has been reported since the 1950s (Cunningham 1979). James and Beaumont (1972), and Cuddihy (1977) found that pahautea forest received the most deer use and was particularly poor condition. There is some evidence that deer browse can influence beech regeneration (Allen and Allan 1997, Rogers and Leathwick 1997, Husheer et al. 2003). A widescale study of the Southern Ruahines suggested that deer browse, creating a dense sward of grasses and shrubs which inhibited tree seedling recruitment, was

DRAFT

partially responsible for loss of red beech forest in the area (Rogers and Leathwick 1997). These issues could also be examined by remeasurement of the permanent forest plots.

A more immediate need is a record of the state of the grassland vegetation which is likely to be most at risk from increased deer use as those areas have been targeted by aerial hunting. If they can be relocated, the grassland transects established to monitor deer impacts in the 1960s and remeasured in 1976 would provide a very useful record.

Conclusion

Deer numbers appear to be increasing in the Pohangina and Pourangaki catchments but changes are not significant.

Recommendations

- Continue to monitor deer use of the Ruahines by periodic remeasurement of pellet lines. Increasing the number of lines remeasured each year will provide better information.

- Supplement this index of deer use by measurement of vegetation condition, initially in the tussock grassland.

- Monitoring of the existing network of permanent plots in the forest will also be necessary to supplement the tentative conclusions drawn from exclosure plots.

- This information could be shared with other groups that have an interest in deer and/or the Ruahines.

DRAFT

References

Allen, R., and C. N. Allan. 1997. Mountain beech forest dynamics in the Kaweka Range and the influence of browsing animals. Science for Conservation 44, Department of Conservation, Wellington.

Allen, R. B. 1993. A permanent plot method for monitoring changes in indigenous forests. Manaaki Whenua - Landcare Research.

Baddeley, C. J. 1985. Assessments of wild animal abundance. FRI Bulletin 106, Forest Research Institute, Christchurch.

Bell, D. J. 1973. The mechanics and analysis of faecal counts for deer census in New Zealand. Protection Forestry Report 124, Forest Research Institute, Rangiora.

Bellingham, P. J., G. H. Stewart, and R. B. Allen. 1999. Tree species richness and turnover throughout New Zealand forests. Journal of Vegetation Science **10**:825-832.

Cuddihy, M. J. 1977. Forests, grasslands and animals of the Southern Ruahine Range. Protection Forestry Report (unpublished) 151, Forest Research Institute, Christchurch.

Cunningham, A. 1971. Field notes from the North Island ranges 1959-1970. unpublished Forest Service Report New Zealand Forest Service, Napier.

Cunningham, A. 1979. A century of change in the forests of the Ruahine Range, North Island, New Zealand: 1870-1970. New Zealand Journal of Ecology **2**:11-21.

Department of Conservation. 1992. Ruahine Forest Park: Conservation Management Plan. Department of Conservation, Napier.

Department of Conservation. 2003. Wairarapa hunting update: autumn 2003. Pages 5 *in*. Department of Conservation, Masterton.

Elder, N. L. 1965. Vegetation of the Ruahine Range: An introduction. Transactions of the Royal Society of New Zealand **3**:13-66.

Fleury, W. 1980. Forests and Animals of the Kaweka Range: report of the 1974-75 survey of the forests and animals of the Upper Ngaruroro Catchment, the Upper Tutaekuri Catchment, the Upper Mohaka Catchment. New Zealand Forest Service, Palmerston North.

Hawcroft, A. 2005. Deer pellet monitoring in tussock grassland in the western Ruahines. Unpublished Wanganui Conservancy Monitoring Report 2005/10, Department of Conservation, Wanganui.

Husheer, S., D. A. Coomes, and A. W. Robertson. 2003. Long-term influences of introduced deer on the composition and structure of New Zealand Nothofagus forests. Forest Ecology and Management **181**:99-117.

James, I. P., and P. E. Beaumont. 1971. Report on a Survey of the Vegetation of the Southern Ruahine Range. Protection Forestry Branch Report 80, New Zealand Forest Service, Rangiora.

Jenkins, C. 1981. Animal Population Survey of the Southern Kawekas and N.E. Ruahines. New Zealand Forest Service, Napier.

Knowlton, J. E. 1982. A comparison between the presence-absence and point-distance deer census techniques in the Urawera situation. unpublished report New Zealand Forest Service.

DRAFT

Oaks, T. J. 1983. Animal Survey of the Ruahine Range. Unpublished report New Zealand Forest Service, Palmerston North.

Peltzer, D. A., R. B. Allen, and G. M. Rogers. 2003. Relationship between animal pests and condition of vulnerable forest types: red beeck collapse and mortality of *Libocedrus bidwillii*. DRAFT Landcare Research Contract Report LC0203/160, Landcare Research and Department of Conservation, Lincoln.

Rogers, G. M., and J. R. Leathwick. 1997. Factors predisposing forests to canopy collapse in the Southern Ruahine Range, New Zealand. Biological Conservation **80**:325-338.

Steffens, K., and A. Hawcroft. in preparation. The impact of red deer (Cervus elaphus scotius) in the western Ruahines: evidence from exclosure plots. DRAFT Wanganui Conservancy Monitoring Report 2006/03, Department of Conservation, Palmerston North.

Walls, G. 1998. Mid Pohangina Valley exclosure plots March 1997. Conservation Advisory Science Notes 179, Department of Conservation, Wellington.

DRAFT

Appendix 1 Technical specifications provided to field workers

Equipment

A map of the lines and copies of the 1982–3 line location notes will be given to each team. Teams will also need:

- Data recording sheets (waterproof paper)
- GPS
- Compass
- General Map
- Measuring tape
- Permolat
- Hammer and nails for marking lines on trees
- Aluminium pegs for marking lines in the tussock
- Pencils

All other equipment needed to meet the Area Office's health and safety requirements. Area Staff will conduct a safety briefing.

Measuring existing pellet lines

There are seven existing lines to be remeasured in Oroua and eight in Kawhatau. Replicate as closely as possible the method followed in the 1981/82 animal survey (Bell, 1973 referred to in Oaks 1983) and in 2000 and 2001.

- Navigate to the line start (should be marked with permolat).
- Complete a new line location form if conditions have changed since the 1980s.
- The first plot will be virtually at the line start and the others should be 20m apart along the bearing on the line location sheet (each plot should be marked with permolat).
- Complete a pellet survey sheet for each line. Label each sheet with the observer's full names, the date and the sheet number (e.g. 2/4 if it is the second sheet out of four used on that line).

On each sheet record:

- Area (= Ruahines).
- Catchment (= 12 for Kawhatau, 16 for Oroua).
- Line = line number as shown on map and lists provided.

DRAFT

- Plot = plot number, 1 is the plot nearest the line start.
- Slope = measure the average slope of the plot with a clinometer.
- Altitude = to the nearest 10m either estimate from map or use GPS.
- Aspect = measure with a compass at right angles to the general lie of the plot, to 5 degrees.
- Habitat = the 3 digit code that best describes the vegetation in and around the plot (teams will get a laminated sheet with the codes and vegetation types).
- Physiography = describe as a **R**idge (including spurs), **F**ace, **G**ully or **T**errace.

Search the plot systematically and thoroughly. Growing vegetation should be pushed aside and large woody debris can be cleared away.

- Record the presence of intact deer, possum, goat, pig, hare or sheep pellets in a radius of 114cm from the plot centre with a 1 in the P/A cell. If they are not present record a –.
- Record the horizontal distance in cm:

  from the plot centre to the nearest pellet group (rp)

  from the centre of that group to the next nearest (rn); If there is no group within 3m record a –.

- 'INTACT' pellets means: WHOLE, with a COMPLETE OUTER COATING: no disintegration, no flaking or wearing away of the outer surface, no cracks (except fine, from rapid drying), no holes (eg from invertebrates), not under water or moved by water/wind from its original place of deposition.
- INTACT PELLET GROUP means: six or more pellets are intact and at least one pellet is visible without moving leaf litter. It is important to find all the pellets in a group, so it is ok to move the litter once you have seen one.
- THE PELLET GROUP CENTRE. For a heap, this is easy. For a string, it is in the middle of the long axis of the string, weighted towards the biggest cluster.

DRAFT