AN OUTBREAK OF TUBERCULOSIS IN A MANAWATU DEER HERD

THE SOURCE, ITS PERPETUATION AND PERCOLATION

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INTRODUCTION

This paper is a case study of a major tuberculosis outbreak on a red/fallow deer farm in the Feilding area, an area which is generally regarded to be Tb-free. The outbreak was a consequence of the movement of infected deer into the area and resulted in considerable investigative and risk-management work as well as the accompanying cost and inconvenience to the farmer and his neighbours.

This outbreak also demonstrated some interesting epidemiological features of the disease, which are of relevance to the management of similar episodes.

In addition the difficulty in obtaining good epidemiological data became apparent throughout the investigation. This prevented us from being able to analyse prevalence and incidence rates and hindered assessment of relative risk of potential causative factors, which is essential in order to be able to make recommendations for disease control and prevention.

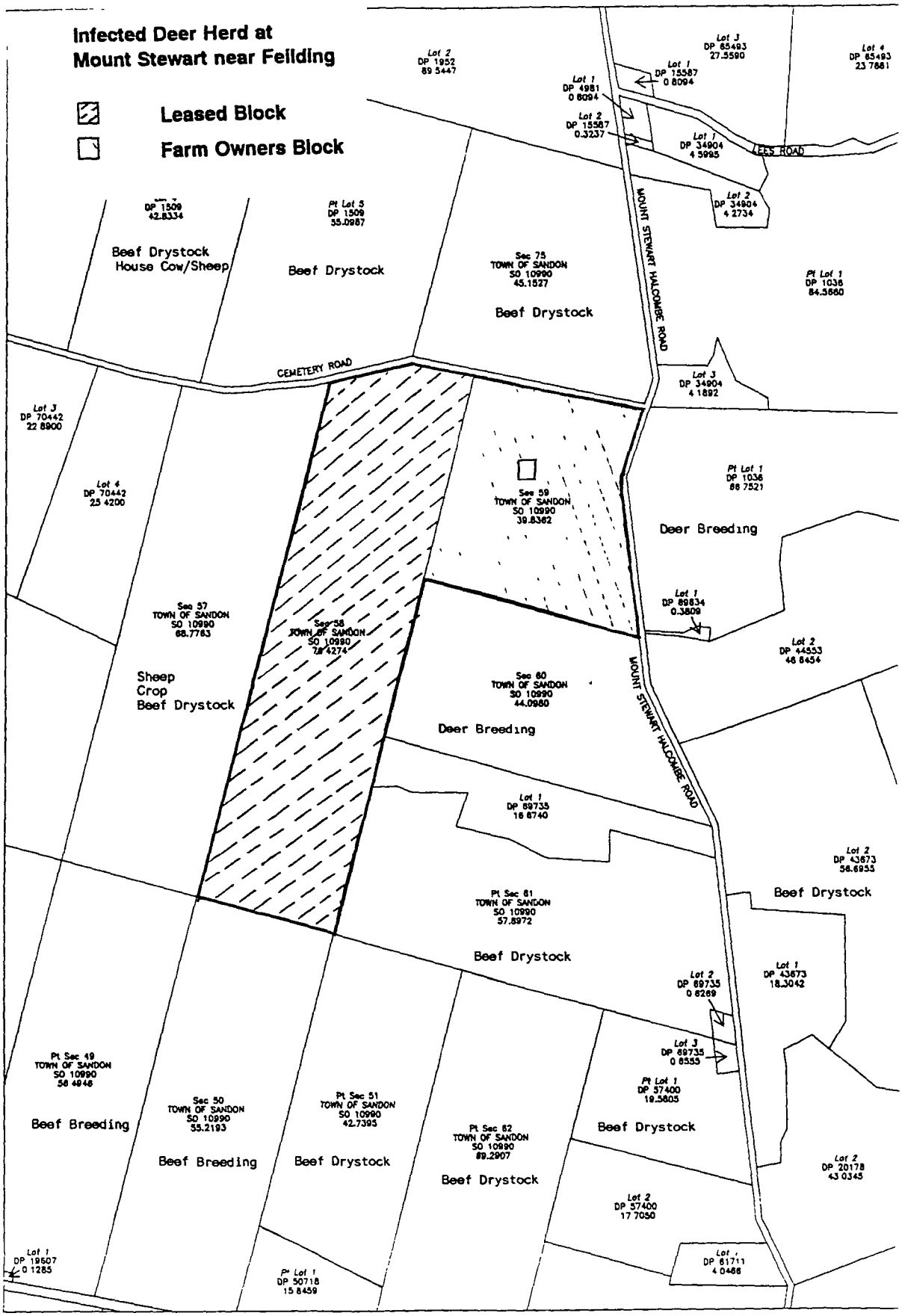
1. THE CASE HERD

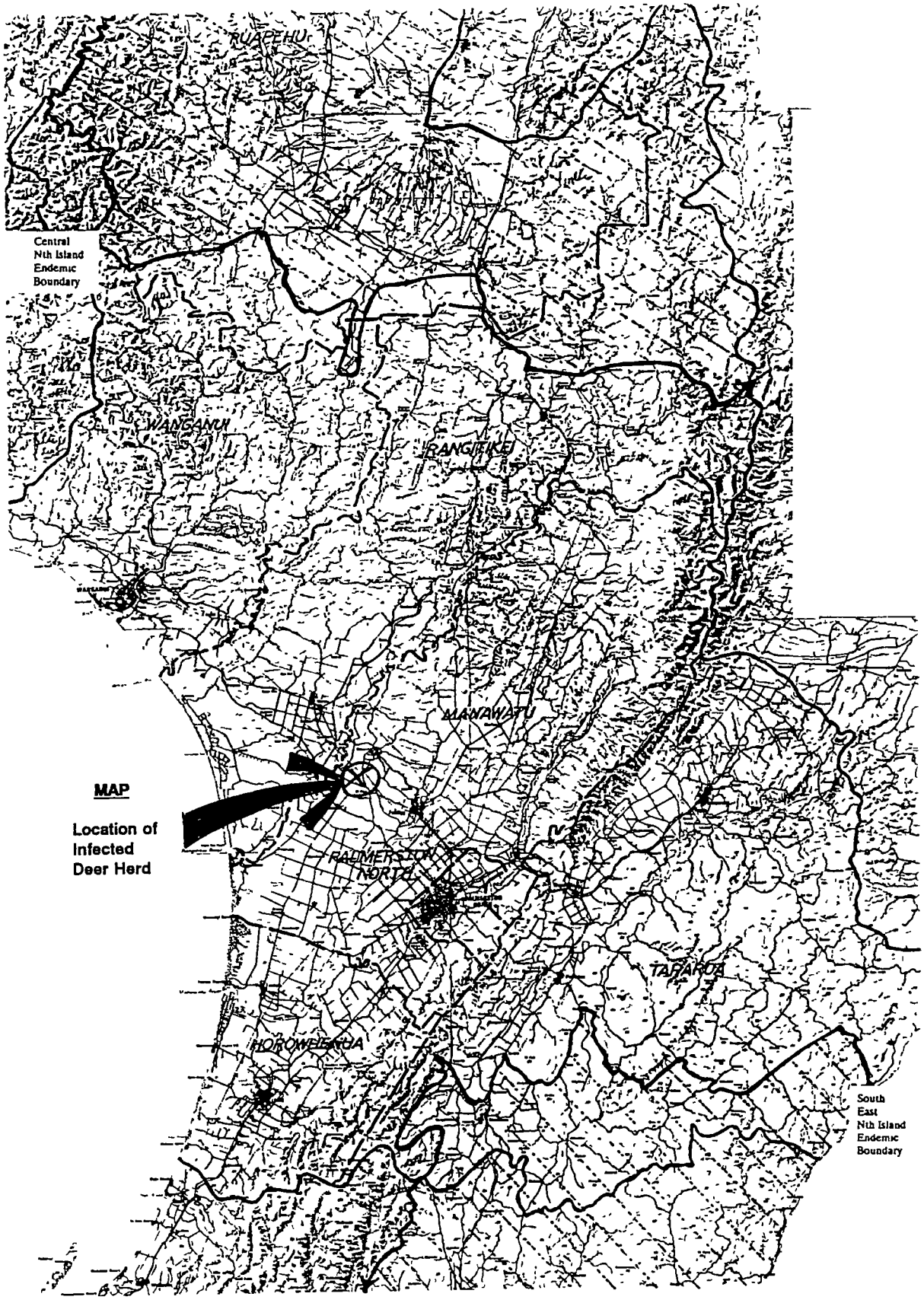
1.1 Tuberculosis History of the Area

The Manawatu/Horowhenua has long enjoyed a history of being "Non-Endemic" for bovine tuberculosis, i.e. there is no evidence to date of persistent infection in the feral animal species of the area. This is despite the proximity of the well-recognised Endemic areas of the Wairarapa and the King Country. Both deer and cattle continually move, mainly for finishing, from these endemic tuberculosis areas into the improved pastures and easier country of the Horowhenua/Manawatu [See map].

Some may argue that the lack of vector feral species in the Horowhenua/Manawatu is the reason why Tb has not become established. Others may hypothesise that this is due to the fact that any infected livestock coming into the area are only here a short time before being slaughtered. Also these generally young animals are on a rising plane of nutrition with consequentially robust immune systems (O'Reilly and Costello, 1988) and generalised tuberculosis is rarely seen. Therefore the risk of leakage into feral animals in most cases is unlikely.

In addition the possum "buffer" operations in place in the North Wairarapa and Southern King Country areas are effective in preventing spread of Tb - infected feral animals, particularly possums.


Infected Deer Herd at
Mount Stewart near Feilding
Leased Block
Farm Owners Block
Lot 2 DP 1952 89 5447
Lot 1 DP 4981 0 8094
Lot 2 DP 15587 0.3237
Lot 1 DP 15587 0 8094
Lot 3 DP 65493 27.5590
Lot 4 DP 65493 23 7881
Lot 1 DP 34904 4 5995
LEES ROAD
Lot 2 DP 34904 4 2734
MOUNT STEWART HALCOMBE ROAD
DP 1509 42.8334
Beef Drystock House Cow/Sheep
Pt Lot 5 DP 1509 55.0987
Beef Drystock
Sec 75 TOWN OF SANDON SO 10990 45.1527
Beef Drystock
Pt Lot 1 DP 1038 84.5660
CEMETERY ROAD
Lot 3 DP 34904 4 1892
Lot 3 DP 70442 22 8900
Lot 4 DP 70442 25 4200
Sec 59 TOWN OF SANDON SO 10990 39.8362
Pt Lot 1 DP 1038 88 7521
Deer Breeding
Lot 1 DP 69834 0.3809
Lot 2 DP 44553 46 8454
Sec 57 TOWN OF SANDON SO 10990 68.7763
Sec 58 TOWN OF SANDON SO 10990 78 4274
Sheep Crop Beef Drystock
Sec 60 TOWN OF SANDON SO 10990 44.0980
Deer Breeding
MOUNT STEWART HALCOMBE ROAD
Lot 1 DP 69735 16 6740
Lot 2 DP 43673 58.6955
Beef Drystock
Pt Sec 61 TOWN OF SANDON SO 10990 57.8972
Beef Drystock
Lot 2 DP 69735 0 6269
Lot 1 DP 43673 18.3042
Lot 3 DP 69735 0 8555
Pt Lot 1 DP 57400 19.5805
Pt Sec 49 TOWN OF SANDON SO 10990 58 4946
Beef Breeding
Sec 50 TOWN OF SANDON SO 10990 55.2193
Beef Breeding
Pt Sec 51 TOWN OF SANDON SO 10990 42.7395
Beef Drystock
Pt Sec 62 TOWN OF SANDON SO 10990 89.2907
Beef Drystock
Beef Drystock
Lot 2 DP 20178 43 0345
Lot 2 DP 57400 17 7050
Lot 1 DP 19607 0 1285
Pt Lot 1 DP 50718 15 8459
Lot 1 DP 61711 4 0486


RUAPEHU
Central
Nth Island
Endemic
Boundary
WANGANUI
RANGITIKEI
MANAWATU
MAP
Location of
Infected
Deer Herd
PALMERSTON
NORTH
TARARUA
HOROWHENUA
South
East
Nth Island
Endemic
Boundary

Despite this "clear" status the prevalence of Tb of cattle herds in the Horowhenua/Manawatu area has generally been at about 1.0 % and in recent years has risen to 2.0 % of deer herds. This is approximately five times more for cattle and ten times more for deer than the internationally acceptable level of freedom for tuberculosis (0.2%).

So can we consider the Horowhenua/Manawatu to be tuberculosis free?

Most herd breakdowns are of singleton culls (slaughter stock) or reactors and trace back generally indicates that the animal was tuberculous prior to moving into the area. However, because of the animal trading and dealing policy in the area and the lack of permanent identification on the animals as well as the inability of many meat companies to supply detailed identification information on "Tb culls", it is often impossible to trace back further than the tuberculous animal's last "port of call" (e.g. sale yards) prior to slaughter.

When trace back investigation indicates a risk to the "clear" (Non Endemic) Tb area status - either by establishing that infected stock have been bred and have always grazed in the area or where a number of tuberculous animals are concentrated in a small area and have resided there for a considerable length of time, then extra procedures are added to the local Management Plan for tuberculosis control.

1.2 History of the Farm

The case farm is situated in the Mount Biggs locality on the Feilding - Mt Stewart Highway. The owner farms red and fallow deer on the block and also during the seasons 1989/1990, 1990/1991 and 1991/1992 leased out a major portion of the block to a Hawkes Bay - based corporate farming group for the purpose of finishing red deer hinds.

The owner also owns a fallow breeding unit nearer to Feilding. Deer move one way only from the Feilding farm up to Mt Stewart and are finished there and then go on to the Deer Slaughter Premises. At times the owner also buys in stock for finishing, often cull hinds, and places them onto his "top" farm.

Thus the Mt Stewart farm is a finishing farm for both fallow and red deer. Although there is only one set of yards, the deer on the leased block at the time of this outbreak were farmed and managed separately to the owner's own finishing herd. As is usual in this type of operation, stock occasionally get mixed together.

The total area of the farm is 116 hectares (76 hectare leased block + 40 hectare freehold). The area is open, improved pasture land with few trees. As is often the case in the Manawatu, the 1991 winter was wet and cold and the spring was late.

1.3 History of the Animals

The owner's own fallow herd on his Feilding property has been in existence for eight years and has been under a whole herd testing programme since 1989. It attained accredited Tb free status when 214 breeding animals were tested in 1991. The Mt Stewart "top" farm has been farmed as a venison operation for many years and up to the time of this incident had not had a whole herd test, although some miscellaneous tests had been carried out.

Because of the connection with the Hawkes Bay herds, at least one of which was known to be on Movement Control and several others of which had a history of infection, this Mt Stewart deer farm was placed under Movement Control in September 1990. This took place prior to the regulation that deer from Infected Movement Control properties could only move directly to slaughter.

The agreement between the farming parties concerned and the then current MAFQM Veterinary Officer was that all the Hawkes Bay deer were to be slaughtered and any other deer on the property were to be Tb tested negative prior to removal of the notice. Whilst the notice was in force, it was agreed that no more deer would be added to the herd from the potential infected sources.

Despite this more deer from Hawkes Bay continued to move on to the Mount Stewart deer farm. Discussions with the appropriate farm managers at a later date revealed that these deer were not Tb tested prior to movement and not all source herds were Accredited Tb Free. This was a contravention of rule 5.2 of the Deer Tuberculosis Control Scheme Rules of March 1990. Subsequently it was also ascertained that further deer were brought onto the property illegally i.e. they left a Movement Control property in Hawkes Bay without a movement permit and without having been Tb tested.

At the beginning of the winter of 1991 there were approximately 950 red finishing hinds belonging to the Hawkes Bay Company and approximately 470 fallow deer and 300 red deer of the owners running on the farm. The Hawkes Bay deer were run in three separate mobs of "heavy", "mediums" and "lights". There were approximately equal numbers, i.e. 300 plus, in each group.

In May 1991 one red hind that had been brought in from the Wellington area, now known as Endemic for Bovine Tuberculosis, showed a lesion histologically typical of tuberculosis in the mediastinal lymph node when slaughtered. This sample failed to culture Mycobacterium bovis. This animal had grazed on the owners smaller block and was only present at Mt Stewart for approximately one month.

1.4 Management of the Animals/Results of Slaughter

During the Winter/Spring/Summer of 1991/92 both the owner's deer and the Hawkes Bay origin deer were slaughtered as they reached the 75 kg target weight. The owner's deer and the three farmed groups of Hawkes Bay hinds essentially were run as four separate groups. No hay or supplements were fed out to any deer during the Winter/Spring period of 1991. Although there was not what appeared to be a shortage of feed quantity, in retrospect, the quality was probably not good and the lightest mob of the Hawkes Bay deer apparently failed to thrive.

Drafting, which took place generally once a fortnight, commenced in July and continued into the Spring and Summer period. Only one mob was yarded at one time i.e. once the "heavy" mob were mostly slaughtered those in that mob that had not achieved the target weights were drenched and released to graze with the "medium" mob and so on.

By early October all of the mobs had been yarded at least once and all stock that had been slaughtered on account of the lessee had not shown any evidence of Tb at slaughter. Approximately 500 animals remained to be slaughtered.

During the October draft three of approximately 100 of the Hawkes Bay deer showed singleton lesions suggestive of bovine tuberculosis. The lesions were in the retropharyngeal lymph nodes in two animals and the mediastinal lymph nodes in one animal. Of these Mycobacterium bovis was cultured from one lesioned animal.

Then during November 1991 approximately another 50 Hawkes Bay deer were drafted and tuberculosis was seen in six of these animals. All lesions were singleton and were in the retropharyngeal lymph nodes. Again animals that did not reach the desired weight were drenched and returned to pasture with the remaining mobs.

By this time this somewhat high level of infection (for what was considered to be a Tb "clear" area) was causing concern so there were communications between myself, the manager of the Hawkes Bay Farming corporation who owned the deer, my Hastings MAF Veterinary Officer colleague and other interested parties.

These discussions revealed that the deer belonging to the group that were being finished directly from the properties in Hawkes Bay i.e. the stags from the same breeding sources, were not showing such a high level of infection. Thus it seemed that there was a problem on or around the Mt Stewart farm.

Again the question was raised whether the Manawatu area was really "Non endemic" for bovine tuberculosis or whether infection was in feral animals and the outbreak was a result.

The deer slaughtered in December from the leased block showed further Tb infection. Of approximately 150 animals killed 26 showed lesions suggestive of tuberculosis. These were mostly the hinds from the original "light" mob that had been run on the block furthest from the deer yards and furthest from the farm owner's deer. Of these deer all but three had lesions histologically typical of bovine tuberculosis in the retropharyngeal lymph node. Three of these deer showed multiple large lesions, one animal had extensive lesions in the retropharyngeal, mediastinal and ileojejenal lymph nodes. One animal was condemned for tuberculosis.

Only one of the remaining 200 deer killed in January showed evidence of tuberculosis. This was in a bronchial lymph node.

Also during the months of July 1991 to January 1992 the farm owner drafted approximately 250 fallow and red deer to the Deer Slaughter Premises. None of these animals showed lesions suggestive of tuberculosis at slaughter.

In summary 36 deer out of a line of hinds of approximately 950 showed lesions at slaughter suggestive of tuberculosis. Thirty one of these infected deer had lesions in the retropharyngeal lymph node. Mycobacterium bovis was cultured from lesions in ten animals, in fact from all lesions where culture was requested. These positive cultured lesions were from animals killed on most separate kill days from October to January.

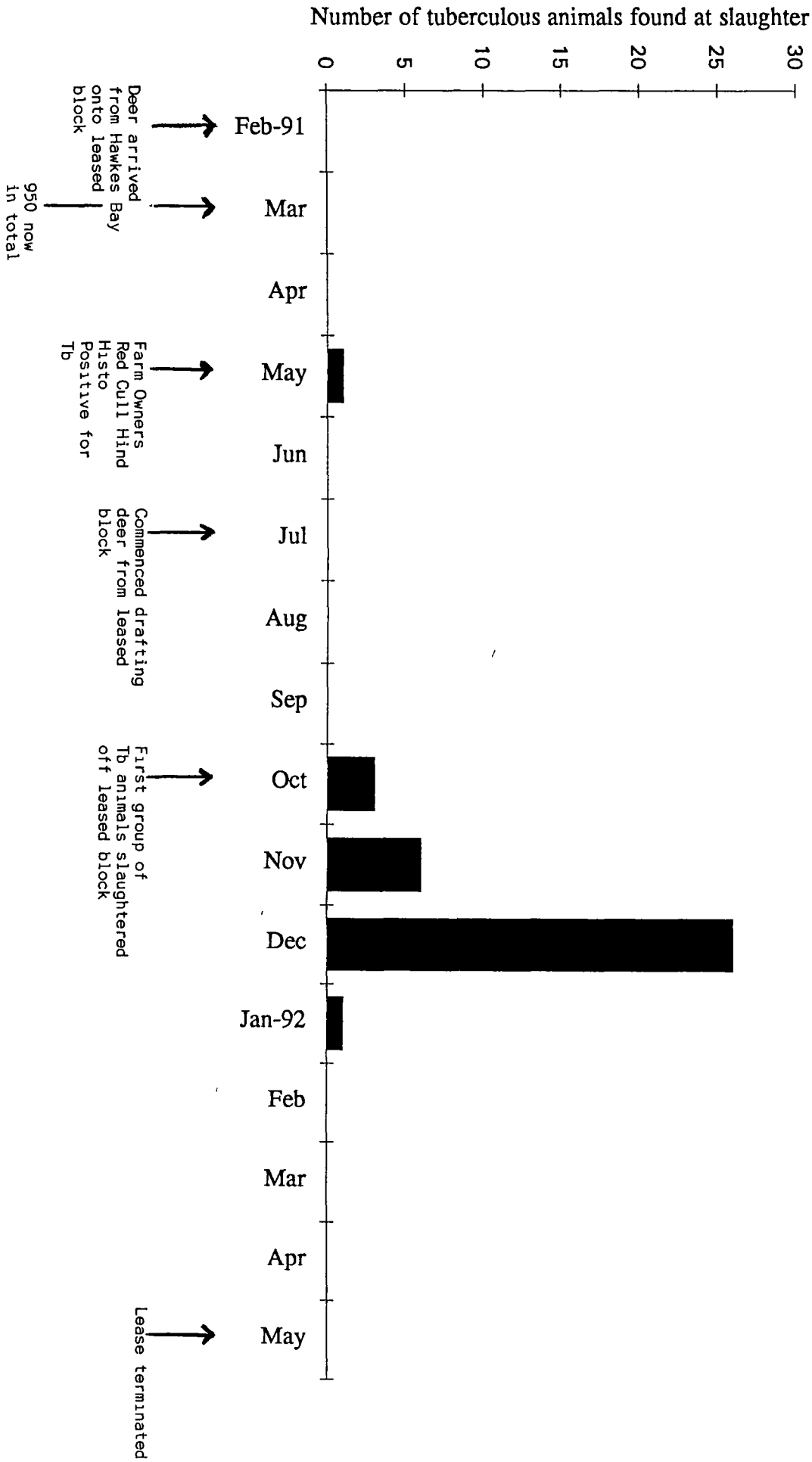
TUBERCULOUS DEER

DETAILED POST MORTEM RESULTS FROM DEER SLAUGHTER PREMISES
MOUNT STEWART DEER FARM

SLAUGHTER DATE	ANIMAL ID	HEAD	LNS	THORAX		ABDOMEN		PERIPHERAL	COMMENTS
		Ret LN[a]	Other Head LN	Med LN[b]	Bro LN[c]	MLN[d]	Ileoj LN[e]		
14 5 91	5			✓					Owners deer ex Wellington M bovis not cultured
16 10 91	No Tag			✓					Hawkes Bay Farming Group deer M bovis
19.10 91	1629	✓							M bovis
21 10 91	1495	✓							M bovis
7 11 91	89/832	✓							
11.11 91	1340 1369 407 845	✓ ✓ ✓ ✓							
12 11 91	1301	✓							M bovis
8 12 91	101 44 47 60 72 76 87 93 96 98	✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓	✓				✓		44 - Multiple lesions 47 - M bovis 76 - M bovis 98 - M bovis
14 12.91	105 25 34 5 50 64 72 88 89	✓ ✓ ✓ ✓ ✓ ✓		 ✓ ✓	 ✓			 ✓ 	 5 - M bovis
20 12 91	20 36 48 55 67 72 85	✓ ✓ ✓ ✓ ✓ ✓ ✓	 ✓			✓ ✓ ✓ 			 36 - M bovis
6 1 92	6				✓				M bovis
27 2 92	5	✓							Owners fallow spiker M avium cultured
TOTAL	38	31	1	5	2	3	1	1	

(a) Retropharyngeal Lymph Node
(b) Mediastinal Lymph Node
(c) Bronchial Lymph Node
(d) Mesenteric Lymph Node
(e) Ileojejenal Lymph Node

NB: As far as could be ascertained nearly all deer slaughtered had not been subject to Tb testing in their life time.


TUBERCULOSIS OUTBREAK IN A DEER HERD AT MOUNT STEWART NEAR FEILDING
Number of tuberculous animals found at slaughter
0
5
10
15
20
25
30
Feb-91
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan-92
Feb
Mar
Apr
May
Deer arrived from Hawkes Bay onto leased block
950 now in total
Farm Owners Red Cull Hind Histo Positive for Tb
Commenced drafting deer from leased block
First group of Tb animals slaughtered off leased block
Lease terminated

1.5 Epidemiological Features

We compared these slaughter results with those of the source herds in Hawkes Bay. The level of infection in the Feilding herd was far greater than was being seen in the source herds.

This posed the following questions:

* Why was there more of a problem at Feilding?
* Was it a problem involving feral vectors?
* Why this sudden high prevalence of disease in later lines?
* Was the hind bought in from the Wellington area the source of infection?

Our assessment at this point was as follows:

- **Results of Neighbours Testing and Slaughter**

  Most neighbours were dry stock cattle farmers and none had shown evidence of Tb infection during previous winter kills nor previous season at test. The farm owner himself had killed several hundred deer during the same time period, July 1991 to February 1992, and apart from the Wellington hind killed in May 1991, none had shown any evidence of tuberculosis.

- **Feral Animal Situation**

  Possum numbers in the area were very light. There were no feral pigs nor deer present in the area.

- **Wellington Hind**

  This animal had never had any direct or indirect contact with the infected mob, particularly with the heavily infected mob that grazed on the western boundary in the autumn of 1991. She grazed at Mt Stewart for one month only prior to slaughter. The lesion from the mediastinal lymph node although histologically typical for tuberculosis failed to grow mycobacteria. Thus it was most unlikely that this animal spread the disease to the Hawkes Bay deer.

- **Hypothesis**

  Looking at all the facts we came up with the following most likely scenario:

  "That a few animals entered the property with infection during the Autumn of 1991. These animals failed to thrive and reach target weights in the early drafts and were therefore returned to pasture. These infected animals then grazed with other deer that perhaps because of poor feed and the wet cold climate had a lowered resistance to tuberculosis infection. Several of the infected animals could have been yarded with other stock many times during the late Winter/ Spring period and may have been drenched on those occasions. Infection could have been easily transferred during the yarding and drenching process"

2. PROCEDURES TO DEFINE THE EXTENT OF PROBLEM AND PROVE HYPOTHESIS

MAF Quality Management staff visited and questioned all neighbours in early 1992. All deer and cattle that were not going directly to slaughter during the next two to three months were subject to a tuberculosis test. This was completed by June 1992.

All results were negative except one suspect Tb cull from the farm owner's deer killed in February. This was a fallow spiker that had been mixed with the Hawkes Bay mob in the Winter of 1991. The lesion was typical of Tb on histology but eventually cultured Mycobacterium avium. None of the other deer belonging to the farm owner had lesions typical of Tb at slaughter. The herd most at risk, another small red deer breeding herd which had shared a common boundary all winter with the heavily infected mob, showed some positive reactions to the standard Tb test. These reactors were all slaughtered and none showed any visible lesions of tuberculosis at necropsy (NVL). It was theoretically possible this herd could have had direct contact through the fence with the heavily infected mob.

As a precaution and to protect the albeit light possum population in the area a request for a Brief Localised Immediate possum control operation (BLIP) was put forward. This was carried out in March 1992.

Thus the clear (Non Endemic) tuberculosis status of the Mt Stewart area, although challenged, still remained credible. Testing and slaughter surveillance for this current 1992/93 season has reinforced that conclusion.

3. THE COST OF THE BREAKDOWN AND SUBSEQUENT PROCEDURES

3.1 Direct Costs

1992

	$
MAF Quality Management	
VO Time (includes consultation/ liaison/PR investigations etc)	1,920.00
LO Time (casing and record checking)	1,350.00
LO Testing time	600.00
Travelling	360.00
Laboratory Tests	1,860.00
Local Farmers	
Local Deer Farmer extra testing	700.00
Animal Health Board	
Cost of BLIP control	1,023.00
Hawkes Bay Farming Company	
Loss of value of 36 deer carcasses being downgraded to local trade price and one condemned	6,570.00

1993

MAF Quality Management

Cost of extra follow up testing and record checking	800.00
FARM LOSS	6,570.00
COSTS INCURRED BEYOND FARM GATE	8,613.00
TOTAL DIRECT COSTS	15,183.00

3.2 Indirect Costs

Includes time for investigations, discussions, PR - including media response, field days, liaison with AHB, Regional Council and Farm Managers. Also case preparation time.

MAF Quality Management

(For Hastings, Palmerston North and Regional staff)	$
VO Time	12,000.00
LO Time	3,600.00
Travelling	900.00

Regional Council

(For appropriate Hawkes Bay and Manawatu/Wanganui staff)

Staff Time	1,200.00

Farm Managers Time

(For those in Hawkes Bay and Feilding)	1,440.00
TOTAL INDIRECT COSTS	19,140.00
3.3 TOTAL COSTS - DIRECT AND INDIRECT	$34,323.00

4. DISCUSSION

In this outbreak the major barrier to investigating the problem was a lack of good raw data. I refer particularly to specific information on stock movements viz which farms the hinds had originated from, when they moved and how many.

Investigating this outbreak highlighted to me the importance of permanent animal identification at least back to the farm of origin, that is where the animal had been born. A unique number/code would then follow the animal through its rearing and finishing stages right to the slaughter floor and would be of enormous assistance in unravelling the source of infection in such outbreaks be it of Tb or any other disease (or residue) problem.

In addition the question of liability for the outbreak was raised particularly as the facts behind the deer movement from Hawkes Bay to this farm at Mt Stewart became clearer. In this age of "user pays" and the Animal Health Board's philosophy of expecting farmers to become more responsible for tuberculosis control on their own farm perhaps expecting farmers/operators/agents to pay for the "damage control" is not unrealistic. This would be very relevant when there had been a clear breach of the Tuberculosis regulations or the Deer Tuberculosis Scheme Rules which were written originally with disease containment specifically in mind.

I strongly recommend therefore that all of us involved with animal disease control, particularly those diseases soon to be covered by a Pest Management Strategy under the terms of the soon to be enacted Biosecurity Bill, keep clear concise records as to stock movements, identification of those animals moved and tested for disease, and tallies of stock at all times. Thus the herd of origin Tb status and the area Tb status can be easily checked in the event of a breakdown and unravelling the mystery of where an infection originated from is made easier.

The other interesting point that this case highlights is ,what appears to be, a transfer and circulation of infection primarily in a specific group of animals at least within a 7-8 month period. Irish workers found that kept under good husbandry conditions tuberculous cattle do not infect other cattle when being run together for up to 9 months (O'Reilly and Costello, 1988). The fact that deer seem to be more "susceptible" is perhaps now a well recognised phenomenon in New Zealand. However most outbreaks of Tb in deer herds are still related to the single tuberculous cull or reactor which may have had the disease for some time and the infected animal fails to spread Tb to its cohorts. On occasions we still see explosive outbreaks of the disease in deer herds. In such cases there appears to be a multitude of factors involved; overtaxing of the immune system in some way, such as poor nutrition , plus the existence of at least one highly infected and therefore potentially infective animal as well as management conditions that allow for the spread to occur. (De Lisle pers. comm., Griffin et al 1991). In this case frequent yarding, drenching and perhaps even dusty yards appeared to have facilitated the spread.

Overall we can only hope that all parties involved in this outbreak have learned from the experience.

REFERENCES

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O' Reilly, L M; Costello,E. (1988) Bovine tuberculosis with special reference to the epidemiological significance of pulmonary lesions. Irish Veterinary News 10: 10, 11-21; 33 ref.