Descriptive epidemiology of cattle movements in two departments of Buenos Aires province, Argentina

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Outline

- Introduction
- Materials and methods
- Results
- Discussion
- Conclusion

Introduction

- Movement from one location to another involves an interaction of all three vertices of the epidemiologic triad whereby individuals are moved through space, over time

- Where individuals are in a contagious state at the time of movement, direct and indirect contact increases the risk of introducing disease into populations that were previously free of disease

Introduction

- In the outbreak of FMD disease that occurred in Great Britain in 2001, spread of disease during the early days of the epidemic was influenced by contact patterns, largely related to animal movement (Kao 2002; Mansley et al., 2003)

- Similar findings noted in relation to other diseases and outbreaks:
  - bovine tuberculosis (Barlow et al., 1998)
  - bovine brucellosis (Sheahan et al., 2002)
  - contagious bovine pleuropneumonia (Kusiluka and Sudi, 2003)
  - 2000 – 2002 outbreak of FMD in Argentina (Perez et al., 2004)

Introduction

- A descriptive epidemiological analysis of data retrieved from the Argentinian animal movement database for two departments in the province of Buenos Aires during 2004

- Aim: to describe, compare and contrast cattle movement patterns in two agriculturally diverse areas of the province

Introduction

- Why is this important?
  - given the importance of beef exports to the Argentinian economy and the likelihood of re-introduction of FMD virus, a knowledge of the farms (or at the very least, areas of the country) which have recently supplied animals to infected premises expedites backward tracing activities in the event of an exotic disease emergency
  - knowing more precisely where to look for disease allows investigative resources to be focused in the early days of an exotic disease emergency, facilitating prompt control and eradication

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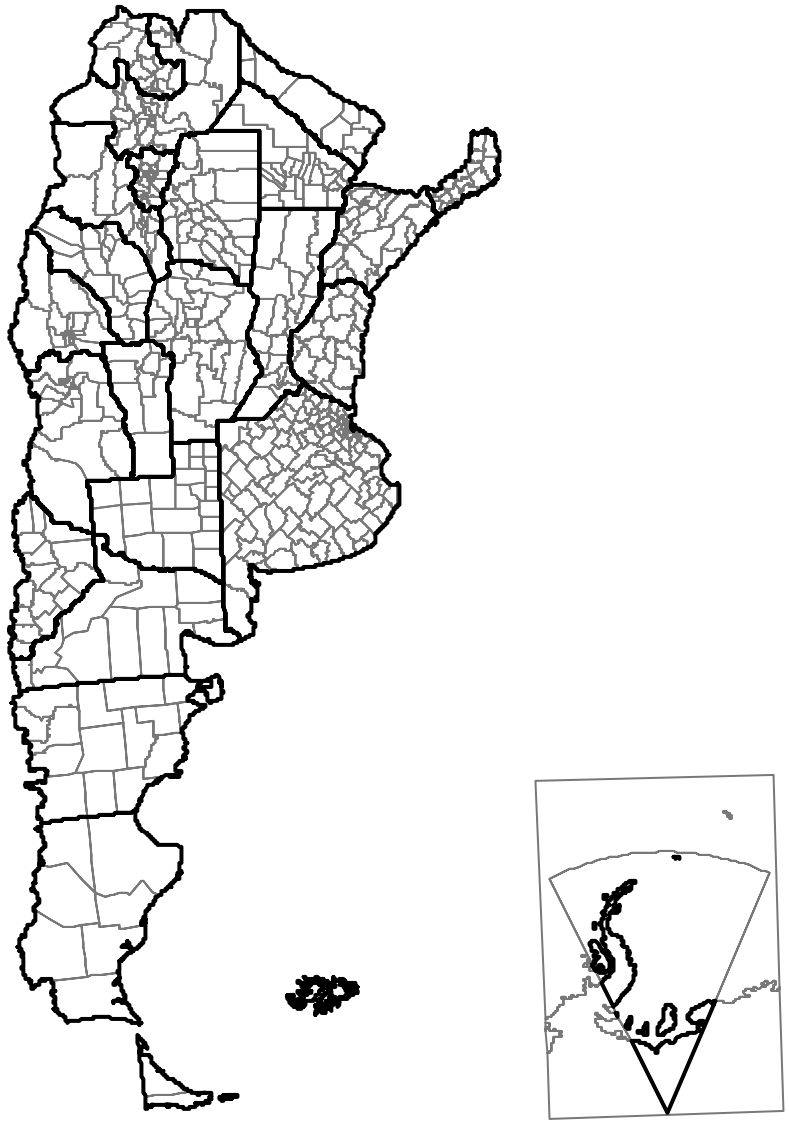
Materials and methods

- In order to transport live animals for any reason Argentinian livestock producers must first declare to local sanitary authorities details of the intended movement

- Movement details include
  - RENSPA of the premises initiating the movement
  - date on which the movement will occur
  - species of animals involved
  - number of animals per age category
  - movement reason
  - RENSPA of the destination premises

Materials and methods

- Study population: cattle enterprises in the departments of Monte and Tres Lomas in the province of Buenos Aires
- Time frame: 1 January 2004 to 31 December 2004
- Finishing-related movements described, since these events represent the most direct means of farm-to-farm transfer of infection



Materials and methods

- Variables investigated
  - frequency of movement events
  - destination of off-farm movement events (where they went)
  - source of on-farm movement events (where they were from)

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Materials and methods

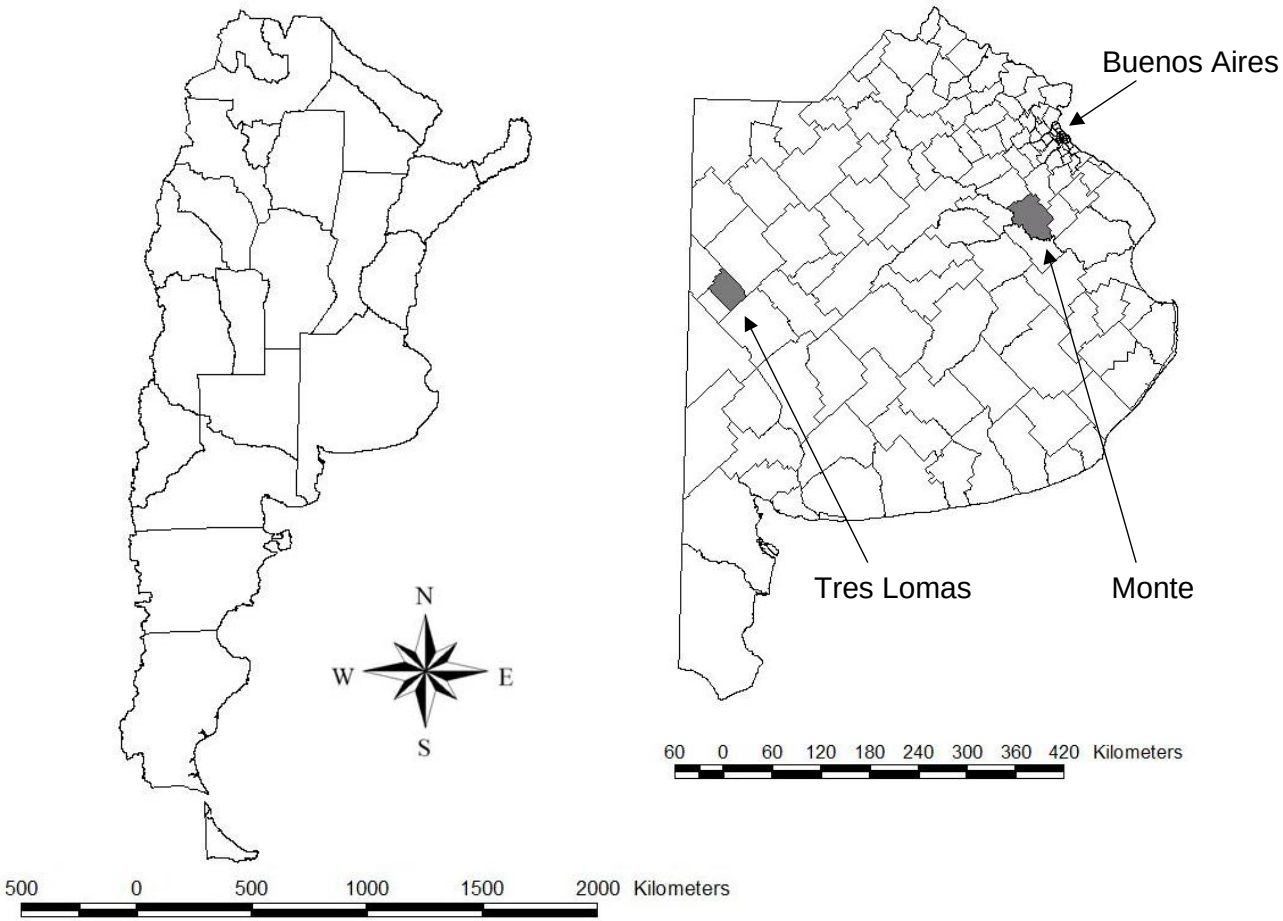
Variable	Argentina	New Zealand	Australia
Population ($\times 10^6$)	39	4	20
GDP per capita (USD) [a]	$12,400	$23,200	$30,700
Land area ($\times 10^6$ sq km)	2.7	0.27	7.7
Cattle ($\times 10^6$) [a]	36	9	24
Cattle per sq km [a b]	20	27	5
Cattle exports (USD/person) [a]		5.90	3.90

[a] 2002

[b] Agricultural land

Source: http://www.fao.org/ag/aga/glipha/index.jsp

Map showing the boundaries of the provinces of Argentina. Insert: map of departments in Buenos Aires province, showing the location of Monte and Tres Lomas.



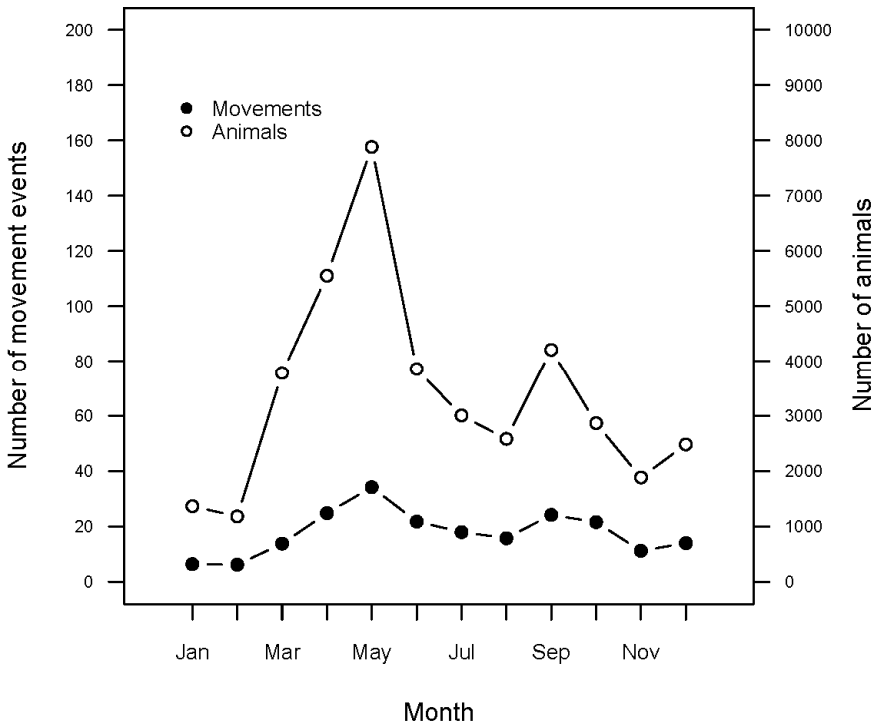
Results

Department	Area [a]	Head	Number of premises (%)				
			Dairy	Breeding	Finishing	Mixed	Total
Monte	189	143,000	50 (9%)	415 (75%)	61 (11%)	27 (5%)	553 (100%)
Tres Lomas	125	91,000	24 (6%)	0 (0%)	155 (39%)	219 (55%)	398 (100%)

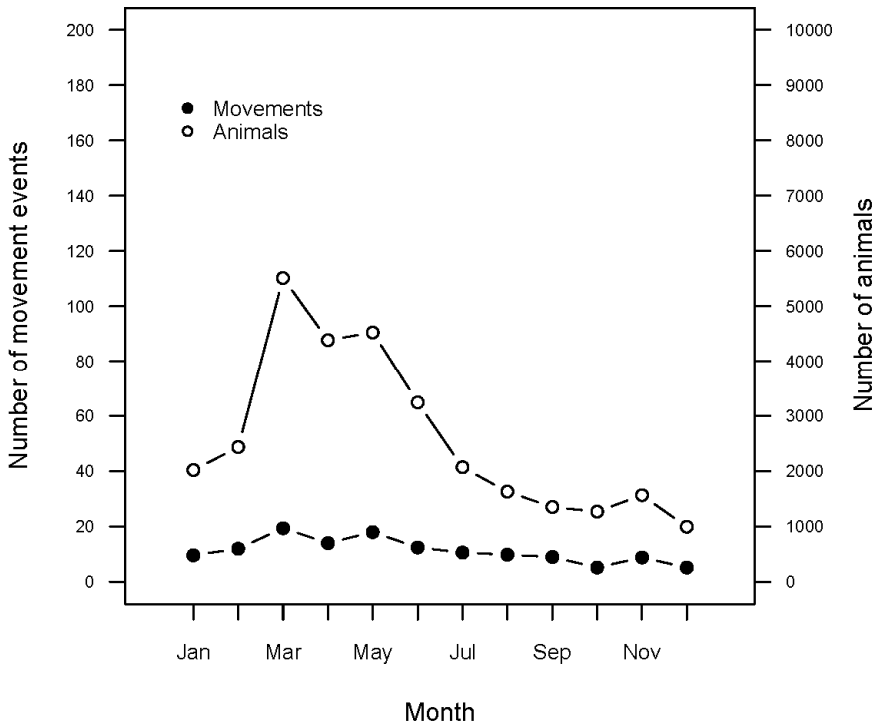
[a] Hectares (× 1000).

[b] Beef enterprises involved in breeding and finishing activities.

Cattle movements in Buenos Aires province, Argentina in 2004. Total number of on-farm movement events and total number of stock moved onto farms for finishing, Monte and Tres Lomas.

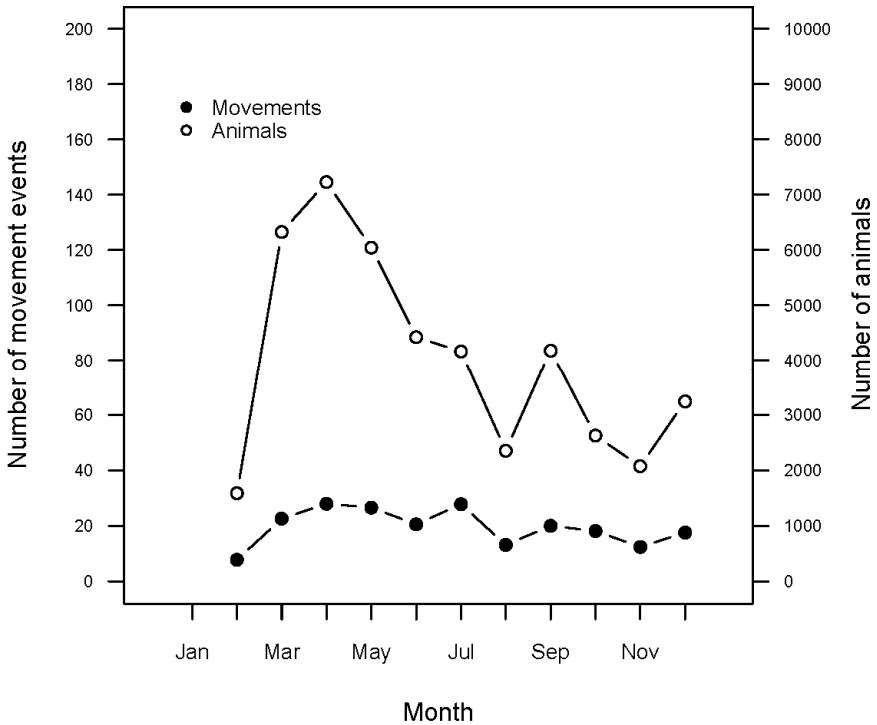


On farm movements: Monte

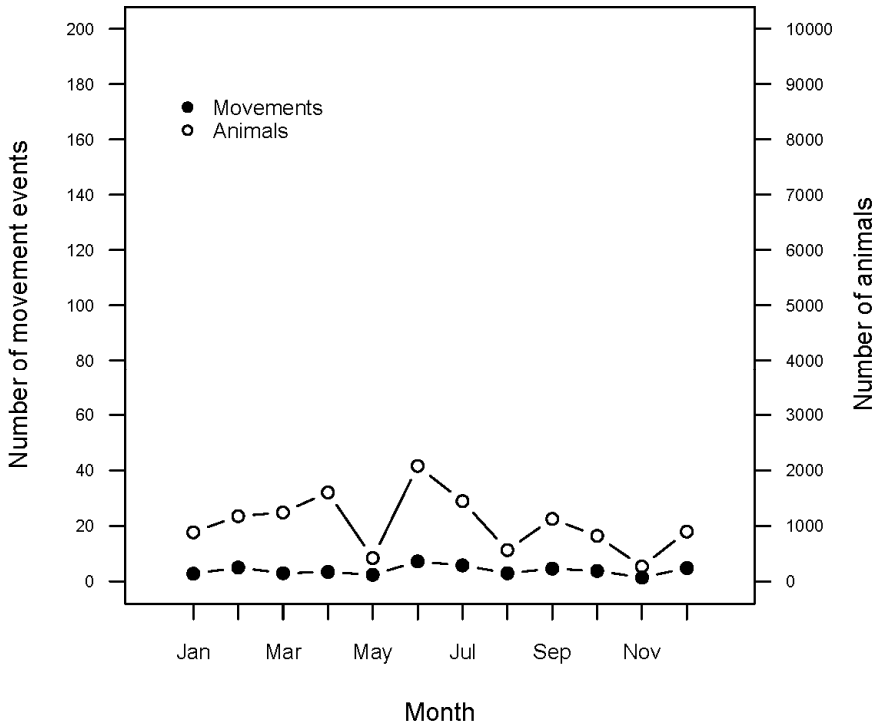


On farm movements: Tres Lomas

Cattle movements in Buenos Aires province, Argentina in 2004. Total number of off-farm movement events and total number of stock moved off farms for finishing, Monte and Tres Lomas.

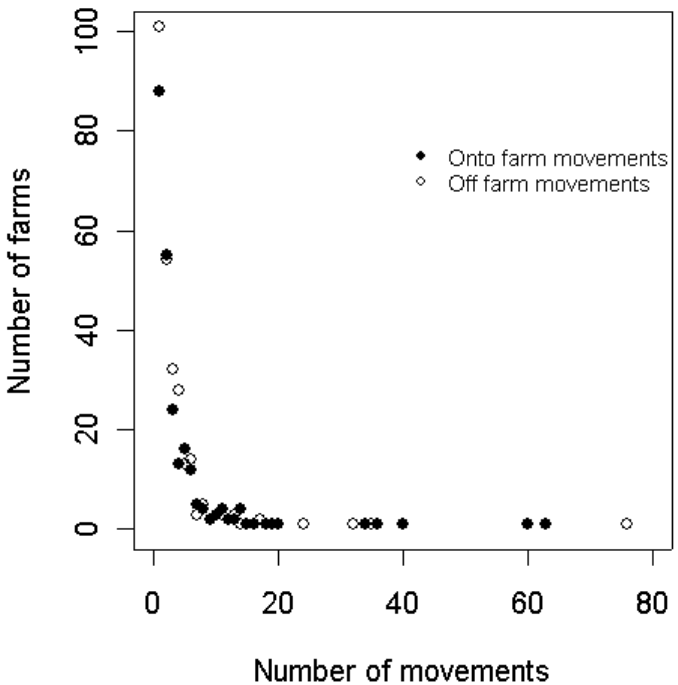


Off farm movements: Monte

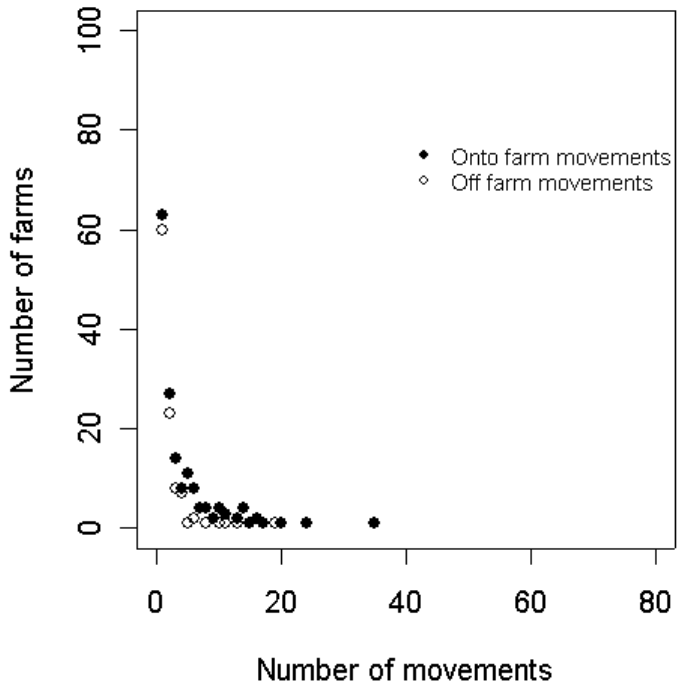


Off farm movements: Tres Lomas

Cattle movements in Buenos Aires province, Argentina in 2004. Scatterplot showing the distribution of the number of onto and off farm finishing-related movement events per farm, Monte and Tres Lomas.

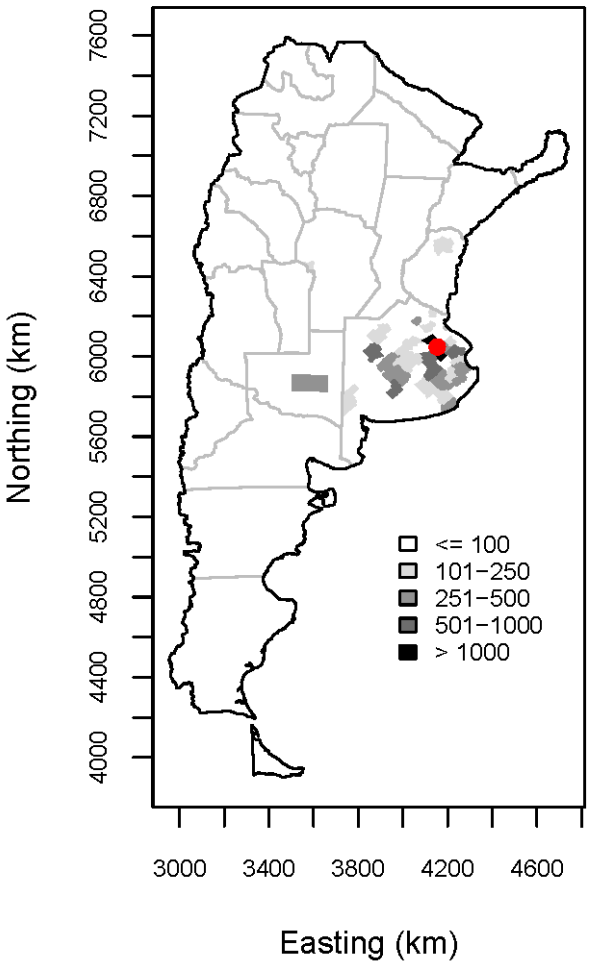


Movements per farm: Monte

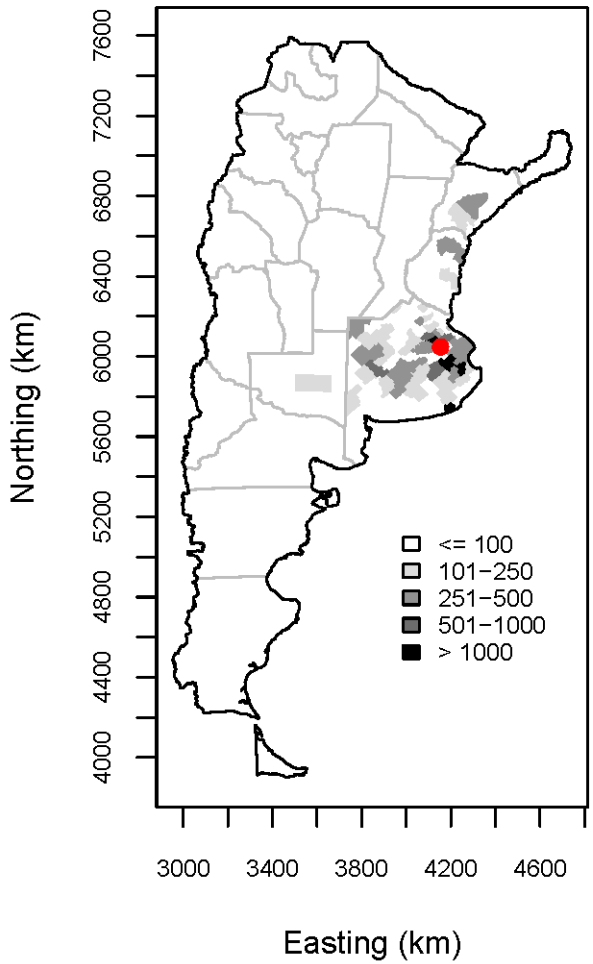


Movements per farm: Tres Lomas

Cattle movements in Buenos Aires province, Argentina in 2004. Choropleth map of Argentina showing the departments of origin of cattle moved **onto Monte** farms during 2004 for the purpose of finishing.



Jan - Apr



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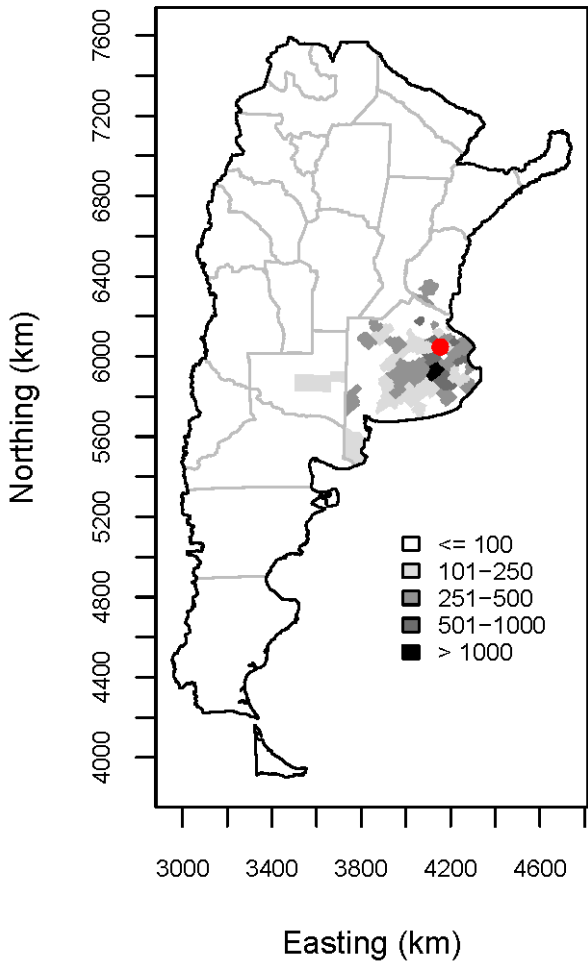
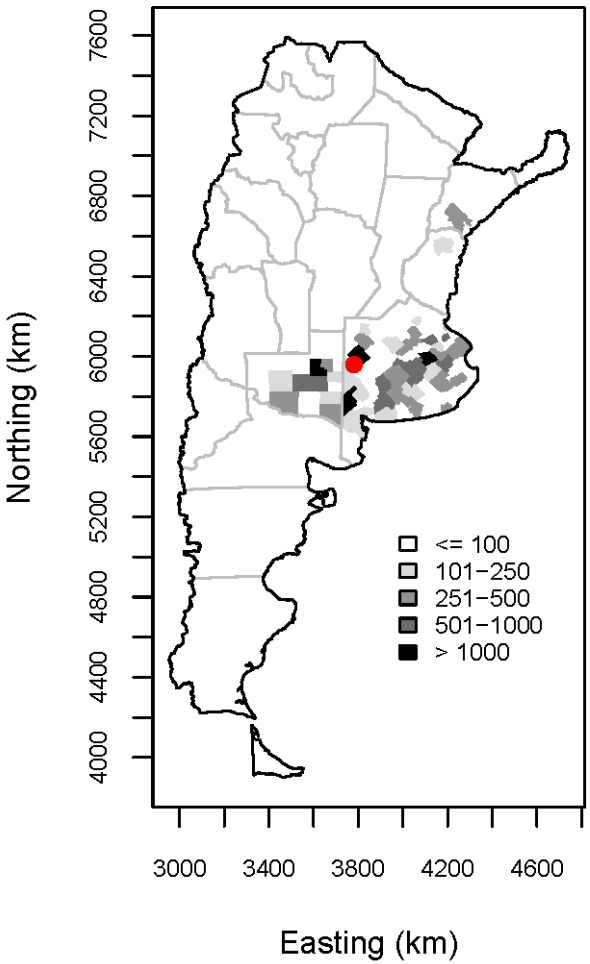


Sep - Dec

Source of onto farm movements mostly within Buenos Aires

Cattle movements in Buenos Aires province, Argentina in 2004. Choropleth map of Argentina showing the departments of origin of cattle that moved **onto Tres Lomas** farms during 2004 for the purpose of finishing.



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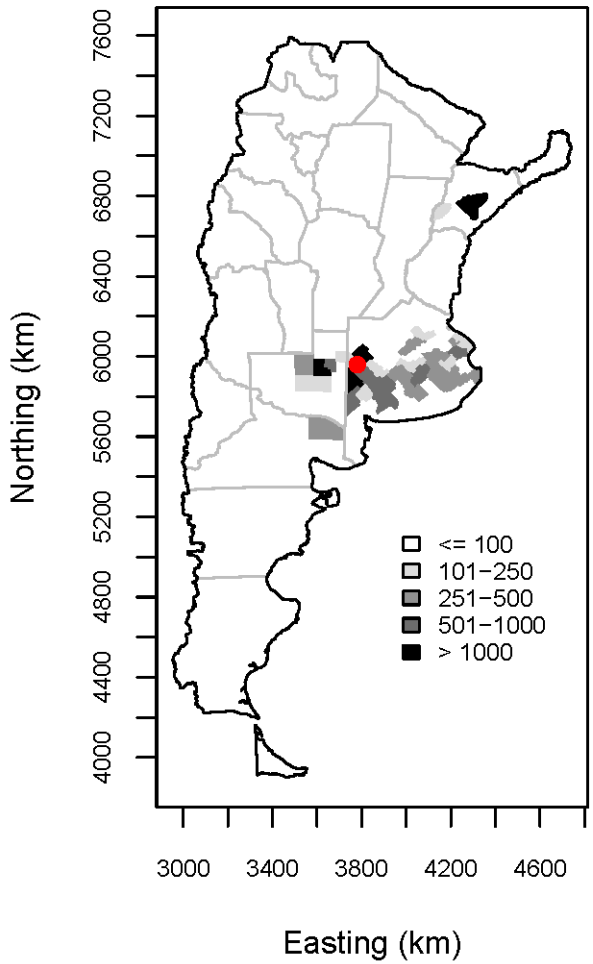

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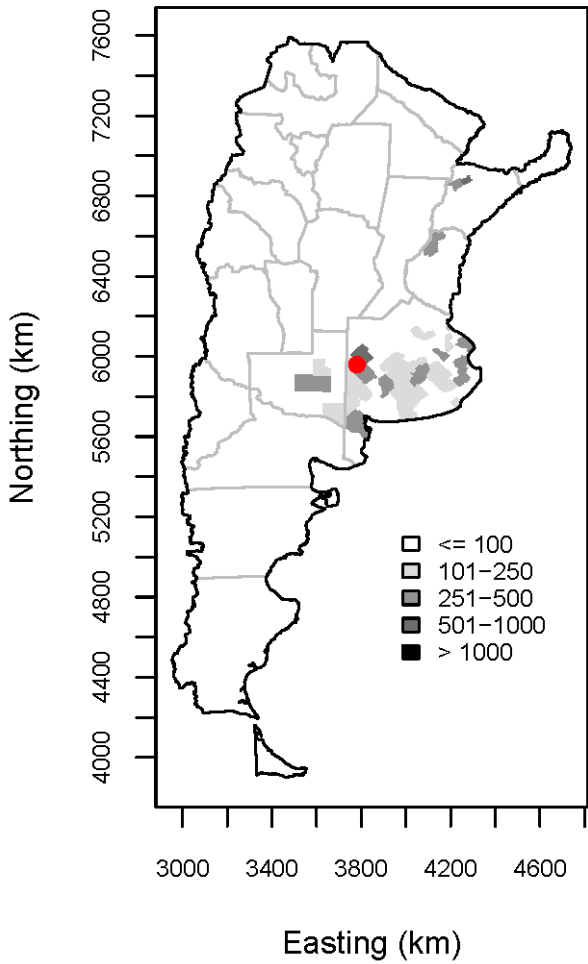
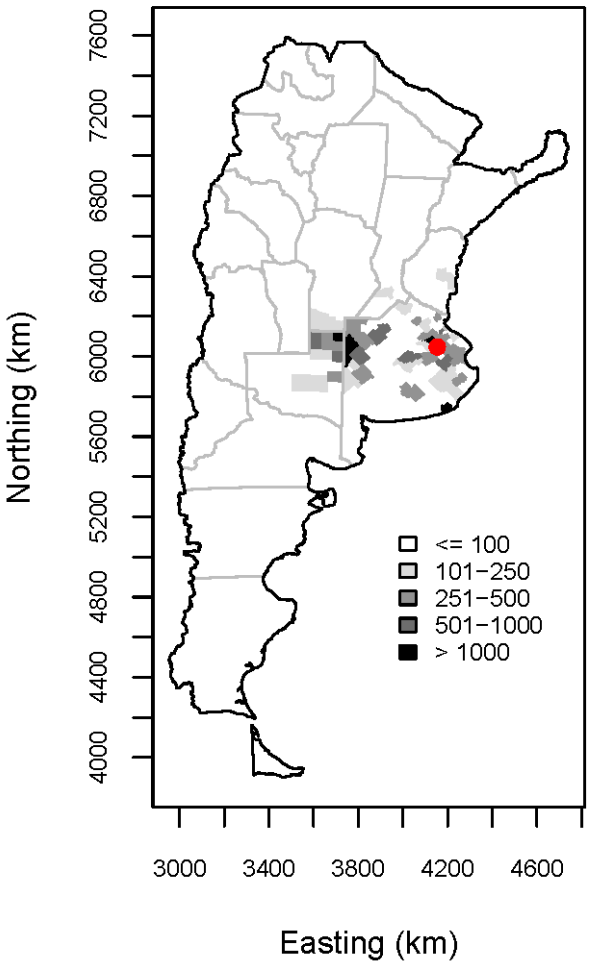


Sep - Dec

Source of onto farm movements more widely dispersed

Cattle movements in Buenos Aires province, Argentina in 2004. Choropleth map of Argentina showing the departments of destination of cattle that moved **off Monte** farms during 2004 for the purpose of finishing.



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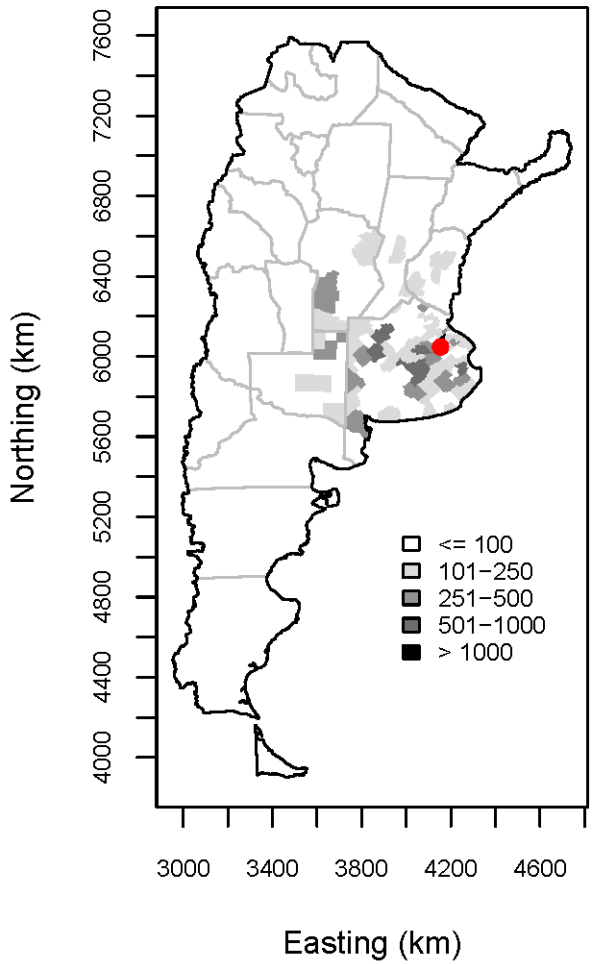

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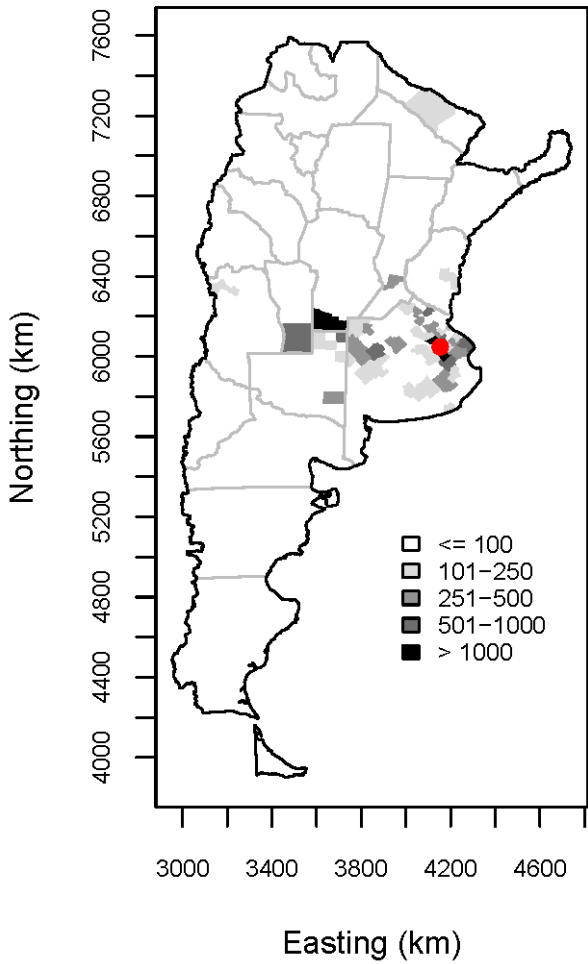
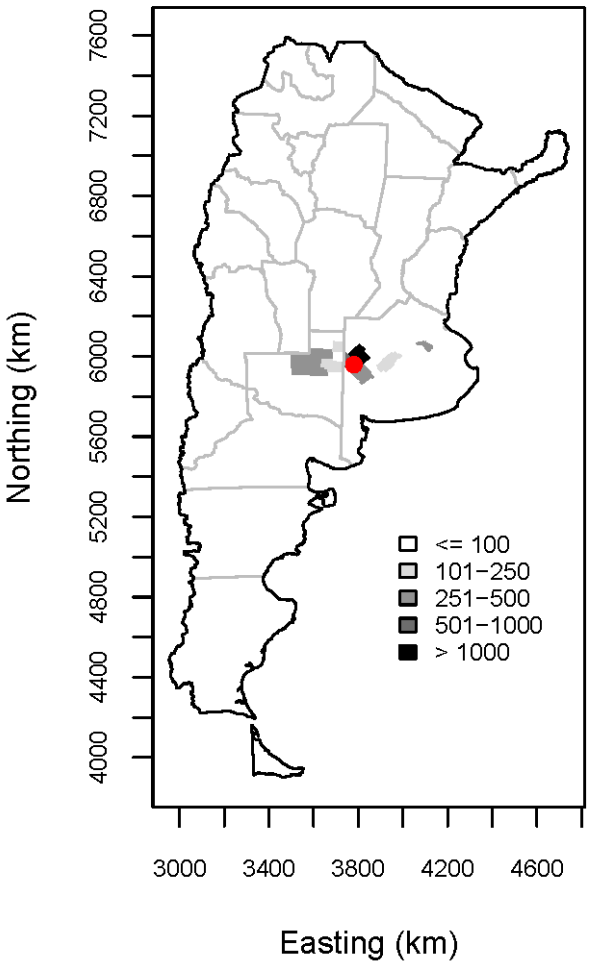


Sep - Dec

Cattle movements in Buenos Aires province, Argentina in 2004. Choropleth map of Argentina showing the departments of destination of cattle that moved **off Tres Lomas** farms during 2004 for the purpose of finishing.



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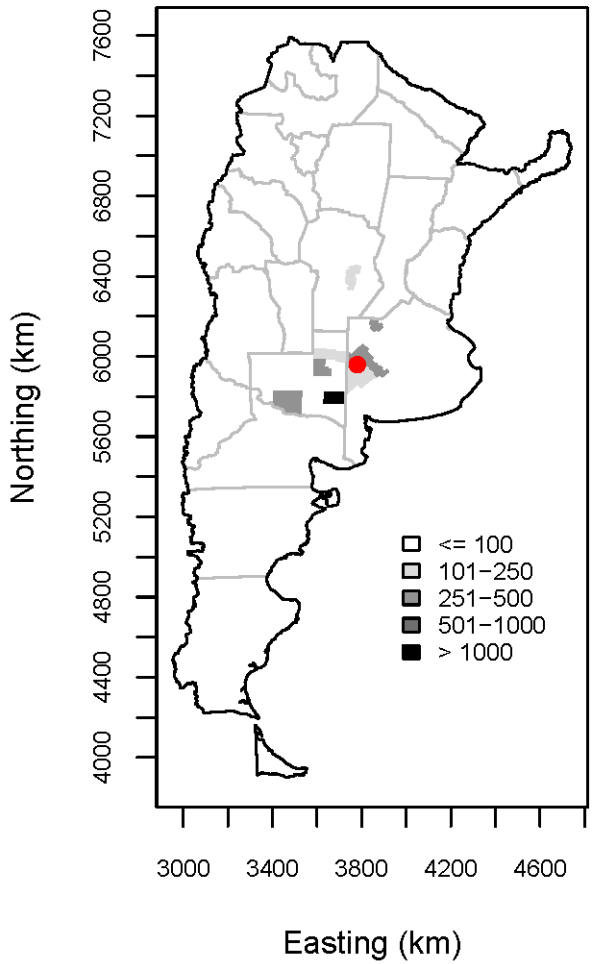

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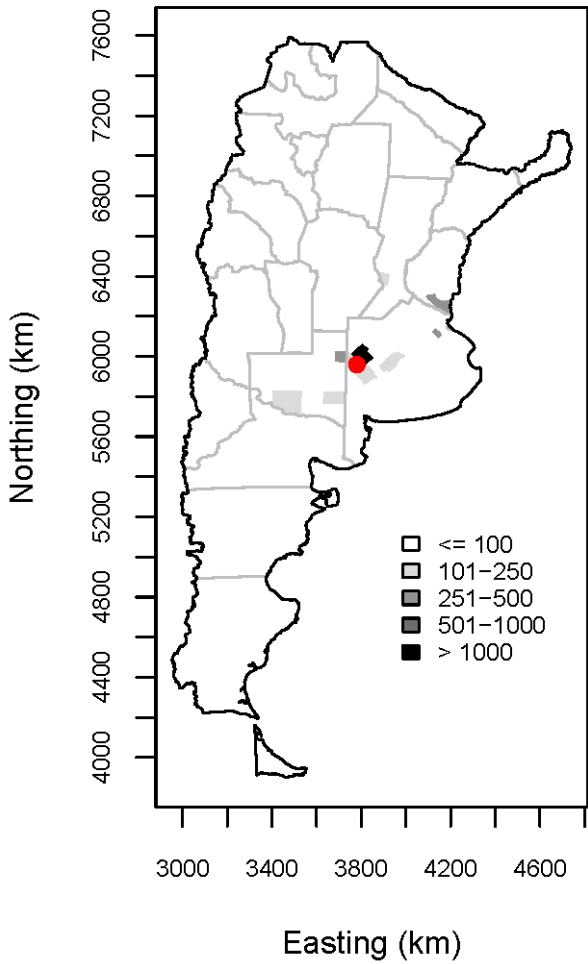

Sep - Dec

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Discussion

- Information bias
  - purposive selection of departments
  - farm managers moving animals without permit
  - farm managers failing to make a movement following a permit being issued
  - different number of animals moved *cf* those stated on permit
- Analytical bias
  - restricted to single movement events, ignoring the fact that cattle may be moved on more than one occasion during their lifetime

Discussion

- Acknowledging these limitations, these analyses
  - indicate the times of the year when cattle movement events are concentrated
  - identify cattle source and destination areas

- A working knowledge of these details is important
  - allows tracing activities to be conducted with greater efficiency and precision
  - allows tracing activities to be focused on farm premises that are known to make relatively frequent movement events, given the greater risk of disease transfer associated with this managerial characteristic

Discussion

- Seasonal patterns
  - greatest number of onto and off farm movement events for finishing occurred from April to June consistent with young stock being moved onto finishing farms following weaning
  - in Monte there was a 1.8-fold increase in the number of onto and off farm finishing-related movement events in the period from April to September, compared with the remainder of the year
  - similar trend noted for Tres Lomas, where numbers of movement events increased by a factor of 1.2

Discussion

- Onto farm movements
  - Monte: the majority of onto farm movements where from departments located within the province of Buenos Aires
  - Tres Lomas: onto farm movements were from departments that were more widely dispersed

Discussion

- Exotic disease incursions into Argentina are likely to enter from the north (Mattion et al., 2004)
  - 22 of 670 (3%) of onto farm movements in Tres Lomas were from farms located in northern border provinces
  - 5 of 1060 (0.5%) of onto farm movements in Monte were from farms located in northern border provinces
- For 2004 at least, in the event of an exotic disease incursion in the north, the risk of a movement related contact occurring in Tres Lomas was greater than it was in Monte

Discussion

- Off farm movements
  - Monte: off farm movements where to departments located within the province of Buenos Aires, with smaller numbers to departments in neighbouring provinces
  - Tres Lomas: off farm movements were relatively infrequent and were to nearby departments

Discussion

- Hypothesis
  - departments with a mixture of breeding and finishing enterprises (such as Monte) simultaneously receive and distribute cattle, and as a result, behave as potential recipients and distributors of infectious disease
  - departments comprised of finishing enterprises (such as Tres Lomas) are predominantly recipients of cattle, behaving primarily as recipients of infectious disease, rather than distributors

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Conclusion

- The frequency of cattle movement varies throughout the year, with the greatest number of movement events (and therefore potential risk of spread of infectious disease) occurring from April to September

Conclusion

- We hypothesise that the nature of cattle movement patterns is dependent on the relative mix of cattle enterprise types in each department

Conclusion

- Further analyses of the Argentinian animal movement database, particularly the application of social network analyses, will allow patterns of secondary and higher order contacts to be described in greater detail – providing further insight into animal movement patterns in this population

Conclusion

- What is the relevance of this to us?
  - the importance of a knowledge of animal movement patterns is just as relevant to Australia and New Zealand as it is to Argentina
  - Argentina has developed a simple and robust system for monitoring animal movement patterns, capable of providing information of direct relevance to disease control
  - how do we compare?

Acknowledgements

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