A review of animal health research opportunities in Nusa Tenggara Timur and Nusa Tenggara Barat provinces, eastern Indonesia

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This review was commissioned by ACIAR to obtain further information on the subject area. The conclusions of this report are not necessarily endorsed by ACIAR.

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Cover: Young Bali cattle being sold at the weekly cattle market in Masbajik, Central Lombok (Nusa Tenggara Barat). Photo: Neil MacLeod

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Abbreviations and glossary

ACIAR	Australian Centre for International Agricultural Research
AI	avian influenza
AQIS	Australian Quarantine and Inspection Service
BPLM	Bantuan Pinjaman Langsung Masyarakat (Direct Financial Community Aid)
BPTP	Balai Penerlitian Ternak Produksi (Livestock Production Research Facility)
BVD	bovine viral diarrhoea
BVDV	bovine viral diarrhoea virus
CHAPS	Cattle Health and Productivity Survey
CSF	classical swine fever
DGLS	Director-General of Livestock Services (Directorate General Peternakan)
CV	a term similar to Pty Ltd, denoting a particular type of company
Dinas Peternakan	Department of Livestock Services
DOC	day-old chicks
EIVSP I	Eastern Islands Veterinary Services Project Phase I
EIVSP II	Eastern Islands Veterinary Services Project Phase II
HS	haemorrhagic septicaemia
IBR	infectious bovine rhinotracheitis
JE	Japanese encephalitis
kabupaten	district/regency
kecamatan	sub-district
NAQS	Northern Australia Quarantine Strategy
NGO	non-governmental organisation
NSW	New South Wales
NTASP	Nusa Tenggara Agricultural Support Projects
NTB	Nusa Tenggara Barat
NTT	Nusa Tenggara Timur
NTTIADP	Nusa Tenggara Timur Integrated Area Development Project
Otonomi	Indonesian Government policy of decentralising administrative functions to the provinces and kabupaten
Pendapatan Asli Daerah	a tax imposed by a kabupaten
PCR	polymerase chain reaction
propinsi	province
Rp	rupiah (monetary unit of Indonesia)
TTS	Timor Tengah Seletan/South Central Timor
TTU	Timor Tengah Utara/North Central Timor
UNUD	Udayana University, Denpasar, Bali

Executive summary

Nusa Tenggara Timur (NTT) and Nusa Tenggara Barat (NTB) provinces are considered by the central government to be major sources of slaughter animals for the rest of Indonesia

In NTT, the reduction in available land for livestock raising, coupled with the need for increased food production because of the rising population, continues to put pressure on most livestock populations. Unless efforts are made to intensify livestock production, the province will soon not be able to meet its own requirements let alone provide livestock for for other provinces.

In NTT, markets exist and can be expanded for all major livestock types and their products. In particular, there are ready markets for goats, pigs, cattle and chickens, and their products, and a potential market for deer and deer products.

In NTB, livestock populations are either relatively stable or increasing. The government believes a tripling of current livestock numbers is possible.

There are existing markets for goats, cattle, chickens and eggs in NTB, and opportunities for expansion and improvement in some areas associated with the production of these livestock. Markets for pig products are limited, and further expansion in production of pigs is unlikely to be supported by the government.

Research is required in both the production and health areas if livestock-raising systems are to be enhanced or, in some cases, expanded. There is also a need to investigate why, in areas such as Kabupaten Sikka, NTT, increases in production made over preceding decades are now in decline.

Generally, there is a need to look at opportunities for intensification of systems. In both NTT and NTB, the area of land available for traditional, subsistence livestock production is declining. Where crop residues are available, their use needs to be further investigated. Unfortunately, particularly in NTT, there are only limited opportunities to source useful amounts of crop residues.

Disease control and prevention issues highlighted in this study included:

- reproductive diseases—brucellosis, *Neospora* sp., bovine viral diarrhoea, infectious bovine rhinotracheitis, leptospirosis, trichomoniasis and campylobacteriosis in cattle
- parasites—sarcoptic mange in goats, and *Fasciola gigantica, Thelazia rhodesii* and *Toxocara vitulorum* in cattle
- excessive mortality rates—anthrax in goats, anthrax and haemorrhagic septicaemia in cattle, classical swine fever in pigs, avian influenza, Newcastle disease and infectious bursal disease in poultry, and surra in horses.

Because of the preference for local slaughter and the use of ‘wet markets’ in Indonesia, most livestock are transported live within and from NTT and NTB. Opportunities exist to improve transport systems so as to reduce in-transit body-weight losses and promote better animal welfare.

Abattoirs generally do not have the capacity or infrastructure to allow the export of fresh meat, although there are sufficient flights to and from the major capitals in both provinces to move produce by air to Jakarta and Surabaya.

By far the major limitation observed in the animal health system across the Indonesian archipelago has come through recent changes to government processes, known as ‘Otonomi’. This entails the devolution of administration, responsibility and the associated budget away from the central Jakarta-based government, to the provinces and kabupaten. As a result, a complex administrative structure and power base has become even more difficult to navigate, particularly for issues such as disease control.

Because diseases are not stopped by borders, mounting a disease-control program in the new environment provides many more challenges. It is now necessary, more than ever before, to ensure all levels of government, particularly at provincial and kabupaten levels, are fully aware and supportive of a program, otherwise it will not succeed.

The new structure within Indonesia has removed from the central government much of the authority for undertaking disease-control activities. The system is analogous to the federal system of government in Australia, in which the states have the major operational role, in particular the system operating in New South Wales (NSW), where rural lands protection boards provide animal health services on behalf of and in cooperation with the state department of primary industries. Australia, and NSW in particular, is thus in a good position to assist all levels of government in Indonesia to adapt to the new government and power-sharing arrangements.

Zoonoses and food-safety issues covered include rabies, anthrax, bovine brucellosis, taeniasis, *Salmonella enteriditis*, Japanese encephalitis and chemical residues.

Major environmental constraints in this area of Indonesia relate principally to climate and soil types. While the eastern islands are located within the tropics, climate varies from lowland, low-rainfall coastal regions to high-altitude, high-rainfall areas. Soil types also vary widely, from those that are extremely fertile and based on volcanic activity to infertile, marine-derived soils. In general, these conditions result in short periods of abundance, i.e. the wet season, followed by long periods in which forage and feed-stuffs are in short supply verging on famine (dry season). Any research aimed at improving access to cheap, reliable, livestock feeds should be supported.

Possible collaborators for future research are detailed in the report. The Northern Australia Quarantine Strategy of the Australian Quarantine and Inspection Service (AQIS) is particularly relevant. It currently undertakes limited routine studies in eastern Indonesia. Collaboration with AQIS could result in a number of opportunities to develop ongoing surveillance projects that would benefit both Australia and Indonesia.

Recommendations

- The development of group-based, micro-credit-funded layer and broiler systems should be developed and trialled as a means of intensifying chicken and egg production in eastern Indonesia.
- Village chicken distribution projects developed and implemented during the AusAID-funded Eastern Islands Veterinary Services Project Phase II (EIVSP II), particularly those in Nusa Tenggara Timur, should be assessed and evaluated, in order to better understand disease risks and technology adoption for improving village chicken management in the eastern islands of Indonesia.
- An in-depth study of cattle production in Nusa Tenggara Timur, focusing on reasons for the apparent decline in cattle numbers, should be undertaken as a matter of urgency.
- The recommendations of the Cattle Health and Productivity Survey (CHAPS) of cattle distribution programs across Nusa Tenggara Timur and Nusa Tenggara Barat remain relevant and should be reviewed and implemented where possible.
- The bovine brucellosis control program in West Timor should be urgently reviewed to allow constraints to achieving eradication to be identified and removed. Part of the review should investigate the effect that new government arrangements under Otonomi are having on the ability to undertake disease-control programs in general.
- The raising of livestock in Kabupaten Sikka should be investigated to learn why livestock production, particularly of goats and cattle, is in decline.
- Dr Yacob Nulik's (BPTP Naibonet) proposal to use plantation-estate by-products such as cocoa pods and cashew nuts as sources of feed for goat intensification programs could provide an opportunity for a number of pilot programs.
- The control of internal parasites in goats reared under intensive conditions (possibly including comparative trials of traditional medicines) could be undertaken in both Nusa Tenggara Timur and Nusa Tenggara Barat as part of a larger project trialling intensification of goat production using plantation-estate by-products.
- A project to examine diseases potentially affecting the reproductive performance of cattle in West Timor should be developed and supported. The project should include a review of the existing bovine brucellosis control program, identifying successes and constraints, and make recommendations on how to continue to control and eventually eradicate brucellosis from the province. The project should consider carrying out a serological prevalence survey across West Timor to determine existing brucellosis prevalence for comparison with the survey undertaken from May 1996 to November 1997. The serological survey could also be used to test for the prevalence of

Neospora, bovine viral diarrhoea virus, infectious bovine rhinotracheitis and leptospirosis. Additional areas of investigation could include assessment of the efficacy of new brucellosis vaccines in *Bos sondaicus* and the training of Indonesian laboratory staff at the Disease Investigation Centre, Denpasar in the use of polymerase chain reaction technology for testing of trichomoniasis and campylobacteriosis.

- The development and piloting of low-cost animal identification systems should be incorporated into an animal production or animal health project in Nusa Tenggara Timur.
- The following research and development recommendations from the Cattle Health and Productivity Survey (CHAPS) carried out in cattle distribution programs across Nusa Tenggara Timur and Nusa Tenggara Barat should be considered for research projects:
  - Further work is needed to define the prevalence of and losses due to *Paramphistomum* spp., *Fasciola gigantica, Toxocara vitulorum* and *Thelazia rhodesii*, and to develop cost-effective control measures for these diseases. This will require well-coordinated national and local approaches.
  - Further research is necessary to clarify the importance of leptospirosis, bovine viral diarrhoea, and infectious bovine rhinotracheitis on cattle production in Nusa Tenggara.
- The impact of *Fasciola gigantica* on Australian cattle imported into Indonesia should be investigated to verify the significance of reports that imported Australian cattle fail to thrive.
- Investigations into the protective immunity developed following vaccination of cattle and buffalo with the Pusvetma-manufactured haemorrhagic septicaemia vaccine should be undertaken to determine the most appropriate vaccination regime.
- ACIAR's present project in Alor, investigating vaccination and control programs for classical swine fever, should be strongly supported. It has the capacity to benefit many individuals on Alor, through the control of the disease, as well as offering methods that can be used in other parts of Indonesia for the same purpose.
- Consideration should be given to identifying a young Indonesian veterinarian from Nusa Tenggara Timur to undertake a Masters degree in association with the current ACIAR project investigating classical swine fever in Alor.
- Claims of diagnosis of haemorrhagic septicaemia/ septicaemia epizootica in pigs in Nusa Tenggara Timur should be investigated and the cause of claimed haemorrhagic septicaemia mortalities ascertained.
- The methods used in Nusa Tenggara Timur to limit the introduction of avian influenza should be assessed for use in other parts of eastern Indonesia.
- Impediments to improving poultry health, including attitudes to the use of Newcastle disease virus vaccine, should be examined through a review of the EIVSP II poultry distribution programs.
- An alternative to Naganol needs to be developed for treatment of horses with surra.
- A project that will provide opportunities for Indonesian government officials from national, provincial and kabupaten levels to study the Australian animal health system should be considered. The project should allow Indonesian government staff to see how a system composed of independent authorities can work collectively to control or eradicate diseases of importance. This could be built into a project to control trans-boundary diseases such as rabies and bovine brucellosis.
- ACIAR should consider assisting Indonesia to re-examine its Animal Health Information System, with the aim of helping it to re-establish the system under the policy of Otonomi.
- A project to assist with the control and eradication of rabies in Nusa Tenggara Timur should be considered despite rabies not being a disease of production animals. As a disease that needs to be controlled across a number of different kabupaten and across the Dinas Peternakan (Department of Livestock Services) and Dinas Kesehatan (Department of Health) it provides an ideal opportunity to build and strengthen relationships and administrative structures that have been affected by Otonomi.
- Further research should be undertaken to identify and rectify the cause of the anaphylactic reactions occurring with the Pusvetma anthrax vaccine or to identify alternative vaccines for use in goats.
- Development of serological tests for assessing animal immunity following anthrax vaccination may allow assessment of vaccination status and better definition of risk areas for the purposes of more-targeted vaccination programs.

- The development of a rapid crush-side anthrax test should be pursued in Australia.
- The development of an anthrax test for soil should be supported.
- An investigation into the prevalence and impacts of hydatids in animals and people in Nusa Tenggara Timur and Nusa Tenggara Barat should be considered, with a view to developing control and advisory programs for this parasite.
- A project that transfers technology for the identification and control of *Salmonella enteriditis* in Bali should be considered as it would benefit Balinese and visitors to Bali.
- The ongoing development of Indonesia's capability and capacity to test for and monitor pesticide residues in vegetable and meat products should be investigated.
- The Australian Quarantine and Inspection Service should be approached with a view to designing an improved Northern Australia Quarantine Strategy surveillance program for eastern Indonesia.

Introduction and terms of reference

As part of the ongoing commitment of the Australian Centre for International Agricultural Research (ACIAR) to animal health research in Indonesia, I was asked to undertake a scoping mission to the eastern islands of Indonesia to identify possible research projects. I have had a long association with Indonesia and the Indonesian animal health system. From 1989 to 1992, I held the position of animal health adviser with the Eastern Island Veterinary Services Project Phase I (EIVSP I) and, from 1995 to 1998, I was team leader and animal production adviser with the Eastern Islands Veterinary Services Project Phase II (EIVSP II). I have also undertaken a number of other short-term consultancies in Indonesia. I am currently employed as New South Wales (NSW) Chief Veterinary Officer and Director of Animal and Plant Biosecurity with the NSW Department of Primary Industries. My itinerary during the review is given at Attachment 3.

This report addresses the following terms of reference provided for the mission by ACIAR.

The purpose of the consultancy is to identify research opportunities in animal health (production) in Indonesia consistent with the mandate of ACIAR to alleviate poverty with a focus on village smallholders. Notwithstanding, research that will overcome constraints in a production system that is driven by a commercial imperative and that will have benefits to smallholders will often have sustainable adoption. Additionally, the wider biosecurity environment should be considered, particularly problems in control of infectious disease at a national, provincial or regional level that may be overcome in part by research sponsored by ACIAR.

The consultant will identify:

1. opportunities to improve livestock production, with an emphasis on small ruminants, pigs and poultry—the systems identified should be demand driven (markets already present and growing, or have products with the potential to be marketed in some way); a program to develop cattle production is in place, but health constraints in particular should be noted if they are considered significant
2. research that will support viable production systems, such as enhancement of the supply chain beyond the farm gate, approaches to control and prevention of diseases, and availability of resources to grow the industry (inputs)
3. more general environmental, social and regulatory constraints to the development of the industries/products identified under 1. above, and the research needs to overcome those constraints
4. issues for research (policy, regulatory, technical solutions and understanding, delivery of control) in the wider environment of infectious animal disease in Indonesia that are important for Indonesia and the region
5. likely research partners in Indonesia and Australia to further develop ideas for research.

Addressing term of reference 1

Identify opportunities to improve livestock production, with an emphasis on small ruminants, pigs and poultry. The systems identified should be demand driven (markets already present and growing, or have products with the potential to be marketed in some way). A program to develop cattle production is in place, but health constraints in particular should be noted if they are considered significant.

General comment

Nusa Tenggara Timur (NTT) and Nusa Tenggara Barat (NTB) are considered by the central government of Indonesia to be major sources of slaughter animals for the rest of the country.

In NTT, the reduction in land available for livestock raising, coupled with the need for increased food production because of the rising population, continues to put pressure on most livestock populations. Unless efforts are made to intensify livestock production, the province will soon not be able to meet its own requirements let alone provide livestock for export to other provinces. Given this province's closeness to Australia, this should be of significant concern to Australia. Many of the Indonesian fisherman who visit Australia illegally each year originate from this part of Indonesia. They come to Australia because there are insufficient fish in their own waters to sustain the fishing industry. The money they earn allows them to buy the food they need to feed their families. Fish and meat from livestock produced in this province provide the main sources of protein for these people. If there are not enough fish or livestock to feed a growing population it is inevitable that they will look to somewhere that is seen to have a surplus of food. The end result at best is likely to be an increase in the number of illegal fisherman and, at worst, an increase in the number of people attempting to enter Australia illegally in search of food or work.

In NTT, markets exist and can be expanded for all major livestock types and their products. In partic-

Table 1. Average livestock prices (rupiah) in Nusa Tenggara Timur, 2004 and 2005

Animal type	Price 2004	Price 2005
Ongole cattle—male breeder	2,500,000	3,000,000
Ongole cattle—female breeder	2,250,000	2,750,000
Bali cattle—male breeder	2,750,000	3,500,000
Bali cattle—female breeder	2,500,000	3,000,000
Buffalo—male breeder	2,500.000	3,000,000
Buffalo—female breeder	2,250,000	2,750,000
Horse	2,250,000	2,250,000
Goat—male breeder	425,000	475,000
Goat—female breeder	375,000	425,000
Sheep	400,000	425,000
Pig—male breeder	400,000	425,000
Pig—female breeder	350,000	375,000
Day-old chicken—layer	6,500	6,500
Day-old chicken—broiler	4,500	4,250
Village chicken	35,000	37,500
Broiler	15,000	19,000

Source: Statistik Peternakan Tahun 2004 and 2005 (p. 76, Table 32), Dinas Peternakan Propinsi, NTT.

ular, there are ready markets for goats, pigs, cattle and chickens, and their products, and a potential market for deer and deer products.

In NTB, livestock populations are either relatively stable or increasing. The government believes a tripling of current livestock numbers is possible.

There are existing markets for goats, cattle, chickens and eggs in NTB, and opportunities for expansion and improvement in some areas associated with the production of these livestock. Markets for pig products are limited, and further expansion in production of pigs is unlikely to be supported by the government.

Nusa Tenggara Timur

Livestock (Tables 1 and 2) and human population statistics have been sourced from NTT Dinas Peternakan annual livestock reports. While there are always debates about the accuracy of these reports, my experience has been that, at least with cattle numbers, they are as good as comparable statistics in Australia, and suffer from similar problems. For example, they generally tend to understate the numbers of livestock slightly because livestock owners do not want the government to know exactly how many stock they have. As such, they are as good as you can get and they are sufficiently accurate to observe trends, highlight issues and use for planning livestock programs. Recent changes to the kabupaten (district) structure in NTT have resulted in the splitting of some districts. For the purposes of comparing data for areas before the splits, the data from the new kabupaten have been reassembled under the old structure: the old Kabupaten Kupang includes the new Kabupaten Kupang, the City of Kupang and the islands of Rote and Ndao; the old Kabupaten Flores Timur (Flortim) includes the new Kabupaten Flortim and the new Kabupaten Lambata.

Changes in the livestock populations in NTT between 1994 and 2004 (Attachment 1) demonstrate that livestock production systems in this province are in crisis. All major and the majority of the minor livestock species populations have sharply declined over the 10-year period although there are some individual kabupaten where this trend has not occurred in all livestock species. Possible reasons for these declines, their consequences, and opportunities for halting them are discussed for each livestock group later in the report, but of major importance for all livestock groups is the human population pressure occurring across this province.

Figure 1 and Attachment 1 provide details of the human population changes in NTT from 1994 to 2004. The average increase across the province has been in the order of 22%, with six kabupaten

Table 2. Livestock commodity prices in Nusa Tenggara Timur (2004 and 2005) and Nusa Tenggara Barat (2005 and 2006). Prices are rupiah per kilogram, except for milk, where prices are rupiah per litre, and eggs, which are per item.

Commodity	NTT	NTB 2005/2006	
	2004/2005	Lombok	Sumbawa
Beef	28,000/35,000	34,000/39,000	25,000/32,500
Buffalo meat	23,000/35,000	?/21,000	?/33,000
Goat meat	28,000/34,000	27,000/31,000	26,000/33,000
Mutton	20,000/25,000	?/31,000	?/31,000
Pork	20,000/22,500	26,000/28,000	–
Chicken	22,500/25,000	15,000/15,250	14,000/17,000
Milk	2,000/2,000		
Cattle hide—wet	7,000/7,000		
Cattle hide—dry	8,000/8,000	12,500/13,250	10,000/6,250
Buffalo hide—wet	3,000/3,000		
Buffalo hide—dry	7,500/7,500	12,500/13,250	10,000/6,250
Goat hide—wet	6,000/6,000		
Goat hide—dry	12,000/12,000	17,500/12,250	15,000/15,250
Egg—layer	700/1,000	500/525	600/725
Egg—village chicken	1,250/1,500	1,150/900	1,000/1,000
Egg—duck	1,500/1,750	850/725	800/1,025
Egg—quail	300/400		

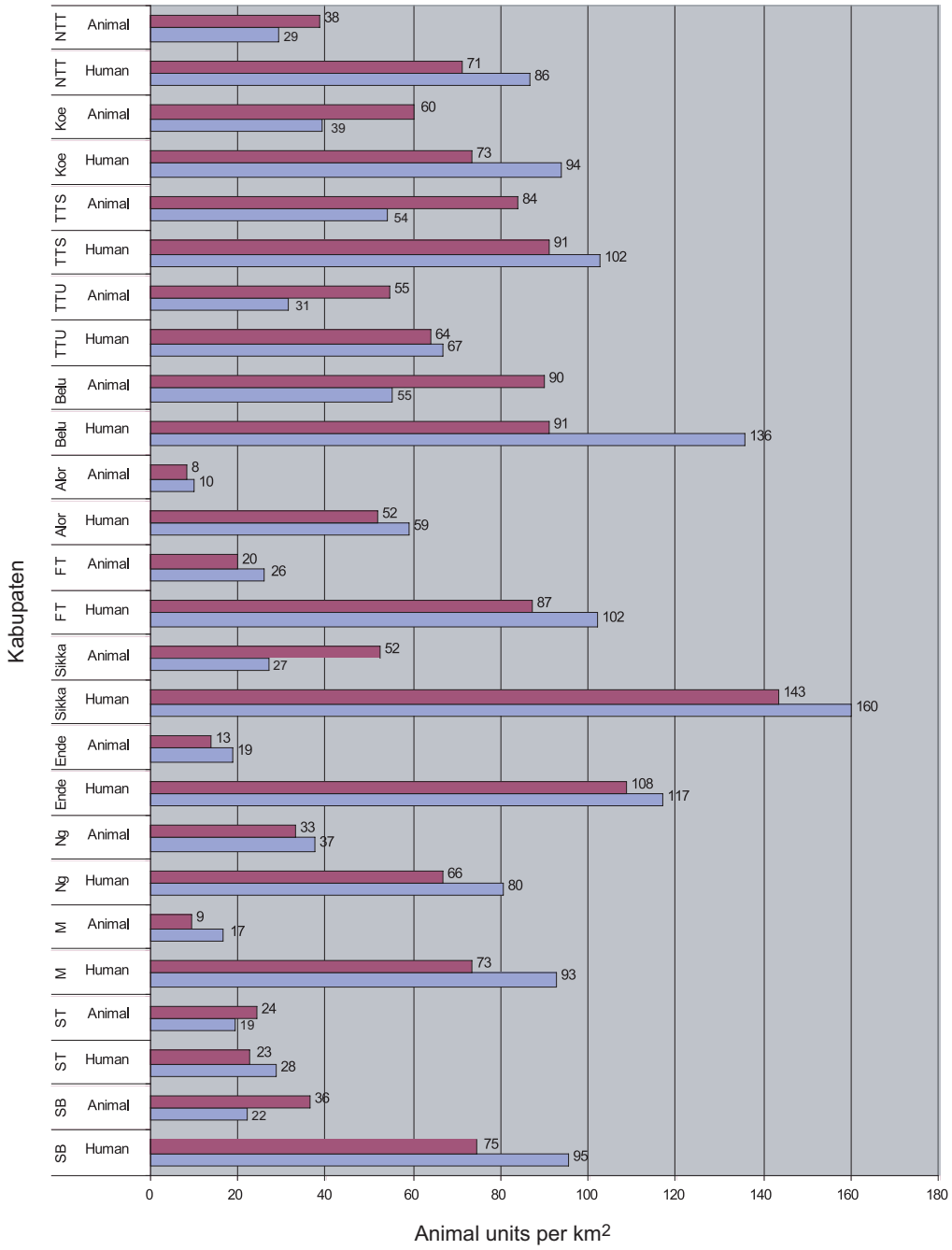

Figure 1. Human and livestock population densities in Nusa Tenggara Timur during 1994 and 2004

increasing by more than 20% (Kabupaten Belu 49%, the Kupang region 28%, Sumba Barat 28%, Manggarai 27%, Sumba Timur 24% and Ngada 21%) and four by more than 10% (Flortim 17%, Alor 14%, TTS 13% and Sikka 12%). These rises in population have resulted in an increase in the population density to more than 50 persons/km^2, a level far above that which can sustain the traditional slash-and-burn agricultural systems (Fox 1997). This increase in population has inevitably led to a reduction in land available for agricultural and, importantly, livestock production purposes, as well as increasing the need for the slaughter of livestock for food. Attachment 1 details the substantial increases that have occurred in the number of animals slaughtered for local consumption.

Nusa Tenggara Barat

The province of NTB consists of two major islands, Lombok and Sumbawa. Lombok is approximately 5,000 km^2 in area and has a population of about 2.5 million people. The area of Sumbawa is approximately 15,000 km^2 and it has about 1 million people. Livestock management in Lombok is generally described as being semi-intensive, i.e. most animals are kept in small groups either tied to trees or kept in small yards and hand fed by cutting and carrying fodder to the animal. Sumbawa has some livestock managed in this way, but the majority are herded, i.e. under an extensive system. Table 3 gives livestock population statistics for NTB for the years 2003–2005, and Table 4 average livestock prices in July 2005. Unlike NTT, livestock populations in NTB are either relatively stable or increasing. The government believes that NTB is capable of tripling its livestock numbers.

Goats

Goats are valued for religious purposes in Islamic communities, especially around the major Islamic holidays, e.g. Hari Raya Hardji, but also throughout the year as a source of meat. There are thus large markets for goats and goat meat throughout Indonesia, particularly on Java and in Jakarta. There is also some potential for export to other Islamic countries. The Director General of Livestock Services (DGLS) indicated that there is a good export market for goats to Malaysia. At this stage this market is supplied mainly from Java.

Table 3. Livestock populations in Nusa Tenggara Barat, 2003–2005

Animal	2003	2004	2005
Cattle	406,938	419,569	426,003
Buffalo	157,199	161,359	156,792
Goats	254,625	282,500	300,280
Sheep	17,503	18,573	17,037
Pigs	30,390	31,689	33,174
Village chickens	3,973,925	4,134,044	3,890,117
Layer and broiler chickens	1,085,519	1,561,716	1,401,936
Ducks	566,074	476,060	466,282

Table 4. Average livestock prices (rupiah), Nusa Tenggara Barat, July 2005

Animal type	Lombok	Sumbawa
Bali cattle	2,000,000	1,750,000
Buffalo	500,000	450,000
Horse	–	–
Goat—slaughter	500,000	500,000
Goat—breeder	300,000	275,000
Pig	230,000	–
Day-old chick—layer	5,250	–
Day-old chick—broiler	3,750	4,000
Village chicken	30,000	35,000

Source: <www.disnak-ntb.go.id>.

Nusa Tenggara Timur

Total goat numbers across NTT fell by approximately 23% from 1994 to 2004 (Table 5), but this decline was not uniform across the province, with some kabupaten substantially increasing their goat numbers—Sumba Timur +178.3%, Ende +61.33%, Manggarai +26.56%; some others only slightly increasing or decreasing their numbers—Ngada +6.59%, TTU +4.8%, Alor +1.46%; and others substantially reducing their numbers—Kupang –33%, TTS –56%, Belu –80%, Sikka –39%, FlorTim –10%, Sumba Barat –23%.

At the same time, however, the number of goats slaughtered per year in NTT has risen by 400%, from 28,479 in 1994 to 142,328 in 2004.

When the Dutch introduced livestock into NTT, they decreed that the province was to be established as the cattle-breeding centre for Indonesia, with Bali cattle in Timor, Ongole cattle in Sumba and Madura cattle in Flores. They also limited the introduction of other livestock that might compete with cattle, such as goats. This did not change substantially after Indonesia gained its independence, other than that Balinese cattle replaced Madurese cattle on Flores. With markets established for cattle, and the adoption of cattle into the social and religious structure of NTT, goats have not been as prominent in NTT as they have in other parts of Indonesia.

In the past, projects such as the Nusa Tenggara Timur Integrated Area Development Project (NTTIADP), the Nusa Tenggara Agricultural Support Project (NTASP) and EIVSP II avoided goat distribution programs in West Timor because of environmental and social concerns, and only supported limited goat projects in some areas such as Sikka, where there was land-use zoning, effective livestock control and adequate supplies of forage crops (Simpson 1996).

Of particular concern in West Timor, and a major reason for not developing goat livestock distribution projects during EIVSP II, was the excessive grazing pressure on the land from existing livestock. Simpson (1996) demonstrated that stocking rates in Kupang, TTS, TTU and Belu kabupaten were, on average, 71 animal units per km^2, and that this was already preventing the natural regrowth of tree species. Further, Simpson noted that it would not be possible, during a short-term project, to develop forage crops to supply the initial feed requirements of goats in any livestock distribution. This, plus the likely failure of recipients to adequately control their goats—resulting in social disharmony and forcing other farmers to waste valuable time and resources building bigger fences to keep the goats out, meant that goat distribution programs were not supported in EIVSP II. Vegetation programs with forage species, on the other hand, were supported, in the hope that growing additional forage would pave the way for increased livestock production at some future date.

Simpson (1996) did not include horses in his calculations of livestock pressures, claiming they 'were of minor importance'. I have recalculated the animal units per square kilometre figures for 1994, including horses, on the basis that they eat the same forages as other livestock. From this, it can be seen in Attachment 1 that the average livestock figures for West Timor (kabupaten Kupang, TTS, TTU and Belu) were approximately 72 animal units/km^2 in 1994 and that this had fallen to 42 in 2004. Superficially at least, this would indicate that there should be more feed opportunities available. Over the same period, however, the human population in West Timor rose from 79.7 to 99 people/km^2 and the number of goats slaughtered per year rose from 6,056 to 52,825. In all other kabupaten except Kabupaten Ende, there was a substantial rise in the annual number of goats slaughtered between 1994 and 2004.

Interestingly, the fall in goat numbers seen in West Timor is not uniformly apparent in other kabupaten on other islands in NTT. On Flores, for example, in kabupaten Ende, Ngada and Manggarai, goat numbers increased by 61%, 7% and 27%, respectively, between 1994 and 2004, accompanied by increases in the

Table 5. Nusa Tenggara Timur goat population, slaughter and export—comparative statistics for 1994 and 2004

	1994	2004	Percentage change
Population	599,975	462,102	–23
Slaughtered locally	28,479	142,328	+400
Exported for slaughter	0	9,139	+9,139
Exported for breeding	0	0	0

numbers of goats slaughtered of 13%, 1061%, and 2,140%, and this despite population densities of 117, 80, and 93/km^2 in these kabupaten.

There has obviously been a large shift in NTT's acceptance of goats as a source of meat since 1994 and current production rates cannot meet goat meat demand in the province.

Possible reasons for the increased acceptance include:

- rising population pressures forcing the people to look for alternative meat sources
- a change in the religious or cultural mix in NTT, increasing the demand for goat meat
- increased access to goats and goat meat due to an increase in goat numbers following the implementation of goat distribution programs.

Evidence of an increased desire for goat meat by the NTT population can also be seen in the prices being paid for it, compared with other meats (see Table 2). Prices for goat meat in NTT are comparable with beef prices and are higher than those for pork, mutton and intensively reared poultry meat. This, and the high prices for livestock (see Table 1), confirm advice from the Kepala Dinas Peternakan and his staff that there is a good market for goats in NTT.

Discussions with personnel at all levels of government support the likelihood that there are large domestic markets for goats and goat meat throughout Indonesia, and particularly in Jakarta, as well as possible export markets in Malaysia. Current exports of live goats from NTT are limited (Table 5), with a total of 9,139 (Sikka 5,053; Sumba Timur 3,912) being officially exported during 2004 to South Sulawesi, Jakarta and West Java (see also Tables S1 and S2 in Attachment 2). There is also some evidence of an unofficial trade occurring between kabupaten on Flores and Alor, involving fishermen and traders from Sulawesi, and to Kupang.

Although some of the markets available are for breeding stock, most demand is for live animals delivered into wet markets for slaughter. Live animal transportation issues, such as ensuring sufficient feed and water are available to reduce live-weight losses during the voyage, minimising handling stress and reducing mortalities, are all areas that could be researched. The possibility of developing markets for meat slaughtered and processed in NTT before delivery, either chilled or frozen, to markets in other parts of Indonesia, could be investigated.

Figure 2. The author and Dinas Peternakan staff at a goat market in Nusa Tenggara Barat

Nusa Tenggara Barat

Goats have always been popular in NTB. They are reared for religious purposes and for cash income, generally in confined yards (kandangs) or tied to trees. The government has, for some time, been encouraging expansion of the number of goats raised in NTB. It has done this through distribution programs aimed at alleviating rural poverty and has ongoing programs to improve the type of goat raised, through purchase and distribution of the larger, Atawa goat.

Table 3 records the number of goats in NTB from 2003 to 2005. Over that period, there was an increase in goat numbers from 254,625 to 300,280 head, an approximately 18% rise. Prices for goat meat (Table 2) rose from Rp24,500/kg to Rp28,500/kg over the same period, and increased to Rp31,000/kg in 2006, indicating a steady demand. These prices are averages and do not show the price spikes that occur around the time of the Muslim holidays. The livestock market price for live goats, however, after sitting at Rp250,000 since 2002 for both slaughter and breeder goats, rose sharply from 2005 to 2006 (Table 4). This may be the result of the inflationary pressures the whole country is experiencing or may indicate other factors affecting the availability of goats, resulting in a potential shortage and therefore a market opportunity.

The majority of goats raised are consumed locally within NTB, although in the past there was some trade of breeding stock from Sumbawa to Kalimantan. This has not occurred recently. Goats are generally marketed at local livestock saleyards. During discussions with cattle traders in Lombok, they indicated that they would be prepared to look at exporting goats to other parts of Indonesia and possibly Malaysia, but that at this stage the market differential was not enough for them to consider these markets.

Access to feed and forage in NTB, particularly Lombok, was not seen as limiting goat production at this stage, although it was recognised that, for the purposes of goat distribution projects, it would need to be ensured that the recipients of the goats had access to sufficient land to grow enough feed.

Animal health issues of major concern are anthrax and scabies. Anthrax outbreaks are common on Sumbawa, are often associated with goats, and frequently result in human deaths (see Table 12). The anthrax vaccine produced and used in Indonesia is made for use in cattle. It is also recommended for use in goats but it is known to cause anaphylactic reactions in some of them. Government staff have reported a fall in the number of goat farmers who are prepared to vaccinate their goats because of a fear that they will lose their animals. This is understandable, given the attachment goat owners often form with their animals, as well as their concerns about the loss of highly priced livestock. While Lombok has not had an outbreak of anthrax since 1988, it does, and will continue to the foreseeable future, rely on a vaccination program against anthrax to maintain its freedom from the disease. Reluctance by goat farmers to vaccinate their goats could jeopardise Lombok's ongoing freedom from clinical disease caused by anthrax. A proposal aimed at eliminating anthrax from both Lombok and Sumbawa has been prepared by Dr Anak Agung Gde Putra, head of the Disease Investigation Centre in Denpasar, in conjunction with NTB provincial and kabupaten governments.

Scabies is relatively common in goats, but infrequently causes deaths. Production losses are common where the disease occurs. In the mid 1980s, the provincial government began an attempt to eradicate scabies from Lombok, using Ivomec. The head of the Dinas Peternakan NTB admitted that this had not been successful, in part because of the difficulty in ensuring all animals were treated. Also, it was difficult to ensure that all treated animals were free after treatment and individual animal-health providers had been reluctant to eradicate the disease for fear of losing a lucrative income from either selling the treatment required or from buying infected animals, treating and fattening them, and reselling them at a profit.

Sheep

Sheep numbers in NTB and NTT are relatively small, due to a general lack of demand for sheep meat. The sheep are a fat-tail variety. Most of the population in both provinces prefer all other meats over sheep meat.

The number of sheep in NTB has been relatively static at approximately 17,000 for the past 3 years (Table 3) and information on mutton prices is not collected, signifying the sheep's lack of importance in that province.

In NTT, the majority of sheep are on the islands of Sabu, Rote and Ndao, where they have been traditionally kept and eaten. They have been forced out of most of mainland Timor through a governor's decree because they are known to carry malignant catarrhal fever, a fatal disease of Balinese cattle.

Rusa deer

The Rusa deer occurs naturally in eastern Indonesia, but its numbers are now limited due to population pressures on their habitat and indiscriminate slaughter.

Because there are no established markets for Rusa venison, prices for live animals and the meat are not recorded by the government. There is anecdotal evidence, however, that Rusa meat is highly prized in the local Kupang market as well as in Jakarta.

Because of these markets and because of his wish to protect the remaining Rusa living in the forests of Alor, the *bupati* (regent) in Alor is encouraging farmers to domesticate them. His plan is to protect the environment while finding additional sources of income for poorer farmers.

There have been several Rusa farms set up on Timor in the past by wealthy landowners, at Champlong, Kabupaten Kupang, for example, but most of them have disappeared.

There was some research into Rusa carried out at both the University of Cendana in Kupang and the University of Mataram.

Pigs

The pig is a forbidden animal in Islamic communities but common in other communities in eastern Indonesia. Pigs may be sold for cash, kept as a 'savings bank', or slaughtered for feasts. These may be significant life events such as births, marriages and deaths, or at times such as fencing and clearing gardens, weeding and harvesting in the agricultural cycle. In some areas, the ability to slaughter a large pig and provide rice and alcohol enables a farmer to invite neighbours and family to weed his/her garden. Timely weeding significantly increases food crop yields (Simpson 1996).

Nusa Tenggara Timur

There are approximately 1.3 million pigs in NTT (Table 6), spread across all kabupaten (Attachment 1). The numbers fell by approximately 9% between 1994 and 2004. This decline is not uniform, however, with falls of 40–50% in some kabupaten and large increases in others—85% in one case. The increases claimed in total pig numbers in some kabupaten are questionable given the impact that classical swine fever (CSF) has had in the region since its arrival in 1998.

During the same time, however, there has been an increase of over 1,000% in the number of pigs officially slaughtered (Table 6), confirming the importance of pigs as a meat source in NTT. It is likely that slaughter figures are more accurate than total numbers of pigs because they should reflect numbers passing through government-monitored slaughter houses and/or sold through markets.

Most pigs in NTT are kept in small groups of 1–2 sows, occasionally up to 5. They are sometimes kept in yards and hand fed, but more often move freely around villages, scrounging food scraps. There are some slightly larger groups kept by churches and church schools, as in, for example Sikka and Ende, and there is one larger piggery with 30–40 sows at Tarus in Kabupaten Kupang.

Pigs are generally slaughtered on site for local consumption. Some are slaughtered at abattoirs for sale through the local wet markets.

Live pig prices are comparable to goat prices (Table 1), but pork prices are cheaper than goat meat prices by about Rp11,500/kg (Table 2).

A number of government programs over the years have aimed at increasing the population and quality of pigs in NTT. Superficially at least, from the increase in pigs slaughtered and the relatively small decline in pig numbers, it appears that these programs have been relatively successful despite feed limitations and the incursion of CSF.

Nusa Tenggara Barat

There are approximately 30,000 pigs in NTB, with this number relatively static over the 2003–05 period (Table 3). Both Lombok and Sumbawa are predominantly Muslim and so pigs and pig products

Table 6. Nusa Tenggara Timur pig population, and slaughter and export numbers, 1994 and 2004

	1994	2004	Percentage change
Population	1,406,072	1,276,164	9
Slaughtered locally	36,757	556,834	1,415
Exported for slaughter	0	0	0
Exported for breeding	0	0	0

are not eaten or used by this sector of the population. Pigs are kept only on Lombok, where there are Hindu and Christian communities. No domestic pigs are kept on Sumbawa.

Breeder pigs are cheaper in Lombok than in NTT, but pork prices are higher in Lombok (Table 2). There is little opportunity for an increase in pork production systems in NTB and there would be little support from the NTB government to do so. Any shortfall in demand is likely to be met from Bali, where pigs are more culturally acceptable and abattoirs and processing facilities already exist.

Poultry

Traditionally managed village chickens (*Ayam kampung*) are widespread and are sold for cash or used as a form of currency. They are also used for small feasts, family visits, and in traditional practices for diagnosis and treatment of community and health problems such as failure of monsoon rains, ill health and other misfortunes (Simpson 1996).

Intensive broiler and egg-production facilities are limited and generally exist only near the provincial capitals of Kupang and Mataram. Day-old chicks (DOC) are usually sourced from Surabaya, Java or sometimes from Bali.

Diseases of major importance limiting chicken production in eastern Indonesia include avian influenza, Newcastle disease, infectious bursal disease (Gumboro disease) and pox.

Nusa Tenggara Timur

The statistics in the Dinas Peternakan's annual report for poultry in NTT do not record accurately the numbers of broiler, layer or slaughtered chickens.

Commercial poultry

Day-old chicks for layers and broilers have, in the past, been sourced from both Surabaya and Bali, but since the threat of avian influenza, DOCs and eggs have been allowed into NTT from only a restricted number of farms in the Surabaya region that have been able to demonstrate a high level of biosecurity and management. The cost of 100 DOCs delivered to Kupang is currently Rp125,000. The cost of delivery of eggs from Java is Rp13,000/kg.

There is one commercial egg producer in Kupang, owned by a Chinese Indonesian businessman who also owns the largest produce store in Kupang (Toko Waris). He has 50,000 layers and supplies 25% of the commercial Kupang egg market. The remaining commercial eggs used in Kupang and NTT come directly from Surabaya. The retail egg price in Kupang during 2005 was Rp1,000/egg.

Eggs from village chickens attract a higher price than commercially produced eggs. Village chicken eggs sold for Rp1,500 each during 2005.

The Kupang market handles 7,000–8,000 broiler chickens per day. This has increased from 3,000–4,000 per day 2 years ago. The price of commercially produced live chickens has remained steady at around Rp12,000 each over the same period, despite

Figure 3. Broiler chickens being delivered to market in Kupang, Nusa Tenggara Timur

increases in the cost of DOCs and feed. Most broiler producers in the area have small flocks of fewer than 100 birds, but there are some larger producers, the largest being Drh Agus Bale who has approximately 30,000 birds at any one time. The fact that the price of commercially bred chickens has remained steady for some time suggests that this market is presently being met by existing production, although Drh Bale believes the market will continue to expand and there will be opportunities for other broiler producers to supply the Kupang market. There are certainly opportunities for smaller broiler units to be set up in the kabupaten capitals.

Drh Bale and his wife Professor Dr Jublin Bale-Therik were part of the EIVSP II team that designed and implemented a chicken distribution program during 1995–98 (see next section for more details). In discussions on how commercial production of broilers and eggs might be expanded in NTT, it was suggested that:

- a funding scheme similar to that used for EIVSP II should be considered, i.e. a micro-credit program
- only people who had some experience raising chickens (i.e. they already had 40–50 chickens) should be considered
- those considered should be interviewed to assess their suitability
- individuals should be allocated specific tasks, i.e. make someone responsible for hatching, someone for raising the birds, and someone for managing them as either layers or broilers. Another person should be responsible for selling feed and accessories.

***Recommendation*: The development of group-based, micro-credit-funded layer and broiler systems should be developed and trialled as a means of intensifying chicken and egg production in eastern Indonesia.**

Village chickens

The meat from village chickens is preferred over that from commercially raised chickens and sells for a higher price. Live village chickens sell at the Kupang markets from Rp17,000 for small birds up to Rp50,000 for larger birds.

It is difficult to establish the total number of village chickens in NTT as they are kept throughout the province in all villages and are bred and slaughtered throughout the year outside the official abattoir system. Dinas records show a population of 9,389,207 in 2004, a rise of 32% since 1994, and state that 14,130,760 were slaughtered during 2004, an increase of 32% since 1994. Meat and eggs from village chickens provide the main protein source for the majority of the people in NTT and are highly prized. They are raised mostly for home consumption, but are also sold, mainly at local markets, for their cash income. There was also mention at Balitvet and in NTT, however, that, at some time in the past, village chickens had been exported from Indonesia to Japan and other Asian countries.

Figure 4. Village chickens in Nusa Tenggara Timur

There is and will continue to be a strong demand for village chickens for local and possibly export markets.

EIVSP II (1995–98) developed a program to distribute chickens to NTT, NTB and East Timor, and goats to NTB. It used a radically new approach (at least for Indonesia) for assisting poor farmers, based on ideas from the micro-credit schemes used by the Grameen Bank in Bangladesh. In Indonesia up until then, all livestock distribution programs had left it to the government to buy and distribute live animals. EIVSP II pushed lending directly to farmers, teaching them how to purchase and care for their own livestock and to repay cash rather than livestock. Built into this scheme was the need to purchase services such as vaccines and medicines from government or non-governmental organisation (NGO) staff. The purpose of this was to get farmers away from a handout mentality and into a more user-pays frame of mind and, at the same time, support the technical adviser in the village. These concepts, particularly as they relate to the distribution of funds for livestock distribution programs have, in part, been taken up and used nationally since about 1999–2000 when they were accepted by Dr Sofjan Dradjat, the DGLS Director of Animal Production at the time and later Director-General of DGLS.

It is now 8 years since EIVSP II finished. The ongoing strength of the market for village chickens warrants revisiting EIVSP II village chicken distribution sites, particularly in NTT, to assess and evaluate their successes and failures, in particular the adoption or lack of adoption of vaccination and disease-control programs in order to improve village chicken management.

***Recommendation*: Village chicken distribution projects developed and implemented during the AusAID-funded Eastern Islands Veterinary Services Project Phase II, particularly those in Nusa Tenggara Timur, should be assessed and evaluated, in order to better understand disease risks and technology adoption in order to improve village chicken management in the eastern islands of Indonesia.**

Nusa Tenggara Barat

Chicken production in NTB is similar to that in NTT; there are both commercial and village chicken systems. Importation of chickens other than DOCs into NTB is illegal. Importation of chicken meat is also illegal except for meat destined for the KFC franchise. The government admits, however, that the illegal importation of chicken meat is a problem. Table 7 details DOCs and chicken meat imported into NTB from 2001 to 2005. Table 4 lists live animal prices and Table 2 commodity prices. Prices for both eggs and chicken meat are higher in Sumbawa than in Lombok, but lower than prices for the same commodities in NTT.

As with NTT, government and NGOs have in the past recognised the importance of poultry production, particularly village chicken production for the population of NTB and have supported distribution programs. EIVSP II also distributed chickens in NTB, but under a format with more government control. A robust market exists for live chickens, chicken meat and eggs in NTB.

Cattle

The Directorate General of Livestock Services reconfirmed that it continues to see NTT and NTB as the source of cattle for the rest of Indonesia. Cattle in eastern Indonesia can be raised in extensive or semi-intensive systems. In the drier areas, they are generally herded as groups in grazing systems, whereas in wetter areas they are held either individually tied to a tree or in small yards, and fed hand-cut material. Both of these systems provide the owners with an income, but cattle are also used for several other purposes, such as land preparation, pulling ploughs or 'rencah' (the herding of cattle or buffalo in flooded rice paddies to trample and puddle the soil before transplanting rice). In some areas, they are used as a 'savings bank' and sold only when the farmer requires cash. Cattle are also kept for social status, for use as bridal dowries, and for traditional ceremonies and feasts.

Nusa Tenggara Timur

As mentioned earlier, when the Dutch introduced livestock into NTT they decreed that the province was to be established as the cattle-breeding centre for Indonesia, with Bali cattle in Timor, Ongole cattle in Sumba, and Madura cattle in Flores. They also limited the introduction of other livestock, such as goats, that might compete with cattle. This did not change substantially after Indonesia gained its independence, other than that Madurese cattle were replaced with Bali cattle on Flores.

Cattle production in NTT has declined markedly over the past 10–12 years. Table 8 gives comparative data for NTT for 1994 and 2004, derived from NTT Dinas Peternakan annual livestock reports, and Attachment 1 provides comprehensive data on a kabupaten basis.

Cattle production in NTT faces problems similar to those affecting goat production discussed earlier. Of major importance is the 22% increase in the number of people in NTT over the period. This increase is likely to be reducing both the area of land available for cattle production and the amounts of feed and forage available for ruminants. It is also driving an increased demand for meat, resulting in a 93% increase in the numbers of animals slaughtered locally.

The provincial Dinas Peternakan is very aware of the declining numbers of cattle in NTT and has stopped the export of breeder cattle in an effort to halt it. As can be seen from Table 8 (see also Tables S3 and S4), this is unlikely to achieve anything substantial, given the small number of breeder cattle exported.

The number of cattle exported for slaughter has also fallen, by 14%. Slaughter cattle, by law, are supposed to be either male or infertile female, and while the majority of cattle exported for slaughter are male, this is no longer the case in locally slaughtered cattle. Despite the need for official certification by a government official that a female is infertile before it can be slaughtered, Dinas Peternakan staff estimate that

up to 70% of cattle slaughtered in NTT are fertile females. Thus, the increasing demand for meat by the rising population is resulting in the slaughter of the NTT breeding herd, a circumstance that will have long-term dire consequences if it continues.

***Recommendation*: An in-depth study of cattle production in Nusa Tenggara Timur, focusing on reasons for the apparent decline in cattle numbers, should be undertaken as a matter of urgency.**

The EIVSP I, a joint AusAID – Indonesian Government program working in NTB and NTT from 1989 to 1995, published a report on the outcomes of a 'Cattle health and productivity survey' (CHAPS) carried out in cattle distribution programs across NTB and NTT. Attachment 4 'Outcomes of cattle health and productivity survey (CHAPS) seminar May 1994', lists recommendations for cattle production, farmer education, land management, technology transfer, research and development and policy development to support and increase cattle production in NTT. Although CHAPS was limited mostly to cattle distrib-

Table 7. Day-old chicks (DOCs) and chicken meat imported into NTB, 2001–05

Year	2001	2002	2003	2004	2005
DOCs	9,076,000	8,135,500	7,972,000	8,253,000	8,549,175
Chicken meat (kg)	61,988	95,121	161,501	122,154	55,377

Table 8. Nusa Tenggara Timur cattle population, slaughter and export statistics, 1994 and 2004

	1994	2004	Percentage change
Population	786,295	522,929	–33
Slaughtered locally	20,766	40,110	+93
Exported for slaughter	70,905	61,211	–14
Exported for breeding	659	0	– 659

Figure 5. Balinese cattle (sapi Bali): CV Kolompok Usaha Mandiri holding stalls, Desa Gunungsari, Lombok, Nusa Tenggara Timur

uted as part of a number of Indonesian Government livestock-distribution programs, these recommendations are valid in the wider area of cattle rearing and are probably more important now than they were then.

***Recommendation*: The recommendations of the Cattle Health and Productivity Survey (CHAPS) of cattle distribution programs across Nusa Tenggara Timur and Nusa Tenggara Barat remain relevant and should be reviewed and implemented where possible.**

CHAPS did not identify bovine brucellosis as a major problem of cattle in government livestock-distribution programs and correctly observed that the criteria used to select cattle for these programs, if followed, were sound. However, the EIVSP also confirmed, quantified and helped with the development of a control program for bovine brucellosis, specifically for West Timor.

Brucellosis control programs began in West Timor in 1992–93. In 1998, the director-general of DGLS targeted brucellosis as a major economic disease in seven provinces, including NTT, and allocated resources to these control programs. At a national meeting in 2002, it was proposed that the aim should be to eradicate brucellosis from Timor.

The serious depletion of cattle breeding stock in West Timor is most likely being driven by excess slaughtering. The ability to maintain or increase cattle numbers clearly relies heavily on access to sufficient feed and water in the first instance, but diseases such as bovine brucellosis, trichomoniasis, vibriosis (= campylobacteriosis) and possibly bovine viral diarrhoea (BVD), have the capacity to severely reduce fertility and production.

Bovine brucellosis was most likely introduced into Timor in the 1970s or early 1980s, in cattle imported from Australia. Surveillance by Indonesians and Australians as part of the AusAID-funded EIVSP determined the extent of brucellosis within NTT and a control program aimed at reducing the prevalence of the disease was developed.

It is now 8 years since this program was fully implemented and, although it has been reasonably successful, there is an urgent need to review it, to identify and remove any constraints to eventual eradication of the disease.

Some potential constraints include:

- change in governance due to Otonomi, the devolution of government services and administration from Jakarta to the provinces and kabupaten. Individual kabupaten have not allocated funds for ongoing control; staff and managers have been changed, and veterinary support is lacking; kabupaten do not understand the control program, the disease or the reasons for wanting to control it; restrictions on movement between kabupaten, villages etc. are not being enforced; differences between kabupaten in charging an exit tax are encouraging illegal movements of cattle from Belu to Kupang for export
- a move to vaccination in low-prevalence areas, rather than test and slaughter (Kupang)
- failure to identify animals that have been vaccinated (Belu), and therefore difficulties in knowing if a reaction was due to disease or vaccination.

***Recommendation*: The bovine brucellosis control program in West Timor should be urgently reviewed to allow constraints to achieving eradication to be identified and removed. Part of the review should investigate the impact that new government arrangements under Otonomi are having on the ability to undertake disease-control programs in general.**

Nusa Tenggara Barat

Unlike in NTT, cattle production in NTB has steadily increased and local authorities believe that further increases are possible. They claim a calving rate of 86% and say that their cattle are high-quality animals. They have a very strong quarantine system that restricts the movement of cattle into NTB and from island to island. They have therefore managed to keep out a number of diseases that are common elsewhere. The same attention to detail and discipline has allowed them to eradicate brucellosis from Lombok. Their record on controlling anthrax is also impressive (see page 35).

The Dinas Peternakan believes that the province's freedom from brucellosis has allowed the sale of breeder cattle to other parts of Indonesia at a premium. Table 9 details exports of slaughter and breeder cattle in 2004 and 2005. Breeder cattle were sent to a range of locations in Indonesia, including Bengkulu, Kalimantan Timur, Kalimantan Seletan, Kalimantan Barat, Papua and Sumatra Seletan.

Hadji Saat, a cattle trader in CV Kolompok Usaha Mandiri, NTB, advised that he sells both

breeding and slaughter cattle to markets across Indonesia, including Jakarta, Kalimantan and Sulawesi. He also said that the market for slaughter cattle in Jakarta had been flat for some time and was no higher than the local market so, at the time, he was not supplying Jakarta as it was not profitable to do so. He was filling orders for slaughter cattle to Sulawesi. (Local prices at the time were approximately Rp14,500/kg live weight. Estimated costs from the Dinas Peternakan of getting animals to Jakarta from Lombok were around Rp4,000/kg live weight.)

Table 9. Exports of slaughter and breeding cattle from Nusa Tenggara Barat, 2004 and 2005

	2004	2005
Slaughter cattle	14,260	18,679
Breeder cattle	5,653	2,896

Hadji Saat said he had no problems getting the type of cattle he needed, whether that be breeding or slaughter animals. His estimated time to assemble a group of 100 breeding cattle was less than a week. He purchases the cattle he needs direct from the market to the specifications he needs, although sometimes with slaughter cattle he will purchase animals and have someone fatten them for him. Breeding cattle specifications for export require a height at the withers of 102 cm for females and 105 cm for males. The minimum weight for export cattle is 300 kg.

He advised that the majority of farmers in NTB, and on Lombok in particular, had only one or two breeding cattle and could not expand much further because of the limited amount of land they could either own or lease and the need to also use the land for other purposes. Most farmers kept their animals tied up and brought food and water to them. He could not see this changing. There are some differences in Sumbawa, where there is more land, farmers may have more cattle and may sometimes herd them.

As in NTT, it is illegal to export female cattle for slaughter, or to slaughter female cattle in local abattoirs, unless they are deemed to be infertile. In NTB, this is interpreted as being over 15 years old or holding a certificate from the Department of Livestock Services attesting to the animal's infertility. Infertile female cattle are branded on the cheek with an 'S' to indicate clearance for slaughter. During discussions, the trader did not mention the law on slaughtering female cattle, but said it was unlikely that fertile female breeding cattle would be slaughtered. He said that farmers in NTB were very reluctant to sell them if they knew they were for slaughter and that, usually, other farmers would buy fertile cattle for themselves as they saw the value in them as breeding animals.

Buffalo

Buffalo are kept for purposes similar to those for cattle. As a generalisation, they are less important in economic terms, but they can be very important or highly valued for traditional ceremonies or bridal dowries.

Nusa Tenggara Timur

Table 10 gives buffalo statistics for kabupaten in NTT.

Nusa Tenggara Barat

Buffalo numbers in NTB were relatively static during 2003–05 (see Table 3), with 156,792 recorded in 2005. Prices for live animals are substantially lower in NTB (Rp500,00) than those in NTT (Rp2 million plus), although the prices of buffalo meat appear to be comparable. There were 9,209 buffalo exported for slaughter from NTB in 2004 and 13,916 in 2005, and 1,054 and 0 exported as breeder animals in the same years.

Table 10. Nusa Tenggara Timur buffalo population, slaughter and export numbers, 1994 and 2004

	1994	2004	Percentage change
Population	164,828	136,968	–17
Slaughtered locally	871	5,809	+567
Exported for slaughter	12,841	7,501	–42
Exported for breeding	0	0	0

Addressing term of reference 2

Identify research objectives that will support viable production systems, such as enhancement of the supply chain beyond the farm gate, approaches to control and prevention of diseases, and availability of resources to grow the industry (inputs).

General comment

Research is required in both the production and health areas if production systems are to be enhanced or, in some cases, expanded. In some instances, there is also a need to examine areas, such as Kabupaten Sikka, NTT, where increases in production made over preceding decades are now in decline.

There is a general need to look at opportunities for intensification of systems. In both NTT and NTB, the area of land available for traditional subsistence livestock production is declining. The use of crop residues for feed requires further investigation. Unfortunately, particularly in NTT, opportunities to source useful amounts of crop residues are limited.

Disease control and prevention issues highlighted in this study included:

- reproductive diseases—brucellosis, *Neospora* sp., BVD, infectious bovine rhinotracheitis (IBR), leptospirosis, trichomoniasis and campylobacteriosis in cattle
- parasites—sarcoptic mange in goats, and *Fasciola gigantica, Thelazia rhodesii* and *Toxocara vitulorum* in cattle
- excessive mortality rates—anthrax in goats, anthrax and haemorrhagic septicaemia in cattle, CSF in pigs, avian influenza, Newcastle disease and infectious bursal disease in poultry, and surra in horses.

Because of the preference for local slaughter and the use of 'wet markets' in Indonesia, most livestock are transported live within and from NTT and NTB. Opportunities exist to improve transport systems so as to reduce in-transit body-weight losses and promote better animal welfare.

Abattoirs generally do not have the capacity or infrastructure to allow the export of fresh meat, although there are sufficient flights to and from the major capitals in both provinces to move produce by air to Jakarta and Surabaya.

Goats

It is obvious from the increasing numbers of goats now being slaughtered in both NTB and NTT, and the relatively strong price that continues to be paid for goat meat, that there are substantial markets within the individual provinces for goat meat and that these markets will continue to need increasing levels of production to meet demand. This is particularly evident in NTT. There is also strong evidence that there are substantial opportunities for the export of live goats to other parts of Indonesia, as well as possible export markets in neighbouring countries such as Malaysia.

While goats have been raised for both food and commerce in NTB for some time, this has not been the case in NTT where cattle have traditionally been the ruminant of choice. Nevertheless, the acceptability of raising goats and eating goat meat has risen significantly in NTT in the past 10 years.

Goats are often seen to have a number of benefits over cattle for smallholder farmers. These include: their potential productivity is greater because they are more fertile and fecund; they are easier to manage and handle because they are smaller; they eat less and eat a wider range of material; they cost less, so they are more affordable and, compared with cattle, there is less risk of a large loss if one dies.

Unfortunately, they are also seen to have a number of problems that can, if not managed, cause major social and environmental problems. Goats are notoriously difficult to restrain. Previous experience has shown that, in areas where there are no laws to penalise goat owners if their goats escape and destroy neighbouring gardens, neighbours have to spend many unproductive hours building and maintaining

their garden fences. This also causes disharmony within the local population. Goats are also extremely destructive, eating and destroying areas of forest, scrub or gardens if they are left unattended or allowed to overgraze.

These problems are not insurmountable and, indeed, have been overcome in some areas.

For some time, there has been a move to improve feed and forage availability through the planting of tree legumes such as *Leucaena leucocephala*, *Sesbania grandiflora* and *Gliricidia*. Simpson (1996) gives a number of examples where adoption of forage-tree technology has allowed increased production of livestock. The following extracts from his report have particular relevance.

Utilization of crop residues by farmers in the Oesau plain

Forage crop development in Desa Kayu Putih was observed and discussions held with farmers. In this area the farmers are using crop residues from irrigated vegetable and maize brown as a vegetable (corn on the cob). Irrigation development with pumped groundwater wells was introduced in the Oesau plain in 1986 under the USAID funded Small Scale Irrigation Management Project (SSIMP). This project installed irrigation equipment (pump and distribution system) and provided farmer training and start-up capital for pump operation and maintenance.

During the initial stages of irrigation development livestock intrusion into irrigated plots was a serious problem. This was overcome by the construction of fences, however, as the fences weakened over the years the incidents of livestock intrusion reoccurred. This led to numerous disputes over livestock control, how the animal broke free from its tether, and the quality of fences. Finally, the precedent was set that the slaughter of just the one animal was not sufficient to compensate for the damage done to high value vegetables. In some cases the livestock farmer had to give the food crops farmer and additional 3 animals. Faced with theses pressures the traditional power base and influence of the livestock owners was weakened. This shift in the balance of power from cattle owner to crops farmer has resulted in improved livestock control in certain areas of the Oesau plain. While not yet dispensable, the requirement for fencing should gradually decline in the coming years. Another feature of this evolutionary process is the development process (which is still ongoing) has so far taken 10 years. In this example, livestock control is a key factor, but economic pressures are also an important change agent.

In this area of Oesau a set of preconditions now exists to promote the planting of *S. grandiflora* on the fiel bunds in groundwater irrigation schemes.

Adoption of indirect terracing by farmers in Kabupaten Sikka

This example of agricultural innovation using *L. leucocephala* was reported by Piggin and Parera (1984). In Kabupaten Sikka, Flores, efforts to develop improved soil conservation systems were initiated by the Dutch in 1930 by promoting the planting of *L. leucocephala*. The farmers however, did not adopt this technology at that time because of fears that the plant would get out of control and become a weed in cropping areas. Interest in food cropping and reducing soil erosion was stimulated in 1964 when by common consent of the farmers all small livestock (goats and pigs) and large livestock (mainly horses) had to be penned or tethered. This eliminated the need for fencing thus freeing up labour for other activities. In 1967 a Catholic priest Fr. P. Bollen, established a small demonstration of *L. leucocephala* planted in contour hedgerows for soil conservation using indirect terracing. In this system the hedgerows stabilize the top soil and over time form terraces. In 1968 on farmer adopted this technology, and after three years of cropping this farmer's yields were stable. In 1972 this experience prompted a farmer cooperative, Ikatan Petani Pancasila, to plant *L. leucocephala.*

In 1974 a cooperation program was formed between the Kabupaten government, Biro Sosial Maumere and Yayasan Pembangunan Sosial. The objective of this program was to develop indirect terracing with *L. leucocephala* to stabilize 30,000 ha of erosion prone land in five years (1974 to 1979). In the same year the BIMAS national food crops intensification program was introduced to Kabupaten Sikka. Under the leadership of V. Parera (who was the head of Dinas Pertanian in Kabupaten Sikka at that time), this credit program was only offered to those farmers who adopted indirect terracing. Parera (1982), reports that in 1982 approximately 20,000 Ha of land had been planted to indirect terracing using *L. leucocephala*. This development of forage resources enabled introductions of Bali cattle under a credit scheme. Cunha (1982) reported that the cattle population in Sikka had increased from only 50 head in 1970 to over 2,000 head in mid 1982.

A comparison of the numbers of livestock in Kabupaten Sikka in 1994 and 2004 (Attachment 1) reveals that livestock numbers reached a level well above the 2,000 cattle recorded in 1982 and, although they are still well above this level, they are now in decline. In the neighbouring kabupaten of Ende, Ngada and Manggarai, however, livestock numbers are rising rapidly. The rise and subsequent decline in Sikka needs to be investigated, as it may provide information that could assist with the development of similar systems elsewhere, as well as help to explain the limits to production by these methods.

***Recommendation*: The raising of livestock in Kabupaten Sikka should be investigated to learn why livestock production, particularly of goats and cattle, is in decline.**

Alternative feed sources for livestock, particularly goats, should also be examined. Alternative sources in West Timor appear to be limited to crop residues from small-scale farming. In Flores, however, there are cashew, cocoa and coconuts plantations with substantial crop residues that could be used for stock feed.

Dr Yacob Nulik of the Livestock Production Research Facility (BPTP) in Naibonet is currently looking for support to trial a number of crop residue options for feeding goats in Ende. The goats would be kept in yards and hand fed on treated crop residues such as the skin of the cocoa fruit or fermented and ground cashew fruit. Given the restricted land availability in both NTT and NTB, and the likelihood that population pressures will continue to exacerbate this problem, a project of this type would provide additional useful information on the intensive raising of goats.

***Recommendation*: Dr Yacob Nulik's (BPTP Naibonet) proposals on using plantation-estate by-products such as cocoa pods and cashew nuts as sources of feed for goat intensification programs could provide an opportunity for a number of pilot programs.**

As with other ruminants, the most important issues facing goat production in the eastern islands of Indonesia are, in order of importance, access to sufficient water, sufficient feed, and health issues (particularly parasites).

It may be inevitable that goats kept in close confinement will develop health problems. A component of the project recommended could look at animal health issues such as internal parasitism and how keeping them in close confinement affects health risks.

Part of the project above, or another in either or both provinces or Bali, could also investigate the use of traditional medicines in the control of internal parasites. Dr Frans Umbu Data, Rector of the University of Nusa Cendana, Kupang (Undana) and Dr Made Damriyasa, Dean of Veterinary Science, Udayana University, Bali, both expressed interest in testing traditional medicines for parasite control.

***Recommendation*: The control of internal parasites in goats reared under intensive conditions (possibly including comparative trials of traditional medicines) could be undertaken in both Nusa Tenggara Timur and Nusa Tenggara Barat as part of a larger project trialling intensification of goat production using plantation-estate by-products.**

Scabies/sarcoptic mange

Scabies was identified as a major problem of goats in NTT and NTB. Treatments are available for sarcoptic mange and, although they are relatively expensive, the prices being paid for goats suggest that owners should be able to purchase these treatments. A review of treatment and control methods used in other tropical countries may provide some additional ideas but, in general, the problems, in NTT at least, are more likely to be the result of either a lack of understanding by farmers that treatment is available, or limited access to treatments due to isolation.

Taeniasis/cysticercosis/hydatid disease and anthrax were both raised as major problems associated with goats. As these problems affect other species and are principally zoonoses they are discussed under 'Food safety organisms' on page 39.

Cattle

Cattle reproduction

As detailed earlier, cattle production in NTT has plummeted over the past 10–12 years, while numbers slaughtered for local consumption have increased by 93%, with a large part of the increase being accounted for by female animals. The high percentage of female slaughter cattle indicates that local beef consumption is exceeding production and that the long-term breeding population will continue to decline if no action is taken. The provincial Dinas Peternakan has banned the sale of breeder cattle and established breeding centres in each of the kabupaten. In addition, they have allocated funds from the Bantuan Pinjaman Langsung Masyarakat (BPLM) to encourage and help farmers to purchase and rear cattle.

In order to protect the NTT population of breeding cattle, the slaughter of female cattle must be reduced or stopped, and steps taken to ensure that remaining breeding cattle are fertile. While much of this will depend on access to sufficient feed and water, ensuring that breeding stock is free of reproductive disease is

also important. Bovine brucellosis has already been identified as a major concern in West Timor and a control program has been in place there for about 8 years. Unfortunately, due to a number of changes in government policy, particularly those resulting from Otonomi, the coordinated approach that was developed at the start of the program has faltered in some areas and is reducing on the program's capacity to control the disease. Of particular concern is the need to have kabupaten governments recognise the need to work together across the four kabupaten in Timor.

Since the implementation of this program, there have been a number of developments in the use of new brucellosis vaccines. Strain 19 has been used in West Timor but, as occurred in Australia, cattle vaccinated with this vaccine strain are frequently difficult to differentiate from naturally infected animals. New vaccines developed in the United States have the potential to remove this source of confusion but, up until now, they have not been tested in *Bos sondaicus* cattle.

Dr Maria Geong, the head of the Animal Health Sub-Dinas in NTT, completed her PhD at Murdoch looking at the control of bovine brucellosis. As part of her doctoral studies, she examined the use of Strain 19 vaccine in *Bos sondaicus* cattle. She is therefore in an ideal position to support investigations into the potential use of these new vaccines by another young veterinarian.

Drh Susan M. Noor MVSc from Balitvet completed her Masters degree in brucellosis in the 1980s, with Alan Husband at the University of Sydney, and could assist in a project of this type.

New serological tests have been developed recently for bovine viral diarrhoea virus (BVDV) and *Neospora* sp., both of which have been increasingly associated with infertility in cattle elsewhere around the world.

New polymerase chain reaction (PCR)-based tests have recently been developed for trichomoniasis and vibriosis (campylobacteriosis).

***Recommendation*: A project to examine disease issues potentially affecting the reproductive performance of cattle in West Timor should be developed and supported. The project should include a review of the existing bovine brucellosis control program, identifying successes and constraints, and make recommendations on how to continue to control and eventually eradicate brucellosis from West Timor. The project should consider carrying out a serological prevalence survey across West Timor to determine existing brucellosis prevalence for comparison with the survey undertaken from May 1996 to November 1997. The serological survey could also be used to test for the prevalence of *Neospora*, bovine viral diarrhoea virus, infectious bovine rhinotracheitis and leptospirosis. Additional areas of investigation could include comparison of new brucellosis vaccines in *Bos sondaicus* and the training of Indonesian laboratory staff at the Disease Investigation Centre, Denpasar, in the use of polymerase chain reaction technology for testing of trichomoniasis and campylobacteriosis.**

Dr Maria Geong has identified Drh Melki at the NTT provincial Dinas Peternakan as a possible Masters or PhD candidate for a project of this kind.

Disease control and diagnosis

As an adjunct to the above program, low-cost methods of identification need to be developed to allow better tracking of individual animals. Dr Maria Geong is currently developing a system of cattle 'passports' with the aim of trialling them in the kabupaten in West Timor.

***Recommendation*: The development and piloting of low-cost animal identification systems should be incorporated into an animal production or animal health project in Nusa Tenggara Timur.**

***Recommendations*: The following research and development recommendations from the Cattle Health and Productivity Survey (CHAPS) carried out in cattle distribution programs across Nusa Tenggara Timur and Nusa Tenggara Barat should be considered for research projects:**

- **Further work is needed to define the prevalence and losses due to *Paramphistomum* spp., *Fasciola gigantica*, *Toxocara vitulorum* and *Thelazia rhodesii* and to develop cost-effective control measures for these diseases. This requires well-coordinated national and local approaches.**
- **Further research is necessary to clarify the importance of leptospirosis, bovine virus diarrhoea, and infectious bovine rhinotracheitis to cattle production in Nusa Tenggara.**

There were comments from Dinas Peternakan staff in both NTB and NTT that, as a result of *Fasciola gigantica* invasion, cattle imported from Australia do not do well.

***Recommendation*: The impact of *Fasciola gigantica* on Australian cattle imported into Indonesia should be investigated, to verify the significance of reports that imported Australian cattle fail to thrive.**

Haemorrhagic septicaemia/septicaemia epizootica (*Pasteurella multocida*)

Haemorrhagic septicaemia (HS) remains an important disease in eastern Indonesia. The governments in NTT and NTB spend a large proportion of their funds on vaccination programs for this disease every year, but mortalities continue to occur. There were 488 mortalities due to HS reported in NTT cattle in 2005 (TTU 105, Rote/Ndao 13, Alor 8, Ngada 165, Manggarai 2, Sumba Timur 176 and Sumba Barat 19) and 265 cases reported in buffalo (Rote/Ndao 11, Ngada 190, Manggarai 10, Manggarai Barat 2 and Sumba Barat 52).

The HS vaccine used in Indonesia is produced at Pusvetma Surabaya. It is normally administered once a year, but there are concerns that it does not provide protective immunity for 12 months.

***Recommendation*: Investigations into the protective immunity developed following vaccination of cattle and buffalo with the Pusvetma-manufactured haemorrhagic septicaemia vaccine should be undertaken to determine the most appropriate vaccination regime.**

Anthrax

See page 35.

Livestock transport

Currently, live cattle shipped to Java lose approximately 5% of their body weight during transport. Yacob Nulik, BPTP Naibonet, is attempting to develop low-cost methods of harvesting tree-legume leaves during the growing period and manufacturing stock cubes for use on board livestock transports and in the dry season.

Postharvest technology

Given the massive decline in cattle numbers it might be premature to seek opportunities for slaughtering cattle in Timor and transporting meat rather than live animals to Java, but there might be opportunities to develop chilled meat products for beef, chevron, venison and possibly village chicken meat. There are frequent flights into and out of Kupang—to Denpasar, Surabaya and Jakarta—so finding transport for a high-quality product would not be a problem. At this stage, however, abattoirs would require substantial upgrading, and an effective cold chain would have to be developed.

Pigs

Classical swine fever was identified as the pig disease of major importance in NTT.

The disease was first reported in Indonesia in North Sumatra in July 1994. It is thought that it entered Indonesia from northern Malaysia with the movement of live animals. From North Sumatra it spread to Central and South Sumatra, then to Java near Jakarta in February–March 1995. CSF was next reported in Bali and West Kalimantan in October 1995. Estimates of 300,000 to 400,000 mortalities from a total population of approximately 1,000,000 pigs were reported in Bali at the time. In late 1995 – early 1996, CSF occurred in North and South Sulawesi and, in July–August 1997, was reported in Dili, East Timor. The earliest reports of possible CSF in NTT were from Sumba and Flores in mid 1997 but it was not confirmed until 1998. It is now believed to be endemic in eastern Indonesia.

As indicated earlier, pigs are an important part of the economic, social and cultural fabric of eastern Indonesian society, and the large and ongoing mortalities that occur due to CSF can dramatically affect the wealth and nutrition of a substantial portion of the population. Vaccination programs, supported to varying degrees by the Government of Indonesia, are being undertaken in an attempt to control CSF.

If the statistics in Attachment 4 are to be believed—population decreases of 45%, 23%, 58% and 62% in Kabupaten Kupang, Belu, Sumba Timur and Sumba Barat, respectively, but population increases of 85% and 74% in Alor and Flores Timur—either some kabupaten have been able to keep out CSF or the control programs are being implemented to differing degrees and achieving very variable results.

***Recommendation*: ACIAR's present project in Alor investigating vaccination and control programs for classical swine fever should be strongly supported. It has the capacity to benefit many individuals on Alor through the control of the disease, as well as offering methods that can be used in other parts of Indonesia for the same purpose.**

There was widespread support for the ACIAR project currently operating in Alor and there were suggestions that it may be worth extending it to other islands. Dr Maria Geong suggested that ACIAR might like to consider allowing a young NTT veterinarian to become involved and use the work as the basis of a Masters degree.

***Recommendation*: Consideration be given to identifying a young Indonesian veterinarian from NTT to undertake a Masters degree in association with the current ACIAR project investigating CSF on Alor.**

Haemorrhagic septicaemia/septicaemia epizootica (*Pasteurella multocida*)

While haemorrhagic septicaemia (HS) is normally considered to be mainly a disease of cattle and buffalo, 476 cases were diagnosed in pigs during 2005. These were reported in Kabupaten TTU (82), Alor (1), Ngada (237) Manggarai (68) Manggarai Barat (84) and Sumba Barat (4). The diagnosis of this disease in pigs needs to be confirmed because, if correct, pigs would be identified as an as yet poorly understood reservoir of HS. If the cause of mortalities in these pigs is not HS, the true cause needs to be diagnosed. This would result, it is hoped, in more appropriate responses and abandonment of HS vaccination of pigs.

***Recommendation*: Claims of diagnosis of haemorrhagic septicaemia/septicaemia epizootica in pigs in Nusa Tenggara Timur should be investigated and the cause of claimed haemorrhagic septicaemia mortalities ascertained.**

Poultry

Avian influenza

In all locations, most discussions of animal diseases eventually came back to avian influenza (AI). This consultancy was not asked to assess AI as a research issue but there may be some very useful lessons to be learnt from actions taken in NTT. In particular, the methods used by the provincial Dinas Peternakan to limit the possible introduction of AI from Java and Bali.

***Recommendation*: The methods used in Nusa Tenggara Timur to limit the introduction of avian influenza should be assessed for use in other parts of eastern Indonesia.**

Newcastle disease and Gumboro disease

These remain diseases of concern. Newcastle disease virus vaccine manufactured in Indonesia and elsewhere is readily available in towns but, because of inadequate cold chains, access to it remains restricted outside towns. The Australian-developed V4 vaccine is not used in this area because of the widely known poor results achieved during trials carried out in the early 1990s. The EIVSP II poultry-distribution project built access to vaccines and medicines into its project design so that, at the end of the project, these items would continue to be available. A review of the project could provide useful information on disease constraints to expanding village poultry production.

***Recommendation*: Impediments to improving poultry health, including attitudes to the use of Newcastle disease virus vaccine, should be examined through a review of the EIVSP II poultry-distribution programs.**

Horses

While not considered by most Australians as a meat source, horse are dual-purpose animals in Indonesia, being used for riding as well as a source of meat.

Surra is considered to be the major disease concern of horses throughout NTB and NTT. The only drug available to treat this condition is Naganol, but it is hard to get and expensive.

***Recommendation*: An alternative treatment to Naganol needs to be developed for treatment of horses with surra.**

Addressing term of reference 3

Identify more general environmental, sociological and regulatory constraints to the development of the industry/product in 1. and identify the research needs to overcome those constraints.

General comment

Major environmental constraints in this area of Indonesia relate principally to climate and soil types. While the eastern islands are located within the tropics, climate varies from lowland, low rainfall coastal regions to high-altitude, high-rainfall areas. Soil types also vary widely, from extremely fertile soils of volcanic origin to infertile, marine-derived soils. In general, these conditions result in short periods of abundance, i.e. the wet season, followed by long periods where forage and feed-stuffs are in short supply and verging on famine (dry season). Any research aimed at improving access to cheap, reliable livestock feeds should be supported.

Pendapatan Asli Daerah

As a result of the Otonomi policy that has been adopted across Indonesia, individual kabupaten have been given a large portion of the budget to control and autonomy to make decisions that were previously the responsibility of the central or provincial governments. As mentioned in other parts of this report, this has created a number of problems for disease programs that transcend kabupaten or provincial borders. These issues are generally covered in other parts of this report, but one area that has not been mentioned elsewhere has been the Pendapatan Asli Daerah, a tax imposed by some kabupaten for a variety of reasons. While it appears that the collection of some of these taxes is illegal, it has not yet been possible for the central government to have them removed. With respect to livestock, some kabupaten impose a tax on exported produce, including livestock. Their impact on disease-control programs will need to be considered as they are influencing where animals are exported. For example, most cattle from West Timor are now being exported from Kabupaten Kupang because its tax is lower than that levied by other kabupaten in West Timor. Previous brucellosis surveys have identified the areas around the port in Kupang as a hot spot for brucellosis. This tax is likely to exacerbate this problem. Further issues relating to Otonomi are discussed in the next section.

Addressing term of reference 4

Identify issues for research (policy, regulatory, technical solutions and understanding, delivery of control) in the wider environment of infectious animal disease in Indonesia that are important for Indonesia and also the region.

General comment

By far the major limitation observed in the animal health system across the Indonesian archipelago has come from the recent changes to government following implementation of the decentralisation policy commonly known as Otonomi. With the devolution of administration, responsibility and the associated budget away from the central government in Jakarta to the provinces and kabupaten, already complex administrative and power-sharing arrangements have become even more so, particularly as they affect matters such as disease control.

Because diseases are not stopped by borders, mounting a disease-control program in the new environment provides many more challenges. It is now necessary, more than ever before, to ensure all levels of government, particularly at provincial and kabupaten levels, are fully aware and supportive of a program, otherwise it will not succeed.

The new structure within Indonesia has removed from the central government much of the authority for undertaking disease-control activities. The system is analogous to the federal system of government in Australia, in which the states have the major operational role, in particular the system operating in New South Wales (NSW), where rural lands protection boards provide animal health services on behalf of and through the state department of primary industries. Australia, and NSW in particular, is thus in a good position to assist all levels of government in Indonesia to adapt to the new government and power-sharing arrangements.

Zoonoses and food-safety issues covered under this term of reference are rabies, anthrax, bovine brucellosis, taeniasis, *Salmonella enteriditis*, Japanese encephalitis and chemical residues.

Otonomi and its effects on the Indonesian animal health system

Indonesia had, until recently, a very centralist form of government ruled primarily from Jakarta, with authority passing down first to the provinces, then the kabupaten. This centralist approach ensured that the budget, and therefore power, was held in the first instance by Jakarta, in this case the DGLS. Thus, most power was in the hands of the central government, with diminishing amounts held by the provinces and kabupatens.

Otonomi aims to change the balance of power by devolving administration, responsibility and the associated budget away from the central government to the provincial and kabupaten level. This is being done in an attempt to better respond to regional and local problems. The reallocation of responsibilities for local management along with the major portion of the budget down to kabupaten level has resulted in complex administrative and power-sharing arrangements, particularly for issues such as disease control. Where, in the past, central government or a province could devise a program and then drive its uptake by providing budget, allocation of the budget down to kabupaten level has removed this leverage.

The government of each kabupaten has become effectively autonomous or at least semi-autonomous, determining its own priorities and allocating budgets accordingly. In effect, this means that there are now 16 kabupaten governments in NTT and 9 in NTB, all potentially working independently.

This devolution of power and budget has left DGLS staff feeling powerless and blaming the provincial Dinas Peternakan for failures in the national animal health system. It is also testing a legislative infrastructure that was designed for a more centralised system. At the same time, the provincial Dinas

Peternakan, which still rely on the kabupaten for much of their operational infrastructure, are also frustrated because they do not have as much influence as they once had. This frustration is further exacerbated by the lack of appreciation at a kabupaten level of the issues associated with the need to control animal diseases, particularly the imperative to work together cooperatively across geographical boundaries. This is having an adverse effect on disease-control programs, particularly in NTT.

Unfortunately, DGLS staff have not yet been able to accept or adapt to the new role they need to fill under Otonomi. These difficulties have been further exacerbated by the recent loss of a number of experienced staff and will be compounded further with the retirement of other senior staff in the near future.

Of the officials interviewed at all levels of government, the head of the Dinas Peternakan in NTB, Drh Muthalib, seemed to have best understood and adapted to the changes and challenges of Otonomi. His strategy to overcome the problems created has been to recognise that he no longer has an implicitly accepted authority to demand action and that he has to meet regularly with Dinas Peternakan Kabupaten staff as well as other kabupaten and provincial government officials and politicians to inform them about the need for, and benefits of, an animal health system. This approach, plus the relatively smaller number of kabupaten in NTB, allow communication and meetings to occur more easily. In addition, there is generally greater acceptance of authority and government structure in NTB. These circumstances have allowed the province to continue to offer a functional government animal health service.

In NTT, there is strong evidence of a fragmented system that is failing to control important production-limiting and zoonotic diseases, such as rabies and brucellosis. NTT has always had more difficulty than NTB in maintaining a cohesive animal health system. The province is spread over a much larger geographical area, has double the number of kabupaten distributed across many more islands, a greater number of linguistic and cultural groups that can all be fiercely independent, and a generally low level of education. The shifting of authority and budget from a centrally controlled, provincially led animal health system to the kabupaten has exacerbated what was already a difficult situation. The head of the animal health subdinas, Dr Maria Geong, with support from the head of the Dinas Peternakan, Ir. Littik, is doing an excellent job driving change at a provincial level, but will continue to struggle to unite independent kabupatens into a cohesive animal health system without substantial support. Ir. Littik was due to retire in July 2006, Dr Geong's continuing success in making changes will be partially determined by whoever replaces Ir. Littik.

Similar to the new Indonesian system, Australia's system of government is based on a federation of autonomous states with the central or Commonwealth government relying on the states to provide operational support for programs carried out within or across their borders. There are obviously fewer states in Australia than there are kabupaten or provinces in Indonesia, and circumstances here are therefore less complex, but the same sorts of problems arise. If a central government wishes to tackle a problem that transcends a number of autonomous borders, it must first convince each of the areas concerned of the need and importance to do so, following which a system of coordination needs to be agreed. In NSW, there are further similarities in structure, with the rural lands protection boards equating to kabupaten in some respects.

The Australian Government has legislative and consultative mechanisms to allocate responsibilities to the different levels of government, then coordinate the development and implementation of agreed policies and programs. These include the Animal Health Committee (AHC), the Primary Industry Health Committee (PIHC), the Primary Industry Standing Committee (PISC) and the Primary Industry Ministerial Council (PIMC) system, which allows strategic planning and implementation of the general government animal health system. In addition, the Consultative Committee on Emergency Animal Diseases (CCEAD) and National Management Group (NMG) structure is used in conjunction with AUSVETPLAN and the Emergency Animal Disease Response Agreement (EADRP) to link and prepare government and the livestock industries so that the nation can respond to emergency and exotic disease threats. Another body, Animal Health Australia, helps to develop and coordinate activities across government and the livestock industries.

Comments were made at both DGLS and in NTT of the legislative deficiencies that existed under the present Indonesian legal system with respect to control of animal diseases. These included a lack of a legislated line of authority and insufficient powers under quarantine laws to restrict the movement of livestock or livestock products between provinces, kabupaten or islands.

There are a number of useful concepts within Australian structures and legislation that could assist Indonesian government officials to adapt and reshape their animal health system.

***Recommendation*: A project that will provide opportunities for Indonesian government officials from national, provincial and kabupaten levels to study the Australian animal health system should be considered. The project should allow Indonesian government staff to see how a system composed of independent authorities can work collectively to control or eradicate diseases of importance. This could be built into a project to control trans-boundary diseases such as rabies and bovine brucellosis.**

Indonesia's National Animal Health System relies on the cooperation of all levels of government to undertake disease surveillance and control programs. The system is not working. Information is not flowing up from kabupaten to province to DGLS level. The cause is multifactorial but includes a lack of leadership and changes due to Otonomi. The systems that are in place have had, over the years, inputs from many countries, including Australia, Britain and the United States. In addition to the project suggested above that will help develop communication between governments, there is a need to focus on collection of surveillance data.

***Recommendation*: ACIAR should consider assisting Indonesia to re-examine its Animal Health Information System with the aim of helping it to re-establish the system under the policy of Otonomi.**

Zoonoses

Rabies

Rabies occurs throughout different parts of Indonesia and spread to NTT in the late 1990s.

Nusa Tenggara Barat

Nusa Tenggara Barat is currently free of rabies, but the authorities there recognise the threat posed from NTT now that rabies is widespread in Flores. The main route of spread from Flores is likely to be by boat through the port of Sape in Bima. People consulted advised that they need an awareness program in Bima and across NTB to reduce the possibility of rabies being brought into the province.

Nusa Tenggara Timur

The 2005 annual report of the NTT Department of Health records 2,841 people being bitten by dogs in Flores and adjoining islands, with 21 people reported as dying from rabies. The kabupaten with the highest incidence of bites and mortalities was Manggarai with 1,241 reported bites and 8 human deaths. Initial attempts to eradicate the disease through the slaughter of dogs and cats were unsuccessful, as animal owners, understandably, hid them from authorities. Subsequent programs developed by the provincial Dinas Peternakan in conjunction with DGLS and individual kabupatens have attempted to control the disease through vaccination. Unfortunately, recent changes to staff in DGLS, the reduction in budget from central government and an increased emphasis on the need to control avian influenza in Java have meant there has been no rabies vaccine (or any other type of vaccine) supplied to NTT from the central government for the past two years and there is unlikely to be any in the foreseeable future. This, coupled with the independent activities of individual kabupaten that have chosen to ignore provincial control advice, all indicate that, unless a coordinated approach is achieved across the island of Flores and within the province of NTT, the disease will continue to spread. An example of the detrimental effects of an individual kabupaten acting independently are obvious in Manggarai where, because they have adopted a policy of trying to kill all dogs rather than vaccinating, the incidence of dog bites and human mortalities has risen.

Nusa Tenggara Timur is the nearest part of Indonesia to Australia, adjoins East Timor and is the source of some of the illegal fishermen who visit Australia's northern shores. There are thus some compelling reasons for Australia to help in the control and eradication of rabies from this area.

While rabies is generally not seen as a disease of production animals and therefore would not normally be considered as an area for ACIAR involvement, the control or eradication of this disease requires the application of processes similar to those used for the control and eradication of other animal and human diseases: coordination, development and implementation of policies and programs across different provinces, government departments and non-governmental organisations, the need to develop

alternative technologies for vaccination and the need to develop appropriate extension methodologies. With respect to vaccination for the control of rabies, some work has been carried out in Europe on the use of oral vaccines given in meat baits. This technology could be developed further in NTT, for ultimate expansion to the rest of Indonesia if successful.

***Recommendation*: A project to assist with the control and eradication of rabies from Nusa Tenggara Timur should be considered, despite rabies not being a disease of production animals. As a disease that needs to be controlled across a number of different kabupaten and the Dinas Peternakan (Department of Livestock Services) and Dinas Kesehatan (Department of Health) it provides an ideal opportunity to build and strengthen relationships and administrative structures that have been affected because of Otonomi.**

Anthrax

Except for Bali, anthrax occurs throughout Indonesia. An anthrax vaccine, used principally for cattle but also other species such as goats, is produced in the government vaccine laboratories (Pusvetma) in Surabaya.

Nusa Tenggara Timur

Despite an ongoing government-sponsored vaccination program for animals in NTT for over 20 years, anthrax still occurs sporadically in both people and animals. In NTT, it is still common for villagers to butcher animals that have died and distribute the meat to various families. This frequently results in human mortalities from anthrax. The Department of Health reported one human death from this cause in Kabupaten Sikka in 2006 and five in Manggarai in 2005. They advised that the kabupaten most frequently affected were Sikka, Ngada and Manggarai, although they also admitted that they were not always told when and where deaths had occurred. These figures are slightly different from those reported by the Department of Livestock Services (Table 11) but indicate an ongoing problem.

One of the reasons vaccination has not been successful in NTT is the unplanned distribution of vaccine. Previously, because projects of this type were not directly controlled by staff with an animal health understanding and, because staff are paid for carrying out vaccination, vaccine has been allocated across the province according to staff income needs rather than disease occurrence. Recent changes to the administration of funds of this type have allowed Dr Maria Geong to take control of the provincial portion of the anthrax vaccination program and to put some science into the distribution and use of the vaccine. This should result in better disease control.

Dr Geong has been mapping where anthrax has occurred in the past, in an attempt to identify contaminated land so that methods of restricting access of stock can be investigated and to allow better allocation of available vaccine. She is interested in investigating the effect of soil pH on anthrax as part of attempts to better understand the reasons the disease occurs in

Table 11. Numbers of cases of anthrax recorded in animals and people in Nusa Tenggara Timur, 1994–2005

Kabupaten	Year	Cattle	Buffalo	Horse	Goat	Pig	Human deaths
Manggarai	1994	158	–	–	–	–	–
Ngada	1995	18	113	7	–	28	–
Manggarai	1996	193	74	17	92	–	–
Manggarai/Ngada	1997	19	–	–	–	–	–
Manggarai	1998	19	–	–	–	–	–
Manggarai	1999	–	3	–	–	–	–
Ngada/Sikka	2000	6	4	2	–	–	–
Manggarai	2001	3	57	–	–	–	7
Ngada/Sikka	2002	88	43	20	–	–	19
Ngada/Sikka	2003	–	–	3	–	–	3
Ende/Kupang City	2004	6	–	–	1	1	14
Ngada	2005	34	39	15	–	–	–
Total		544	333	64	141	29	43

Source: Dinas Peternakan NTT, Public health planning document for 2007

some regions and not others. Geologically, Timor and Flores are very different. Timor has a limestone–coral basis and its soils are therefore very alkaline, whereas Flores has more acidic, volcanic soils.

Nusa Tenggara Barat

Table 12 lists the number of human cases of anthrax and associated mortalities, from 1989 until 2005. All these cases have been on the island of Sumbawa and most in the kabupaten of Sumbawa and Bima. Local authorities consider anthrax to be a re-emerging disease that had apparently been under control from the mid 1990s onward but had been increasing since 2001. Some 80% of cases are recorded from September to December, 17% from January to April and 3% from May to August. The September–December period coincides with the first half of the wet season and January–April the second half. Anthrax in people is seen as a disease of the wet season in NTB. There are enough antibiotics available in the health system, but a program is needed to ensure that all sectors are working together to control the disease. The Department of Health considers that anthrax is currently endemic in NTB.

The problems as NTB authorities see them are that:

1. there is no specific awareness program about anthrax in anthrax areas
2. the detection of human cases of anthrax and their reporting to the provincial Department of Health is often not timely
3. the information provided to the Human Health Post is often poor because of the distance from and difficult circumstances experienced at the site of the outbreak
4. coordination between the Department of Health and the Department of Livestock Services needs to be improved
5. funding for a special project on anthrax is not yet available.

Their suggestions are to:

1. improve cooperation between the various groups and programs to control anthrax
2. make a strong commitment to a program to get rid of anthrax
3. improve the understanding and motivation of the people so that they do not slaughter and eat animals that may have anthrax
4. educate people to buy only meat that has been slaughtered at an abattoir. Meat from abattoirs has a guarantee of safety, because the Department of Livestock Services has inspected the animals and meat.

The Dinas Peternakan reported that the disease in people is often seen in a cutaneous form, particularly in people who have been involved in cutting or carrying the meat, but that sometimes multiple deaths occur from eating anthrax-infected carcases. There have been occasions where buried, anthrax-infected carcases have been re-interred and eaten, causing multiple deaths.

Table 12 provides details of anthrax cases in NTB since 1988. The last cases recorded on the island of Lombok were in 1988, when an unrecorded number of cattle died. At the time,12 people were also reported to be infected and two of them died. Since that time, all cases in NTB have occurred on Sumbawa, primarily in goats but also in some cattle and buffalo.

NTB's success in controlling anthrax on Lombok is a testament to the strength of the provincial Dinas Peternakan in that province and its close relationships with kabupaten and provincial staff and farmers over a long period. Anthrax has been brought under control with a comprehensive vaccination program and the enforcement of a quarantine policy that restricts the movement of livestock onto Lombok without strict screening. As a result of this success, the head of the Animal Disease Investigation Centre in Denpasar, in collaboration with the provincial and kabupaten Dinas Peternakan, have proposed a program—'Program Pemberantasan kasus anthraks di Pulau Sumbawa dan Pulau Lombok, NTB'—aimed at eliminating anthrax from the islands of Lombok and Sumbawa. Much of the proposed program revolves around accepted practices that have already been proven to work on Lombok; that is, mapping of the areas where anthrax has occurred, targeted vaccination programs, movement controls from known infected areas, appropriate methods of disposal, and education of the farmers, but areas that need further research have also been identified.

As discussed under term of reference 1, the vaccine produced at Pusvetma has resulted in a number of goats dying due to an anaphylactic reaction and this has meant that goat farmers have become reluctant to vaccinate their animals.

Table 12. Anthrax cases recorded in Nusa Tenggara Barat since 1988

No.	Kecamatan, kabupaten	Village	Month and year	Animal species infected	Humans
1	Janapria, LomTeng	1 Kenyalu	Jan 1988	Cattle	12 infected, 2 dead
2	Bolo, Bima	2 ?	Dec 1991	1 goat	0
		3 ?	May 1992	1 cattle, 1 goat	0
		4 ?	Jun 1992	1 cattle, 2 goats	0
		5 ?	Jan 1994	1 cattle	0
		6 ?	Mar 1994	1 goat	0
		7 ?	Aug 1995	1 goat	0
		8 ?	Oct 1995	2 cattle	0
		9 ?	Nov 1995	1 buffalo	0
		10 ?	Apr 1999	3 goats	?
		11 ?	Aug 1999	2 goats	?
		12 ?	Oct 1999	1 goat	?
		13 ?	Jun 2000	1 cattle	?
		14 ?	Oct 2002	2 cattle	?
		15 ?	Jan 2003	1 goat, 1 cattle, 4 goats	?
		16 Leu	May 2002	2 goats	?
		17 Nata	Aug 2003	1 cattle	0
3	Rasanae Timur, Bima	18 ?	Oct 1999	1 cattle	?
		19 ?	Feb 2001	6 cattle, 6 goats, 1 horse	?
		20 ?	Feb 2002	1 cattle, 2 goats	?
		21 ?	Sep 2002	1 cattle,1 horse, 1 goat	?
		22 Kendo	2003	1 goat	?
		23 Penatoi	2003	1 goat	?
		24 PenanaE	2003	1 goat	?
		25 Kumbe	May 2004	1 goat, 2 cattle	0
4	Rasanae Barat, Bima	26 SambinaE	Feb 2005	1 goat	?
		27 Paruga	Feb 2001	1 goat	0
5	Wera, Bima	28 ?	Aug 1999	1 goat	?
		29 Hidirasa	Aug 2001	3 goats	?
			Dec 2001	1 goat	0
			Jan 2004	1 goat	0
			Mar 2005	1 goat	0
		30 Nunggi	Sep 2002	1 buffalo	?
		31 Tawali	Sep 2002	1 buffalo	?
6	Sape, Bima	32 ?	Oct 1999	2 goats	?
		33 ?	Feb 2002	1 horse	?
		34 Kaleo	Feb 2002	1 horse	0
		35 Naru	Jan 2003	1 goat	?
		36 Rai Oi	Feb 2003	1 goat	?
		37 Rasabou	Jan 2005	1 goat	0
7	Wawo, Bima	38 ?	Jan 1997	1 buffalo	?
			Aug 1997	1 buffalo	?
		39 Maria	Jan 2003	1 goat	0
			Feb 2003	1 goat	0
8	Madapangga, Bima	40 Dena	Oct 2002	1 cattle	?
9	Ambalawi, Bima	41 Tolowata	Dec 2002	1 cattle	?
		42 Wawu	Jun 2005	1 cattle	0

Table 12. (cont'd) Anthrax cases recorded in Nusa Tenggara Barat since 1988

No.	Kecamatan, kabupaten	Village	Month and year	Animal species infected	Humans
10	Donggo, Bima	43 Doridungga	1997	goat	2 dead
			Dec 2002	64 goats	15 infected, 9 dead
			Jan 2003	5 goats	0
		44 ?	Feb 2002	1 cattle	?
		45 Sai	Feb 2001	1 cattle	?
			Sep 2002	1 horse	0
		46 Bajo	Feb 2003	1 goat	?
		47 Punti	Jan 2003	2 goats	?
			Feb 2003	5 goats	0
		48 Sarita	Jan 2003	1 goat	?
		49 Sampungu	Nov 1991	1 cattle	?
			Jan 2003	1 goat	0
11	Langgudu, Bima	50 Doro O'o	Jan 2005	1 goat	0
12	Woha, Bima	51 ?	Nov 1991	1 goat	0
13	Monta, Bima	52 Sondo	Jan 2003	1 buffalo	0
14	Sanggar, Bima	53 Kore	Aug 2004	1 goat	0
15	Kota Bima	54 Jatiwangi	Dec 2001	1 goat	0
		55 Jatibaru	Sep 2002	1 cattle	0
		56 Rabangodu	Sep 2002	1 horse	0
16	Dompu, Dompu	57 Lepadi	1985	2 goats	2 dead
			1986	1 goat	1 dead
			Jul 1995	1 goat	0
			2000	1 cattle	0
		58 ?	Jul 1995	1 goat	?
		59?	2000	1 cattle	?
17	Hu'u, Dompu	60 ?	Jul 1995	1 goat	?
		61 Lune	Aug 2003	4 cattle	?
		62 Rasabou	Jul 1995	1 goat	0
18	Empang, Sumbawa	63 ?	Aug 1995	buffalo, horse	?
		64 Empang Bawa	Dec 2004	1 buffalo	0
19	Lunyuk, Sumbawa	65 Padasuka	Apr 2003	1 cattle	0
20	Sumbawa, Sumbawa	66 ?	1978	2 buffalo, 1 goat, 1 horse	0
		67 Brangbeji	1997	1 cattle	2 infected
		68 Kreke	1998	1 cattle	2 infected
		69 Seketeng	Mar 2005	3 goats	0
21	Lapelopok, Sumbawa	70 ?	Feb 1992	1 horse	?
		71 Dete	Jul 2002	1 cattle	0
22	Ropang, Sumbawa	72 Totebal	2002	1 cattle	6 infected
			May 2005	1 buffalo	0
23	Moyohulu, Sumbawa	73 ?	Jan 2004	3 buffaloes	0
		74 Lito, Lito B, Pelita	Nov 2004	2 buffaloes, 3 cattle	4 infected
		75 Batu Tering	Jun 2004	3 buffaloes	0
		76 Pernek	Jun 2004	1 buffalo	0
24	Alas, Sumbawa	77 Pernang	Jan 2004	1 cattle	0
25	Moyohilir, Sumbawa	78 Batubangka (Ds Sengkal)	Oct 2004	4 buffaloes, 4 cattle, 6 dogs, 1 chicken	4 infected
		79 ?	Feb 1999	2 cattle	0
		80 Berare	Sep 2004	10 cattle, 1 buffalo	0
		81 Ngeru	Oct 2004	1 buffalo	3 infected
26	Labuan Badas, Sumbawa	Karang Dima (Dusun Bangkong, Pamulung Bangkong)	Oct 2004	1 cattle, 1 goat	0

As the majority of cases of anthrax occur in goats, this will severely influence the potential for success of the program. There has been a report from Yogyakarta that the anaphylactic reactions may be due to injecting the vaccine into the muscle rather than subcutaneously, but the most widely accepted theory is that it is probably a reaction to the saponin in the vaccine.

***Recommendation*: Further research should be undertaken to identify and rectify the cause of the anaphylactic reactions occurring with the Pusvetma anthrax vaccine, or to identify alternative vaccines for use in goats.**

Additional areas of research suggested include development of serological tests that will allow an assessment of the immunity of vaccinated animals. The same tests could potentially be used to carry out a survey that would allow identification and mapping of areas where anthrax occurs.

***Recommendation*: Development of serological tests for assessing animal immunity following anthrax vaccination may allow assessment of vaccination status and may assist to better define risk areas for the purposes of more targeted vaccination programs.**

Diagnosis of anthrax has traditionally been undertaken using stained smears of blood and other body fluids. Because Bali is free of anthrax, samples from suspect anthrax cases cannot be sent to Denpasar and are examined in the Type B laboratory in Mataram or Kupang. This, plus the difficulty in transporting potentially dangerous specimens long distances, supports further research into the development of a rapid crush-side test for anthrax. Trialling of an anthrax crush-side test has been undertaken recently in Australia, at the Victorian Institute of Agricultural Science but, due to confidentiality agreements with the developer, it is unlikely this test will be made available to anyone outside of the US military.

***Recommendation*: The development of a rapid crush-side anthrax test should be pursued in Australia. (See next section for suggested collaborators on this project.)**

The development of a test to identify contaminated soil could help with the identification of environmental 'hot spots', such as where an animal had previously died or been inappropriately disposed of, allowing these areas to be isolated. Tests of this sort would also be of immense value in Australia, and NSW in particular, where cases of anthrax occur sporadically throughout the year.

***Recommendation*: The development of an anthrax test for soil should be supported.**

Bovine brucellosis

Bovine brucellosis was discussed in detail earlier. EIVSP I and II demonstrated that, in addition to causing disease and production losses in cattle, bovine brucellosis was a human health problem in Timor. There is a continuing need to control and eradicate brucellosis from cattle in Timor, for both livestock production and human health reasons.

Table 13. Cases of hydatid disease recorded at abattoirs in Nusa Tenggara Timur in 2005

Kabupaten/city	Hydatid cases
Kupang City	213
TTU	3
Sikka	26
Ngada	372
Manggarai Barat	4

Food safety organisms

Taeniasis/cysticercosis—hydatid disease

Hydatids were identified by the Dinas Peternakan in NTT and NTB as a major issue but were not mentioned by the Department of Health in NTT. Table 13 gives the numbers of cases of hydatid disease recorded at abattoirs in NTT. The Department of Health in NTB admitted that it would not be notified of hydatid cases, because it did not keep these kinds of statistics. A national workshop on cysticercosis/taeniasis, including representatives from both the Department of Health and Department of Livestock Services was to be held in Kupang in July 2006. Kupang was chosen to host the workshop because of the very high incidence of this parasite in people, pigs and goats in NTT (Dr Maria Geong, pers. comm.).

***Recommendation*: An investigation into the prevalence and impacts of hydatids on animals and people within Nusa Tenggara Timur and Nusa Tenggara Barat should be considered, with a view to developing control and advisory programs for this parasite.**

Salmonella enteriditis

Salmonella enteriditis infects poultry and their eggs. According to the 2004 annual report of Australia's National Enteric Pathogens Surveillance Scheme, '*S. enteriditis* was the most common *Salmonella* acquired overseas, the majority of infections reported from visitors to countries in South-East Asia, particularly Indonesia (Bali)'. Of the 269 infections of *S. enteriditis* acquired overseas in 2004, 118 or 44% of these occurred in Bali.

New South Wales (since 1997) and Victoria (since 2004) have run a very successful voluntary industry-based accreditation scheme to combat *S. enteriditis.* This program requires biosecurity precautions to be taken at egg-producing farms to ensure *S. enteriditis* is not introduced, as well as requiring routine testing. Dr Agung, head of the Animal Health Laboratory in Denpasar, is interested in developing the laboratory's capability to test for this organism and in developing a program for egg producers in Bali. There is an opportunity for a transfer of technology here that would provide benefits to both Indonesians and Australian visitors to Bali.

***Recommendation*: A project that transfers technology for the identification and control of *Salmonella enteriditis* in Bali should be considered, as it would benefit Balinese and visitors to Bali.**

Japanese encephalitis

The NTB and NTT provincial departments of health are working with the Department of Health in Jakarta, Litbang Health and PATH, an American NGO, to identify people displaying clinical symptoms consistent with Japanese encephalitis (JE). A program of human surveillance for JE at multiple sites in Indonesia began about 18 months ago. Cases have been diagnosed at all sites, confirming JE as an endemic disease in Indonesia (Dr Susan Hills, pers. comm.).

Nusa Tenggara Timur. Of the more than 40 cases of JE investigated in this province during 2005, three hospital cases in Kupang and four in Kabupaten TTU were confirmed. The authorities are interested in further work to define the extent of the problem and to assess the socioeconomic impact of JE in NTT.

Nusa Tenggara Barat. So far 305 suspected cases have been recorded in the kabupaten or cities of Mataram, Lombok Barat, Lombok Tengah and Lombok Timur, and serological samples have been taken for testing. At the time of my visit no results had been received. There was concern that many of these cases have no association with pigs.

Dr Agung at the Animal Disease Investigation Centre in Denpasar reports 50–70% prevalence of JE in pigs in Indonesia (serological). He warned that research into JE prevalence was a sensitive topic with the Indonesian Government because of the possible impact on the tourist market if it became widely known that JE occurs frequently. Dr Agung noted too that his centre had recently participated in trials with Peter Daniels from the Australian Animal Health Laboratory on what is the best indicator of presence of JE—cattle or pigs.

Chemical residues

Indonesia is the third largest user of pesticides in the Asian region, after China and India, but very little is known about the level or extent of pesticide residues in Indonesian produce (Dr Yulvian, pers. comm.). Balitvet has a role in testing local product and material imported from places such as Australia. Dr Yulvian advised that, previously (before avian influenza), Indonesian poultry meat exports to Japan and Singapore had been suspended because of excess pesticide residues. Australia exports large numbers of live cattle and some meat products, all of which may be tested at any time by the Indonesian Government. It is important that Indonesian laboratories use the same or similar tests to Australia, to ensure comparable results. (Live cattle imported from Australia are not all killed for consumption in Indonesia. Some are either re-exported, or slaughtered and their meat exported, to Malaysia and the Philippines. Ensuring that Australian cattle fattened in Indonesia are residue free is also important for our ongoing trade.)

The Department of Health in NTT expressed concerns about levels of chemicals in foods produced locally, providing examples of local sellers of chicken meat treating the meat with diluted formalin to prolong its unrefrigerated shelf-life, using borax in meat balls and spraying vegetables with a variety of

products that could cause residues in the plants or in animals fed them. Similar concerns were raised in NTB.

Having lived in Indonesia for 6 years and attempted to grow vegetables that were devoured by insects, as well as seen near-pristine vegetables presented in the markets, I have to suspect that the use of pesticides is widespread.

***Recommendation*: The ongoing development of Indonesia's capability and capacity to test for and monitor pesticide residues in vegetable and meat products should be investigated.**

Dr Yulvian advised that he had co-authored several project proposals submitted to ACIAR for consideration but that he was unaware of the outcome of these submissions.

Addressing term of reference 5

Identify likely research partners in Indonesia and Australia to further develop ideas for research noted above.

General comment

When working in eastern Indonesia, it is best, wherever possible, to work through the existing government and university systems. In this regard, DGLS should be kept informed of all proposed and ongoing research.

The Northern Australia Quarantine Strategy of the Australian Quarantine and Inspection Service (AQIS) currently undertakes limited routine studies in eastern Indonesia. These include short-term visits by Australians to sites in Indonesia to collect specimens. Consideration should be given to modifying this approach so that funds are directed towards supporting ongoing Indonesian-based sampling programs using local staff, particularly those trained in Australia, or by other Australian projects in Indonesian laboratories. Benefits of an approach like this would include an improved and more frequent sampling regime, better diagnostic capacity in Indonesian laboratories and an immeasurable increase in general goodwill towards Australia. Collaboration with AQIS could result in a number of opportunities to develop ongoing, surveillance projects that could benefit both Australia and Indonesia.

***Recommendation*: The Australian Quarantine and Inspection Service should be approached with a view to designing an improved Northern Australia Quarantine Strategy surveillance program for eastern Indonesia.**

Potential researchers

Animal production—general

- Dr Yacob Nulik, head of the Animal Production Research Station at Naibonet, NTT

Anthrax

- Dr Michael Hornitsky, Elizabeth Macarthur Agricultural Institute, Menangle, NSW, Australia Dr Hornitsky has worked on anthrax in NSW for over 20 years.

Avian influenza

- Dr Indrawati Sendow DVM MSc, Balitvet
- Dr Drh Gusti Ngurah Mahardika, Animal Molecular Biomedical and Biological Research Unit, Faculty of Veterinary Science, Udayana University (UNUD), Denpasar
- Drh Ketut Santhia, Disease Investigation Centre, Denpasar
- Dr Peter Daniels, Australian Animal Health Laboratory (AAHL)

Brucellosis

- Drh Susan M. Noor MVSc, Balitvet
- Dr Maria Geong, Dinas Peternakan, NTT

Deer production

- Professor Drh Adji Santoso Dradjat MPhil PhD, Professor of Animal Reproduction, Livestock Faculty, University of Mataram
- Professor Tony English, University of Sydney

Epidemiology

- Drh Tri Satya P. Naipospos (Tata), Jl Taman Sari III No. 8 Taman Cimanggu, Bogor, West Java; email: civasland@yahoo.com; phone: 0251 363833

Japanese encephalitis

- Dr Susan Hills, Program Officer, Japanese Encephalitis Project, PATH, 1455 NW Leary Way, Seattle WA 98107, USA
- Dr Peter Daniels, AAHL

Neospora

- Barbara Moloney, NSW Department of Primary Industries, 161 Kite Street, Orange, NSW 2800, Australia
- Dr J.T. Ellis, University of Technology, Sydney
- Dr Peter Windsor, University of Sydney

Parasitology—general

- Dr Drh I Made Damriyasa MS, Dean, Faculty of Veterinary Science, UNUD
- Dr Drh Gusti Ngurah Mahardika, Animal Molecular Biomedical and Biological Research Unit, Faculty of Veterinary Science, UNUD
- Dr Anak Agung Gde Putra, Head of the Disease Investigation Centre, Denpasar, Bali
- Dr Frans Umbu Datta, Rector, University of Nusa Cendana (Undana), Kupang
- Drh Maxs U.E. Sanam MSc, Livestock Faculty, Undana
- Dr Peter Rolfe, ACIAR
- Gareth Hutchinson, Elizabeth Macarthur Agricultural Institute, Woodbridge Road, Menangle, NSW, Australia

Virology—general

- Dr Indrawati Sendow DVM MSc, Balitvet

Christie, B.M. 2007. A review of animal health research opportunities in Nusa Tenggara Timur and Nusa Tenggara Barat provinces, eastern Indonesia. Canberra, ACIAR Technical Reports No. 65.

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- Drh Ison

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- Dr Yulvian Sani (Yul), Acting Director
- Drh Susan M. Noor MVSc
- Dr Indrawati Sendow DVM MSc

Centre for Indonesian Veterinary Analytical Studies
- Drh Tri Satya P. Naipospos (Tata)

Bali

Disease Investigation Centre, Denpasar
- Dr Anak Agung Gde Putra
- Dr Ketut Santhia

Udayana University
- Dr Drh I Made Damriyasa MS, Dean, Faculty of Veterinary Science
- Dr Drh Gusti Ngurah Mahardika, Animal Molecular Biomedical and Biological Research Unit, Faculty of Veterinary Science

Other
- Dr Alan Wilson

Nusa Tenggara Timur

Department of Livestock Services (Dinas Peternakan)
- Ir. Littik, Head of Department
- Dr Maria Geong, Head of Animal Health section, and staff
- Ir. Pulinggomang, Regional Head of Livestock Services, Alor (Dinas Peternakan Alor)
- Drh Artati Loasana, Head of the Animal Health Type B Laboratory, Kupang
- Drh Caely Apery
- Drh Heni

BPTP Naibonet
- Dr Yacob Nulik
- Ir Ahyar

NTT Governor's Office
- Ir E. Th Salean, Kepala Bappeda Propinsi
- Daniel Nggebu, Economics Unit

University of Nusa Cendana (Undana)
- Dr Frans Umbu Datta, Rector
- Drh Maxs U.E. Sanam MSc, Livestock Faculty
- Prof. Dr Jublin F. Bale-Therik MS, Animal Nutritionist, Livestock Faculty and Provincial Government Gender Advisor

Department of Health, Kupang (Dinas Kesehatan NTT)
- Dr (Bobby) S.M.J. Koamesah MMR MMPK, Kepala Sub Dinas Bina PMK
- Nyoman Saniambara SKM, MKes Community Disease Control, Surveillance Division, East Nusa Tenggara

Other
- Drh Agus Bale, Poultry Farmer (previously Head of the Provincial Animal Health Laboratory and Policy Section, co-team leader of the AusAID-funded Eastern Island Veterinary Services Project and President of the NTT Association of Veterinarians)

AusAID ANTARA Program
- Dr John Maxwell
- John Schottler

Nusa Tenggara Barat

Department of Livestock Services (Dinas Peternakan NTB)
- Drh H. Abdul Muthalib, Head of the Department
- Drh A. Rachman Abidin, Head of Animal Health Branch
- Drh Sahirman, Head of Veterinary Public Health Branch
- Drh Diyan Riyatmoko

University of Mataram
- Prof. Drh Adji Santoso Dradjat MPhil PhD, Professor of Animal Reproduction, Livestock Faculty, Department of Health (Dinas Kesehatan NTB)
- Dr Muchkmad Ismail, Head of the Sub-Dinas Pencegahan, Pemberantasan Penyakit (Community Disease Control), and staff

Other
- Hadji Saat, Cattle Trader, CV Kolompok Usaha Mandiri

References

In addition to a range of Dinas Peternakan documents from Nusa Tenggara Timur and Nusa Tenggara Barat, the following were consulted.

Fox J.J. 1997. Harvest of the palm: ecological change in eastern Indonesia. Harvard University Press, Cambridge, Massachusetts.

Powling, J. (ed.) 2005. National Enteric Pathogens Surveillance Scheme human annual report 2004. Microbiological Diagnostic Unit, Public Health Laboratory, Department of Microbiology and Immunology, The University of Melbourne, Victoria 3010, Australia.

Salisbury R.M. 1995. Outcomes of Cattle Health and Productivity Survey (CHAPS) seminar, May 1994, second edition. Unpublished report of the Eastern Islands Veterinary Services Project Phase Two.

Simpson S. 1996. Second report on the training and extension component. Unpublished report of the Eastern Islands Veterinary Services Project Phase Two, December 1996.

Attachment 1

Comparison of livestock populations, numbers slaughter and exported, human population and land area in NTT during 1994 and 2004

	Kupang	Kupang*		TTS		
	1994	2004	Percentage change	1994	2004	Percentage change
Animal population						
Cattle	225,570	151,412	–32.88	226,746	116,169	–48.77
Buffalo	25,478	17,168	–32.62	2,538	515	–79.71
Horses	17,448	16,101	–7.72	18,786	4,706	–74.95
Goats	164,886	109,907	–33.34	77,580	33,668	–56.60
Sheep	94,388	49,578	–47.47	–	0	
Pigs	311,333	171,701	–44.85	187,554	243,235	29.69
Chickens—village	1,527,641	2,066,804	35.29	518,523	781,731	50.76
Chickens—layer	11,875	83,321	601.65	3,000		–100.00
Chickens—broilers	670,130	3,813	–99.43	8,100		–100.00
Ducks	14,093	20,805	47.63	6,026	9,679	60.62
Animals slaughtered						
Cattle	10,935	11,614	6.21	1,573	8,911	466.50
Buffalo	0	728	728.00	–	22	22.00
Horses	311	419	34.73	–	123	123.00
Goats	4,556	33,851	643.00	–	10,370	10,370.00
Sheep	0	13,745	13,475.00	–	0	
Pigs	9,884	74,919	657.98	1,202	106,131	8,729.53
Chickens—broilers	650,026	3,750	–99.42	7,857		–100.00
Chickens—village	2,291,462	3,110,540	35.74	777,785	1,176,505	51.26
Chickens—layer	5,938	71,240	1,099.73	1,500		–100.00
Ducks	8,456	10,715	26.71	3,616	4,985	37.86
Animals exported (slaughter)						
Cattle	20,114	40,207	99.90	19,204	6,159	–67.93
Buffalo	1,792	2,142	19.53	119	100	–15.97
Horses	113	174	53.98	120		–100.00
Goats	–	174		–		
Area (km^2)	7,339	7,339		3,947	3,947	
Population	537,029	686,240	28	357,859	404,516	13
Population/km^2	73	94		91	103	
Land (ha)	197,562	243,913		79,262	58,243	
Animal units	442,101	285,135		331,021	213,799	
Animal units/km^2	60	39		84	54	

Cattle 250 kg = 1.0 animal unit
Buffalo 400 kg = 1.4 animal unit
Horses 250 kg = 1.0 animal unit
Goats 30 kg = 0.21 animal unit
Sheep 30 kg = 0.21 animal unit
Pigs 60 kg = 0.35 animal unit
* Kupang = Kabupaten Kota Kupang, Kupang, and Rote and Ndao

Attachment 1 (cont'd)

	TTU			Belu		
	1994	2004	Percentage change	1994	2004	Percentage change
Animal population						
Cattle	108,672	57,003	–47.55	120,344	92,586	–23.07
Buffalo	2,121	706	–66.71	20,651	2,513	–87.83
Horses	9,029	2,278	–74.77	16,158	3,730	–76.92
Goats	14,897	15,621	4.86	59,514	11,664	–80.40
Sheep	–	35		–	23	
Pigs	62,923	57,523	–8.58	119,131	90,656	–23.90
Chickens—village	101,261	139,621	37.88	499,488	773,479	54.85
Chickens—layer	5,136		–100.00	2,850		–100.00
Chickens—broilers	7,889		–100.00	1,163		–100.00
Ducks	7,528	8915	18.42	53,528	20,018	–62.60
Animals slaughtered						
Cattle	1,397	4,372	212.96	2,734	7,102	159.77
Buffalo	–	30	30.00	72	107	48.61
Horses	–	59	59.00	–	97	97.00
Goats	1,500	4,811	220.73	–	3,593	3593.00
Sheep	–	10	10.00	–	6	6.00
Pigs	922	25,099	2,622.23	4,248	39,556	831.17
Chickens—broilers	7,652		–100.00	1,128		–100.00
Chickens—village	151,892	210,130	38.34	749,232	1,164,087	55.37
Chickens—layer	2,568		–100.00	1,425		–100.00
Ducks	4,517	4,591	1.64	32,117	10,309	–67.90
Animals exported (slaughter)						
Cattle	14,485	7,660	–47.12	10,119		–100.00
Buffalo	471	225	–52.23	425		–100.00
Horses						
Goats	–			–		
Area (km^2)	2,669	2,669		2,445	2,445	
Population	170,391	177,918	4	222,603	331,412	49
Population/km^2	64	67		91	136	
Land (ha)	16,000	86,399		29,750	24,010	
Animal units	145,822	83,690		219,607	134,018	
Animal units/km^2	55	31		90	55	

Cattle 250 kg = 1.0 animal unit
Buffalo 400 kg = 1.4 animal unit
Horses 250 kg = 1.0 animal unit
Goats 30 kg = 0.21 animal unit
Sheep 30 kg = 0.21 animal unit
Pigs 60 kg = 0.35 animal unit

Attachment 1 (cont'd)

	Alor			FlorTim	FlorTim*	
	1994	2004	Percentage change	1994	2004	Percentage change
Animal population						
Cattle	5,807	1,243	–78.59	3,176	2,909	–8.41
Buffalo	–	0		46	38	–17.39
Horses	716	143	–80.03	5,019	3,982	–20.66
Goats	24,029	24,379	1.46	92,043	82,381	–10.50
Sheep	134	6	–95.52	6,441	2,564	–60.19
Pigs	32,484	60,311	85.66	90,686	158,309	74.57
Chickens—village	152,016	371,724	144.53	505,508	690,443	36.58
Chickens—layer	2,963	6,230	110.26	22,126		–100.00
Chickens—broilers	1,250		–100.00	–		0.00
Ducks	5,925	11,444	93.15	20,959	28,534	36.14
Animals slaughtered						
Cattle	181	95	–47.51	139	223	60.43
Buffalo	2	0	–100.00	–	1	1.00
Horses	–	4		–	103	103.00
Goats	1,444	7,509	420.01	5,396	25,373	370.22
Sheep	–	2		40	711	1677.50
Pigs	3,108	26,316	746.72	3,135	69,076	2103.38
Chickens—broilers	1,213	5,327	339.16	–		
Chickens—village	228,024	559,445	145.34	758,262	1,039,117	37.04
Chickens—layer	1,482		–100.00	11,063		–100.00
Ducks	3,555	5,894	65.79	12,575	14,695	16.86
Animals exported (slaughter)						
Cattle						
Buffalo					3	
Horses					1	
Goats	–			–		
Area (km^2)	2,864	2,864		3,079	3,079	
Population	147,646	168,965	14	268,110	313,609	17
Population/km^2	52	59		87	102	
Land (ha)	2,750	7,149		8,500	56,546	
Animal units	22,967	27,616		60,681	80,191	
Animal units/km^2	8	10		20	26	

Cattle 250 kg = 1.0 animal unit
Buffalo 400 kg = 1.4 animal unit
Horses 250 kg = 1.0 animal unit
Goats 30 kg = 0.21 animal unit
Sheep 30 kg = 0.21 animal unit
Pigs 60 kg = 0.35 animal unit
* FlorTim = Kabupaten FlorTim and Lambata

Attachment 1 (cont'd)

	Sikka			Ende		
	1994	2004	Percentage change	1994	2004	Percentage change
Animal population						
Cattle	7,490	4,711	–37.10	4,330	6,517	50.51
Buffalo	549	495	–9.84	1,974	2,515	27.41
Horses	14,410	3,185	–77.90	3,045	2,547	–16.35
Goats	56,846	34,742	–38.88	12,207	19,694	61.33
Sheep	–	201	201.00	269	48	–82.16
Pigs	158,490	88,843	–43.94	42,432	61,592	45.15
Chickens—village	319,100	495,559	55.30	1,812,619	1,699,494	–6.24
Chickens—layer	20,000		–100.00	24,127	306	–98.73
Chickens—broilers	8,000		–100.00	2,308		–100.00
Ducks	26,973	44,347	64.41	37,324	56,622	51.70
Animals slaughtered						
Cattle	799	361	–54.82	1,082	500	–53.79
Buffalo	142	21	–85.21	87	107	22.99
Horses	–	83	83.00	–	66	66.00
Goats	1,464	10,701	630.94	5,351	6,066	13.36
Sheep	–	56	56.00	–	13	13.00
Pigs	1,518	38,765	2,453.69	2,165	26,875	1141.34
Chickens—broilers	7,760		–100.00	2,239	262	–88.30
Chickens—village	478,650	745,816	55.82	2,718,929	2,557,739	–5.93
Chickens—layer	10,000		–100.00	12,064		–100.00
Ducks	16,184	22,839	41.12	22,394	29,160	30.21
Animals exported (slaughter)						
Cattle		31		75	175	133.33
Buffalo		49		560	300	–46.43
Horses		30		270		–100.00
Goats	–	5,053		–		
Area (km^2)	1,731	1,731		2,046	2,046	
Population	247,557	276,590	12	221,750	238,486	8
Population/km^2	143	160		108	117	
Land (ha)	8,937	19,389			910	
Animal units	90,078	47,022		27,610	38,288	
Animal units/km^2	52	27		14	19	

Cattle 250 kg = 1.0 animal unit
Buffalo 400 kg = 1.4 animal unit
Horses 250 kg = 1.0 animal unit
Goats 30 kg = 0.21 animal unit
Sheep 30 kg = 0.21 animal unit
Pigs 60 kg = 0.35 animal unit

Attachment 1 (cont'd)

	Ngada			Manggarai		
	1994	2004	Percentage change	1994	2004	Percentage change
Animal population						
Cattle	19,910	33505	68.28	9,884	10225	3.45
Buffalo	15,687	11923	–23.99	9,884	34733	251.41
Horses	12,056	8097	–32.84	8,429	7218	–14.37
Goats	39,192	41776	6.59	32,465	41088	26.56
Sheep	4,953	3064	–38.14	93	93	0.00
Pigs	106,168	131393	23.76	75,134	126689	68.62
Chickens—village	390,265	609767	56.24	521,990	615209	17.86
Chickens—layer	10,714		–100.00	2,235		–100.00
Chickens—broilers	–			327		–100.00
Ducks	10,816	17132	58.40	1,929	8051	317.37
Animals slaughtered						
Cattle	530	2570	384.91	291	784	169.42
Buffalo	96	506	427.08	132	1473	1015.91
Horses	–	211	211.00	–	188	188.00
Goats	1,108	12867	1061.28	565	12655	2139.82
Sheep	–	849	849.00	–	26	26.00
Pigs	2,016	57331	2743.80	6,821	55279	710.42
Chickens—broilers	–			317		–100.00
Chickens—village	585,398	917700	56.77	782,985	925890	18.25
Chickens—vayer	5,357		–100.00	1,118		–100.00
Ducks	6,490	8823	35.95	1,157	4146	258.34
Animals exported (slaughter)						
Cattle	828	313	–62.20	893	5,766	545.69
Buffalo	902	854	–5.32	2,595	3,664	41.19
Horses	42		–100.00	848	2,639	211.20
Goats	–			–		
Area (km^2)	3,037	3,037		7,136	7,136	
Population	201,553	244,242	21	520,971	661,337	27
Population/km^2	66	80		73	93	
Land (ha)	5,625	15193		14,750	77089	
Animal units	100,357	113,698		65,285	119,058	
Animal units/km^2	33	37		9	17	

Cattle 250 kg = 1.0 animal unit
Buffalo 400 kg = 1.4 animal unit
Horses 250 kg = 1.0 animal unit
Goats 30 kg = 0.21 animal unit
Sheep 30 kg = 0.21 animal unit
Pigs 60 kg = 0.35 animal unit

Attachment 1 (cont'd)

	Sumba Timur			Sumba Barat		
	1994	2004	Percentage change	1994	2004	Percentage change
Animal population						
Cattle	43,596	40,325	–7.50	10,770	6,324	–41.28
Buffalo	40,810	33,603	–17.66	45,090	32,759	–27.35
Horses	36,700	27,577	–24.86	20,792	16,852	–18.95
Goats	13,338	37,125	178.34	12,978	10,057	–22.51
Sheep	2,012	891	–55.72	66	0	–100.00
Pigs	78,320	32,788	–58.14	141,417	53,124	–62.43
Chickens—village	350,301	516,275	47.38	424,239	629,101	48.29
Chickens—layer	–			649		–100.00
Chickens—broilers	–			407		–100.00
Ducks	–	2,432	2,432.00	1,612	2537	57.38
Animals slaughtered						
Cattle	466	3,093	563.73	639	485	–24.10
Buffalo	–	1,425	1,425.00	340	1,389	308.53
Horses	–	718	718.00	35	439	1,154.29
Goats	5,664	11,434	101.87	1,431	3,098	116.49
Sheep	–	247	247.00	–	0	
Pigs	1,006	14,307	1,322.17	732	23,180	3,066.67
Chickens—broilers	–			395		–100.00
Chickens—village	525,452	776,994	47.87	636,359	946,797	48.78
Chickens—layer	–			325		–100.00
Ducks	–	1,252	1,252.00	967	1,307	35.16
Animals exported (slaughter)						
Cattle	4,120		–100.00	1,067	900	–15.65
Buffalo	4,434		–100.00	1,543	164	–89.37
Horses	4,284		–100.00	1,832		–100.00
Goats	–	3,912		–		
Area (km^2)	7,000	7,000		4,052	4,052	
Population	159,391	198,186	24	302,239	386,557	28
Population/km^2	23	28		75	95	
Land (ha)	18,625	215,797		26,625	83,635	
Animal units	168,066	134,405		146,923	89,744	
Animal units/km^2	24	19		36	22	

Cattle 250 kg = 1.0 animal unit
Buffalo 400 kg = 1.4 animal unit
Horses 250 kg = 1.0 animal unit
Goats 30 kg = 0.21 animal unit
Sheep 30 kg = 0.21 animal unit
Pigs 60 kg = 0.35 animal unit

Attachment 1 (cont'd)

	NTT		
	1994	2004	Percentage change
Animal population			
Cattle	786,295	522,929	–33.49
Buffalo	164,828	136,968	–16.90
Horses	162,588	96,416	–40.70
Goats	599,975	462,102	–22.98
Sheep	108,356	56,503	–47.85
Pigs	1,406,072	1,276,164	–9.24
Chickens—village	7,122,951	9,389,207	31.82
Chickens—layer	105,675	89,857	–14.97
Chickens—broilers	699,574	3,813	–99.46
Ducks	186,713	230,516	23.46
Animals slaughtered			
Cattle	20,766	40,110	93.15
Buffalo	871	5,809	566.93
Horses	346	2,510	625.43
Goats	28,479	142,328	399.76
Sheep	40	15,665	39062.50
Pigs	36,757	556,834	1414.91
Chickens—broilers	678,587	9,339	–98.62
Chickens—village	10,684,430	14,130,760	32.26
Chickens—layer	52,840	71,240	34.82
Ducks	112,028	118,716	5.97
Animals exported (slaughter)			
Cattle	70,905	61,211	–13.67
Buffalo	12,841	7,501	–41.59
Horses	7,509	2,844	–62.13
Goats	0	9,139	9139.00
Area (km^2)	47,345	47,345	
Population	3,357,099	4,088,058	22
Population/km^2	71	86	
Land (ha)		888,273	
Animal units	1,820,517	1,366,665	
Animal units/km^2	39	29	

Cattle 250 kg = 1.0 animal unit
Buffalo 400 kg = 1.4 animal unit
Horses 250 kg = 1.0 animal unit
Goats 30 kg = 0.21 animal unit
Sheep 30 kg = 0.21 animal unit
Pigs 60 kg = 0.35 animal unit

Attachment 2

Supplementary tables

Table S1. Details of horse and goat exports from Nusa Tenggara Timur, 2004

Kabupaten	Horses		Goats		Destination
	Breeding	Slaughter	Breeding	Slaughter	
Kupang	–	174	–	174	Jakarta, West Java
TTS	–	–	–	–	
TTU	–	–	–	–	
Belu	–	–	–	–	
Alor	–	–	–	–	
Lembata	–	–	–	–	
FlorTim	–	–	–	–	
Sikka	–	1	–	5053	Jakarta, West Java, South Sulawesi
Ende	–	30	–	–	
Ngada	–	–	–	–	
Manggarai	–	–	–	–	
Sumba Timur	–	2,638	–	3,912	South Sulawesi
Sumba Barat	–	–	–	–	
City of Kupang	–	–	–	–	
Rote/Ndao	–	–	–	–	
Manggarai Barat	–	–	–	–	
NTT total	0	2,844	0	9,139	

Source: Statistik Peternakan Tahun 2004, Dinas Peternakan Propinsi, NTT, p. 72, Table 27

Table S2. Details of horse and goat exports from Nusa Tenggara Timur, 1994

Kabupaten	Horses		Goats		Destination
	Breeding	Slaughter	Breeding	Slaughter	
Kupang	–	113	–	–	East Java
TTS	–	120	–	–	East Java
TTU	–	–	–	–	–
Belu	–	–	–	–	–
Alor	–	–	–	–	–
Lembata	–	–	–	–	–
FlorTim	–	–	–	–	–
Sikka	–	–	–	–	–
Ende	–	270	–	–	East Java
Ngada	–	42	–	–	East Java
Manggarai	–	848	–	–	East Java
Sumba Timur	–	4,284	–	–	East Java
Sumba Barat	–	1,832	–	–	East Java
City of Kupang	–	–	–	–	–
Rote/Ndao	–	–	–	–	–
Manggarai Barat	–	–	–	–	–
NTT total	0	7,509	0	–	–

Source: Statistik Peternakan Tahun 1994, Dinas Peternakan Propinsi, NTT, Table 27

Table S3. Details of cattle and buffalo exports from Nusa Tenggara Timur, 2004

Kabupaten	Cattle		Buffalo		Destination
	Breeding	Slaughter	Breeding	Slaughter	
Kupang	–	37,424	–	1,856	Jakarta, West Java
TTS	–	2,765	–	10	Jakarta, West Java
TTU	–	6,159	–	100	Jakarta, West Java
Belu	–	7,660	–	225	Jakarta, West Java
Alor	–	–	–	–	
Lembata	–	–	–	–	
FlorTim	–	–	–	–	
Sikka	–	–	–	3	Jakarta, West Java
Ende	–	31	–	49	Jakarta, West Java
Ngada	–	175	–	300	Jakarta, West Java
Manggarai	–	313	–	854	Jakarta, West Java
Sumba Timur	–	5,766	–	3,414	Jakarta, West Java, South Sulawesi
Sumba Barat	–	–	–	–	
City of Kupang	–	900	–	164	Jakarta, West Java
Rote/Ndao	–	18	–	274	Jakarta, West Java
Manggarai Barat	–	–	–	250	Jakarta, West Java
NTT total	0	61,211	0	7,501	

Source: Statistik Peternakan Tahun 2004, Dinas Peternakan Propinsi, NTT, p. 72, Table 26

Table S4. Details of cattle and buffalo exports from Nusa Tenggara Timur during 1944

Kabupaten	Cattle		Buffalo		Destination
	Breeding	Slaughter	Breeding	Slaughter	
Kupang	584	20,114	–	1,792	Jakarta, East Java
TTS	75	19,204	–	119	Jakarta, East Java
TTU	–	14,485	–	471	Jakarta, East Java
Belu	–	10,119	–	425	Jakarta, East Java
Alor	–	–	–	–	
Lembata	–	–	–	–	
FlorTim	–	–	–	–	
Sikka	–	–	–	–	
Ende	–	75	–	560	Jakarta, East Java
Ngada	–	828	–	902	Jakarta, East Java
Manggarai	–	893	–	2,595	Jakarta, East Java
Sumba Timur	–	4,120	–	4,434	Jakarta, East Java
Sumba Barat	–	1,067	–	1,543	Jakarta, East Java
City of Kupang[a]	–	–	–	–	
Rote/Ndao[a]	–	–	–	–	
Manggarai Barat[b]	–	–	–	–	
NTT Total	659	70,905	0	12,841	

Source: Statistik Peternakan Tahun 1994, Dinas Peternakan Propinsi, NTT, Table 26

[a] In 1994, figures for the City of Kupang and the islands of Rote and Ndao were included in Kabupaten Kupang.

[b] In 1994, figures for Manggarai Barat were included in Kabupaten Manggarai.

Attachment 3

Itinerary

Monday 12 June	
1700–1745 1850–2030 2100	Orange to Sydney ZL 0179 Sydney to Adelaide DJ 0416 Arrived accommodation: Oaks Plaza Hotel, Glenelg
Tuesday, 13 June	
1025–1410 1530	Adelaide to Denpasar (Flight: GA723) Arrive accommodation: Udayana Lodge, Bukit Jimbaran, Bali
Wednesday, 14 June 2006	
0900–1600 1820–1900 2100	Disease Investigation Centre, Bali, Jl. Raya Sesetan No 266, Pegok, Kotak Pos 3322, Bali • Dr Anak Agung Gde Putra, Director • Drh Ketut Santhia Denpasar–Jakarta (Flight: GA883) Arrived accommodation: Parklane, Jl. Casablanca, Jakarta
Thursday, 15 June 2006	
0900–1015 1100–1230 1230–1530	Meeting with Dr Tata Hutabarat Director of Animal Health, Directorate of Animal Health, Jl Harsono RM No. 3, Build. C 9th Floor, Pasar Minggu, Jakarta • Drh Bagus • Drh Nuri • Drh Ison Jakarta–Bogor (by car) Arrived accommodation: Crawford Lodge, Jl Pangrango 2, Bogor
Friday, 16 June 2006	
0900–1300	BALITVET, Jl RE Martadinata no. 30, Bogor • Dr Yulvian Sani, Acting Director • Dr Indrawati Sendow • Drh Susan Noor
1300–1440	Bogor–Jakarta (by car)
1730–2010	Jakarta–Denpasar (Flight: GA414)
2030	Arrived accommodation: Udayana Lodge, Bukit Jimbaran, Bali
Saturday, 17 June 2006	
1505–1635	Denpasar–Kupang (Flight: MZ610) Arrived accommodation: Kristal Hotel, Jl. Timor Raya no. 59, Kupang
Sunday, 18 June 2006	
1000–1300 1430–1730 1900–2130	Meeting with Dr Maria Geong Kepala Sub-Dinas Kesehatan Hewan and Ir Pulinggomang, Kepala Dinas Peternakan, Kabupaten Alor • John Maxwell, Program Director, ANTARA, Jl Monginsidi 2, Kupang • John Schottler, Manager, ANTARA
0830–1115 1145–1300	Dinas Peternakan NTT , Jl. Veteran Kelapa Lima, Kupang • Ir Littik, Kepala Dinas Peternakan NTT BPTP NTT (Naibonat), Jl. Raya Timtim km.32, Naibonat, Kupang • Ir.Ahyar, Kepala Seksi Kerjasama dan Pelayaan Pengbagian

Monday, 19 June 2006 (con't)	
1330–1630	Meetings with staff and inspection of Provincial Animal Health Laboratory Type B • Drh Artati Loasana • Drh Caely Aperi • Drh Henni • and staff
Tuesday, 20 June 2006	
0700– 1200–1300 1310–1500 1500–1700	Meetings at University of Nusa Cendana (Undana) • Dr Frans Umbu Datta, Rector • Drh Maxs U.E. Sanam MSc Livestock Faculty Further discussions at Provincial Dinas Peternakan and report writing Meeting with Ir Yacob Nulik at Kristal Hotel Discussions with • Prof. Dr. Jublin F. Bale-Therik MS, Animal Nutritionist, Livestock Faculty, University of Nusa Cendana and Provincial Government Gender Advisor. • Drh Agus Bale, Poultry Farmer (previously Head of the Provincial Animal Health Laboratory and Policy Section, and previously Co-Team Leader of the AusAID-funded Eastern Island Veterinary Services) Inspection of broiler poultry unit, Tarus, Kupang
Wednesday, 21 June 2006	
0800–0930 1030–1330 1420–1520 1530–1600 1750–1920 2015	Meeting with NTT Department of Health • Dr (Bobby) S.M.J. Koamesah, MMR, MMPK – Kepala Sub Dinas Bina PMK • Nyoman Saniambara SKM, MKes Community Disease Control, Surveillance Division, East Nusa Tenggara Further discussions at Provincial Dinas Peternakan and report writing Further discussions with Drh Artati Loasana, Provincial Animal Health Laboratory Meeting with John Maxwell and John Schottler, ANTARA Kupang–Denpasar (Flight: MZ611) Arrived accommodation: Udayana Lodge, Bukit Jimbaran, Bali
Thursday, 22 June 2006	
0515 0630–0700 0730–1100 1100–1230 1300–1400 1430–1500 1500–1600 1645 1930–2130 	Depart Udayana Lodge Denpasar–Mataram (Flight: MZ6600) Meetings at Dinas Peternakan NTB • Drh H Abdul Muthalib Head of the Department of Livestock Services • Drh A Rachman Abidin Head of Animal Health Branch NTB • Drh Sahirman Head of Veterinary Public Health Branch NTB Meetings at University of Mataram (UNRAM) • Prof. Drh Adji Santoso Dradjat MPhil, PhD, Professor of Animal Reproduction, Livestock Faculty, University of Mataram Discussions with staff from NTB Animal Health Laboratory Type B Inspection of Animal Health Post, Selagalas and discussions with head of post; • Drh Diyan Riyatmoko Visit livestock market, Selagalas Arrived accommodation: Grand Legi, Jl Sriwijaya no. 81, Mataram, NTB Dinner with • Drh H. Abdul Muthalib • Drh A. Rachman Abidin • Prof. Drh Adji Santoso Dradjat

Friday, 23 June 2006	
0800–0930	Meeting with Dinas Kesehatan Department of Health, NTB • Dr Muchkmad Ismail Head of the Sub-Dinas Pencegahan, Pemberantasan Penyakit (Community Disease Control), and staff
0930–1000	Meeting with Drh H. Abdul Muthalib
1000–1100	Meeting with cattle trader H. Saat and inspection of holding facilities, Gunungsari.
1100–1530	Report writing
1725–1755	Mataram–Denpasar (Flight: MZ6609) Arrived accommodation: Udayana Lodge, Bukit Jimbaran, Bali
Saturday, 24 June 2006	
8.30 – 12.00	Udayana University
12.30–15.30	Further discussions with Dr Maria Geong Discussions with Dr Alan Wilson INIRADEF
Sunday, 25 June 2006	
Morning	Report writing
2340–0725^{+1}	Denpasar to Sydney (Flight: GA 0706)
Monday 26 June 2006	
1200–1245	Sydney to Orange (Flight: ZL 0174)

Attachment 4

EASTERN ISLANDS VETERINARY SERVICES PROJECT

OUTCOMES OF CATTLE HEALTH AND PRODUCTIVITY SURVEY (CHAPS) SEMINAR MAY 1994

*** SECOND EDITION ***

This document contains the major recommendations of the seminar in both the English and Indonesian Languages.[1] The first edition was distributed in June 1994 and should now be discarded. This second edition was prepared by Ir (Ida) Wirdahayati R.B. front Sub-BPT Lili. Most of the changes are in the Indonesian version, where errors have been removed and some sections have been made clearer.

The proceedings, including the papers presented at the seminar, are published separately in two books, Book A and Book B.

RALPH SALISBURY
AUSTRALIAN TEAM LEADER
MATARAM NTB, INDONESIA
MAY 29 1995

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[1] Only the English-language version is presented here.

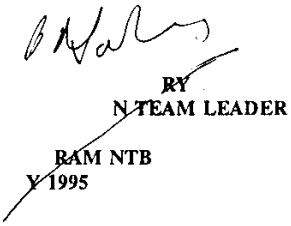
FOREWORD TO SECOND EDITION

The First Edition of 'Outcomes of the CHAP Survey May 1994' was distributed in June 1994. Top priority was given to quick production and distribution. Early in 1995 Ir (Ida) Wirdahayati R.B. undertook a thorough review of the document and has provided a new translation into Indonesian. As a result of her work, I am pleased now to distribute this Second Edition which replaces the First Edition. The First Edition has been extremely useful as a basis for discussion and planning. The Second Edition, together with the CHAPS Books A and B, now provides a complete guide to the information available from the survey in East and West Nusa Tenggara. The CHAP Survey in East Timor was completed recently and the outcomes of that survey will be documented during Phase 2 of EIVSP.

The contents of this document are the result of a great deal of hard work and cooperation between many people in Indonesia and Australia. The planning, implementation and analysis of the results of the CHAP Survey represented the most complex and demanding component of Phase 1 of the Eastern Islands Veterinary Services Project. The outputs show that these activities were also very productive and rewarding.

This document represents the major recommendations from the final CHAPS Seminar held at BPPH Denpasar in May 1994. The proceedings, including the papers presented at the seminar, have already been distributed as CHAPS Book A and CHAPS Book B which were produced with a minimum of editing to save time. Further copies of all of these documents are available from the EIVSP Office.

I gratefully acknowledge the support of the Directorate General of Livestock Services of Indonesia, of the managing agency New South Wales Agriculture and of the Australian Government through the Australian Agency for International Development (AusAID, formerly AIDAB) of the Department of Foreign Affairs and Trade. It would take several pages to thank all the people who have made substantial contributions to these outcomes and I hope that they will all accept my personal thanks. However, I must make special mention of Dr Bruce Christie, former Australian Animal Health Adviser to NTT, and Mr Ian Patrick, former Long Term Adviser in Economics based in Denpasar, without whose driving force and many hours of painstaking work these outcomes could not have been achieved. This document is the result of their partnership with Dr Abdullah Banualim and his wife It Wirdahayati in the days immediately after the seminar.



RALPH SALISBURY
AUSTRALIAN TEAM LEADER
EIVSP
MATARAM NTB
May 1995

CONTENTS

[2] Not presented here

OUTCOMES OF CATTLE HEALTH AND PRODUCTIVITY SURVEY SEMINAR MAY 1994

After the seminar held at Balai Penyidikan Penyakit Bewan Wilayah VI, Denpasar from 15–17 May 1994, a small committee consisting of Dr Bruce Christie, Mr Ian Patrick, Dr Abdullah Banualim and Ir R.B. Wirdahayati met for two days to prepare the following record of the seminar outcomes. On 18 May, Drh Margaretha A. Madjid and Drh Abdul Muthalib provided valuable assistance to the committee.

The document is divided into two sections:

SECTION A: RECOMMENDATIONS ON OVERCOMING CONSTRAINTS TO CATTLE PRODUCTION AT CHAP LOCATIONS

SECTION B: CHAPS AS A MODEL FOR FUTURE CATTLE DISTRIBUTION PROGRAMS

SECTION A
RECOMMENDATIONS ON OVERCOMING CONSTRAINTS TO CATTLE PRODUCTION AT CHAP LOCATIONS

The recommendations are separated into 5 sub-sections;

1 CATTLE PRODUCTION
2 FARMERS
3 LAND
4 TECHNOLOGY
5 POLICY

1 CATTLE PRODUCTION

A cow's ability to produce a live calf that can survive to 12 months of age was used during analysis of CHAPS data to define productivity. The principal factors affecting productivity in CHAPS cattle were cow fertility and calf mortality. Factors reducing cow fertility and increasing calf mortality, have been identified and recommendations are presented. Information on disease is also presented.

1.1 Fertility

Major constraints to cow fertility as identified by CHAPS are low body weight, breeding management, breed and type.

1.1.1 Low Body Weight

Constraints on body weight exist in the areas of feed quality, quantity and availability, parasite control and use of animals for draft (ploughing) purposes.

1.1.1.1 Feed/Forage Quality, Quantity and Availability

The quality and quantity of feeds and forages, particularly native grasses, is reduced significantly during the long dry season experienced in Nusa Tenggara. This is particularly true in Timor, Sumba and eastern Sumbawa.

Recommendations for improving feed/forage quality, quantity and availability:

* **Encourage planting of more tree legumes such as Turi (*Sesbania grandiflora*), Lamtoro (*Leucaena leucocephala*) and Gamal (*Gliricidia maculata*) in farmers' gardens either as an alley crop or along fences.**

Tree legumes can provide a source of high quality feed during the dry season. Approximately 90 trees are required to supply feed for a cow or bull for 6 months.

* **Encourage the conservation and use of crop by-products, particularly from legume crops, for cattle feed.**

Crop by-products generally contain higher amounts of protein than dry grass or rice straw. The inclusion of a small proportion (10–20%) of these as part of the animals' diet would improve the quality of the dry season basal ration.

* **Encourage conservation of good quality grasses and tree leaves that are available during the wet season by making hay at the end of the wet season.**

Further research may be needed to develop simple technologies that could be used by farmers for conservation of fodder (section 4.2.1).

* **Encourage farmers to feed cattle when yarded overnight.**

Cattle at extensive sites are generally kept in yards overnight, restricting their access to feed and water for up to 12 hours a day.

* **Encourage farmers to feed better quality feeds to target animals e.g. cows with calves or in late pregnancy, during the dry season.**

* **Ensure adequate availability of land for grazing or fodder production.**

Productivity in CHAPS cattle was related to land availability. Sites with less land for grazing or fodder production were less productive. Government programs need to provide more watering points, to improve the quality of existing grazing land and to motivate farmers to keep a special area for planting good quality, high producing fodder crops (see section 5.2).

1.1.1.2 Parasite Control

CHAPS has demonstrated decreased growth rates in cattle infected with *Fasciola*, *Toxocara vitulorum* and *Thelazia rhodesii*. Other parasites were identified as occurring at CHAPS locations but due to the nature of the survey, losses due to these could not be assessed and further applied research is required (see section 4.2.2).

* **Ensure that veterinary, para-veterinary and production staff are aware of the epidemiology, diagnosis, treatment, prophylaxis and economic importance of *Fasciola*, *Toxocara vitulorum* and *Thelazia rhodesii* (see Section 4.1.1).**

* **Advise farmers of the economic importance of these parasites and of methods of treatment and control.**

1.1.1.3 Use of Animals for Draft Purposes

* **Teach farmers the importance of maintaining cow body weight particularly in draft animals.**

Cows used for draft purposes lost more weight than those that were not used for draft. Farmers need to be made aware of the need to keep cow body weight high to maintain fertility.

1.1.2 Breeding Management

* **Ensure that bulls have access to cows at the right time—encourage communal housing of female cattle with the bull.**

At most semi-intensive sites bulls were owned by one owner. Problems with heat detection and access to bulls occurred at some sites.

* **Ensure body weight is adequate and provide adequate feed (see Section 1.1.1).**
* **Ensure the quality of bulls is maintained or improved (genetic and physical) in cattle distribution programs by following existing national criteria for selection of breeding animals.**
* **Ensure the quality of bulls is maintained or improved (genetic and physical) at extensively managed and privately owned sites by advising farmers of criteria for the selection of breeding animals.**

There has been some concern expressed that the genetic and physical quality of cattle in Nusa Tenggara is deteriorating.

* **Complement artificial insemination (AI) programs with access to bulls.**

It would appear that techniques being used for artificial insemination at CHAPS sites are inadequate. Further investigations are needed into the causes of these failures but, as a safeguard until AI techniques are improved, a bull should be kept with cows participating in AI programs.

* **Cull infertile and diseased animals.**

Farmers should be encouraged to cull unproductive cattle in order to reduce grazing and environmental pressure (see section 5.1).

1.1.3 Broad Type

* **Improve Ongole genetics.**

Ongole cattle were generally less fertile than Bali cattle.

1.2 Calf Mortality

Despite concerted attempts to investigate calf mortalities at CHAPS sites, no calves were post-mortemed during CHAPS. The cause of calf mortalities could not be demonstrated and further investigations are needed. A seasonal effect on mortality did not occur until calves were older than 6 months of age indicating that lack of feed in the dry season may have been a major factor. Parasites may also have been involved.

* **Support further investigations into the causes of calf mortalities in Nusa Tenggara.**

1.3 Disease

Parasitic disease due to *Fasciola*, *Toxocara vitulorum* and *Thelazia rhodesii* have been discussed in section 1.1.1.2. Other parasites are discussed in section 4.2.2.

*** Ensure cattle selected for distribution programs are free from reproductive diseases.**

Brucellosis was not observed in CHAPS cattle but it is known to exist in parts of Timor. Care should be taken when choosing cattle for distribution programs to ensure they do not have Brucellosis. The fact that there was no brucellosis in CHAPS cattle shows that the criteria used for distribution of cattle by NTASP were sound.

*** Continue to improve field and laboratory diagnostic services in Nusa Tenggara so that diagnosis, treatment and reporting of disease is improved.**

Positive serology was recorded for Leptospirosis, Bovine Viral Diarrhoea, Infectious Bovine Rhinotracheitis, Bluetongue, Bovine Ephemeral Fever and Haemorrhagic Septicaemia but there was no evidence of clinical disease (see section 4.2.2).

2 FARMERS

2.1 Farmer Management Skills

*** Improve farmer cattle handling and management skills through training.**

Cattle farmers at both semi-intensive and extensive sites initially had little knowledge of forage requirements, breeding management, disease control etc. Advisory programs need to be developed and funded to ensure that farmer management skills are raised. CHAPS data has now been analysed and results will be published in proceedings from the CHAPS seminar held in Bali. These results can now be used to produce advisory material for farmer training.

*** The Government of Indonesia and EIVSP supply funding to relevant advisory bodies in Nusa Tenggara, for example Balai Informasi Petani, to produce advisory material from CHAPS data for farmer training.**

*** EIVSP supply funding for GOI staff to return to CHAPS locations and inform farmers of the survey's findings.**

2.2 Cattle as Production Units

Farmers who valued their cow as an asset rather than as a production unit, produced less calves. Farmers need to be educated as to the benefits of producing calves. This is particularly important for farmers in cattle distribution projects.

2.3 Farmer Aspirations

*** Include farmers in decision making.**

When distributing cattle through cattle programs, the aspirations of the farmer must be considered. Farmers must be included in decision making (bottom up). This will give farmers a sense of ownership of the program and ensure cooperation.

3 LAND

*** Adequate land must be available for either grazing or forage production. If insufficient land is available, then distribution of other livestock types e.g. chickens, pigs, goats, may be more appropriate.**

*** Existing criteria for selection of cattle distribution sites are adequate but not always followed. Government must ensure they are adhered to.**

*** The Government may need to develop a policy to protect grazing lands in Nusa Tenggara as population pressure begins to reduce available grazing land.**

4 TECHNOLOGY (R&D)

4.1 Staff Training

4.1.1 Improved Disease Diagnosis

*** Continue to develop field and laboratory disease diagnostic and treatment services so that disease can be rapidly treated and reported.**

EIVSP has been involved in training veterinary and paraveterinary staff in Nusa Tenggara for approximately 5 years and CHAPS has been an integral part of that training program. There are still many areas of Nusa Tenggara where farmers cannot routinely seek trained assistance when their cattle are sick. Training must continue.

4.1.2 Cattle Production

*** Copies of the CHAPS seminar proceedings should be provided to Provincial and Rabupaten levels of the Dinas Peternakan and Balai Informasi Petani in Nusa Tenggara.**

*** Information from CHAPS should be made available to veterinary and animal husbandry training institutes throughout Indonesia for use in undergraduate training programs. Copies of the proceedings from the CHAPS seminar should be provided to these institutes by EIVSP.**

4.2 Research

4.2.1 Conservation of High Quality Feeds and Forage

Technology for hay making (at the end of the wet season) and storage of crop by-products needs to be reviewed.

Research needs to be undertaken on methods of preserving forages that grow in the wet season. There is generally a surplus of feed during the wet that cannot be utilised. Techniques for making hay are inappropriate due to the high moisture levels. Techniques for making silage are generally too difficult and forage quality too poor.

*** Simple, inexpensive methods of forage conservation need to be developed so that excess feed produced in the wet season can be stored for use in the dry season.**

*** Appropriate techniques should be implemented and demonstrated at sites throughout Nusa Tenggara.**

4.2.2 Disease Diagnosis

CHAPS has identified the presence of a number of parasitic diseases within the survey cattle. *Fasciola gigantica*, *Toxocara vitulorum* and *Thelazia rhodesii* have all been shown to affect growth rates. It was impossible to quantify any losses due to these as the survey design was only capable of providing prevalence data.

*** Further work is needed to define the prevalence and losses due to *Paramphistomum* spp., *Fasciola gigantica*, *Toxocara vitulorum* and *Thelazia***

***rhodesii* and to develop cost-effective control measures for these diseases. This requires well coordinated national and local approaches.**

Positive serology has been recorded in CHAPS cattle for Leptospirosis, Bovine Virus Diarrhoea, Infectious Bovine Rhinotracheitis, Bluetongue, Bovine Ephemeral Fever and Haemorrhagic Septicaemia. There was no evidence of clinical disease. Data from CHAPS suggests these diseases were not important.

* **Further research is necessary to clarify the importance of Leptospirosis, Bovine Virus Diarrhoea and Infectious Bovine Rhinotracheitis on cattle production in Nusa Tenggara.**

4.3.3 Artificial Insemination

AI techniques used in Nusa Tenggara at present produced poor conception rates in CHAPS cattle.

* **AI techniques being used in Nusa Tenggara need to be investigated to determine the cause of the poor results.**

4.2.4 Disease Diagnosis

Some tests used for disease diagnosis during CHAPS gave inconsistent or inaccurate results e.g. Haemorrhagic Septicaemia, Bovine Virus Diarrhoea.

* **Laboratory methods of disease diagnosis must be improved.**

4.2.5 Water

Much grazing land is inaccessible during the dry season due to a lack of water. Cattle can only move approximately 5 km from a water source when grazing. This lack of water restricts the quality and quantity of feed available.

* **Methods of providing water for stock need investigation.**

5 POLICY

5.1 Culling

* **Encourage the culling of infertile or diseased animals.**

5.2 Land

* **The Government may need to develop a policy to protect grazing lands in Nusa Tenggara as population pressure begins to reduce the availability of grazing land.**

5.3 Water

* **Provide Government support for programs that will supply water to areas that cannot be utilised for grazing during the dry season because of a lack of water.**

5.4 Staff Training

* **Provide support for ongoing training of veterinary and production professional and technical staff in Nusa Tenggara in areas concerning cattle production.**

5.5 Farmer Training

*** Increase Government funding for extension programs that teach farmers better cattle raising techniques.**

5.6 Cattle Distribution Programs

The criteria for selection of the NTASP cattle distribution sites are sufficient to ensure that the correct sites will be chosen. However, the CHAPS has shown that in reality all the criteria have not been met, particularly with regard to feed availability throughout the year and the available levels of grazing and arable land. These two factors should be emphasised in future distribution programs. The criteria (Appendix 1) in themselves do not ensure that farmers, after fulfilling their obligations to the project, will continue in cattle production. The Sambelia site is an interesting example. Even though productivity at Sambelia was the highest in the project area, farmers did not wish or could not afford to keep their stock after their obligations were completed. The poorest farmers in the area therefore were not able to take advantage of the long term benefits of cattle production because their short term needs were more important.

From the information gained from Form J and from the entire CHAPS survey, the following recommendations are made.

*** If long term cattle productivity is a goal of the distribution program farmers must be educated to understand that the major benefit of cattle ownership is breeding value and not asset value.**

The high priority placed on cattle as an asset has led to two results; firstly, farmers at some sites (in particular Naukae, Benlutu and Praya), have not been as concerned about production, while secondly at Sambelia, the cows have been productive but as soon as responsibilities to the project were completed cows were sold to repay debts.

*** A detailed comparison of the sites, Sambelia and Taliwang, plus Talibura and Kringa, would provide vital information on the long term viability of distribution programs.**

Sambelia and Taliwang are the two most productive sites, however they have vastly different management systems and different retention decisions once repayment is completed. Talibura and Kringa (Flores) have similar resources, management techniques etc. but different productivity levels. Why?

*** Extensive farming systems should be encouraged in NTT.**

Raknamo is the most profitable site, it is a traditional, free grazing stocking system. Naukae and Benlutu run cattle intensively and have the highest level of hand feeding and hand watering in the project area, but low levels of productivity. Intensive systems in these areas require high labour input with no short term economic gain.

*** If grazing country is not available to a farming group in NTT, farmers should not be given cattle.**

Goats or chickens plus management education may be better options.

*** If productivity is the major goal of the distribution program, the sites selected in NTB should include significant levels of irrigable land.**

This will ensure the inclusion of cattle into the farming system and help provide feed in the dry season.

* **Farmer groups should be interviewed one year after completing repayments.**

This survey would check the numbers of farmers retaining their cattle and the usefulness of cattle in the farming system. This would form the basis for improving the success of the distribution program. The CHAPS Form J could be used for this purpose.

* **Farmers must not be forced to return the first two calves but must have the opportunity to select when repayment should occur, ensuring that two calves are repaid within six years of receiving the cattle.**

This will give farmers the opportunity to keep their first calf and hence begin their own production system much quicker.

* **Farmers should receive a cow of sufficient body weight to ensure body weight is not a factor limiting conception rate. Ongole cattle should be more than 290 kg and Bali cattle more than 220 kg. In this way the time between receival and first calf can be minimised.**

Cattle at some CHAPS sites failed to reach these body weights by the end of the survey and many farmers were unable to repay the required calves in the period allowed.

SECTION B
CHAPS AS A MODEL FOR ASSESSING FUTURE CATTLE DISTRIBUTION PROGRAMS

1 INTRODUCTION

This discussion is based on the experience gained from the organisation and running of the Cattle Health and Productivity Survey (CHAPS). This survey and the ensuing analysis has defined the constraints affecting cattle production at cattle distribution sites and can be applied to semi-intensive cattle management systems in NTT and NTB.

The most important thing to do when starting a survey is to define the aims. These aims will influence such factors as the number of sites, cows and farmers to be included in the survey, frequency of sampling, types of disease to be investigated and forage and socio-economic data to be collected. The following discussion aimed to define methods for determining the constraints to cattle production in Nusa Tenggara, derive recommendations for overcoming these constraints and produce a model to assess other systems.

Each survey must encompass four areas:

* **Production; weight, calving percentage and interval, calf mortality, weaning rate. This is the base data and forms the dependent variable.**
* **Disease information; prevalence of diseases which may be affecting production and consideration as to whether the survey is the best way to collect information on each disease.**
* **Forage; the major type, quantity and quality of feed grazed and handfed.**
* **Socio-economics; interview the farmers to obtain information on the social, physical, farming systems and economic variables which limit productivity.**

2 NUMBER OF CATTLE AND SITES

To be able to collect the data as outlined below an average of 50 cows (plus bulls and young animals) is a workable number of cattle to sample per day. This should, in Nusa Tenggara, provide a representative sample of the cattle population. Every farmer who owns a cow within this sample should be interviewed.

Replacement of cattle which die or leave for some reason is an important issue. Every effort should be made to ensure that the same cattle and farmers attend each sampling for the duration of the survey. Unless a farmer can attend at least 80 per cent of the samplings the correlations between individual farmers and their cattle cannot be accurately estimated. To obtain useful individual cow and farmer data, at least two years of consistent attendance is required.

The selection of sites is determined by what factors are believed to influence productivity or which factors the survey wishes to analyse. For example, if the physical environment is to be considered, sites with similar management, household and other factors should be selected. However, if cattle management systems are deemed to be important, sites where management systems vary, while other factors are held constant, should be selected.

From CHAPS it is clear that the physical environment influences productivity, therefore future selection of sites should attempt to limit the effects of the environment; sites should be selected which are close together such as Kringa and Talibura in Flores, or Benlutu and Naukae in West Timor.

3 FREQUENCY OF DATA COLLECTION

The length of the survey should be three years. This allows for six months of organisation, six months to carry out two trial samplings and two years of good quality data. The production, forage and socio-economic data should be obtained four times per year, corresponding with the beginning of the wet season, middle of the wet season, beginning of the dry season and the middle of the dry season. The actual timing of these should be decided from rainfall records for the individual survey areas.

The six months of organisation must involve the development of the survey aims and assessment of the abilities of staff and organisations to fulfil these aims. It will also include the site selection, infrastructure development and definition of responsibilities for all individuals and organisations. It must also involve the drafting of the survey forms and preliminary training of all staff to be involved in the actual survey.

The second six-month period will be used as a trial of the survey, as a method of obtaining base data and as an opportunity to gain farmer confidence. As with CHAPS, farmer confidence cannot be immediately guaranteed. This is particularly important with regard to the socio-economic survey. This, plus the training required of the interviewers in order to obtain unbiased data, means that useful accurate data will usually not be obtained until after two trial interviews.

The productivity data, however, is more objective. Its accuracy can be guaranteed from the first trial sampling. It is important at this first trial to ensure correct identification of cattle and collect base data such as date of birth, number of calves etc.

The trial sampling will be an important time to test the efficacy of the sampling (forage, sera and faeces) systems developed plus the transportation and analysis of samples.

In some cases the system will work without any problems. If this is the case preliminary decisions about future data collection can be made. If the system does not provide accurate results it must be repeated until it does. For example, brucellosis may be considered to be important, therefore during the first six months a system whereby brucellosis can be tested is planned. If this system works well and results are accurate and negative, a decision can be made to do no more testing for 12 months. However, if the samples are spoiled or the system breaks down for some reason, it must be repeated until an accurate result is obtained.

Disease analysis in this type of survey will only provide an indication of disease prevalence. From surveys such as this, areas of future research may be defined and implemented within the framework of the survey e.g. *Fasciola* trials within the CHAPS.

The forage analysis will also need time to develop a workable system. As with disease, the first year or year and a half will be used to determine potential problems, the second to test ways to overcome these problems.

It is necessary to obtain at least two years of accurate production, socio-economic, and forage production data to ensure that constraints to production can be confidently identified.

4 TRAINING

4.1 Field Staff

The first year of the survey is designed to ensure that the data collected in the following two years is accurate. Training will be required in the areas of clinical examination, specimen collection, cattle handling, pregnancy testing, forage sampling, condition scoring etc. To ensure the smooth running of the survey and to minimise bias, it is preferable that the same people are used at the same sites at each sampling. This is particularly important for the socio-economic part of the survey, where farmers must develop confidence in the interviewers and the interviewers must become proficient in using the survey forms.

4.2 Farmers

It is vital that the farmers understand the reasons behind the survey and understand the benefits that will accrue to them through their involvement. It is also necessary to obtain the farmers' confidence to be able to ensure good attendance and accurate data. It would also be useful to encourage the farmers to keep records of income in between samplings. This would also lead to the availability of more accurate data.

4.3 Data Entry and Checking

Data should be combined at one location but individual laboratories/institutes responsible for analysis should enter their own data in a predetermined format/ dataset. One person should be responsible for data entry. Checking of data should be carried out by another person who has expertise in the area, e.g.parasitological data to be checked by a parasitologist.

The final version of the checked data should be available on disc at least one month before the next sampling is to begin. This will ensure that there is adequate time to construct the relevant forms and list of farmers and cows which should attend. It would also allow time to make some decisions about the necessity of collecting disease information at the coming sampling.

5 IDENTIFICATION SYSTEMS

5.1 Farmers and Cattle

Each farmer must receive a unique number which will identify that farmer. Lists of farmers' names and numbers must be available at all samplings, with reasons for non-attendance noted. Farmers who cannot attend a sampling must be interviewed within the next week to ensure that their information is collected.

Cows should also receive a unique number, attached by eartag. Calves should be numbered with the same number as their mother with an additional number to indicate the number of the calf e.g. calf number 002.3 is the third calf from cow number 002.

5.2 Samples

Samples that are collected during CHAPS should be recorded on field data sheets (Form E) at the time of collection. All samples collected from an individual cow should be listed next to that cow's number and be allocated a specimen number. The specimen number and not the cow number should be written on the specimen container. The field data sheet is then the key document for identification of samples. Many transcription errors will be avoided using this method and incorrectly numbered specimen containers or specimen containers with numbers that are difficult to read can be easily checked by reference to the field recording sheet.

6 DEFINING RESPONSIBILITIES

Every person involved in the survey should have a clear understanding of their responsibilities. These should be compiled into a manual like the one prepared for the CHAPS in Timor Timur and be made available before the trial sampling.The manual should include the responsibilities of staff at the survey, getting the samples to the laboratories and who is responsible at the laboratories for data entry, checking, analysis and distribution of results.

7 TYPE OF DATA TO BE COLLECTED

7.1 Cow Productivity and Health

The following production data should be collected at each site; condition score, weight, attendance (reason for non attendance) date if died or sold, vaccination (month/year and type), pregnancy tested (yes/no), age of foetus, date of last calf, calf eartag number, number of sera collected, EDTA and faeces collected.

Other data should be collected regarding breed, sex and date of birth at the first sampling (or before). This data should be checked at each subsequent sampling. Depending on the aims of the survey other measurements may also be required such as; scrotal circumference, height, girth and length of the cow.

Base data concerning date of birth, date of last calf, pregnancy diagnosis, weight and sex from the previous sampling should be available to be checked at the subsequent sampling. Lists of this data plus all cows and other cattle tested and lists of who should attend must be constructed before each sampling.

7.2 Cattle Health

Serological surveys to test for prevalence of disease or antibodies will determine if there are some diseases which warrant more detailed examination. Faeces can be collected to determine the extent of parasite problems at the sites.

7.3 Socio-economic

It will be necessary to collect the following socio-economic data; cattle management system, time taken to feed and water, quantity and type of feed handfed, sources of water, use of cattle for ploughing and manure for fertiliser, bull management, sources and levels of income (farm and off-farm), types of livestock and crop production, levels of consumption, sale etc.

Other information concerning farmer education, religion, land ownership and availability, family size, house construction and possessions, should be collected once at the beginning of the survey and once at the end.

7.4 Forage

The type and quantity of the most important feeds grazed and handfed plus chemical analyses to determine protein, mineral, energy and fibre levels must be undertaken at each sampling.

8 REPORTING AND ANALYSIS

8.1 To the Farmer

The farmer should receive information about; cattle body weight, pregnancy diagnosis, and quantity of feed. This information should be made available, if not immediately, then certainly at the next sampling.

8.2 To the Province

The province will require a different type of data. It will require a selection of all the raw data in the form of a summary book. It should receive data on disease, forage and cattle productivity on a site basis to allow comparisons between sites. This information should be made available quarterly to allow extension of results back to the villages.

8.3 To the Central Government

Summary books of the base data plus lists of contraints and recommendations on how to improve productivity and the farming systems should be available to the central government on a annual basis. Results and conclusions should be presented at an end of survey seminar as soon as possible after the completion of the survey.

APPENDIX 1
Criteria for the Selection of NTASP Sites

Selection of Project Locations:

1. Road accessibility year round—potential for satgas effectiveness and supervision of the credit program
2. Area of topography with 0–15% slopes
3. Adequate water supply year round for humans and livestock (ideally with rainfall in excess of 1,000 mm and more than 5 months of rain)
4. Adequate nutritional supplies year round and potential for increase
5. Existing livestock populations and potential for increase
6. Areas with relatively low percentage ownership of cattle and buffalo
7. Total areas of arable and rangeland
8. Absence of virulent and contagious animal disease in the area
9. Presence of other projects and possible interface
10. Local government agreement on recommended selected villages
11. Proximity of a SRI branch in the target area
12. Proximity of animal health post (poskeswan)
13. Proximity of agricultural extension office (BPP)
14. A functioning co-operative (KUD) in the target area
15. Majority of farming community below the poverty line

Selection of Participants

1. Participants should be small local farmers (priority for farmers below the poverty line)
2. Participants should be residents of the project area and be of good behaviour
3. Participants should be adults and married
4. Landownership or right of use by subsistence farmers (priority given to farmers who possess between 0.5–2 ha of land and who are able to provide forage)
5. Priority will be given to farmers who do not own cattle or buffalo
6. Farmers should be prepared to enter into a contract with the project and abide by project guidelines
7. Farmers should be prepared to sign a credit contract with the SRI