

Rabies and dog ecology in Flores

Drh. Tata Hutabarat, Drh. Maria Geong, Dr. Alan Newsome, Dr. Alan Ruben and Dr Stephen Cutter.
This version edited by Stephen Cutter.

Rabies is endemic in the Central and Western provinces of Indonesia, with near or total disease elimination achieved in significant areas. A fisherman first introduced rabies into Flores in 1997. Since that time there have been over 4,000 courses of immunoprophylaxis given to humans and 97 human deaths with a culling program involving up to 500,000 dogs. This has had a profound effect on the people of Flores who have an important social, cultural and dietary relationship with dogs.

The ecology of dogs in Flores extends beyond their own inter-relationships to those with their owners and their cultural values. The dogs are not running wild, but live in a mutualistic relationship with farmers, villagers and townfolk. They are destined as food. They are highly prized and culturally very important. Dog ecology in Flores cannot be discussed fully without understanding the nature of the strong bonds with people and the effect of this on population sizes of dogs in villages and towns.

Dogs are kept around houses and farms for several sound reasons. They protect the home compound from thieves raiding household property and planted crops grown around houses. Dogs chase off wild pigs and rats from crops around the home and those planted on land outside villages. As a consequence good guard dogs are highly prized.

Dog meat is greatly favoured, but not only for its taste and nutritional value, it is believed to have medicinal properties and certain cuts are believed to be aphrodisiacal. Dogs are used in other feasts and celebrations. Even favourite guard dogs may be eaten, eventually. The people of Flores also consistently stated that they like dogs for themselves, enjoy their company and just having them around.

To date, rabies has been controlled principally by the almost complete elimination of dogs from five of Flores' six districts. This is no longer considered acceptable as part of the long-term solution by any interest groups on the island. A system of temporarily controlling overall numbers (partial elimination), coupled with a vaccination program, is widely favoured.

INTRODUCTION

In June 2001 I was invited to join a 'dog ecology' scoping study. This was undertaken at the request of the Director General of Livestock Services (DGLS) of the Directorate of Animal Health, Indonesia. It was funded by the Australian Centre for International Agricultural Research (ACIAR) and the Department of Agriculture, Fisheries and Forestry – Australia (AFFA). It was carried out under the joint auspices of the Co-operative Research Centre for Aboriginal and Tropical Health (CRCATH), DGLS, AFFA and ACIAR. I was invited to join as a representative of 'Big Lick' so as to provide a comparison to indigenous community dog health issues in Australia

and to look for cultural information that could be useful in the event of a rabies outbreak amongst the dogs in Australia's indigenous communities.

The team consisted of four other people, two more from Australia and two from Indonesia:

- Drh. Tata Hutabarat, Veterinary Epidemiologist, formerly Head of Disease Control Sub-Directorate of the Directorate of Animal Health, Jakarta and currently the Director of Livestock Development of the Directorate General of Livestock Services, Indonesia.
- Drh. Maria Geong, Veterinary Epidemiologist with the Provincial Livestock Services of East Nusa Tenggara based in Kupang, West Timor and President of the Indonesian Veterinary Association (IVA) of East Nusa Tenggara Branch.
- Dr. Alan Newsome, Wildlife Ecologist. Career interest with National and International experience and expertise in dog ecology (dingoes, wild dogs in Papua New Guinea, dog control on Christmas Island and currently Nauru).
- Dr. Alan Ruben, an epidemiologist, public health physician and paediatrician with experience of project work in developing countries.

Since its introduction in 1997 by the dog of a fisherman from Buton Island, the spread of rabies through the island of Flores has been rapid and devastating. Rabies has resulted in over over 4,000 courses of immunoprophylaxis given to humans and 97 human deaths with a mass slaughter program involving up to 500,000 dogs and the commencement of an immunisation campaign for domestic mammals, namely dogs, cats and monkeys.

INDONESIA AND FLORES

Flores is located in the Southern Province of East Nusa Tenggara (also called Nusa Tenggara Timur) of Indonesia. It is located just North of Timor. Most of East Nusa Tenggara, including Flores Island, is Christian.

Flores is mountainous throughout its length, with peaks rising to over 2000m. It has a population of just over 1.56 million people who live mainly around the coastal areas. The principal economic activities are agricultural. The road network is sparse due to the mountainous terrain, the existing main roads are reasonably well maintained but travel is very slow.

TYPE OF DOGS IN FLORES

Dogs have been in South East Asia for around 5,000 years. Fossils have been found in nearby Timor about 3000 years ago. It is likely that dogs first arrived in Flores about then.

Dogs are descended originally from wolves. Some primitive dogs, such as dingoes and related dogs, retain many similar characteristics to them including the ability to maintain self-sustaining populations away from human habitation. There are, however, substantial differences in behaviour between these primitive breeds and true domestic dogs. Hybrids between primitive dogs and true domestic dogs tend to resemble domestic dogs in behaviour although they can look a lot like the primitive breeds in appearance.

Despite living a semi free-range life style and a having superficial resemblance to dingoes, though mainly smaller, the dogs seen on Flores seemed to be domestic dogs rather than dingo -type dogs, although they could well be hybrids. They have a mutualistic relationship with humans.

There are important behavioural traits that make it unlikely that the domestic dogs in Flores would set up self-sustaining feral populations.

THE ECOLOGY OF DOGS, THEIR ROLE IN CULTURE, AGRICULTURAL AND FOOD SYSTEMS IN FLORES.

Dog ecology is the study of the dog(s) and its (their) environment, or the life history of the dog.

The dog's environment in Flores is complicated as they have a life style that is both domestic and free ranging. In addition there has been a drastic change in their life style, dog populations greatly reduced by rabies and culling for rabies control.

The dog's relationship with people, other animals (prey, predators and competitors) and other dogs are all part of a dog's environment. Major influences on the dog's life's history are human interactions, the need to find food (foraging, hunting, etc) and interaction with other dogs.

Dogs are an integral part of the environment of the people of Flores. Dogs are valued for a variety of diverse reasons. They primarily seem to be valued as guards and friends and are used as food and as guards for crops.

Dogs are highly regarded in Flores and although we did speak to several people who no longer owned dogs, everybody wished to keep dogs. Ultimately dog numbers will return to original levels due to their important roles as guards, friends/pets, hunters, and in culture and food. Mostly these niches have not been filled and it is clear that the people see the dogs roles as very important. As such it is inevitable that the dogs will be returned to fill the vacuum, unless public education and other measures to limit dog numbers succeed. During the dog depopulation many children as well as women and some men were extremely upset about having to kill their dogs, there was reputedly much crying and grieving.

THE DIET OF DOGS

Food-finding occupies a major portion of the dog's energy expenditure. Most owners stated that they did not deliberately feed their dogs but did give them left-over food, primarily plant carbohydrates as food. Rice, bananas/plantain, cassava, taro, coconut, cakes/bread, and a variety of fruit and cooked vegetables are eaten, either

alone or with traces of meat. The only significant source of animal protein offered by people is the left-over scraps.

Dogs readily help themselves to unattended food. Several people identified this as a major drawback to owning a dog and this behaviour could well identify the offender as being the next dog to be eaten.

The dogs probably acquire a significant portion of their protein source through hunting and scavenging, mostly insects and other invertebrates, rodents and lizards. Larger prey is acquired by scavenging road kill and other deaths. Most food would be sourced from people's homes.

In areas where dog numbers are low, almost all food would be supplied by the owner due to the risks to the dog of culling or theft should the dog wander in search of food. Virtually all dogs we saw were fit, healthy and well nourished, even those dogs that spent almost all their time chained up and not able to seek food for themselves.

DOG RANGING

All dogs seemed quite domesticated so it is unlikely that they roam far. The owners of the dogs knew their dogs occasionally wandered for short periods during the day or longer at night but almost always came back. Many owners in areas with minimal dog numbers, tie their dogs up at night to prevent them from wandering. When food is scarce the dogs roam much further to seek it. Other dogs would limit their roaming to areas that they dog feel secure in. People also play a major role in dog movements, as dogs will often follow their owner into strange areas, often long distances to trade or visit. Dogs were often taken to fields which could be quite some distances away and expected to stay there to protect the crop.

People moving dogs would undoubtedly be the main source of long distance movement of infected dogs. This was the cause of rabies being introduced to Flores in the first place. Many dogs are now tied up for much of the time and so their home range is obviously very limited.

Almost invariably the dogs were not allowed into the house but lived around the outside. They slept in shelter under the eaves of the house, usually sheets of wood or bamboo leaning against the house.

DOG EATING

Dog eating seemed to fall into three categories - ceremonial, therapeutic and general consumption. The dog is not a common part of the diet, its most important role is ceremonial. The dog is eaten at a variety of important events - weddings, graduations, promotions and some specific religious events. They are used as a bride price with up to 20 dogs being required. In areas of reduced dog numbers, if sufficient numbers of dogs can not be found then it is considered acceptable to owe the bride's family the remainder. It is clear that people anticipate a return of dog numbers in the near future and the debt must be settled then. The necessity to have dogs at these events does vary between cultural groups - for some it is more important than others. In most cultural events it is essential to have at least one dog, although more are definitely preferable.

Despite the low numbers of available dogs, dogs have not been permanently replaced in ceremonies. Either a single dog is used (often at great cost and from other districts) where many dogs were previously used and the rest of the food is made up of substituted meat (usually pork). Alternatively, if a dog cannot be found, a speech is made to the effect that, unfortunately, a dog could not be procured and everyone should pretend that the available food is dog.

Dogs may be bought for ceremonial purposes in areas where dogs are rare. However, traditionally and in areas where dogs are still common, they are usually traded from friends and relatives with the expectation of reciprocation when the need arises.

Dog meat, particularly the leg muscles, is also considered to improve the health of people and "raise their blood pressure". The meat is either cooked or dried and is then mixed with chillies, pepper, nutmeg and pawpaw leaves (to tenderise the meat). It is then cooked without water in its own juices. The resultant dish is very spicy. This is then eaten, particularly by women and children who are weak or feverish. Dog meat is also considered to have an aphrodisiac effect in men. Dog meat from any part of the body however cooked, will have some aphrodisiac effect, but the preferred cut is the intercostal muscles. These are pickled in palm sugar alcohol. This is believed to be a very potent aphrodisiac. Unlike other parts of Asia there seems to be no difference in terms of colour, gender or nature of the dog and the aphrodisiac or therapeutic effect.

We visited one restaurant in Ruteng which served dog meat on a daily basis. The restaurant owner would usually buy one dog each day. She had four regular customers who ate dog in the restaurant as well as a vigorous take-away trade. The price of one serve was Rp5,000 (\$1), which she said covered her costs, and allowed for a small profit.

The price of an adult dog was in the region of Rp150,000-200,000 (AUS\$30-50). To put that in perspective, the minimum daily wage is Rp10,000 (AUS\$1.85). In areas where dogs were in short supply prices were higher, and conversely lower where dogs were abundant. This contrasts with provinces such as Western Java where an adult dog may fetch up to and over one million Rupiahs (AUS\$200).

There seemed to be little preference for particular dogs to eat. Mostly it was a particular reason for not eating a dog - if you had two dogs and one was to be eaten, then the least useful or least popular dog was the one to be eaten.

Castrated dogs were thought to be fatter and therefore juicier, male dogs thought to be tastier than females but, overall, there seemed to be little difference to suggest one dog against another. Children in particular seemed to have strong views against eating a particular dog, indeed they are often against eating any dogs. When dogs are to be eaten they are usually killed by a single blow to the head. Often a person who is very skilled at killing dogs is called in to do this, particularly so if the owners are very attached to the dog. There was general agreement that dog meat was very delicious.

DOGS IN AGRICULTURE

The principal role of dogs in agriculture is to guard farms against human thieves and animal pests, namely rodents, wild pigs and monkeys. The dogs also guard their owners, and guide their owners home in the dark. One farmer told us that he was once attacked by wild pigs but saved by his dogs.

The effect of the dog cull on agriculture has been thought by farmers to be significant. We were shown (photographic) evidence of significant crop damage by rodents and pigs to coconut, corn, groundnut and cocoa. The civet cat and monkey attack the major cash crop of the highlands, coffee. Prior to the cull, dogs would be left tethered on the fields overnight to scare away pests. Since the reduction of dog numbers, farmers and their families sleep on the fields, even barking to scare away pests.

EFFECTS OF THE BEHAVIOUR OF RABID DOGS

Rabid dogs are often attacked by other dogs due both to the rabid dogs' aggressive behaviour and to their wandering through other dogs' territory. If a rabid dog attacks one dog of a group then other members will join in to defend it. Dogs will defend their territory, group members and their owners from a strange or aggressive dog. Such interactions spread rabies.

AGE OF DOGS

Most of the dogs we saw were quite young. Most females were in the process of rearing their first or second litter. Most males were under 18 months of age. This is particularly true of areas where dog depopulation has occurred.

INTERACTIONS WITH WILD CARNIVORES

Flores is inhabited by an introduced population of the common palm civet (*Paradoxurus hermaphroditus*) and there is a possibility of a small population of feral dogs.

The civet is rarely seen but primarily is known to eat rats and mice for which reason it was probably introduced. It is possible that the civet may become a reservoir host for rabies since it is a carnivore and would not infrequently come into contact with dogs. Should rabies eradication in the dogs become successful it may be an issue as to whether a perpetuating cycle exists in the civets. However a sylvatic cycle of rabies has never yet been reported for South East Asia and it seems likely that the density of civets is low.

It is unlikely, in our opinion, that a wild dog population exists on Flores. In areas of low dog densities the people stated that they did not exist. In Maumere, one man did tell us that he did see wild dogs very rarely (one dog every 5 years or so). He had only seen individual dogs and not packs of dogs, nor had he seen any with pups. It is likely that these dogs are either strays lost from other areas or aberrant individuals that have moved away from human habitation rather than members of a viable wild population. These lone dogs were considered to be belonging to "ghosts". It was considered bad luck to catch or kill one of these dogs as the "ghost owner" of the dog would be angry that their dog had been taken.

The bad luck was considered to be specific to the person

taking the dog. If a person was prepared to risk the bad luck then other people had no objections to that person taking or killing the dog. It is important to note that even these apparently wild dogs were still considered to be dependent on an 'owner'.

INTERACTIONS WITH PIGS

Dogs and pigs can in many ways be considered as competitors for the same food in some areas. For example, in Northern Australia, when dog or dingo numbers are reduced, pig numbers dramatically increase. However the competition in Flores could not be considered particularly direct. All pigs we saw were kept confined to pens and fed, whereas dogs were free ranging. All pigs were fed regularly and were healthy and in good condition. The dogs were fed the same sort of food as pigs (mostly rice and left over food scraps). Pigs are more omnivorous than dogs and so a greater variety of plant waste could be fed to them. In areas where the dogs had been depopulated, the food traditionally fed to dogs is now generally given to pigs. Some people felt that more pigs are kept now than before but others disagreed saying there had been no change, or possibly a decline, in pig numbers. Some considered wild pigs the main threat to crops and consequently a function of the dog was to chase the wild pigs away.

Wild and free ranging domestic pigs can do enormous amounts of damage to crops in a short time. In general dogs chase the pigs away from the crops but do not catch them. One owner did tell us that his dogs did save him from an attack by wild pigs. This is an expected behaviour of the dog and they receive no special treatment as a reward. Most people seemed to think there had been increase in damage to crops by wild pigs following the reduction in dog numbers.

INTERACTIONS WITH MONKEYS

Wild populations of at least one species of Monkey inhabit Flores - the crab-eating or long tailed Macaque (*Macaca fascicularis*). They are occasionally kept as pets on Flores, and have been included in the depopulation and vaccination efforts.

They are also susceptible to rabies. They have a tendency to bite people and so are of concern in rabies control. Monkeys are also highly visual crop raiders. Dogs are used as guards to protect crops from monkeys. It was not clear if crop damage by monkeys was significantly changed with the reduction of dog numbers.

INTERACTIONS WITH RODENTS

A substantial portion of a dog's role is to chase and kill rats and mice that are eating the owner's crops or vegetables in the garden. Dogs are probably mostly useful as a deterrent to rodents but are known to kill quite a number of them as well as digging up and destroying burrows and hiding-holes that rodents might use.

It is also possible for these rodents to become infected with rabies although usually dogs or cats would kill any oddly-acting rodents fairly quickly. It is possible that dogs would become infected if bitten by rabid rodents but less likely to become infected by eating them.

It appears there was a substantial increase in rodent

numbers with the reduction of dog numbers and a substantial increase in crop damage as well. Rodents are also vectors of a number of human diseases.

INTERACTIONS WITH CATS

Cats are common in Flores. They have been included in the depopulation and vaccination efforts. Whilst they are unlikely to maintain a rabies cycle by themselves, they may become infected and subsequently infect humans. Rabid cats can be very aggressive.

Cats also compete with dogs (and civets) for some foods - both those offered by humans and those hunted. Cats are better at rodent control than dogs in a domestic situation but not as effective in a field. They would also offer little threat to wild pigs, monkeys or thieves. Dogs may attack, kill and even eat cats from time to time. This would be particularly so of any cats behaving oddly, such as those infected by rabies. As with rodents, it is possible that dogs would become infected if bitten by a rabid cat.

INTERACTIONS WITH CHICKENS

Chickens are ubiquitous in Flores where they are used for meat, eggs and cock-fighting. Whilst dogs may eat some chickens the likelihood of being punished by humans for this activity makes it unlikely that hunting chickens is a common activity of dogs. Indeed, we witnessed many chickens that had close access to dogs and the dogs remain completely passive to their presence.

Most people did not consider predation on chickens by dogs significant. Chickens and dogs would also have some crossover in food competition particularly for food scraps thrown into the yard by people.

INTERACTIONS WITH CATTLE (BANTENG), BUFFALO, HORSES AND GOATS

Despite these species being widespread and common in Flores and being an occasional source of food for dogs, we did not see any evidence of significant interaction between dogs and these species. All would be considered 'victim species' with regards to rabies and it is likely that individuals will be infected with rabies following dog bites. These species would represent quite a large investment to local people and as such, their loss may be economically disastrous to families. Humans may also become infected from these species if bitten or by sustaining significant salivary contamination which might be possible during an attempt to dislodge food stuck in the animal's throat. It should be noted that the first confirmed rabies case in an animal in the Ngada district was in a goat.

WILD ANIMALS (PIGS/MONKEYS/BATS ETC) AS A RESERVOIR FOR INFECTION?

All warm blooded animals can be infected by rabies and can pass on the infection in theory but their susceptibility varies. Some relatively sensitive species do not maintain or contribute significantly to the rabies cycle. To the best of current knowledge it is unlikely that a wildlife cycle will become established in Flores. In general, pigs and monkeys are considered dead-end hosts and have not yet been shown to maintain an epidemic.

Whilst they can individually pass on the disease they are

not considered important in maintaining rabies cycles anywhere. In addition no wildlife cycle has been reported in South East Asia despite being established in the dogs for at least 100 years in other parts of Indonesia. This may be due to strain specificities of the rabies virus. Research is currently underway in Indonesia to answer the specific question of rabies virus strain.

Comparatively few species are good vectors for the disease and even fewer become reservoir species. The most likely candidates for maintaining a wildlife cycle are civets, feral cats or dogs. It is less likely in the first two but more possible if there were feral dogs. Civets are a member of the Viverridae, which includes the mongoose and meerkats which are also good reservoir species, so this possibility should not be discounted. However, the species on Flores is widely distributed in South East Asia but no wildlife cycle seems to be present there.

There also seems to be some species selection with rabies where strains that have passed through one particular species for some time tend not to persist or spread very well from other species, even if they can be good vectors for other strains. It is also probable that a rabies-like virus persists in the bat population (some type of bat lyssavirus). This may occasionally cause a rabies-like death in people or possibly other animals but it is highly unlikely to spread much from there. It appears only in the Americas, where vampire bats live, that rabies in bats is epidemiologically significant in rabies transmission.

INTERACTIONS WITH SPIRITS

Several people also mentioned, as an aside as though they were not supposed to talk about it, that dogs are also very useful guards against supernatural beings in particular 'ghosts' and 'devils'. It is believed that dogs can see these 'beings' and both warn the people of their presence and subsequently scare them off.

In addition dogs are thought to have insight into approaching bad events. When several dogs howl together or sequentially, they are telling people and each other of something bad that has, or will, happen, such as someone dying. It is not thought that the dogs cause these events but are actually crying about them too.

DOGS AS PETS / FRIENDS

Dogs are not kept just for their utilitarian uses in Flores. Many people commented that they liked dogs and enjoyed owning them. Many children and adults were observed cuddling, stroking or playing with dogs. People clearly enjoyed their dogs. The fact that ultimately the dogs were destined to be killed and eaten did not interfere with the pet/friend relationship. As one owner commented: "I like having dogs - I feel safer and happier when they are around".

THE RISK TO HUMANS OF NON-CANINE DOMESTIC ANIMALS WITH RABIES

World wide, 99% of rabies deaths are due to dog bites. However any mammal can be infected, and exposure to their bodily fluids, especially saliva, can cause infection. People have been infected after doing a post-mortem on an animal and getting a bonestick injury. Cats in

particular can become infected. While 75% of cats exhibit furious rabies, they are not known to maintain a rabies cycle by themselves but are better seen as spillovers from the dog cycle. In the United States rabid cats are reported more commonly than rabid dogs

DOG NUMBERS

We were advised that usually, almost every family owned dogs, in many cases over five and some cases over ten. Currently, in areas where dog depopulation has been carried out, it is clear that dog owners are in the minority and have a much smaller number of dogs than they would have normally wished to have. Every person we spoke to in those areas wished for more dogs.

In those areas where the dog numbers are relatively unaffected there seemed to be few households with large numbers of dogs (more than five per household). This is probably due to the high economic value of dogs and the social ties that require people with large numbers of dogs to use them at ceremonial occasions. There was little evidence that food or disease (other than perhaps rabies control) seemed to limit dog numbers now. That may well be different in previously, however the utilisation of excess dogs may have minimised this.

Prior to the culling programs instituted as a response to rabies in five of the six provinces, there were an estimated 600,000 dogs in Flores, two for every five people. The current situation is unknown but our own observations and other reports confirm that the dog cull has drastically reduced this population and that scarcity continues despite a cessation of the killing.

MAJOR LIMITING FACTORS ON DOG'S HEALTH AND LIFE EXPECTANCY

The vast majority of dogs are killed by humans to be eaten. Other causes of mortality include trauma, particularly by cars and possibly other dogs, injury when defending fields or property against pests, in particular wild pigs and maybe thieves.

Infectious disease may have been a substantial influence on dogs' lives in the past. However, we saw very little evidence of infectious disease amongst the dogs in Flores at all. Overall the ones we saw were very healthy. Dog depopulation would no doubt have had a positive effect on the health of the remaining animals due to decreased competition and therefore increased available resources. In addition sick or undesirable animals are more likely to have been culled than healthy friendly animals. Dogs are also susceptible to viral diseases. Both parvovirus and distemper are prevalent on Flores and vaccination is rare. Distemper would be a major differential diagnosis for rabies. Other infectious diseases such as heartworm may well be a major cause of mortality of any dogs which are not eaten.

Venomous snakes are known to exist on Flores and may also occasionally contribute to dog mortality, particularly as dogs are likely to seek them out. Komodo Dragons (*Varanus komodoensis*) and saltwater crocodiles (*Crocodylus porosus*) are known to eat dogs, but are unlikely to be significant as are they are very rare on Flores.

CULTURAL FACTORS ABOUT RABIES

Rabies has generated an enormous amount of fear and concern amongst the people of Flores. There seemed to be a very basic understanding of what rabies was, although often in very sketchy detail. People generally knew that rabies was fatal to people and occurred following a dog bite.

Since dog depopulation, people have felt safer with less risk of contracting rabies, and many seemed to feel the risk had largely abated. People felt safer going to strange areas and out at night time, as the risk of being bitten was now considered minimal.

The main disadvantage was the decreased protection at home from thieves, protection in the fields from pests, the loss of dog meat for ceremonies and other purposes and of course companionship. Everyone we spoke to said they basically liked having dogs around.

People are able to recognise their own and their neighbours' dogs so if a strange dog enters the area, it is now killed in case it is rabid. Strange dogs now elicit a lot of suspicion. If a dog bites someone, it is immediately killed. Particularly in areas where dog depopulation has been carried out, the owner who has kept his dogs assumes all risks of the dog biting someone. The dog must be killed, and the owner is liable to pay for any treatment required. It is also understood that the family of the bitten person would be very angry and may seek compensation. In many cases of rabid dog bite, the brain of the possibly infected dog is also destroyed, preventing a definite rabies diagnosis.

CULTURALLY ACCEPTABLE CONTROL MEASURES & BELIEFS AND MISCONCEPTIONS THAT HAVE HINDERED RABIES CONTROL EFFORTS

We were struck by the almost total absence of visible dogs in the Eastern part of the island of Flores, especially compared to the West where rabies has not yet become prevalent and extensive elimination programs have not been carried out. The general consensus from political leaders, veterinarians, animal husbandry officers and the farmers with whom we spoke, was that a combination of elimination and vaccination was the preferred method of rabies control.

As dogs are valuable as guards, pets, and a culturally important food source, any attempt at population control is logically unpopular as it involves the removal of a valuable commodity. It may be useful to look at ways of tying rabies control measures with improving the dogs' value - for example vaccinated and tagged dogs might be allowed to be transported from one district to another where prices are better. One of the members of the team, Dr. Maria Geong who is originally from Flores, relates a story of how she visited the town of Maumere after the elimination campaign had been completed. People there knew she was a veterinarian and held her responsible for the cull (in fact she had been vocally opposed and received much initial criticism from the political authorities for her opposition). People sat outside her hotel all night and barked and howled like dogs, keeping her awake.

There were also misconceptions about rabies and how it was spread. In Ruteng we were told about how the deaths of two people were blamed on rabies, an example of how much fear rabies generates. There was a group of people who spread the rumour that rabies was spread into the district maliciously. Meatballs containing rabies were believed to be thrown into houses and the dogs then ate them and supposedly became rabid. It was also believed that rabies was put into the public water supply and a concurrent banana disease was in fact rabies that had been injected into the banana plant. It was believed that people could get rabies from either eating bananas or drinking the water.

In July 2000 there was a riot in Ruteng in which a number of buildings were burnt. In addition two 'spring-bed' salesmen (from another province, possibly Sulawesi) were accused of spreading rabies in this way after they were seen discarding food which dogs ate. They were killed by the mob. Some people still believe that these 'spring-bed' salesmen are responsible for rabies reaching the area. This may mean that a program involving the baiting of food with oral rabies vaccination may cause confusion.

DOG CONTROL – ELIMINATION

Whilst there has been enormous public co-operation with the culling policies and relative little active resistance, it remains very unpopular with people. One interviewee told us that anyone who harmed his dogs would become his enemy. Everyone we spoke to considered the low levels of dogs now to be a temporary solution only. Every one expects dog numbers to return to normal shortly. Some people expected that this would have eradicated rabies, but others expected rabies vaccination to allow a safe dog population to return. There is even talk of importing safe dogs from other safe islands such as Timor.

Each of the six districts in Flores has made its own decisions regarding rabies control, with varying consultation of local people and decisions made by the Bupati (district administrator). Of the five districts significantly affected by rabies, all chose a dog cull, with most dogs being killed by the owners themselves. In some districts dog culling teams were formed. In general dogs were not killed without the owners' consent. Some people hid their dogs or moved them to other districts. Some of these hidden dogs developed rabies and people died as a result. Many people, including the Bupatis, felt the unpopularity of the dog culls (one Bupati mentioned he was called "Herod") and so are keen for vaccination to commence. The culling generated considerable debate in the press and was roundly condemned by the Veterinary Association of East Nusa Tenggara.

In some cases, the dogs were eaten after being killed in the cull. Many people stated that they knew of others who had kept dogs throughout this time, particularly puppies for whom they felt sorry. Some took them to other areas and released them or gave them to relatives. Whilst people were not forced into killing their dogs, there was considerable community pressure into doing so. Many dog owners were reluctant to talk to us, thinking we were agents of the government and were concerned they may again be pressured into killing their dogs.

RABIES CONTROL – VACCINATION

Vaccination has not been applied in a systematic or widespread fashion except in the district where rabies is not yet prevalent – Manggarai. The vaccination scheme in Manggarai appears to be working well. Initially it was combined with dog reduction and if the owner had more than 2 dogs then they were culled. It has now changed and the owner can have up to 10 dogs but must pay for vaccination costs for all and unvaccinated dogs must be culled.

Trained vaccinators who may be nurses, veterinarians or livestock improvement officers perform vaccination. The vaccination program is modelled on the human health vaccination model. In every square kilometre there is a vaccination centre (usually attached to a human health centre). The dogs are brought there and held by their owners whilst being vaccinated. The dog is then collared with a wire collar and tag. The owner's name and the number of dogs (as well as cats and monkeys) vaccinated, and those they own but are not vaccinated, are recorded.

The owner pays Rp10,000 (A\$1.85) for each vaccination (equivalent to the minimum daily wage). The vaccination is to be repeated annually. For some dogs it was the second time they had been vaccinated. There seems to be a much higher percentage of dogs vaccinated in these areas because the vaccinators go from house to house rather than having the dogs brought to them. It was felt the cost of Rp10,000 per dog meets the costs of the vaccination program other than the human resources. Where insufficient staff from the District Livestock Services were available, Department of Health staff were subcontracted at a cost of Rp25,000 (AUS\$5) a day. We were advised that the immunisation cost of Rp10,000 (AUS\$2) per dog is equivalent to the cost of culling the dog. Vaccination appeared to be eagerly anticipated or well accepted by most people although quite a few people did not know it was possible. There is resentment by some people, particularly owners of many dogs, about having to pay for the vaccination. One owner of a number of dogs had removed the wire collar and tag from the three dogs he had vaccinated. It may be that he would place them on dogs he wished to keep should an inspection occur.

VISITING A VACCINATION POST

One morning we visited a Vaccination Post for rabies used to vaccinate children also. The Community Nurse had agreed to do both jobs. She had vaccinated a total of 100 dogs against rabies since the Program began 4 days earlier. On that morning, 14 people brought in one dog each and the Nurse recorded 32 other dogs as being owned by these 14 people. More than two thirds of dogs owned remained unvaccinated. It seems the cost of vaccination was the problem, and so only the most valued dog was brought in for vaccination by each owner.

If the large build-up of the dog populations continues, then attempts to vaccinate all dogs must fail. The cost of vaccination is 10,000 Rupiah per dog. That amounts to about \$A1.85. This is a paltry sum by Australian standards. In order to avoid the risks of partial vaccination of the dogs on Flores, and on the islands to the east including Timor, appropriate Agencies should be approached seeking the funds to achieve total vaccination.

ADDITIONAL FACTORS LEADING TO THE CESSATION OF THE CULLING PROGRAMS

After the initial implementation there was a general lack of enthusiasm for dog culling and the feeling that it was unnecessary. Dog numbers were so low that it was difficult to maintain the momentum and those that did continue to own dogs were the ones very keen to continue to do so, making any further culling difficult. There is also a very strong feeling that the culling was only for a short time and would be unnecessary in the long term so that people culled their dogs and then thought 'right, that's that then' and did not anticipate that they will take part in further culling. As stated elsewhere, even though there was considerable co-operation by the people, it was an unpopular option. As the epidemic dragged on, the political will to continue has declined.

RECOMMENDATIONS

With the ongoing epidemic on Flores, rabies is advancing through Indonesia toward Timor and New Guinea. It is in Australia's interest to prevent any further spread. This can be achieved in part by the elimination of rabies on Flores.

There currently exists a brief window of opportunity to institute a rabies elimination program on Flores while the dog population is low. It is inevitable that dog numbers will build up again, but widespread culling is seen by all stakeholders as being unacceptable. Once this opportunity has passed, elimination will become much more difficult and considerably more expensive.

In conclusion if rabies on Flores is not controlled the socio-cultural impact of the disease on the island will continue. Furthermore, it is highly likely that rabies will spread to other areas of the East Nusa Tenggara Province including Timor, endangering Australia's status as a rabies-free nation.

It is therefore the opinion of the local officials, this team and the other visiting experts that urgent intervention for rabies control is required on Flores.

ABOUT THE AUTHOR

Stephen Cutter
University Avenue Veterinary Hospital
66 University Avenue
Durack NT 0830
Ph: (08) 89310455
Fx: (08) 89310466
vets@UniAveVets.com

Stephen Cutter graduated from Melbourne University Veterinary School in 1995. After a short stint in dairy practice he established dog programs in Arnhemland, Northern Territory. The program expanded to include the Tiwi Islands and was subsequently joined by several other veterinarians. For several years he alternated between working in animal welfare clinics in Melbourne (in particular the Lort Smith Animal hospital) and the top end. He is a founding member of Big Lick. He is also manager and a partner in University Avenue Veterinary Hospital in Palmerston NT.