

# Climate Futures and Rural Livelihood Adaptation Strategies in Nusa Tenggara Barat Province, Indonesia

Dampak perubahan iklim terhadap mata penghidupan masyarakat di Provinsi Nusa Tenggara Barat, Indonesia

## SURVEY REPORT

# LIVESTOCK PRODUCTION SYSTEMS IN LOMBOK AND SUMBAWA

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JUNE 2011



**Australia Indonesia Partnership**  
Kemitraan Australia Indonesia



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## **Ringkasan (Summary)**

Sebagian besar kehidupan masyarakat di NTB (pulau Lombok dan Sumbawa) sangat bergantung kepada usaha pertanian. Peran ternak ruminansia sangat besar terutama sebagai tenaga kerja dan sumber pendapatan (tabungan) dalam meningkatkan kesejahteraan masyarakat di NTB.

Dalam melaksanakan usaha peternakan, terdapat perbedaan sistem beternak diantara petani di Pulau Lombok dengan di Sumbawa. Umumnya petani di pulau Lombok memelihara ternaknya dengan cara dikandangkan (intensif), sedangkan ternak-ternak di Sumbawa dipelihara dengan cara dilepas (ekstensif). Perbedaan system pemeliharaan ini berimplikasi terhadap kemampuan peternak dalam penyediaan pakan untuk ternaknya dan hal ini juga mempengaruhi jumlah kepemilikan ternak oleh setiap peternak, dimana kepemilikan ternak di Sumbawa jauh lebih banyak dibanding jumlah kepemilikan ternak oleh petani di pulau Lombok.

Program pembangunan yang dilaksanakan oleh pemerintah dalam membangun sarana irigasi (dam/bendungan) di pulau Sumbawa telah mengubah status penggunaan lahan dari lahan kering menjadi lahan sawah irigasi (intensif), tambak, dan hutan produksi. Perubahan fungsi lahan ini berdampak kepada menyempitnya areal "Lar atau So" yang dulunya merupakan tempat penggembalaan umum, sehingga membatasi jumlah kepemilikan ternak oleh petani.

Menyempitnya areal padang penggembalaan (Lar/So) mengharuskan peternak mengubah system beternak dari ekstensif ke intensif. Pola pemeliharaan system intensif ini telah diterapkan di pulau Lombok, dan ke depan para peternak di Sumbawa harus menerapkan pola pemeliharaan system intensif ini. Permasalahan dari system intensif ini, peternak harus menyediakan pakan (cut and carry) dalam jumlah cukup, sementara kuantitas dan kualitas pakan yang tersedia terbatas.

Mencermati kondisi daerah dan kaitannya dengan program bumi sejuta sapi, maka dalam upaya meningkatkan produksi ternak di NTB diperlukan fasilitasi Pemerintah untuk meningkatkan kemampuan adaptasi peternak dalam menghadapi perubahan kondisi biofisik dan social ekonomi yang semakin cepat.

## **I. Introduction**

Ruminant livestock (cattle, buffalo, goats and sheep) play important roles to support livelihood of farmers in NTB. Cattle and buffalo are mostly sold for inter-island export and small number are slaughtered for local consumption. They also used as draught power even though some of their role has been replaced by hand tractors. Goats and sheep mostly slaughtered for local consumption. Horse is important for village transportation. Some people eat horse meat and horse milk from Sumbawa is well known as a health drink.

The importance of livestock is now becoming more apparent because livestock, compared with crops, are less vulnerable to changes in climate conditions such as longer dry season, shift in wet season or long wet season. However, the existence and productivity of ruminant livestock are also affected by changes in land use and socio-economical conditions.

This study was carried out to characterize the current conditions of livestock production systems in Lombok and Sumbawa. Focus of this study was to understand the current conditions, species distribution and richness within different ecological subregions, dynamics, drivers of changes and potential impacts likely to happen. Profiles of the current system will be very useful in understanding farmers ability to adapt to changes in land use, socio-economic and agro-climate condition.

## **II. Methodology**

This survey was carried out by collecting secondary data from relevant government offices. Data were also collected from relevant research reports and from expert opinions. Field visits were carried out to selected locations to observe current situations and to discuss with farmers about the past and current conditions of the production systems.

Locations visited were within central Lombok and Sumbawa districts. These districts were selected because they can represent Lombok and Sumbawa islands respectively and they have distinct biophysical and socio-economical conditions. Farmer information were collected both by individual in-depth interviews and focused group discussions.

Data collected include a) population distribution of each species by district and population growth by species during the period of 1969 – 2010, b) existing government policies and their impact on the systems, c) changes in ecological conditions (native pasture production, carrying capacity, soil degradation, weed invasions etc) and d) farmers perceptions on the past and present conditions of the farming systems.

A series of team discussions were then carried out to analyze data/ information gathered and to describe the current livestock production systems in Lombok and Sumbawa.

### III. Results and discussion

#### 1. General description of the production systems

Lombok has smaller area (only one third of Sumbawa) but has 3 times more people than Sumbawa. However, livestock populations are about the same in the two islands which means that livestock density is much higher in Lombok than in Sumbawa. In the case of cattle population, Lombok has about 55% of the total population.

In Lombok, ruminant livestock (Cattle, buffalo, goats and sheep) are mostly raised in cut and carry system and as a result, livestock ownership is much smaller than in Sumbawa. Most of the productive lands in Lombok are used for crop production, so very little area for extensive livestock production.

In Sumbawa on the other hand, livestock still kept under semi extensive system. Only a small proportion of farmers have started to keep their livestock in pens and fed by cut and carry system.

Figure 1 illustrates the population growth of ruminant livestock in NTB since 1969. Cattle and goat populations increase steadily (even though with significant fluctuation in some periods). Sheep population remains steady, while buffalo population tends to decline.

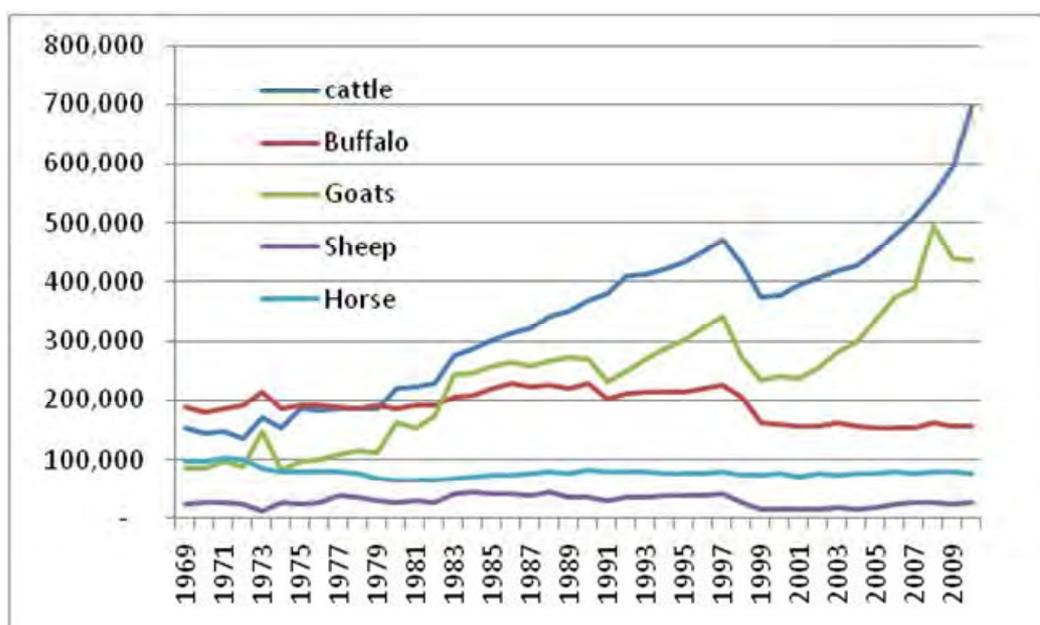


Figure 1. Population growth of ruminant livestock in NTB during the period of 1969 – 2010. (Dinas Peternakan Dan Kesehatan Hewan NTB, 2010).

Livestock distribution by districts in 2010 is presented in Figure 2. Cattle population is highest in Sumbawa, while goats are dominant in Bima district.

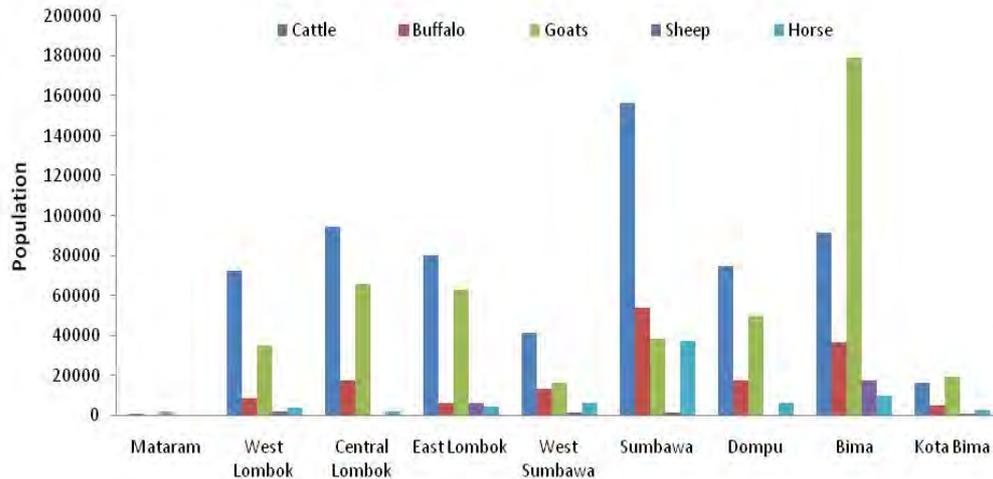


Figure 2. Distribution of livestock by districts in 2010 (Dinas Peternakan dan Kesehatan Hewan NTB, 2010)

In term of relative significance (see Table 1), cattle and goats are the most dominant (and have high potential to be developed further) in west Sumbawa, Sumbawa, Dompu and Bima districts. Goats are significant in West Sumbawa, Dompu and Bima districts. Buffalo and sheep are not significant ( $LQ < 1.0$ ). It is clear that while population of cattle and goats are quite high in Lombok island, the potential for further development is constrained by limited availability of land.

District	Cattle	Buffalo	Goats	Sheep
West Lombok	0.62	0.07	0.30	0.02
Central Lombok	0.78	0.14	0.54	0.00
East Lombok	0.52	0.04	0.41	0.04
West Sumbawa	2.89	0.91	1.15	0.09
Sumbawa	2.62	0.90	0.64	0.02
Dompu	2.42	0.56	1.63	0.01
Bima	1.53	0.61	3.00	0.29
Kota Bima	0.89	0.26	1.03	0.03
Mataram	0.02	0.00	0.05	0.01

Table 1. Location quotient (LQ) of livestock in each district of NTB (LQ based on population per 1000 people).

## 2. Production systems in Lombok

### Species

Livestock are still an important source of livelihood in Lombok. Cattle and goats are the two species that are much higher in number (greater importance) compared to buffalo and sheep.

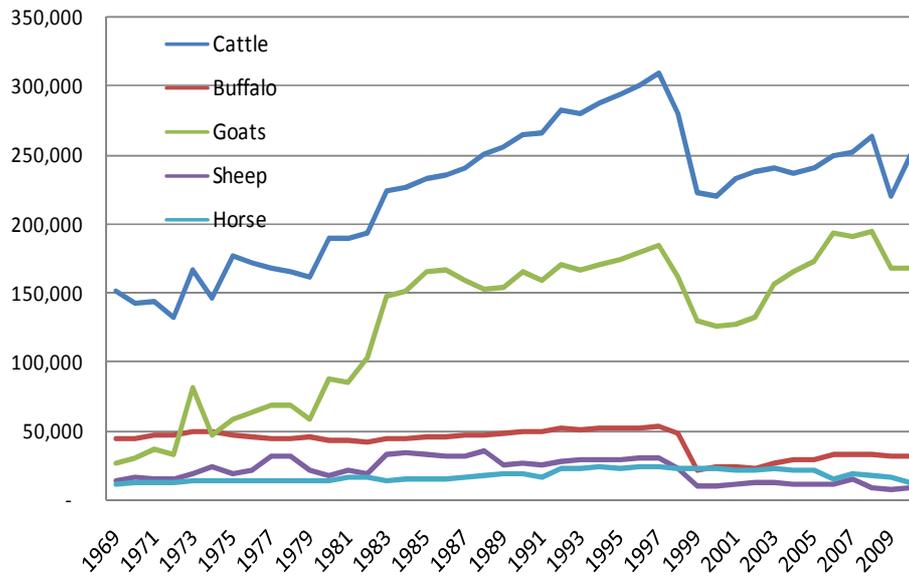


Figure 3. Livestock population in Lombok island (Dinas Peternakan dan Kesehatan Hewan NTB, 2010)

In most areas of Lombok, livestock are raised under smallholder cut-and-carry systems. Adoption of better management system has improved productive and reproductive efficiency of cattle under collective system but do not increase cattle number in the group. This because livestock ownership is small (2 large ruminants per family in average) and livestock are mostly used as saving. Farmers are mostly subsistence so any increase in number of cattle weaned always followed by increase in number of sale due to urgent need for cash, limited capacity to feed and limited space to house the animals.

Traditionally, cattle and buffalo are sold to Jakarta market. However, market (especially breeding stock) has been redirected to other provinces (mostly in Kalimantan) because of tight competition in Jakarta market.

Cattle and goat population may continue to increase but may be limited by capacity of farmers to provide sufficient feeds, space for housing and obtain sufficient cash for their daily needs. Buffalo population will continue to decline due to rapid decline in area for grazing and wallowing.

Buffalo used to be an important ruminant species in south Lombok. Since 1980s, tourism has been developing extensively and some of the communal grazing areas are used to build infrastructure (roads and hotels). As seen in Figure 4, space for buffalo is becoming very limited due to conversions of communal grazing area to non agricultural purposes such as international airport and tourist resorts.



Figure 4. Buffalo wallowing outside the fence of the Lombok International Airport in South Lombok

Cattle are still a dominant species in Lombok, but mostly kept in backyard or in a collective pens (Figure 5). The main constraint faced by the farmers in this production system is the limited capacity to collect feeds. This is because land ownership is very small and many farmers do not have access to land. As a result, the number of animals that can be fed is limited to 2 -3 per family.



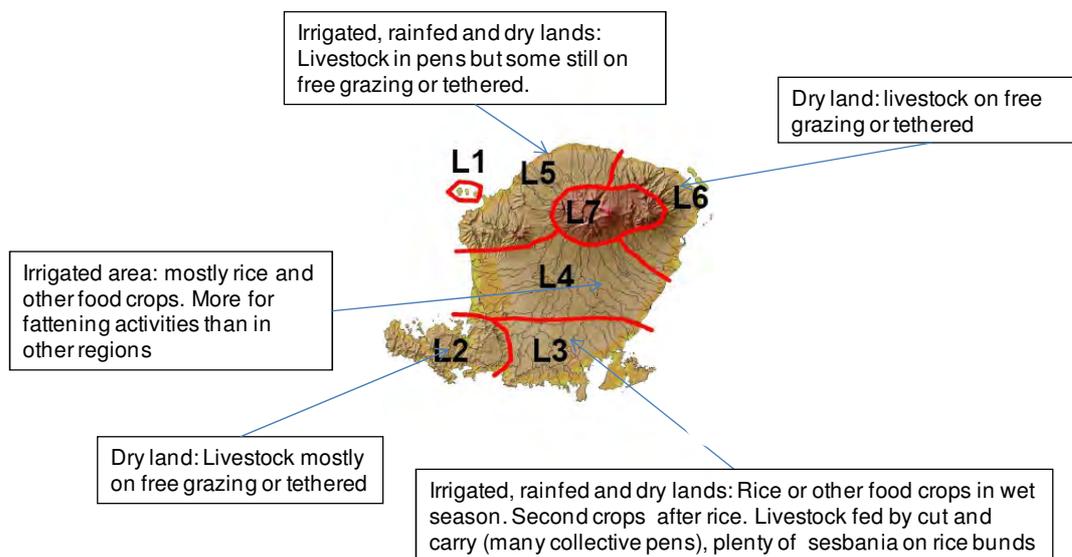
Figure 5. Bali cattle in collective pens.

If no measures are taken to increase farmers capacity to feed and maintain their livestock, number of livestock per household will not increase, even if they have adopted better management system.

## Land use

Land use in Lombok is more intensive compared to Sumbawa. Very little communal grazing area is available due to higher population density compared to Sumbawa. Livestock are raised in the crop-livestock system.

Most of productive lands used for crop production, so very small area for livestock. Land ownership is very small (about 0.3 Ha per household) and declines in size (especially in the irrigated areas). In central Lombok (Van wensveen et al, 2010), almost 40% cattle growers do not have access to land.



Land ownership is getting smaller due to increase in size of household. Value of land is increasing rapidly, so the costs of feeding livestock becoming very high. The drivers of this change includes, rapid population growth and rapid land conversion to non agricultural purposes (urban development, infrastructure etc). The downstream effects are land available to produce forages becoming very limited and time spent and costs to collect feeds becoming very high.

## Collective housing system

Collective housing is very common in Lombok. In this system, a group of livestock growers house their animals collectively in a common place (typically an area of 100 – 1000 m<sup>2</sup>) either



neglected land. Introduced forages (especially elephant grass and king grass) also available, but limited to farmers who have access to land. In some parts of Lombok, tree legumes are quite abundant, but only sesbania is fed in large amount.

Cattle are kept in pens or tethered in backyard, and fed by cut and carry system due to limited communal grazing area and problems with security. In wet season to early dry season, forages are sufficient, but in late dry season farmers have to rely on crop residues. Landless farmers collect forages from road sides, river banks or irrigation channel for free. They can no longer collect grasses from rice bunds for free (land owner used it or sell it to others). Farmers in dry areas such as south central Lombok (L3) often collect grasses or crop residues by truck from other areas (can be as far as 60 km away).

Improved grasses common in L2, L3, L4 and emerging in other irrigated area of Lombok. Sesbania is the most common tree legumes fed to ruminants. It is concentrated in southern part of the island (L3), not much in other areas. Leucaena exists in L2 and L5, but not yet a common feed for ruminants. Gliricidia is scattered in most area as living fences and not much used to feed livestock.

### 3. Production systems in Sumbawa

#### Species

Livestock reproductive efficiency is generally better than in Lombok due to the extensive rearing system (females can be mated during grazing). Live weight gain is slower than in Lombok because availability and quality of feeds are generally lower.

Population of cattle and goats increase steadily, sheep population remains steady while buffalo population declines slightly. The decline in buffalo population may be related to limited area of wetland for wallowing.

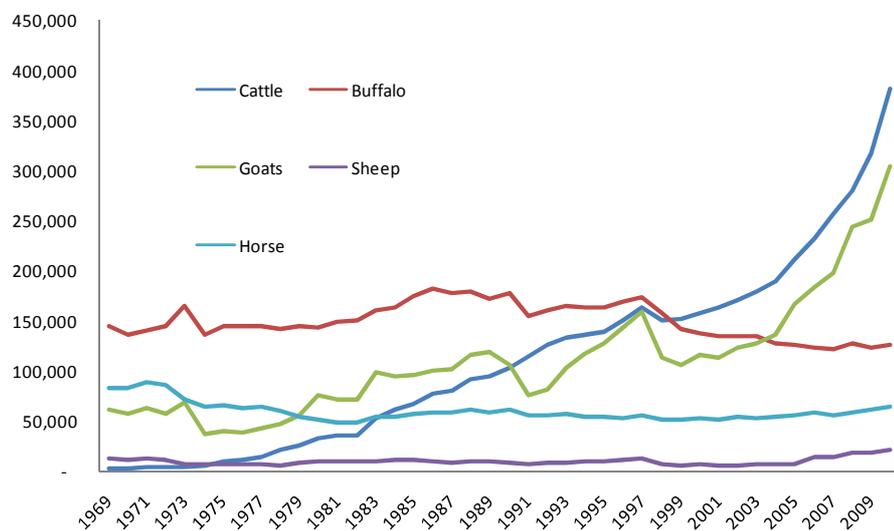


Figure 7. Livestock population in Sumbawa island (Dinas Peternakan dan Kesehatan Hewan NTB, 2010)

Livestock ownership per household is much lower than 10 years ago. This is related to the limited access to free grazing and reduced carrying capacity of the communal grazing area

The dynamics in livestock population growth in Sumbawa have been influenced by:

- Policy: more resources for cattle (Land of a million cattle) and Government buy and redistribute cattle.
- Market: cattle market is bigger, buffalo and goats less preferable in national market.
- Biophysical conditions: reduced area for forage production, buffalo less adaptable to dry areas (do not have sweat gland, have to wallow).
- Cattle and goats are more adaptable to changing climates

### Land use

Land ownership is generally larger than in Lombok but number of harvest per year is less due to limited water availability. Most of livestock growers have access to land. In most areas livestock are tethered, some allowed to graze free. Change to intensive crop and livestock system is emerging.

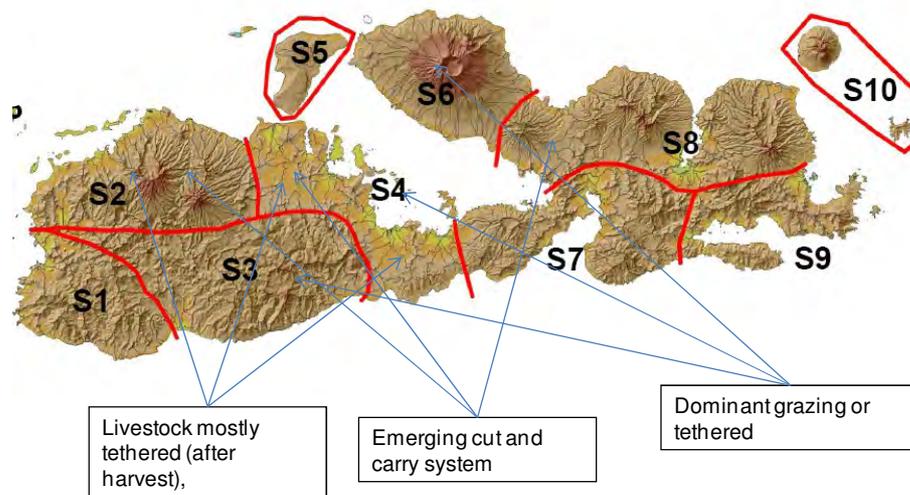


Figure 8. Typical land use in Sumbawa

Land ownership is getting smaller due to increase in size of household. Farmers have started to convert some of dry land and the rain fed areas to be used for livestock production, either in the cut and carry system or mini ranch system. The most important drivers of this change is the rapid decline in area and carrying capacity of communal grazing areas.

### Communal grazing area

Traditionally, livestock are generally raised by semi-extensive system (either grazing full day or grazing day time and housed at night). Livestock are temporarily moved to communal grazing area known as Lar (Sumbawa) or So (Dompu and Bima) when rice field or other cropping area are cultivated. In the past, cropping areas were unused for longer period because irrigation system was not well developed. Therefore, livestock had more opportunity to free graze after harvest. Since the development of dam and irrigation system the intensity of utilization of rice field for food crop production increased so less opportunity for livestock to graze freely after harvest.

Lar or So are communal area that do not entitled to private ownership (state land). They can be native grassland, forest or coastal areas. Lar or So is a very important resource for farmers to produce ruminant livestock at a very low input (low costs)

Currently, the native pastures are heavily degraded due to overgrazing and poor management. The size and carrying capacity of the area have been declining rapidly. As an example, in Sumbawa District, there 60 communal grazing sites (27,783 Ha ) identified but they are mostly within protected forest area. No clear rule on which community groups (villages) who can utilise the area, so the potential conflict is high. They are also generally neglected because no one feels responsible to sustain the productivity of these communal grazing areas. Only 5 officially assigned by Bupati decree for communal use i.e.:

- Ai Ampuk (400 Ha), coordinates of borders still not verified. Some people claim as private property and has not been resolved.
- Lar Badi (400 ha), relatively free from conflict
- Pulau Rakit (1500 ha), but conflict regulations by Forestry Department
- Lutuk Kele (200 ha)
- Limung (1000 Ha), not really communal area but private land organised and developed by the local government as a community based livestock production center.

There are some initiatives to overcome the reduced size of communal grazing areas i.e. to facilitate collective use of private lands, to develop silvopasture in collaboration with the forestry department and to develop crop-livestock integration system. However, these initiatives are still limited to very small area (such as Limung, Sumbawa district) and not yet very effective due to many constraints (funding, socio-cultural etc).

### **Livestock migration and pasture conditions: A case study of Pulau Rakit**

Farmers move livestock (cattle buffalo and horse) from Empang and Terano subdistricts to a small neighboring island called Pulau Rakit. Livestock are taken to Pulau Rakit around February (when all cropping lands are cultivated for food production), and taken back to the mainland around April – May (when most crops have been harvested).

This practice has been taking place for more than 30 years. The main drivers for this change is the reduced carrying capacity of communal grazing area in the mainland of Sumbawa. This happened in line with intensification of crop production (irrigation development) and conversion of communal grazing area to plantation, coastal fisheries and settlement.

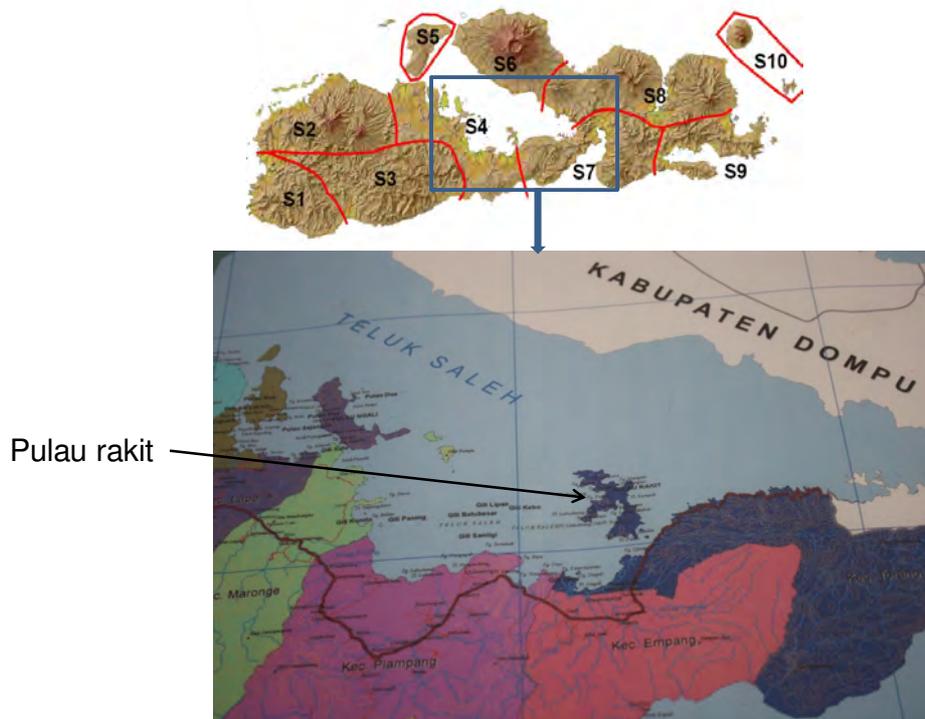


Figure 7. Pulau Rakit, a small island used by farmers in Empang and Terano sub-districts to keep their livestock when cropping lands are cultivated.

Livestock are taken by small boat (on board or just to guide the herd by tethering some of them)



Figure 8. Farmers taking their buffalo from Pulau Rakit back to the mainland after harvest

Legal status of Pulau Rakit is State forest, so the community are not allowed to cultivate. However, farmers have been using the island as temporary grazing area for cattle, buffalo and horse at least since 1970s. The community still utilize the communal areas of Pulau Rakit even though they do not have legal basis for use. Local authority is reluctant to develop the area because of potential conflicts.

The total land area is around 6000 Ha with an estimated carrying capacity of around 0.25 adult cattle per Ha, so total capacity = 1500 adult cattle. Estimated number of livestock on the island can be more than 10,000 at one time (especially during Feb-Mar), so the stocking rate has been much more than its carrying capacity (heavily over grazed).



Figure 9. Conditions of a small island adjacent to Pulau Rakit (upper) never used for grazing because no water and Pulau rakit grazing area (lower).

Figure 9 illustrates the untouched area that could have been similar to the conditions of Pulau Rakit before being used for grazing, and the current conditions of native pasture in Pulau Rakit which is heavily overgrazed and invaded by weeds and trees.

Overgrazing makes the soil open to weed invasions. The major weeds are Chinese apple (*Ziziphus mauritiana*), biduri (*Calotropis gigantea*) and *Chromolina odorata* and some Lantana camara. Weeds and trees may cover the whole island in the next 10 years, so little forages will be available for livestock. Carrying capacity will be dramatically reduced. This will be a big problem because there are about 30,000 heads of cattle, buffalo and horse in nearby area that depend on the communal grazing.

Buffalo are the species that affected most by the change in land use and pasture degradation. Due to their susceptible to heat stress (lack of sweat glands), they have to be near the swamp where they can cool their body (Figure 10).



Figure 11. Buffalo wallowing under tree shed in Pulau Rakit

Cattle are more tolerant to heat but they usually stay under the trees at mid day (Figure 11) and back to the native pasture early afternoon.



Figure 12. A farmer visited Pulau Rakit to observe his cattle

Investment in rehabilitation of communal grazing areas in Pulau Rakit is very difficult, too expensive and socio-culturally not feasible. The most appropriate solution is to facilitate the development of profitable small to medium scale cut and carry systems. A road map should be developed and translated into local government programs to facilitate smooth transition from extensive to intensive system.

#### **4. Change from free grazing to cut and carry**

Because Lar or So are rapidly declining in size and carrying capacity, there is a growing trend to change from extensive system to more controlled system. The major drivers for the change of production system in Sumbawa are:

- Pressure to increase food or cash crop production due to rapid population growth.
- Conversions to rice field due to development of dam and irrigation system.
- Conversion to plantations (cashew etc) and dry land cropping area
- Conversion to coastal fisheries
- Extension of settlement or re-settlement
- Conflict of interest between departments (esp. Forestry and Agriculture) that limit improvement and use
- Overgrazing and weed invasions

The changes vary from simply utilizing parts of farmers land (mostly rain-fed rice field or dryland) to keep their livestock (“micro ranch”). This private area used to keep livestock ranges from 1 to 40 Ha (Figure 13). Livestock are kept in this “micro ranch” all year round and farmers collect feeds from outside to meet feed requirements.

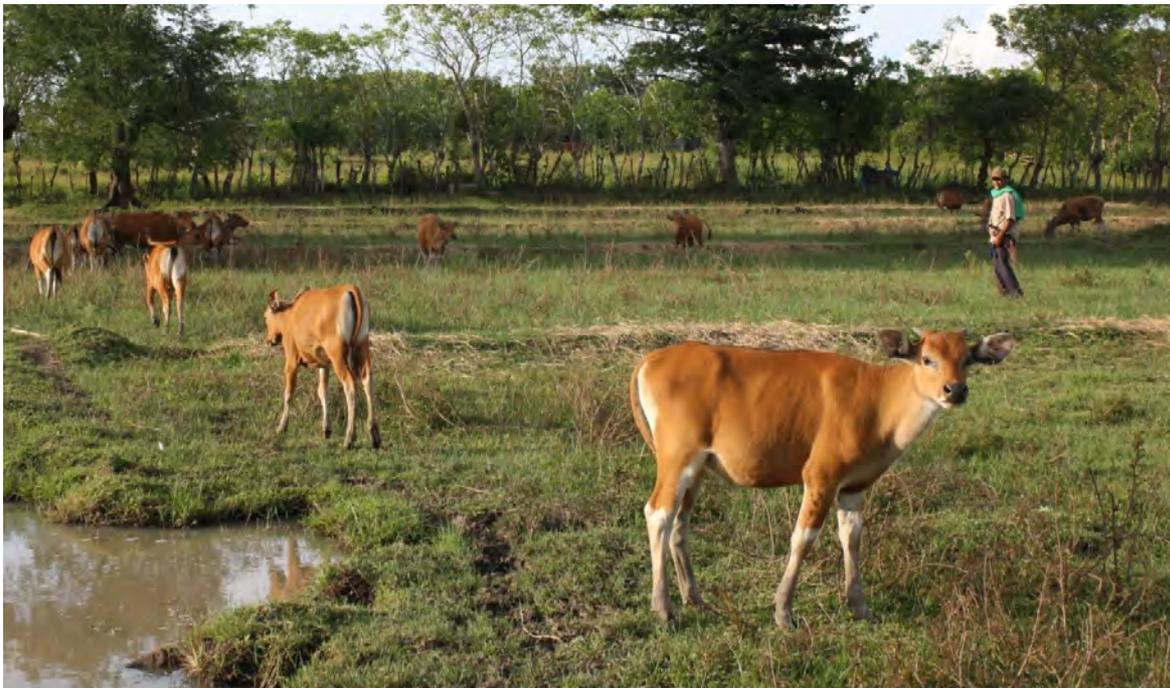


Figure 13. A farmer in east Sumbawa use his 2 Ha rain-fed land to keep his 26 cattle.



Figure 14. Change from free grazing in communal grazing area to private land in West Sumbawa district.

Typically, the area used for this purpose ranges from 1 Ha to 5 Ha. With this size of land, the carrying capacity will not be more than 10 adult cattle if they kept their animals in the area all time. Because they do not have enough feed resources their animals will be let out to graze in the surrounding areas after crop harvest.

The more advanced change is by housing the animals at night in pens and fed by cut and carry system. In this system, farmers have started to plant grasses or tree legumes so they can feed more animal per Ha of land. H Ridwan ( a farmer in west of Sumbawa district, Figure 14) for example, is able to keep 20 cattle in his 3.5 Ha dry land. Hi has 0.50 Ha planted king grass and sesbania for feeding his cattle when cropping land in surrounding areas are used for planting crops. After harvest, he tethers his cattle around but still house them at night.



Figure 14. A family in western part of Sumbawa district housed their cattle at night and plant sesbania as the supplement to king grass.

A more intensive system was found in Rhee sub district of Sumbawa (Figure 15) where a Balinese family with 2 Ha of planted leucaena are able to fatten more than 10 bulls at any time. This family also collect leucaena at roadsides by a small truck.



Figure 15. Nyoman Kembang and his family in Sumbawa feed mostly leucaena for fattening cattle

#### **IV. Concluding remarks**

The different biophysical, demographic and socio-economical conditions of Lombok and Sumbawa result in a distinct livestock production system. In general, Sumbawa island still have some space for semi-extensive production system (free or controlled grazing), which is low cost but less productive, while in Lombok, most of land areas are used for crop production, therefore livestock are raised under cut and carry system.

Land available for extensive livestock production has been declining rapidly due to rapid increase in demands for food crops (area for food crop production expanded or crop production becoming more intensive) and land conversion from native pasture to plantation, fisheries or non agricultural purposes. Communal grazing areas are heavily overgrazed that dramatically reduces the carrying capacity of the native pastures (due to soil degradation and weed invasions). As a result, many farmers who used to have large herd or flock have been forced to reduce their livestock ownership.

Some farmers have evolved successfully into productive cut and carry system. However, many farmers have been poorly prepared to change from free grazing to cut and carry system, resulting in sudden decline in their livestock ownership. Under the cut and carry system farmers are constrained by limited availability of feed resources. In many areas, grasses are difficult to grow due to lack of moisture, so tree legumes (*Leucaena*, *Sesbania* and *Gliricidia*) are the most promising livestock feeds especially in dry areas.

If farmers' capacity in responding to changes of the ecosystem and socio economic conditions do not improve, livestock population may decline in the near future. Adaptation strategies should therefore be developed by adopting best-bet options from relevant research activities, empirical experience from similar conditions and utilizing the local wisdoms.

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### Attachment 1. Ecosystem components and drivers: livestock systems

#### SUMBAWA

Component	General description	Current Status	Spatial Distribution	Dynamics (range, max, min, seasonality)	Drivers/threats	Outputs (ecosystem services)	Projections 2030, 2050, 2100	Data available (Dataset, location, name)	Information gaps (research)
Communal grazing area	Traditionally, livestock are generally raised by semi-extensive system (either grazing full day or grazing day time and housed at night). Livestock are temporarily moved to communal grazing area known as Lar (Sumbawa) or So (Dompu and Bima) when rice field or other cropping area are cultivated. In the past, cropping area were unused for longer period because irrigation system was not well developed. Livestock had more opportunity to free graze after harvest. Since the development of dam and irrigation system the intensity of utilization of rice field for food crop production increased so less opportunity for livestock to graze freely after harvest	Lar or So are communal area that do not entitled to private ownership (state land). They can be native grassland, forest or coastal areas. Lar or So is a very important resource for farmers to produce ruminant livestock at a very low input (low costs) Heavily degraded due to overgrazing and poor management The size and carrying capacity declines rapidly The community still utilise the communal areas such as Pulau Rakit even though they do not have legal basis for use. Local government are reluctant to develop the area because of potential conflicts. There are some initiatives to overcome the reduced size of communal grazing areas a) facilitate collective use of private lands, b) Develop silvopasture in collaboration with the forestry department and c) Develop crop-livestock integration system. However, these initiatives are still limited to very small area (such as Limung, Sumbawa district) and not yet very effective due to many constraints (funding, socio-cultural etc).	Large communal grazing sites (200 to more than 5000 Ha) are distributed within S4 and S6 sub regions Some small sites are found in S2, S3, S7 and S8	-5	Pressure to increase food or cash crop production due to rapid population growth: Conversions to rice field due to development of dam and irrigation system Conversion to plantations (cashew etc) and dry land cropping area Conversion to coastal fisheries Extension of settlement or re-settlement Conflict between departments (esp. Forestry and Agriculture) that limit improvement and use Overgrazing and weed invasions Security from thieves	Production and quality of native pasture is declining rapidly. The carrying capacity of the communal grazing area is currently much lower than in the past Livestock growers are experiencing difficulty to maintain their livestock during wet season before crop harvesting Dramatic change from low cost extensive system to high cost intensive system will force “rich farmers” to sell their cattle due to difficulty in feeding If this trend continues, and no strategic measures are taken, livestock population may decline		Number of sites and area of communal grazing areas in Sumbawa districts (Dinas Peternakan Kabupaten Sumbawa) General conditions of the grazing area.	Number of sites and area of communal grazing areas in Bima and Dompu Current status of the communal grazing area (availability for common use, carrying capacity, potential conflict between community/ groups etc) Impacts of native pasture degradation (or extinction) on livelihood of livestock growers, especially in the S4 regions What adaptation strategies are needed to sustain livestock production in Sumbawa as a response to change in biophysical and socio-economical conditions

Component	General description	Current Status	Spatial Distribution	Dynamics (range, max, min, seasonality)	Drivers/threats	Outputs (ecosystem services)	Projections 2030, 2050, 2100	Data available (Dataset, location, name)	Information gaps (research)
Species	<p>All large livestock species are important for different purposes. Cattle and buffalo are mostly sold for inter-island export and small number are slaughtered for local consumption. They also used as draught power even though some of their role has been replaced by hand tractors</p> <p>Goats and sheep mostly slaughtered for local consumption horse</p> <p>Horse is important for village transportation. Some people eat horse meat and horse milk from Sumbawa is well known as a health drink</p>	<p>Livestock reproductive efficiency is generally better than in Lombok due to the extensive rearing system (females can be mated during grazing)</p> <p>Live weight gain is slower than in Lombok because availability and quality of feeds are generally lower</p>	<p>Cattle: In all sub regions except S1, S5 and S10</p> <p>Buffalo: Mostly in S4 and S6</p> <p>Goats: Scattered</p> <p>Sheep: Scattered</p> <p>Horse: S4</p>	<p>Livestock ownership per household is much lower than 10 years ago. This is related to the limited access to free grazing and reduced carrying capacity of the communal grazing area</p> <p>Population of cattle and goats increase steadily, sheep population remains steady while buffalo population declines slightly</p>	<p>Policy: more resources for cattle (Land of a million cattle). Government buy and redistribute cattle</p> <p>Market: cattle market is bigger, buffalo and goats less preferable in national market</p> <p>Biophysical conditions: Reduced area for forage production buffalo less adaptable to dry areas (do not have sweat gland, have to wallow)</p> <p>Cattle and goats are more adaptable to changing climates</p>		<p>Bali cattle will continue to increase steadily</p> <p>Buffalo population will decline because they are not adaptable to hot and dry climate and area for wallowing is declining rapidly</p> <p>Goat and sheep population will increase if demands increase</p> <p>Communal grazing area will extinct, replaced by small tethering area owned by individual farmers</p> <p>Number of animals that can be managed by a family will decline significantly (slows population growth?)</p> <p>Cut and carry system will emerge in</p>	Population data by districts from Dinas Peternakan offices	Density and productivity of each species in each ecological subregion

Component	General description	Current Status	Spatial Distribution	Dynamics (range, max, min, seasonality)	Drivers/threats	Outputs (ecosystem services)	Projections 2030, 2050, 2100	Data available (Dataset, location, name)	Information gaps (research)
<b>Land use</b>	Land ownership is generally larger than in Lombok but number of harvest per year is less due to limited water availability	Most of livestock growers have access to land In most areas livestock are tethered, some allowed to graze free Change to intensive crop and livestock system is emerging	Extensive livestock production system in all subregions  Cut and carry system emerging especially in S2, S4 and S8	Land ownership is getting smaller due to increase in size of household Farmers have started to convert some of dry land and the rain fed areas to be used for livestock production, either in the cut and carry system or mini ranch system	Rapid decline in area and carrying capacity of communal grazing areas Increasing demands of beef		Some of the cropping areas will be used to plant forages Greater competition on land use between crop production and forage production for cut and carry livestock production	Land use by district from the NTB in Figures (statistics offices)	Adaptation capacity of livestock growers to change from extensive system to intensive system (including change in land use) and the change in their livelihood

## Attachment 2. Ecosystem components and drivers: livestock systems

### LOMBOK

Component	General description	Current Status	Spatial Distribution	Dynamics (range, max, min, seasonality)	Drivers/threats	Outputs (ecosystem services)	Projections 2030, 2050, 2100	Data available (Dataset, location, name)	Information gaps (research)
Land use	Land use in Lombok is more intensive compared to Sumbawa. Very little communal grazing area is available due to higher population density compared to Sumbawa. Livestock are raised in the crop-livestock system	Most of productive lands used for crop production, very small area for livestock. Land ownership is very small (about 0.3 Ha per household) and declines in size (especially in the irrigated areas). Almost 40% cattle growers do not have access to land. In most areas of Lombok, livestock are raised under smallholder cut-and-carry systems.	In the irrigated area (around the "belt" of Lombok, L4), lands are mostly used for growing rice and second crops. In drier areas, more livestock are raised (L2, L3 and L5)	Land ownership is getting smaller due to increase in size of household. Value of land is increasing rapidly, so the costs of feeding livestock becoming very high	Rapid population growth. Rapid land conversion to non agricultural purposes (urban development, infrastructure etc)	Land available to produce forages becoming very limited. Time spent and costs to collect feeds becoming very high		Land use by district (BPS)	Types of forages most suitable under intensive farming systems in different subregions of Lombok

Component	General description	Current Status	Spatial Distribution	Dynamics (range, max, min, seasonality)	Drivers/threats	Outputs (ecosystem services)	Projections 2030, 2050, 2100	Data available (Dataset, location, name)	Information gaps (research)
Collective housing system	Collective housing is very common in Lombok. In this system, a group of livestock growers house their animals collectively in a common place (typically an area of 100 – 1000 m <sup>2</sup> ) either all day or only at night. Feeding and managing the animals remain the responsibility of each farmers, but they collectively work to maintain security and sanitation	There are around 800 collective housing units in Lombok In general, land used for the collective housing is private land (belong to a family) and the group collectively rent the land (paid in cash or with rice).	Scattered throughout the island but more concentrated in L4	The sustainability of this system is uncertain because land tenure is based on informal agreement between farmer groups and the land owner that can be broken by any cause The collective pens often located within or very close to settlement (villages) Sanitation of the collective housing system is generally poor that creates problems both to human and livestock	Security conditions force the farmers to collective systems Policy that regulates long term tenure between the farmer groups and the land owner is not yet effective	Number of livestock that can be managed or owned by a family is limited (1-3 in the case of cattle) Cost of production increases, so livestock production becoming less profitable and motivation to raise livestock may decline as a result		Number, distribution and purpose of collective housing system by district (survey results, ACIAR) Strategies to improve productivity of cattle under collective housing system / empirical experience in 36 farmer groups in central Lombok (research report, ACIAR) Policy (Bupati decree on collective housing system) available for central Lombok	Effective pathway to scale out and scale up the strategies to improve livestock productivity (and farmer income) based on empirical experience in central Lombok

Component	General description	Current Status	Spatial Distribution	Dynamics (range, max, min, seasonality)	Drivers/threats	Outputs (ecosystem services)	Projections 2030, 2050, 2100	Data available (Dataset, location, name)	Information gaps (research)
<b>Forages</b>	<p>Forages available for ruminant livestock in Lombok are mainly native grasses (mix of graminiae and some local legumes)</p> <p>Grasses are collected from rice bunds, road side, irrigation channel, neglected land</p> <p>Introduced forages (especially elephant grass and king grass) also available, but limited to farmers who have access to land</p> <p>In some parts of Lombok, tree legumes are quite abundant, but only sesbania is fed in large amount</p>	<p>Cattle are kept in pens or tethered in backyard, and fed by cut and carry system due to limited communal grazing area and problems with security</p> <p>In wet season to early dry season, forages are sufficient, but in late dry season farmers have to rely on crop residues</p> <p>Landless farmers collect forages from road sides, river banks or irrigation channel for free. They can no longer collect grasses from rice bunds for free (land owner used it or sell it to others)</p>	<p>Improved grasses common in L2, L3, L4 and emerging in other irrigated area of Lombok.</p> <p>Sesbania is the most common tree legumes fed to ruminants. It is concentrated in L3, not much in other areas</p> <p>Leucaena: concentrated in L2, L5, but not yet a common feed for ruminants</p> <p>Gliricidia: scattered in most area as living fences and not much used to feed livestock</p>	<p>Feeds generally scarce in dry season.</p> <p>Farmers in dry areas such as south central Lombok (L3) often collect grasses or crop residues by truck from other areas (can be as far as 60 km away)</p>	<p>Increase in food demands</p> <p>Expansion of housing and infrastructure</p>	<p>Reduced capacity of a farmer to provide sufficient quantity and quality of feeds to their livestock</p> <p>Number of livestock that can be fed by a family is much smaller than in the past.</p> <p>Livestock population and productivity may decline</p>		<p>Benchmarking data of cattle farming system, adoption of introduced forages, use of existing forages etc in 36 farmer groups in central Lombok (ACIAR research report)</p>	<p>Profitable feeding systems for ruminants under intensive farming systems in each sub regions of Lombok</p> <p>Adaptation of the landless farmers to this changing biophysical and socio-economical conditions</p>

Component	General description	Current Status	Spatial Distribution	Dynamics (range, max, min, seasonality)	Drivers/threats	Outputs (ecosystem services)	Projections 2030, 2050, 2100	Data available (Dataset, location, name)	Information gaps (research)
Species	Livestock are still an important source of livelihood in Lombok. Cattle and goats are the two species that are much higher in number (importance) compared to buffalo and sheep. Livestock are mostly used as saving.	Livestock are kept in a smallholder system with very small ownership (1 to 3 animals per family). Livestock are fed by cut and carry or by limited tethering in the cropping area or in the road side.	Cattle and goats exist in all subregions (except in L1 and L7). Buffalo are limited to L3. Sheep are in small number, mostly in drier area of east Lombok (eastern part of L4).	Buffalo used to be the most popular livestock but since the introduction of cattle in the 1960s, buffalo are considered less important. Population of buffalo tend to decline while population of cattle (and goats) increase steadily. Adoption of better management system has improved productive and reproductive efficiency of cattle under collective system but do not increase cattle number in the group. Market for cattle (especially breeding stock) shift to other provinces (mostly in Kalimantan).	Farmers are mostly subsistence so any increase in number of cattle weaned always followed by increase in number of sale due to urgent need for cash, limited capacity to feed and limited space to house the animals. Increased costs of production and transportation to Jakarta or west Java so local livestock (especially cattle) less competitive than imported.	. If no measures are taken to increase farmers capacity to feed and maintain their livestock, number of livestock per household will not increase, even if they have adopted better management system.	Cattle and goat population will continue to increase but may be limited by capacity of farmers to provide sufficient feeds, space for housing and obtain sufficient cash for their daily needs. Buffalo population will continue to decline due to rapid decline in area for grazing and wallowing.	Productivity and population dynamics of Bali cattle in 36 farmer groups in central Lombok (ACIAR research report). Beef supply chain (Deblitz et al, 2010, ACIAR report).	Best-bet scenario for the subsistence farmers (more importantly the landless ones) to at least maintain their livestock number and productivity when resources are depleting.

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#### **FURTHER INFORMATION:**

[http://www.usaid.gov.au/hottopics/topic.cfm?ID=2707\\_8209\\_4232\\_9569\\_1218](http://www.usaid.gov.au/hottopics/topic.cfm?ID=2707_8209_4232_9569_1218)

<http://www.csiro.au/multimedia/Indonesia-And-Climate-Change>

<http://www.csiro.au/news/Improvedclimate-change-projections-SE-Asia>

<http://www.rfdalliance.com.au/site>

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## **Ringkasan (Summary)**

Sebagian besar kehidupan masyarakat di NTB (pulau Lombok dan Sumbawa) sangat bergantung kepada usaha pertanian. Peran ternak ruminansia sangat besar terutama sebagai tenaga kerja dan sumber pendapatan (tabungan) dalam meningkatkan kesejahteraan masyarakat di NTB.

Dalam melaksanakan usaha peternakan, terdapat perbedaan sistem beternak diantara petani di Pulau Lombok dengan di Sumbawa. Umumnya petani di pulau Lombok memelihara ternaknya dengan cara dikandangkan (intensif), sedangkan ternak-ternak di Sumbawa dipelihara dengan cara dilepas (ekstensif). Perbedaan system pemeliharaan ini berimplikasi terhadap kemampuan peternak dalam penyediaan pakan untuk ternaknya dan hal ini juga mempengaruhi jumlah kepemilikan ternak oleh setiap peternak, dimana kepemilikan ternak di Sumbawa jauh lebih banyak dibanding jumlah kepemilikan ternak oleh petani di pulau Lombok.

Program pembangunan yang dilaksanakan oleh pemerintah dalam membangun sarana irigasi (dam/bendungan) di pulau Sumbawa telah mengubah status penggunaan lahan dari lahan kering menjadi lahan sawah irigasi (intensif), tambak, dan hutan produksi. Perubahan fungsi lahan ini berdampak kepada menyempitnya areal "Lar atau So" yang dulunya merupakan tempat penggembalaan umum, sehingga membatasi jumlah kepemilikan ternak oleh petani.

Menyempitnya areal padang penggembalaan (Lar/So) mengharuskan peternak mengubah system beternak dari ekstensif ke intensif. Pola pemeliharaan system intensif ini telah diterapkan di pulau Lombok, dan ke depan para peternak di Sumbawa harus menerapkan pola pemeliharaan system intensif ini. Permasalahan dari system intensif ini, peternak harus menyediakan pakan (cut and carry) dalam jumlah cukup, sementara kuantitas dan kualitas pakan yang tersedia terbatas.

Mencermati kondisi daerah dan kaitannya dengan program bumi sejuta sapi, maka dalam upaya meningkatkan produksi ternak di NTB diperlukan fasilitasi Pemerintah untuk meningkatkan kemampuan adaptasi peternak dalam menghadapi perubahan kondisi biofisik dan social ekonomi yang semakin cepat.

## **Introduction**

Ruminant livestock (cattle, buffalo, goats and sheep) play important roles to support livelihood of farmers in NTB. Cattle and buffalo are mostly sold for inter-island export and small number are slaughtered for local consumption. They also used as draught power even though some of their role has been replaced by hand tractors. Goats and sheep mostly slaughtered for local consumption. Horse is important for village transportation. Some people eat horse meat and horse milk from Sumbawa is well known as a health drink.

The importance of livestock is now becoming more apparent because livestock, compared with crops, are less vulnerable to changes in climate conditions such as longer dry season, shift in wet season or long wet season. However, the existence and productivity of ruminant livestock are also affected by changes in land use and socio-economical conditions.

This study was carried out to characterize the current conditions of livestock production systems in Lombok and Sumbawa. Focus of this study was to understand the current conditions, species distribution and richness within different ecological subregions, dynamics, drivers of changes and potential impacts likely to happen. Profiles of the current system will be very useful in understanding farmers ability to adapt to changes in land use, socio-economic and agro-climate condition.

### **I. Methodology**

This survey was carried out by collecting secondary data from relevant government offices. Data were also collected from relevant research reports and from expert opinions. Field visits were carried out to selected locations to observe current situations and to discuss with farmers about the past and current conditions of the production systems.

Locations visited were within central Lombok and Sumbawa districts. These districts were selected because they can represent Lombok and Sumbawa islands respectively and they have distinct biophysical and socio-economical conditions. Farmer information were collected both by individual in-depth interviews and focused group discussions.

Data collected include a) population distribution of each species by district and population growth by species during the period of 1969 – 2010, b) existing government policies and their impact on the systems, c) changes in ecological conditions (native pasture production, carrying capacity, soil degradation, weed invasions etc) and d) farmers perceptions on the past and present conditions of the farming systems.

A series of team discussions were then carried out to analyze data/ information gathered and to describe the current livestock production systems in Lombok and Sumbawa.

## II. Results and discussion

### 1. General description of the production systems

Lombok has smaller area (only one third of Sumbawa) but has 3 times more people than Sumbawa. However, livestock populations are about the same in the two islands which means that livestock density is much higher in Lombok than in Sumbawa. In the case of cattle population, Lombok has about 55% of the total population.

In Lombok, ruminant livestock (Cattle, buffalo, goats and sheep) are mostly raised in cut and carry system and as a result, livestock ownership is much smaller than in Sumbawa. Most of the productive lands in Lombok are used for crop production, so very little area for extensive livestock production.

In Sumbawa on the other hand, livestock still kept under semi extensive system. Only a small proportion of farmers have started to keep their livestock in pens and fed by cut and carry system.

Figure 1 illustrates the population growth of ruminant livestock in NTB since 1969. Cattle and goat populations increase steadily (even though with significant fluctuation in some periods). Sheep population remains steady, while buffalo population tends to decline.

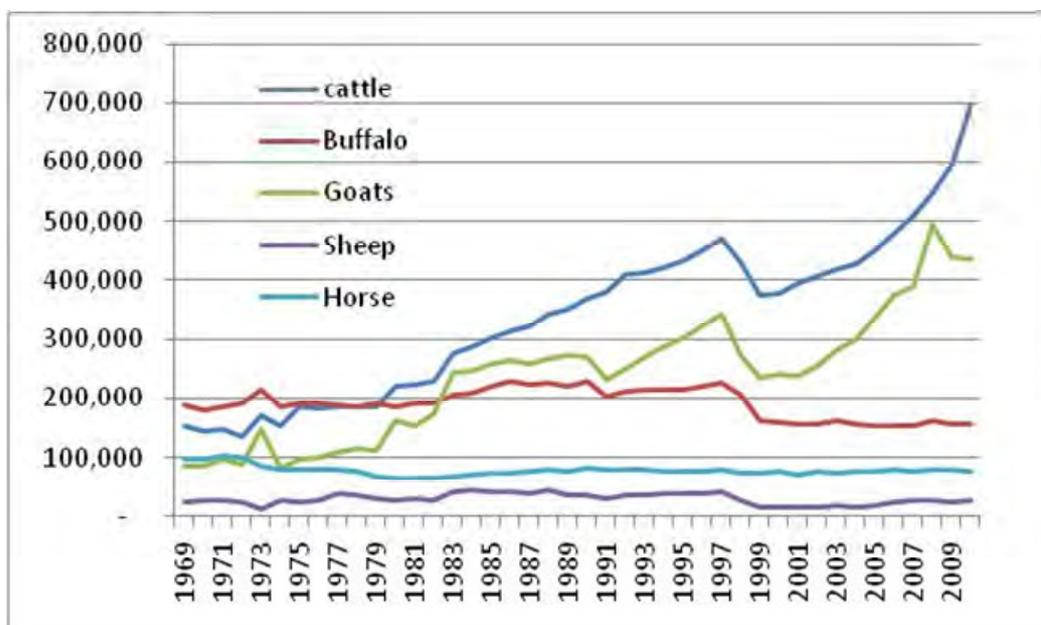


Figure 1. Population growth of ruminant livestock in NTB during the period of 1969 – 2010. (Dinas Peternakan Dan Kesehatan Hewan NTB, 2010).

Livestock distribution by districts in 2010 is presented in Figure 2. Cattle population is highest in Sumbawa, while goats are dominant in Bima district.

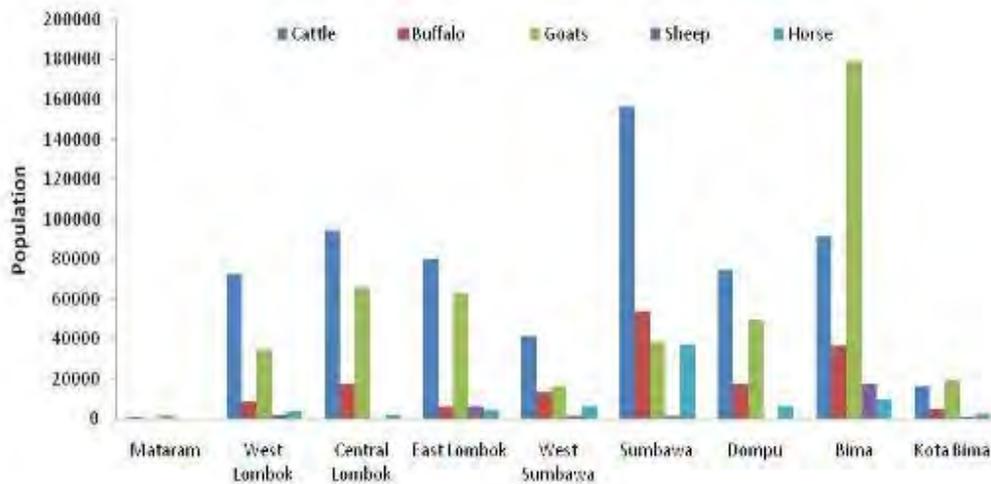


Figure 2. Distribution of livestock by districts in 2010 (Dinas Peternakan dan Kesehatan Hewan NTB, 2010)

In term of relative significance (see Table 1), cattle and goats are the most dominant (and have high potential to be developed further) in west Sumbawa, Sumbawa, Dompu and Bima districts. Goats are significant in West Sumbawa, Dompu and Bima districts. Buffalo and sheep are not significant ( $LQ < 1.0$ ). It is clear that while population of cattle and goats are quite high in Lombok island, the potential for further development is constrained by limited availability of land.

District	Cattle	Buffalo	Goats	Sheep
West Lombok	0.62	0.07	0.30	0.02
Central Lombok	0.78	0.14	0.54	0.00
East Lombok	0.52	0.04	0.41	0.04
West Sumbawa	2.89	0.91	1.15	0.09
Sumbawa	2.62	0.90	0.64	0.02
Dompu	2.42	0.56	1.63	0.01
Bima	1.53	0.61	3.00	0.29
Kota Bima	0.89	0.26	1.03	0.03
Mataram	0.02	0.00	0.05	0.01

Table 1. Location quotient (LQ) of livestock in each district of NTB (LQ based on population per 1000 people).