The role of communal pasture as a source of cattle feed: A case in Lar Badi, Sumbawa

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Abstract. Cattle farming plays a significant role in most economic and social societies in Sumbawa, West Nusa Tenggara, Indonesia. In this area, the majority of cattle are grazed extensively in open grassland. The study aimed to evaluate the role of communal pasture range as a source of cattle feed. The method was descriptive with field verification, took place in Lar Badi, Sumbawa, West Nusa Tenggara, which was one out of 59 pastures in Sumbawa. Data related to pasture conditions, beneficiary farmers, and institutional management were collected from different sources. Lar Badi has a total area 460 ha, where Directorate General of Livestock and Animal Health has a program to improve 100 ha of it with pasture grasses and legumes, such as Lamtoro tarramba and Brachiaria decumbens. The number of beneficiary farmers is 177 farmers from 10 farmer groups. The total number of cattle owned by the farmers is 2,941 heads. The combination of L. tarramba and B. decumbens has total production of 3,100 DM t ha⁻¹ yr⁻¹, while the requirement of 2,941 heads or 1,736.99 animal unit (AU) of cattle was 5,205.15 DM t yr⁻¹. The cattle need the addition of 2,105 DM t yr⁻¹. The capacity of Lar Badi is 0.6 AU ha⁻¹ yr⁻¹. The study suggests increasing forage production capacity to sustain cattle feeding in Sumbawa.

1. Introduction

The West Nusa Tenggara province is the fifth among beef cattle production centers in Indonesia, with a total population of 1,242,749 heads, also supported by buffalo (124,527), horse (47,576), sheep (27,241), and goat (701,427) [1]. The estimated number of livestock slaughtered are beef (55,500), buffalo (4,940), sheep (65), and goat (18,700). In contrast, the total meat production from ruminants is 67,544 tonnes, with contribution from beef (9,823), buffalo (973), and mutton (2,948). On the other hand, quite an amount of livestock species is distributed to other areas, such as beef cattle (12,000), buffalo (2,500), and goats (300), whereas incoming goats are estimated to 700 heads [1].

The livestock population in the province required sustainable management for communal pastures located in West Nusa Tenggara since farmers rely mostly on natural pasture fields to feed their livestock. Therefore, planting a mixed variety of legumes and grasses expects to reach adequate crude protein content and the total amount of forages. Not only that, but the utilization of the pastures for livestock grazing is also beneficial and do not harmful to the environment. Ruminant livestock production in the tropics, which rely on natural pasture fields, frequently causes detrimental effects to the ground and degradation of ecosystems, including scarcity of water, biodiversity, and the impact of climate change (global warming) [2].
Farmer’s institution is one of the crucial aspects of sustainable utilization of communal pastures due to their commitment to pasture management that will contribute to pasture productivity, carrying capacity, and livestock grazed quality in that area. Three processes played a crucial role in enabling the community to take the pasture management approach [3]. Firstly, the traditional leaders who recognize the opportunity, regulate, and mobilized the community. Secondly, informal institutions that govern the access and use of the communal pasture. Thirdly, the local community could effectively interact with various government agencies to safeguard its autonomy [3].

Forage varieties maintain in every pasture will affect their productivity. The composition of plant species found in the natural pasture fields in Selayar Island of South Sulawesi comprises eight species of grasses (44.4%), five species of legume (27.8%), and five other plant species (27.8%) [4]. Those combinations produced an average dry matter and crude protein of 24.74% and 7.46%, respectively, with a total carrying capacity of 1,803 AU ha\(^{-1}\) yr\(^{-1}\) and estimated forage production of 9,914 t ha\(^{-1}\) yr\(^{-1}\) [4]. Improvement of pastured could be made by importing special forage varieties, site adaptation in local conditions, running forage collection, plant breeding, and selection program of certain forage varieties [5].

Besides productivity, it is also essential to manage animal health grazed on the pasture, mostly for parasite infection, as one of the biggest problems in natural pasture fields [6]. Therefore, proper pasture managements are crucial for pasture improvement. Some of the pasture fields are frequently rested from grazing and treated to control parasites’ pasture fields by anthelmintic treatments. The study aimed to evaluate the communal pasture role as a source of cattle feed in Lar Badi, Sumbawa.

2. Materials and methods

This research method was descriptive to describe a phenomenon and its characteristics using actual quantitative data [7]. This research used observation to gather data. Field observation of Lar Badi pasture was conducted in Sumbawa, West Nusa Tenggara Province, in December 2019. Lar Badi was associated with a large pasture area owned by several villages. Lar means a tradition that lasted for generations. It is also the local wisdom of the Sumbawa people. Lar’s boundaries are communally recognizing. Lar Badi means one of 59 lars in Sumbawa. Lar Badi has a total area of 460 ha. Directorate General of Livestock and Animal Health (DGLAH) has a program to improve 100 ha of Lar Badi with pasture grasses and legumes. The program is part of the Pasture Development Project (Pengembangan Padang Penggembalaan), which starts from 2019 until December 2020. This research used the project area (100 ha) as a research location.

The pasture performance was calculated based on potential forage production and cattle requirements [8]. The dry matter (DM) was used as the basis of the analysis. DM was used as an indicator of the number of nutrients available to the animal in a particular feed [9].

| Sex     | Age               | Proportion\(^a\) (%) | Body weight\(^b\) (kg) | Sources |
|---------|-------------------|----------------------|------------------------|---------|
| Male    | Weaning (0-1 years) | 30.85                | 109                    | [12]    |
|         | Yearling (1-2 years) | 41.72                | 162                    | [13]    |
|         | Adult (2-4 years)  | 27.43                | 337                    | [13]    |
| Female  | Weaning (0-1 years) | 13.36                | 105                    | [12]    |
|         | Yearling (1-2 years) | 20.71                | 162                    | [13]    |
|         | Adult (2-4 years)  | 65.92                | 218                    | [13]    |

\(^a\) Proportion of age classification based on national cattle and buffalo census (PSPK) 2011 [14]  
\(^b\) Standard bodyweight of Bali cattle based on age classification

Firstly, the cattle population was calculated based on age classification. The Animal Unit (AU) value was calculated to express the feed requirements of different domestic animals. This research used an AU value equal to 325 kg of cattle [10]. Therefore, data on body weight were also essential.
Since no cattle were weighing in the observation, we used the standard bodyweight to determine the population’s total body weight and the age classification (table 1). DM requirement was derived from the multiplication of the cattle total AU and DM requirement (8.21 kg head$^{-1}$ day$^{-1}$) [11].

Secondly, forage production was calculated based on its potential production. This research did not calculate yield to determine the production of the forage. However, forage production was calculated based on the same forage in the previous research. Forages planted on 100 ha of pasture, consisting of 50 ha of *Lantoro tarramba* and 50 ha of *Brachiaria decumbens*. The productivity of *L. tarramba* and *B. decumbens* was 25,000 kg DM ha$^{-1}$ yr$^{-1}$ [15] and 37,000 kg DM ha$^{-1}$ [16], respectively. Thirdly, a comparison between cattle DM requirement and pasture DM production was conducted to show whether overgrazing or under grazing took place.

3. Results and discussion

The number of beneficiary farmers of Lar Badi is 177 farmers from 10 farmer groups (table 2). The total number of cattle owned by the farmers was 2,941 heads of Bali cattle. The farmer groups were located around the Lar Badi. Although rarely controlled, cattle graze in Lar is relatively safe, and there are almost no thefts. The cattle’s control in the grazing fields usually takes turns between members of the communal [17]. So far, the problems that often occur in the Lar system are the threat of wild animals, such as dogs, that sometimes eat newborn calves, disease danger, and limited forage in the dry season. Livestock in Lar areas was usually given vaccines and medication once a year when registering livestock by the local livestock service [17].

In general, communal pasture was used as a common grazing area, whereas private land was only used for grazing a relatively limited number of cattle. The larger number of livestock was grazed on communal land. Communal land was important for people who do not own private land or for people who own many cattle but do not have sufficient private land [17]. The advantage of private land as grazing land is that it can also develop forage crops for livestock besides planning its use. Private land is usually provided with barrier feed, whereas communal land is rarely fenced. However, the location of the Pasture Development Project in Lar Badi is fenced to secure the asset.

**Table 2.** The population of cattle (heads) owned by each farmer group in Lar Badi (obtained from field observation).

| No. | Farmer Group | Locations             | Members (farmer) | The population of cattle |
|-----|--------------|-----------------------|------------------|--------------------------|
|     |              |                       |                  | Male | Female | Total |
| 1   | Badi Savana  | Lopok Village         | 19               | 70   | 172    | 242   |
| 2   | Brang Badi   | Bage Tango Village    | 21               | 114  | 305    | 419   |
| 3   | Ai Kedit     | Lopok B Village       | 16               | 81   | 203    | 284   |
| 4   | Ai Liang     | Pasinar Village       | 18               | 85   | 236    | 321   |
| 5   | Ai Manggis   | Lopok AB Village      | 17               | 82   | 234    | 316   |
| 6   | Ai Porek     | Kemang Kuning Village | 17               | 65   | 166    | 231   |
| 7   | Jeruk Bang   | Kadewa Village        | 15               | 38   | 90     | 128   |
| 8   | Lenang Goal  | Lopok B Village       | 19               | 100  | 211    | 311   |
| 9   | Lompat       | Lopok Bru Village     | 18               | 96   | 249    | 345   |
| 10  | Tri Bulan    | Temung Jangi Village  | 17               | 95   | 249    | 344   |
|     | Total        |                       | 177              | 826  | 2,115  | 2,941 |

Field observation-only calculated the total population of cattle based on sex in each farmer group. Real cattle weight in the whole community was calculated by multiplying the entire population with standard body weight, as shown in table 1. The result shown in table 3 indicates that the Brang Badi group has the highest total cattle weight, and the Jeruk Bang group has the lowest. The total cattle
weight was used to calculate the AU of the cattle in each farmer groups (table 4). High total cattle weight resulted in a high DM requirement as well. The DM requirement calculation showed that the DM required was 2,941 heads or 1,736.99 AU beneficiary cattle was 5,205.15 t DM ha\(^{-1}\) yr\(^{-1}\).

**Table 3.** The estimated body weight of total population weight (kg) in Lar Badi

| No. | Farmer Group       | Male (kg)\(^a\) | Female (kg)\(^a\) | Total (kg) |
|-----|-------------------|----------------|-----------------|------------|
|     |                   | Weaning\(^b\)  | Yearling\(^b\) | Adults\(^b\) | Weaning\(^c\) | Yearling\(^c\) | Adults\(^b\) |
| 1   | Badi Savana       | 2,353.86       | 4,731.05       | 6,470.74   | 2,412.82    | 5,770.63    | 24,717.36   | 46,456.45 |
| 2   | Brang Badi        | 3,833.42       | 7,704.85       | 10,538.06  | 4,278.54    | 10,232.81   | 43,830.21   | 80,417.89 |
| 3   | Ai Kedit          | 2,723.75       | 5,474.50       | 7,487.57   | 2,847.68    | 6,810.69    | 20,172.24   | 54,516.42 |
| 4   | Ai Liang          | 2,858.25       | 5,744.84       | 7,587.32   | 3,310.61    | 7,917.85    | 33,914.52   | 61,603.40 |
| 5   | Ai Manggis        | 2,757.37       | 5,542.08       | 7,580.01   | 3,282.55    | 7,850.75    | 33,627.11   | 60,639.87 |
| 6   | Ai Porek          | 2,185.72       | 4,393.12       | 6,008.54   | 2,328.65    | 5,569.33    | 20,355.13   | 40,340.49 |
| 7   | Jeruk Bang        | 1,277.81       | 2,568.28       | 3,512.69   | 1,262.52    | 3,019.52    | 12,933.50   | 24,574.32 |
| 8   | Lenang Goal       | 3,362.14       | 6,758.64       | 9,243.91   | 2,959.91    | 7,079.09    | 30,321.88   | 59,726.08 |
| 9   | Lompat            | 3,228.14       | 6,488.29       | 8,718.45   | 3,492.97    | 8,354.00    | 35,782.69   | 66,220.26 |
| 10  | Tri Bulan         | 3,194.52       | 6,420.71       | 8,615.21   | 3,492.97    | 8,354.00    | 35,782.69   | 66,026.61 |
| Total|                  | 27,775.49      | 55,826.37      | 76,354.70  | 29,669.22   | 70,958.67   | 303,937.34  | 564,521.79 |

\(^{a}\) Total weight is a multiplication of total population and the standard bodyweight of Bali cattle shown in table 1

\(^{b}\) Proportion of age classification based on national cattle and buffalo census (PSPK) 2011 [14], where Weaning (0-1 years) 30.85%, Yearling (1-2 years) 41.72%, and Adult (2-4 years) 27.43%

\(^{c}\) Proportion of age classification based on national cattle and buffalo census (PSPK) 2011 [14], where Weaning (0-1 years) 13.36%, Yearling (1-2 years) 20.71%, and Adult (2-4 years) 65.92%

**Table 4.** The calculation result of dry matter requirement based on the animal unit (AU)

| No. | Farmer Group | Total cattle weight (kg) | Animal unit (AU)\(^a\) | DM requirement\(^b\) (t yr\(^{-1}\)) |
|-----|--------------|-------------------------|-----------------------|-------------------------------|
| 1   | Badi Savana  | 46,456.45               | 142.94                | 428.35                        |
| 2   | Brang Badi   | 80,417.89               | 247.44                | 741.49                        |
| 3   | Ai Kedit     | 54,516.42               | 167.74                | 502.67                        |
| 4   | Ai Liang     | 61,603.40               | 189.55                | 568.01                        |
| 5   | Ai Manggis   | 60,639.87               | 186.58                | 559.13                        |
| 6   | Ai Porek     | 44,340.49               | 136.43                | 408.84                        |
| 7   | Jeruk Bang   | 24,574.32               | 75.61                 | 226.59                        |
| 8   | Lenang Goal  | 59,726.08               | 183.77                | 550.70                        |
| 9   | Lompat       | 66,220.26               | 203.75                | 610.58                        |
| 10  | Tri Bulan    | 66,026.61               | 203.16                | 608.80                        |
| Total|              | 564,521.79              | 1,736.99              | 5,205.15                      |

\(^{a}\) 1 AU = 325 kg of total cattle weight [10]

\(^{b}\) Dry matter requirement = 8.21 kg/head/day [11]

Pasture management is essential to balance the need for cattle grazing and keep the land productive. The proper management also ensures that pasture, either natural, communal, or improved, is available for cattle grazing year-round and that the soil remains healthy. Therefore, the total potential production of pasture is significant. Although pasture production is affected by climate, land
condition, forage quality and quantity, grazing frequency and intensity, the potential production calculation is necessary.

The analysis of possible production (DM t ha\(^{-1}\) yr\(^{-1}\)) of Lar Badi, as shown in table 5. The combination of L. tarramba and B. decumbens has a total production of 3,100 DM t 100 ha\(^{-1}\) yr\(^{-1}\) without considering the rainy season and dry season, while the requirement of 1,736.99 AU cattle was 5,205.15 DM t yr\(^{-1}\). Thus, the cattle need the addition of 2,105 DM t yr\(^{-1}\). The capacity of Lar Badi is 0.6 AU ha\(^{-1}\) yr\(^{-1}\), while the ideal capacity in semi-arid Nusa Tenggara is 1.5 AU ha\(^{-1}\) yr\(^{-1}\) [18]. The Pasture Development Project needs to increase production or broaden the project area.

**Table 5.** Estimated total production of pasture (DM t ha\(^{-1}\) yr\(^{-1}\)) in Lar Badi

| No. | Type of grass/legume | Productivity (DM kg ha\(^{-1}\) yr\(^{-1}\)) | Planting area (ha) | Total production (DM t 50 ha\(^{-1}\) yr\(^{-1}\)) |
|-----|----------------------|--------------------------------------------|---------------------|-----------------------------------------------|
| 1   | Lamtoro taramba      | 25,000                                     | 50                  | 1,250                                         |
| 2   | Brachiaria decumbens | 37,000                                     | 50                  | 1,850                                         |
|     | Total                | 62,000                                     | 100                 | 3,100                                         |

*Productivity of Lamtoro taramba and Brachiaria decumbens was 25,000 kg DM ha\(^{-1}\) yr\(^{-1}\) [15] and 37,000 kg DM ha\(^{-1}\) [16]*

Cattle may lose their performances (weight and reproduction ability) if the pasture has limited nutrients. Pasture needs more grass production so that nutrients remain sufficient for livestock. If the pasture is unable to produce more grass, then expensive supplementary feeding may be necessary. The difference in cattle age, size, and lactation status has a different amount of nutrients needed. For example, pregnant animals need more nutrients, while younger, growing animals need diets with higher levels of protein.

Based on this study’s research, Lar Badi needs the addition of grass to supply cattle in the area. For example, from pasture improvement in Kampar, Riau suggested that the use of forages should be integrated to improve the grassland area’s soil fertility by applying organic fertilizer produced from the available livestock population [19]. Therefore, soil fertility will be higher and subsequently followed by higher forage productivity. This effort could be applied to improve pasture production in Lar Badi.

**4. Conclusions**

A combination of Lamtoro tarramba and Brachiaria decumbens planted in Lar Badi has 3,100 DM t 100 ha\(^{-1}\) yr\(^{-1}\). Simultaneously, the requirement of 2,941 heads or 1,736.99 AU cattle was 5,205.15 DM t yr\(^{-1}\). The cattle needed the addition of 2,105 DM t ha\(^{-1}\) yr\(^{-1}\), and the capacity of Lar Badi was 0.6 AU ha\(^{-1}\) yr\(^{-1}\). The study suggests increasing forage production capacity to sustain cattle feeding in Sumbawa.

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