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Communal grazing area is as a potential source of calves in dry Sumbawa Island, Indonesia: the improvement of opportunities and challenges

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Abstract. Sumbawa island is one of cattle centre in Indonesia characterized by grazing system. Most farmers practice integrated crop-livestock system with cattle and rice and or maize being the most common commodities. This paper provided understanding on communal grazing system in Sumbawa, its potency as a source of calves and its opportunity and challenges for improvement. A study was conducted from 2018 to 2019 for three largest communal grazing areas in Sumbawa Island, Lar Badi, Gili Rakit and Doro Ncanga, respectively. Most cattle live on grazing land during the harvest season and return to the village after harvest to graze the remaining crops. Herds were dominated by cows, calves, and young bulls. Despite being a potential source of calves and high in carrying capacity, these areas have common problems such as lack of feed and high calf mortality. At the same time, crop residue available abundantly nearby, yet underutilized due to the labour, transporting cost, and lack of the knowledge. It is concluded that communal grazing areas plays a significant role as calves and feeder producing centre in the dry island of Sumbawa. However, the farmer's awareness and capacity need to be improved for better management to solve the problems and good pasture management in the communal grazing.

1. Introduction

Sumbawa Island is one of the main cattle centres in Indonesia, characterized by traditional extensive management, communal grazing, and long dry season [1,2]. The Majority of the smallholder farmers in Sumbawa practice integrated crop-livestock system with cattle being the most common livestock for an economic buffer if the harvesting failed, savings, and a large expenditure [2]. Cattle farming are dominated by the extensive or semi-extensive system where a large portion of the cattle roam in communal grazing areas [2]. The lack of information to grazing cattle in Sumbawa has made this system a potential source of calves for further breeding or fattening. However, some previous study revealed that low cattle productivity in Sumbawa occurred by the slow growth and high calves' mortality due to the lack of feed and water during the dry season [3,4]. This paper aims to provide an understanding of the communal grazing system in Sumbawa, its potency as a source of calves, opportunities and challenges for improvement.



2. Method

A case study research was conducted from 2018 to 2019 for three main communal grazing areas in Sumbawa Island. The areas were Lar Badi and Gili Rakit in Sumbawa District while Doro Ncanga in Dompu District. The qualitative and quantitative data were input by the interview method. The interviewees were the smallholder farmer hold a grazing field and the government officers of Livestock and Animal Health Office both at district and sub-district level. The data were then analysed descriptively.

2.1. Geographical conditions and farming system in Sumbawa Island

Sumbawa Island is one of the two main island of West Nusa Tenggara (WNT) Province in Indonesia that holds two-third of the 20,153.15 km² provincial total area and nearly half of WNT cattle population of 1,234,357 [5]. Sumbawa Island is dominated by hilly rain fed areas where majority farmers practice integrated crop-livestock system. This island generally receives four to five months of rain season. Hence, the famers rely greatly on livestock for livelihood. Cattle production is one of the most important enterprises to support family an economy and plays a significant role as savings and buffer during harvest failure that can provide fast cash for children schooling, social ceremonies and other large expenditures [6,7]. Meanwhile, the dry season in Sumbawa has enabled farmers to plant crops only once a year by dry tolerant commodities such as maize, peanuts, soybean, and mung bean. A small part of the island is water irrigated where the farmers can plant rice and secondary crops after rice planting.

The cattle in Sumbawa Island is dominated by Bali and local cattle such as Ongole that mostly managed under the conventional extensive or semi-intensive system. The majority of the cattle enterprise is for breeding with 8–1 head ownership in average per household [2]. Some farmers hold tens or even more than one hundred cattle. Feeding management relies on natural grasses with lower quality as a feed source and crop residue [1,8]. Hence, low cattle productivity has been a common case in Sumbawa such as slow growth due to feed scarcity and high calves' mortality ocured low in cow's milk production and harsh environment [1–3,9,10]. During crops season (December to May/June), the cattle are mustered to the grazing land for preventing cattle from destroying crops in the farm and they will be returned back to the villages after harvesting season to graze crop residues. Three communal grazing and its problems:

2.1.1. Lar Badi. Lar Badi is located in Lopok sub-district, Sumbawa district, and quite far from the housing area. This 600-ha grazing is utilized by around 369 cattle farmers from various villages such as Langam, Lopok Bru, and Hijrah. they are raising about 17,000 livestock mainly cattle with some buffalo and horses. There is no MoU on grazing location, only hereditary and oral agreement. The majority of the farmers bring their cattle to the field in the early rainy season in December to June/July after harvesting. However, some farmers keep their cattle throughout the year in Lar Badi, due to the distance and bad road conditions in the rain season, therefore, the farmers usually control their cattle once a month. Sometimes, they lost their calves due to death or theft.

The main problems in Lar Badi are overstocking, insufficiency of feed, and weed invasions. *Chromolaina* as weed invasions has covered half of the grazing land. Hence, the stocking rate of Lar Badi is around 28 animals/ha. This trend showed that stocking density in Lar Badi is overstocking, even though this field can provide feed for the cattle and other livestock there. The average natural grass production in WNT ranges between 3–6 DM/ha or providing for 1–2 cattle/year. This rate is variable between 3–4 head/ha during the wet season and decreased to 0.5 head/ha in the dry season [11]. O'Reagain and Scanlan (2013) recommend that stocking rate of 0.5–1.5 head/ha for tropical areas with natural pasture, their quality decreased rapidly during in the dry season [12]. As a result, grazing cattle in Lar Badi showed low growth of what? and low body condition scores because of insufficiency of feed. The insufficiency of feed will lead to being lower productivity as low nutrition content in the feed is one of the key factors that hampered the cattle growth [13]. Long feed insufficiency in Lar Badi would continue when cattle return home because after August, most crop residue would have finished by that time. Generally, cattle graze whatever left on the ground and would go starving until the next rain season.

2.1.2. Gili Rakit. Gili Rakit is a small uninhabited island located of North Tarano sub-district, Sumbawa District. The island is utilized by the cattle from Empang and Tarano sub-district during in crop season. The cattle ownership in Empang is around 20–30 head per household. Grazing zone in Gili Rakit is distributed based on the cattle village origin and be coordinated by one leader. For example, the cattle from Lamenta village can be grazed in three areas while the cattle from Empang Bawa village. The cattle arrive in Gili Rakit in the early rain season (December) by crossing the strait. At the same time, majority of the cattle in this period are in the second trimester of gestation as calving season in Sumbawa is around May until July [10]. The cattle are returned to the main land in April/May after harvesting. Many calves were born on April but were not strong enough to across the strait to return back. Hence, many of them could not survive in the returning trip. This has been a problem of the communal grazing system in Gili Rakit.

Gili Rakit faced Similar problems with Lar Badi were feed scarcity and over carrying capacity. The 2,316 Ha land in this arid island is utilized by around 19,000 cattle, meaning stocking rate of around 8 head/Ha. On the other hand, carrying capacity in WNT with natural pastures is 1–2 head/ha in average and can increased to 3–4 head/ha during the wet season but decreased to only 0.5 head/Ha in the dry season [11]. Insufficiency of feed in Gili Rakit was worsened by farmers practiced to burn the corn straw after harvesting for the next crop planting round, leaving a little fodder for livestock. The situation is more exacerbated by the wide irrigation area in Empang that enabling farmers to plant crops in two seasons. Therefore, the cattle have to stay longer in Gili Rakit, until August with a little bit of feed. As a consequence, cattle performance is generally poor. A medic veterinary staff reported that many cattle affected Bali ziekte disease, a skin disease triggered by Lantana poisoning because only the Lantana has available around this field.

2.1.3. Doro Ncanga. Doro Ncanga grazing land is located in Pekat sub-district, Dompu District, covering around 6,000 Ha land. It lies in the coastal line of Saleh Gulf and going up to the slope of Tambora Mountain. Some part of the grazing land has been converted for sugarcane plantation and left it 1.900 ha for grazing. It is used by around 1.500 farmers from sub-district of Kempo, Woja, Dompu, and Pekat. This field provided for 20,000 cattle. The grazing area has been allocated based on descendent consensus and farmer agreement. Similar to another grazing land in Sumbawa Island, Doro Ncanga is used mainly during crop season (November–July). The cattle are transported using trucks from the village origin with varying transport costs. For example, from Dompu sub-district which is around 80 km away, the transportation cost is IDR 600,000-800,000/truck/trip with the capacity of 14–16 cattle. The cost will be then distributed proportionally based on the number of cattle in the truck.

The grazing system in Doro Ncanga is unique as cattle seem to know their grazing area and owner. In the morning, cattle graze in the hilly part of Doro Ncanga and the afternoon come down to drink in the coastal area where farmers have provided drinking trough for their cattle herd. Each farmer usually has their well along the coastal line of Doro Ncanga. With this cattle habit, calves are usually tethered close to drinking places to prevent them from following the cows graze in a long distance. The mother will come milking the calve during drinking time. One of the grazer groups that was interviewed in Doro Ncanga was Benteng Bersinas group. This group has 36 members with around 475 cattle. This means cattle ownership is around 13 cattle/farmer. Nonetheless, several of farmers in Doro Ncanga have more than fifty cattle, even more than one hundred. They formed a group basically for patrolling and security purposes. A group of five persons is responsible to control the grazing cattle for two days and two nights to ensure cattle stay in their herd. After two days, cattle patrol will be handed over to the next five persons. There is a farmer groups association for Doro Ncanga grazers. However, the group is not functioning and only used to solve a dispute over grazing areas between farmers or farmer groups

Doro Ncanga has a similar problem with two communal grazing areas that are the insufficiency of feed and overstocking. This study showed that the stocking rate in Doro Ncanga was 10 cattle/Ha. This situation is not suitable for grazing which natural pasture only provided 1–2 head/Ha cattle [11]. As a result, cattle performance is poor too indicated by slow growth and low body condition score.

2.2. Potency as produced of calves and improvement opportunity

This study showed that communal grazing land in Sumbawa Island has a great potency as a source of calves' productivity as cattle herds were dominated by cow. The majority of bulls are sold for family needs, while young bulls will be fattened. An interview with the grazer organization of Lar Badi revealed that about 90% of cattle there were cow. If 50% of the estimated cattle in Lar Badi, Gili Rakit, and Doro Ncanga (17,000; 19,000; and 20,000 respectively) is productive cows, then the number of a potential source of calves is 28,000 cows. The study revealed that cattle in Sumbawa Island are dominated by Bali cattle. The Bali cattle have shown to have high fertility rates with an average inter-calving interval of 11.9 ± 1.9 months [13]; pregnancy rates of 80–100% [14]; and calving rates ranging from 75%–90% [15]. This indicated that their high ability to adapted to a harsh environments and low feed quality [9]. If 80% of total cows in those grazing areas gave birth in every year, then a potential number of 22,400 calves can be produced from these low input system.

Despite the potency of communal grazing land in Sumbawa Island as a source of calves, the main constraints of cattle production in this region are insufficiency of feed both the quality and the quantity throughout the year [9]. This is exacerbated by the traditional management system that relies on natural grass as a source of feed. A study by Bamualim (1996) reported that natural grass in WTN has low crude protein content, >7% from July to December [11]. In that time, since calving from May to July, cows in Sumbawa will experience a nutrition deficiency condition for the next 6 months in their milking period. As a consequence, cows occurred low in milk production, calves will grow slowly, and prone to diseases due to the weak body condition leading to high calf mortality, as in line with a study by Wirdahayati and Bamualim (1990) [15]. This is exacerbated by the cattle migration system to and from communal grazing land and feed scarcity upon arrival in the village origin. As an example, calves had to cross the strait from Gili Rakit to the main land, most of them could not survive. A similar story also appeared in Doro Ncanga where calves had to travel a long distance in a packed truck. Calf mortality in Sumbawa was reported for 5.3% by Panjaitan et al (2003) but accounted for 10.8% in a study by Wirdahayati (1994) [10,16]. Nonetheless, Benteng Bersinar group in Doro Ncanga reported that loss calves around 20–30%. Interviewed farmers in Lar Badi reported a quite similar number while respondents for Gili Rakit could not report the exact number.

Insufficiency of feed has been a classical problem for cattle farming in Sumbawa Island. This region has abundant feed sources from crop residue such as corn. Sumbawa is one of the national corn producer regions. Corn harvested area was recorded for 43,043 ha and 29,512 ha for Sumbawa and Dompu district, respectively [5]. One ha of corn plantation can produce 3–4 ton corn stover in 20% water content [17], produced at least 129,000 and 88,000 tons of corn residues in Sumbawa and Dompu district, respectively. Corn stover is potential as a cattle feed source. By referring to cattle daily dry matter need of 1–3% body weight with crude protein content of 12% for cows [18] while 7.4% of crude protein content in corn stover [19], then corn stover full fill 2–3 of cows feed requirement. The other feed source is legume tree such as leucaena that available in surrounding areas with crude protein content of more than 20% [20]. Utilization of crop residue as a source of feed is of feasible strategies to improve the efficiency of cattle breeding farming [21].

Although crop residue available abundantly in Sumbawa as a source of feed, it has been under-utilized. Amongst influential factors that hamper farmers from improving feeding management and hence cattle farming were:

2.2.1. Cattle farming as a side business: majority of farmers in Sumbawa consider cattle farming as a side business and rarely calculate time, labour, and effort spent versus how to improve farming to get higher profit. This is exacerbated by the fact that a large number of farmers inheritage cattle. Hence, they do not worry about calving rates or calf mortality rates as long as they can sell the cattle. Moreover, farmers often overlook cattle body condition and only mind the number of live cattle although with the poor performance.

2.2.2. Lack of awareness and knowledge for feed conservation: generally, farmers in Sumbawa Island rely on natural grass as a source of feed. The Farmers perceive that nature should nurture the cattle. Hence, planting and conserving forage does not exist on their horizon. Moreover, their knowledge of

feed management, type of feed quality, and feed sources are still limited. This is indicated by underutilized feed quality nearby such as tree legume (*Leucaena leucocephala*). Often cattle graze with almost zero feed available close to the ground while owner only watches with little effort to feed cattle feed requirement.

2.2.3. The extra cost and communal system: providing feed in pasture needs extra cost for labour, transportation, and for establishment feeding trough. Meanwhile, a communal system without fencing allows any cattle to belong to other farmers to feed the available feedstock, too. These two factors have hampered farmers to put effort into providing feed from cattle in the communal pasture. Often farmers only calculate the cost for providing a feed without comparing profits that can be saved from died cattle and losing body condition.

Despite those hampering factors for improving feeding management, one farmer group in Doro Ncanga grazing land, Benteng Bersinar, has made an effort to store feed. They built a barn 8m × 8m in size and designed it to enable cattle feed from the fence. This barn is located near the drinking well. Hence, only cattle that belong to the group can access feed in the barn. The cost for feed collection and transportation is around IDR 400,000. The stock feed/forage twice a week. Then, distributed cost proportionally to each member based on the cattle ownership. By these practices, the interviewed farmers reported that calf mortality decreased significantly. After belonging to the barn, in 2018, 18 calves died from total of 300 cows. Previously, calf mortality reached up to 20%. This model can be an alternative solution to save cattle from starvation in harsh and overstocking communal pasture. Meanwhile, in some centre of Sumbawa, farmers also have store feed (mainly rice- and corn-straw) in a simple house called *pakan sia* in their private paddock. Yet, this practice has not been tried in the communal pasture due to un-functioning grazer groups. It seems that raising farmers' awareness of cattle feed requirements and available opportunities to solve ongoing feed scarcity by utilizing available crop residue is crucial. This needs to be supported by improving farmers' knowledge and skills on feed management for grazing systems. Lastly, the important thing is developing farmer organizational capacity to enable organizing themselves more functionally and effectively.

3. Conclusions

Communal grazing areas are a potential source of calves in dry Sumbawa Island for their size and number of cattle holding. However, overstocking, feed scarcity, and hence low cattle productivity have been a classical problem indicated by high calf mortality, low body condition score, and low growth performance. On the other hand, crop residue such as corn straw available abundantly in the region, yet has been underutilized due to several factors including the perception of farming as a side business, lack of awareness, and knowledge, extra cost requirement, and unorganized communal system. Meanwhile, some centre of farmers have practiced feed conservation resulted in a significant decrease in calf mortality. Hence, raising farmers' awareness of cattle feed requirements and available opportunities to solve ongoing feed scarcity by utilizing available crop residue is crucial. This needs to be supported by improving farmers' knowledge and skills on feed management for grazing systems. Lastly but equally important is developing farmer organizational capacity to enable organizing themselves more functionally and effectively.

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