



Analysis of The Carrying Capacity of Food Crop Follow-up As a Source of Ruminant Animal Feed In Kolaka Regency

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Abstract

The research aims to analyze the ruminant and food crop integration system development in Kolaka Regency using LQ (Location Quotient) analysis and supporting capacity analysis, sourced from secondary data collected from various literature supporting this study. The analysis results showed that the base for cattle development is in Samaturu, Polinggona, and Watubangga subdistricts, and buffalo livestock development bases are located in Latambaga Wolo Iwoimendaa Subdistrict, Baula Subdistrict, Pomalaa Subdistrict, and Tanggetada Subdistrict. The base of goat livestock development is in latambaga, Iwoimendaa, Somalia, and Toari subdistricts with LQ>1 values. As for the analysis of the carrying capacity of beef cattle feed, 19,724 heads (LU), buffalo 23,644 heads (LU), and goats 182,445 heads (LU). In conclusion, the utilization of food crop follow-up results can be a source of animal feed. It gives direction to the utilization of feed resources based on follow-up results.

Keywords: integrated systems, ruminants, food crops

A. Introduction

The development of farms in an area should pay attention to 4 (four) important aspects, namely livestock, human resources, land resources, and technology. The development of farms will run slowly if the business is still considered a side business. The development of farms in an area needs to be analyzed to measure the area's potential because livestock production depends a lot on the supporting capacity of feed reflected in the area of forage land and agricultural

follow-up products. Ruminant cattle are divided into two groups, namely large ruminants and small ruminants. The advantage of raising ruminant livestock is that it can utilize agricultural and plantation products in large quantities as a feed source.

The location quotient method can analyze efforts in knowing the ability of a commodity in the livestock sub-sector as the economic base of an area (Hildawati et al., 2018). The non-base sector is undeveloped or local (Hidayat et al., 2020). In the theory of the economic basis of a region, there are two sectors of activity, namely base, and non-base (Iswardi, 2018). The base sector is a sector that has great potential in determining the overall development of an area. In contrast, the non-base sector supports the overall development (Ariansyah et al., 2020).

The successful effort of development is the right planning (Permatasari et al., 2016). The basic planning must be based on a problem, basic needs, and potential of an area so that the development is carried out appropriately and on target to improve the regional economy of an area. Two agricultural subsectors can not be separated from rural communities, namely rice paddy farming and cattle, especially Bali Cattle (Pranadji & Suhaeti, 2016). The development of ruminant livestock, especially beef cattle, buffalo, and goats, is inseparable from the carrying capacity of the region, especially the source of animal feed derived from agricultural products in the form of food crops, forage, and plantation follow-up products (Pagala et al., 2020). The problem in ruminant livestock development is feed, especially fiber feed (Yamin & Syamsu, 2020). Failure to develop livestock populations in an area is usually a result of under-accounting of the support capacity of available feed (Khadija et al., 2019). So the research aims to analyze the Carrying Capacity of Food Crop Waste as a Source of Ruminant Animal Feed In Kolaka Regency

B. Methodology

1. Research Design

The material used in this study is the collection of beef cattle, buffalo, and goats belonging to ruminants and scattered in the Kolaka Regency. As well as a source of feed derived from agricultural by-products to used it.

2. Data Source

The data used in this study were sourced from Kolaka District Statistics (BPS), which was then collected from various literature to support the analysis results.

3. Research procedure

The research procedure was carried out by collecting and searching for literature related to this study in ruminant livestock populations sourced from the Central Statistics Agency and the Kolaka Regency Agriculture Service (2020).

4. Research Parameters

The parameters measured in this study are:

- a) Ruminant Livestock Development Base
- b) Support Capacity of Ruminant Animal Feed

5. The technique of Data Analysis

Data analysis in research using LQ (*Location Quotient*) analysis, the formula is as follows:

$$LQ_k = \frac{Y_{sk}/Y_{tk}}{Y_{sp}/Y_{tp}}$$

Information:

LQ_k : Location quotient index

As_k : The number of livestock population in sector i in the district/city j

Y_{ork} : Total livestock population in the district/city j

Y_{up} : Total population of sector i in the observed district to be a part (District)

Y_{tp} : The total population of the regency that is part of it

The results of the LQ analysis resulted in 3 (three) criteria, including:

$LQ > 1$: the commodity becomes the basis and has a comparative advantage as well as the results can meet the needs of the region itself. However, it can also be exported outside the region.

LQ=1 : the commodity is classified as non-basis because it does not have a comparative advantage, and its production is only sufficient to meet the region's needs.

LQ <1 : this commodity is also a non-basis because commodity production in a region cannot meet its own needs, requiring external supplies.

Furthermore, for the analysis of carrying capacity with the availability of by-products of food plants it is calculated based on the Muller formula (1974) as follows:

1. Rice straw = (2.5 X harvested area X 0.70) tons BK / year
2. Corn straw = (6.0 X Harvested Area X 0.75) tons BK / year
3. Soybean Straw = (2.5 X Harvested Area X 0.60) tons BK / year
4. Peanut Straw = (2.5 X Harvested Area X 0.60) tons BK / year
5. Sweet Potato Straw = (1.5 X Harvested Area X 0.80) tons BK / year
6. Cassava straw = (1.0 X harvested area X 0.30) tons BK / year

C. Result and Discussion

1. Ruminant Population Structure

Kolaka regency is generally a district with abundant natural resources. The agricultural sector, both food crops, horticulture, livestock, plantations, mining fisheries, and marine, is a resource that can support the community's economy, especially those working in the agricultural and plantation sectors, in a broad sense. The abundance of natural resources is not utilized properly, such as the follow-up of food crops, horticulture, and plantations. So the alternative is the utilization of the follow-up results is the utilization of follow-up products as a source of animal feed, especially in the dry season. Most farmers and farmers of food crops in the Kolaka Regency have not utilized the feed source optimally because it is constrained in knowledge and human resources to support sustainable agricultural systems. It is also a challenge for meat needs that are always increasing compared to the available production. Dependence on beef cattle from abroad has increased, especially in the last ten years, and has exceeded domestic beef production ability. The structure of the ruminant population of Kolaka Regency is presented in Table 1.

Table 1. Ruminant Population in Kolaka Regency

Districts	Beef cattle	Buffalo	Goat	Total
Kolaka	1,092	12	947	2,051
Latambaga	907	33	1,258	2,198
Samaturu	2,678	10	1,269	3,957
Wolo	1,650	31	1,222	2,903
Iwoimendaa	1,011	20	1,204	2,235
Wundulako	1,322	15	1,249	2,586
Baula	1,119	31	1,043	2,193
Pomalaa	1,168	37	1,668	2,873
Tanggetada	2,338	120	1,836	4,294
Polinggona	3,434	24	1,592	5,050
Watubangga	8,522	41	5,515	14,078
Toari	3,715	3	5,200	8,918
Total	28,956	377	24,003	53,336

Source: Kolaka Regency Statistics Agency, 2020.

The population of beef cattle in each sub-district in Kolaka Regency has a different population level and structure. Watubangga District is a district that has the largest population structure for beef cattle. Meanwhile, Latambaga Subdistrict has a beef cattle structure of at least 907 heads. The population of beef cattle in the Kolaka Regency was 28,956 heads. The domestic cattle population fluctuates, although it shows an upward trend. Domestic consumption has also increased every year, with an increasing rate of beef consumption reaching 4.66% (Nursholeh et al., 2020). According to (Nurlaila & Zali, 2020), One of the factors in increasing population is natural potential consisting of rainfall, agricultural land area, breeder household, and population simultaneously, which have a significant effect on increasing the cattle population.

The buffalo population in the Kolaka Regency is 377 heads, scattered in several districts with the largest population in Tanggetada District and the least population in Toari District with three heads. Buffalo cattle (*Bubalus bubalis*) have a strategic role and function in the life of Indonesian society, namely as food and livestock (Hakim & Novra, 2020). The uniqueness of the local Southeast Sulawesi buffalo is that it has a reliable fighting ability. It becomes a source of

fighting buffalo seeds that are often transported to Tanah Toraja, South Sulawesi (Rusdin et al., 2018). Meanwhile, the population of goats in the Kolaka Regency is 24,003, scattered in several districts with the largest population in Watubangga District and 5,515 heads. The lowest population is in Kolaka District, with a total population of 947 heads. Goats have good adaptability to the environment (Agustang et al., 2016). A livestock business can be successful if it can contribute to income and meet farmers' daily needs (Febrianti & Irianti, 2018; Abadi et al., 2018; Soetriono et al., 2019).

2. Determination of Base and Non-Basis Sectors

Kolaka Regency includes several areas with the potential to make livestock development areas in Southeast Sulawesi both in the agro-climate aspect and the socio-economic performance of the community. Efforts can be made to facilitate sustainable livestock development by identifying potential areas based on the resource measurements used by the livestock sector (Dewi, 2019). Determination of the basis and non-basic sectors for ruminant livestock development is presented in Table 2.

Table 2. Analysis of LQ (Location Quotient) Ruminant Livestock.

Districts	LQ (Location Quotient)		
	LQ Beef Cattle	LQ Buffalo	LQ Goat
Kolaka	0.98	0.83	1.03
Latambaga	0.76	2.12	1.27
Samburu	1.25	0.36	0.71
Wolo	1.05	1.51	0.94
Iwoimendaa	0.83	1.27	1.20
Wundulako	0.94	0.82	1.07
Baula	0.94	2.00	1.06
Somalia	0.75	1.82	1.29
Tanggetada	1.00	3.95	0.95
Polinggona	1.25	0.67	0.70
Watubangga	1.12	0.41	0.87
Toari	0.77	0.05	1.30

Source: Processed data analysis, 2020

The results of the LQ analysis of ruminants in Kolaka Regency are presented in table 2. It shows that the basic commodities for beef cattle development are in Samaturu District, Polinggona District, and Watubangga District. Meanwhile, buffalo cattle with an LQ value > 1 are found in Latambaga District, Wolo District, Iwoimendaa District, Baula District, Pomalaa District, and Tanggetada District. Meanwhile, goats with LQ > 1 are found in Latambaga District, Iwoimendaa District, Pomalaa District, and Toari District. The analysis results of the three livestock commodities with an LQ value > 1 have a comparative advantage while the results can meet the needs of their region. However, it can also be exported outside the region. Meanwhile, for Wolo and Tanggetada Districts, the value of LQ = 1 means that the commodity is classified as non-basis because it does not have a comparative advantage, and its production is only sufficient to meet the region's needs. Animal husbandry development aims to create a productive and creative society through strong livestock based on local resources (Khadijah et al., 2019). The distribution of LQ shows that the regional resources owned by Kolaka Regency still support the ruminant livestock sector. The size of the relative population in each region affects the income sector for farmers (Ariansyah et al., 2020).

The tendency to decrease resource availability is empirical evidence that occurs in these areas for various reasons. The expansion of the industrial sector is estimated to be the main cause of changes in the allocation of existing resources. Apart from infrastructural changes, there are changes in the socio-economic structure of the community in the region. Low concentrations of livestock populations combined with a high potential for resource use seem to be a simple reason for this problem. Therefore, institutional factors seem to be factors causing the unused resources available (Khoiri et al., 2018). Obstacles for breeders (livestock keepers) in gaining could access to feed sources (Suarna et al., 2019). This condition can occur because there is a specific resource control structure in the area (Mirza & Rahayu, 2017). The high level of land tenure per individual has resulted in very limited communal land use in several locations, such as Tanggetada District, Polinggona District, and Watubangga District.

3. Analysis of Animal Feed Carrying Capacity

Humans have developed agricultural systems that combine crop production with livestock for a long time. Integrated systems provide a greater variety of products to farming families than companies themselves while also offering a way to utilize crop residues or non-farm land to produce meat, milk, and related products. As well as producing manure, it could improve the fertility and quality of cultivated soil (Hidayati et al., 2020). The concept of integrated agriculture in Indonesia by combining livestock and crops was previously used by farmers even at the beginning when farmers knew about integrated farming systems (Tumewu et al., 2014).

Regarding the provision of feed to increase the livestock population, the availability of suitable land for the growth of types of forage, forage, legumes, and grass is urgent (Delima et al., 2015). If land availability is not taken into account properly, the government program will be very difficult to achieve in the context of national meat self-sufficiency (Iskandar & Nurtalawati, 2019). Analysis of the carrying capacity of beef cattle feed is presented in Table 3.

Table 3. Analysis of Beef Cattle Feed Carrying Capacity

Source Of Feed	Harvested Area	Production (BK/Kg/Yr)	Animal Consumption (BK/kg/head/year)	Carrying Capacity
Rice Straw	21,664	37,912,000	2738	13,846.60
Corn Straw	2,834	12,753,000	2738	4,657.78
Cassava Leaves	112	33,600	2738	12.27
Sweet Potato Leaves	43	51,600	2738	18.85
Peanut Straw	26	39,000	2738	14.24
Soybean Straw	2,143	3,214,500	2738	1,174.03
Carrying Capacity	26,822	54,003,700		19,724

Source: Processed data analysis, 2020.

Data table 3. It shows that for the carrying capacity of beef cattle feed in Kolaka Regency, there are 19,724 livestock units (LU) with a total population of 28,956 heads. It indicates that for beef cattle in Kolaka Regency experiencing overgrazing, it is not sufficient to meet the dry matter needs of beef cattle in a year. One of the alternatives provided is to integrate livestock with plantations or potential land conservation. Land conservation includes many aspects, including optimal land use according to allotment without maintaining sustainable productivity. Oil palm plantations in Kolaka Regency can be a source of animal feed (Pagala et al., 2020). Oil palm plantations have abundant by-products in meeting animal feed needs (Aritonang, 2019). Seeing the potential for rice straw in Kolaka Regency, it has very good potential for developing the livestock sector. The development of cows by utilizing straw as animal feed which can produce manure (*feces*) as an agricultural input, is quite large (Kadir, 2020). The analysis of the carrying capacity of buffalo is presented in Table 4.

Table 4. Analysis of Buffalo Feed Carrying Capacity

Source Of Feed	Harvested Area	Production (BK/Kg/Yr)	Animal Consumption (BK/kg/head/year)	Carrying Capacity
Rice Straw	21,664	37,912,000	2284	16,598.95
Corn Straw	2,834	12,753,000	2284	5,583.63
Cassava Leaves	112	33,600	2284	14.71
Sweet Potato Leaves	43	51,600	2284	22.59
Peanut Straw	26	39,000	2284	17.08
Soybean Straw	2,143	3,214,500	2284	1,407.40
Carrying Capacity	26,822	54,003,700		23,644

Source: Processed data analysis, 2020.

The results of the analysis of the carrying capacity of buffalo livestock integrated with food crops in the Kolaka Regency are presented in table 4. It shows that of the total population of 377 heads, it can accommodate 23,644 livestock units (LU). It shows that the potential for an integrated system between buffalo livestock and food plants can provide basic survival for buffalo livestock. Because from the side of feed, availability is still sufficient (under grazing). Developing a buffalo livestock integration system can be carried out in several sub-districts. It

included Latambaga sub-district, Wolo sub-district, Iwoimendaa sub-district, Baula district, Pomalaa sub-district, and Tanggetada sub-district the buffalo population supports this in these sub-districts. Since a long time ago, the existence of buffalo can not be separated from rural communities, especially areas that have rice fields. It is because buffalo livestock is used as labor, a source of income, and a source of animal protein (Hakim & Novra, 2020). Even on certain days or events, buffalo meat is a menu served by some people (Laksono & Ibrahim, 2020). Furthermore, the analysis of goat feed carrying capacity is presented in Table 5.

Table 5. Analysis of Goat Feed Carrying Capacity

Source Of Feed	Harvested Area	Production (BK/Kg/Yr)	Animal Consumption (BK/kg/head/year)	Carrying Capacity
Rice Straw	21,664	37,912,000	296	128,081.08
Corn Straw	2,834	12,753,000	296	43,084.46
Cassava Leaves	112	33,600	296	113.51
Sweet Potato Leaves	43	51,600	296	174.32
Peanut Straw	26	39,000	296	131.76
Soybean Straw	2,143	3,214,500	296	10,859.80
Carrying Capacity	26,822	54,003,700		182,445

Source: Processed data analysis, 2020.

The development of goat livestock and food crops is an opportunity to be used optimally to fulfill people's meat needs. The results of the analysis of the carrying capacity of goat fodder show that a total harvested area of 26,822 hectares of food crops can accommodate the need for goat feed as much as 182,445 livestock units (LU) of the total population of goats in Kolaka Regency, totaling 24,003 heads. By looking at this potential, it can be concluded that Kolaka Regency has promising potential to develop the goat husbandry sector integrated with food crops. The by-products of cassava plants are very potential as alternative animal feed because they are widely available and do not compete with human needs (Adhianto et al., 2019). Fulfilling the need to feed both in terms of quality and quantity is needed because feed is an important factor in supporting goat productivity (Rama et al., 2014). However, alternative feed that can be used comes from plantation by-products which are potential, cheap, easy to obtain, of good quality, and abundant in availability in oil palm plantations (Rustiyana et al., 2016). Therefore, the potential for ruminant livestock development based on the total feed carrying capacity is presented in Table 6.

Table 6. Total Overall Feed Carrying Capacity of Ruminants

Types of Livestock	Population	Feed Carrying Capacity	Information
Beef cattle	28,956	19,724	Overgrazing (-)
Buffalo	377	23,644	Under grazing (+)
Goat	24,003	182,445	Under grazing (+)
Total	53,336	225,813	

Source: Processed data analysis, 2020

Data table 6. It showed that the total animal feed carrying capacity with a total harvested area of 26,822 hectares could accommodate 19,724 beef cattle (LU), 23,644 buffalo, and 182,445 goats (LU). See table 6 in Kolaka Regency has the potential for the development of goat and buffalo livestock because one of the supports in increasing the population is available, namely in the form of food by-products of food plants. The by-products of food plants can provide solutions in providing animal feed, especially ruminants (Azis et al., 2014). At the same time, it has a positive impact on the sustainability of the ecosystem (Sari et al., 2016). The livestock integration system provides synergy or mutually beneficial linkages in sustainable agricultural management (Afrizal et al., 2014). It provided additional income for farmers in utilizing the by-products of food plants as a source of animal feed (Pramana et al., 2012). In addition to food plants, there are plantation by-products as a source of animal feed (Pagala et al., 2019).

D. Conclusion

Applying an integrated system of livestock and food plants provides a solution or alternative in overcoming food shortages. The results of the LQ (*Location Quotient*) analysis

were 3 (three) sub-districts as the basis for developing beef cattle, 6 (six) sub-districts of buffalo, and 4 (four) subdistricts with an LQ value > 1 with the carrying capacity of animal feed derived from by-products Agriculture. Namely beef cattle, amounting to 19,724 livestock (LU), Buffalo 23,644 livestock (LU), and Goats 182,445 livestock (LU).

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