STUDY OF CARRYING CAPASITY, MITIGATION AND RECOMMENDATION DURING DRY SEASON FOR LIVESTOCK DEVELOPMENT IN GUNUNG KIDUL REGENCY

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ABSTRACT

The GRDP contribution from the agricultural sector in Gunungkidul Regency was highest in the last eight (8) years (2010-2017), ranged from 24.48% - 26.92%. Gunungkidul Regency is a livestock barn for Yogyakarta (DIY) province. The population of beef cattle is 151,578 heads (more than 50%) of a total 304,450 heads or 231,382 animal units (DIY Provincial Agriculture Office, 2018) and goats/sheep 194,843 (37%) of a total 526,590 heads (BPS, 2018). On the other hand, Gunungkidul Regency is often hit by drought during the dry season, resulting in a shortage of food. This study aimed to determine the potential forage along with the sources of animal feed and recommendations for mitigating feed shortages in the dry season in Gunungkidul. Research with survey methods collected primary and secondary data during the dry season, July-November 2018. Primary data were obtained from samples in the Gunungkidul area which were divided into 5 zones. Sources of feed were divided into 4 categories, namely planted forage, agricultural waste and by-products, forages from plantations or integration and forages from Oya watersheds (DAS). The data obtained was analyzed based on a quantitative descriptive design according to four large groups by considering the type and specific origin of the location of the feed source. Potential sources of animal feed in Gunungkidul at the time of this study were 3,262,654.25 tons (DM/ year) consisting of planted forage 3,503.80 tons (0.11%), waste and/or agricultural by products 2,688,921.78 tons (82.42%), forage from plantations or integration 221,662 tonnes (6.79%), and forage from the Oya River watershed in Gunungkidul was 348,566.94 tonnes (10.68%). There was not over grazing in Gunungkidul Regency regarding the potential for livestock feed and the existing livestock needs, in fact it is still excess to meet livestock equivalent to 1,962 cows or 10,986 goats / sheep. However, the data on the biggest potential of feed was came from waste and/or agricultural by-products (possibly) were not collected properly as animal feed because at harvest time (November) farmers are more focused on managing the main product rather than by product. Sources of feed in the form of grass and leafes have not been able to meet the needs of livestock during the dry season, so it is estimated that at least 60 trucks of feed will need to enter the Gunungkidul Regency area every day.

Key words: feed, drought, forages, integration, plantation

INTRODUCTION

Pasture is a place or land that is planted with superior grass and / or legumes (a type of grass / legume that is resistant to trampling of livestock) which is used for grazing livestock (Yunus, 1997). Pasture is a fenced field that is overgrown with forage with high quality and is used to herd ruminants (Parakkasi, 1999), so that it can be called a pasture land. Carrying capacity is the ability of grazing land to produce forage needed by a number of cattle grazing in an area of one hectare or the ability of grazing land to accommodate livestock per hectare. Susetyo (1981) states that several good grazing fields have a capacity of 0.4 hectares for 1 ST

or a hectare unit of land can accommodate 2.5 ST / year. Things that need to be considered in determining the carrying capacity are: estimating the quantity of forage production, determining the *proper use factor*, estimating the need for land area per month and estimating the need for land area per year.

Forage is an important requirement for livestock. Forage plays a role in maintaining rumen health and function. The presence of fiber in forage (cellulose and hemicellulose) is a source of energy for rumen microbes, as well as minerals and protein (especially from legumes) which are a source of N for bacteria and protein products, so the availability of forages needs to be taken into account in raising livestock. The availability of ruminant feed, especially forage in dry land agriculture, is strongly influenced by seasons, namely the dry season and the rainy season. In the rainy season the forage is abundant while in the dry season there is a shortage of forage production, so the quality, quantity and continuity of forage is not guaranteed throughout the year which can have an impact on livestock that cannot produce optimally (Ruswendi, 2004).

Yogyakarta Special Region (DIY) Province recorded that Gunungkidul Regency was a DIY livestock barn. Gunungkidul cattle population was 138,179 heads (out of a total of 277,120 in DIY) or 50% DIY cattle and 182,448 goats / sheep (out of a total 526,590 in DIY) or 34% of the total DIY population (BPS, 2018). Agriculture is still a major revenue so that the GDP contribution of the agricultural sector is always the highest among the other on last eight (8) years between 2010 to 2017 ranged between 24.48% - 26.92%. On the other hand, Gunungkidul is an area that is often affected by drought during the dry season. The drastic reduction in water sources has made Gunungkidul face serious problems in fulfilling feed during the dry season. Therefore, the livestock development planning must be supported by the study of the *carrying capacity* (CC), so that it can estimate the potential increasing of livestock population in Gunungkidul Regency. Based on the narration above, it is necessary to carry out research aimed at determining the availability (type, quantity and quality) of feed and the availability of feed source nutrients and the capacity of ruminants in the agricultural area of Gunungkidul Regency.

MATERIALS AND METHODS

Time And Place

The research was conducted for 6 months (July - November) during the dry season in 2018. Area study only in Gunungkidul Regency because it is a DIY province livestock barn. Gunungkidul cattle population is about 50% of DIY and 34% goats/sheep of the total DIY population (BPS, 2018). Sampling was carried out by dividing the areas based on the directions (West, South, East, central, and North). Potential sources of feed were differentiated into four categories, including 1) Forage originating from pasture land (HPT) which is intended to be planted in yards or rice fields. 2) Agricultural waste or by-products of agriculture 3) Forages which is come form plantation and or integration systems (including leaves, grass field, bushes) 4) Forage fodder in all Oya River watershed (DAS). Cassava is a plant that is widely cultivated by Gunung Kidul farmers. Therefore, specifically the presence of cassava waste or by- product in the form of cassava leaves and cassava peels was also one of the sampling objects in this study. Samples were analyzed at the Laboratory of Forage and Pasture Science, Department of Animal Nutrition and Feed Science, Faculty of Animal Science, Universitas Gadjah Mada.

Materials

The tools were used in this research is peralon sizes $1x1m^2$, a camera for documentation of weeds, tape measure, ruler, rope, bags of paper, staples, markers , plastic baskets, plastic, stakes, trowel, labels, digital scales, oven 55 ^{o}C, willey mill and a set of proximate test equipment. The materials were used in the study were forage samples, 1.25% H_2SO_4, 1.25% NaOH, 95% ethyl alcohol, concentrated H_2SO_4 , Kjeltab, 50% NaOH, 0.1 N HCl, H_3BO_3 0.1 N, mix indicator , and petroleum benzene.

Method

Forage production measurement

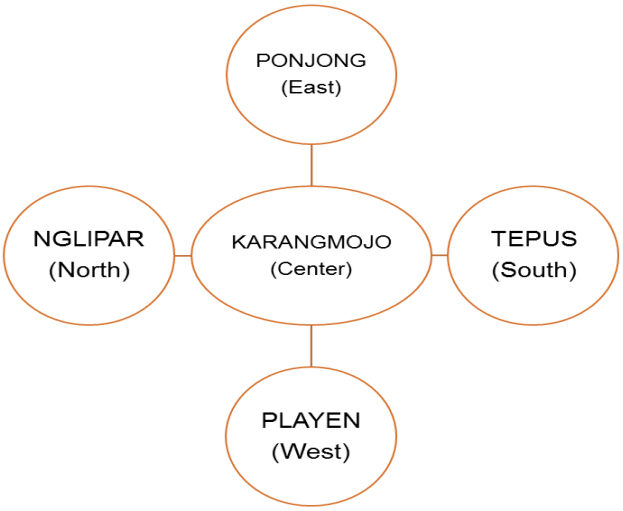
Measurement of forage production used the purpose sampling method. Sampling was done by means of a square (1x1 m). Samples were collected at a different location. There were five directional blocks of sampling based on the location, namely North, South, West, East and Central. Samples were taken from regional representatives in the five regions and then the mean was taken. Illustration of sampling locations can be seen in Figure 1.

Sample preparation and analysis

Samples was cut and weighed, then chopped and put in a newspaper bag (already in the oven at 55 °C for 1 day). The newspaper bag containing the sample was then heated at 55 °C for 3 days. The next *step* is weighed and milled using a willey mill equipped with a filter with a porosity of 1 mm.

Samples were prepared then analyzed proximate including dry matter (DM), organic matter (OM), crude protein (CP), crude fiber (CF) (AOAC, 2005) and crude fat (Kamal, 1994). The results of proximate analysis were used to calculate the nitrogen free extract (NFE) and calculated *tot*al digestible nutrients (TDN) (Hartadi *et al*., 2005).

Figure 1. Illustration of sampling locations in Gunungkidul Regency



Calculation of production and carrying capacity

Based on the results of square sampling method, the available fresh forage production (tonnes/ha) can be calculated using the formula:
Forage harvest (times/year) = number of days in 1 year: planting time (days)
Forage harvest time = 60 days, (360/60) days
= 6 times /year

Fresh forage production (tonnes /ha/yr) =
$\frac{\text{yield of sample (gram/m}^2\text{)} \times 1\text{m}^2 \times \text{harvest (times/yr)}}{100}$

The square size (m^2) = $1x1m^2$
DM production (tonnes/ha) = Fresh production x DM (%)
OM production (tonnes/ha) = DM production x OM (%)
CP production (tonnes/ha) = DM production x CP (%)
AU = animal unit
Livestock carrying capacity (AU/ha/yr) =
$\frac{\text{forage production (tonnes/ha/yr)}}{\text{need for animal feed (tonnes/AU/year)}}$

The feed requirement based on NRC (2000) for 1 AU is equivalent to a male's body weight of 900 lbs or 408.23 kg. The research was conducted using a quantitative descriptive design in accordance with four major groups by considering the type and specific location of the source of the feed .

RESULTS AND DISCUSSION

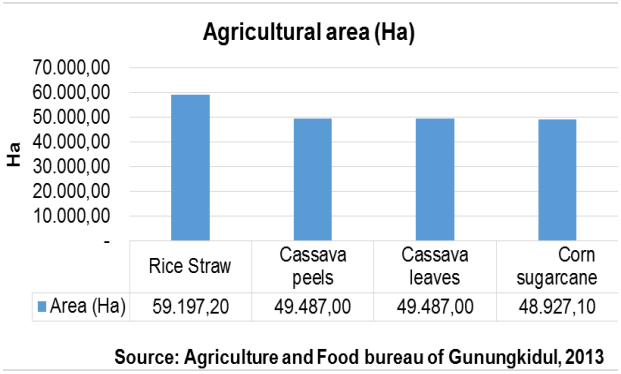
Animal feed production

Gunungkidul Regency consists of 18 sub-districts, namely Panggang, Purwosari, Paliyan, Saptosari, Tepus, Tanjungsari, Rongkop, Girisubo, Semanu, Ponjong, Karangmojo, Wonosari, Playen, Patuk, Gedangsari, Nglipar, Ngawendan Semin Districts. There are 144 villages where 122 villages of which entered the classification of self-help, 17 village self-employment and 5 villages entered self-sufficiency. The map of each sub-district can be seen in Figure 2 as follows:

Figure 2 . District in Gunungkidul Regency (gunungkidulkab.go.id, 2013)

The area some of agricultural land that has the potential to produce a source of feed stuff can be seen in Figure 3 below:

Figure 3. Figure of the agricultural land that potential for producing feed stuff



Source: Agriculture and Food bureau of Gunungkidul, 2013

Researchers took samples in a predetermined location consisting of 17 types of animal feed ingredients representing napier grass, king grass, odot grass, rice straw, cassava pulp, cassava leaves, cassava, and corn straw. The production rate and nutrition of each similar sample were taken from the average number obtained from different places. Secondary data from the Gunungkidul Agriculture Service, journals or from the Central Statistics Agency were collected.

As stated in the methodology there are 4 groupings of sources and /or types of animal feed, the potential for animal feed in Gunungkidul as a result of the field study is as follows:

a) Feed from Forage and Pasture land (HPT)

Forage for livestock that is intended to be planted by farmer, covering an area of 1,421.83 ha (Gunungkidul Agriculture Service, 2013) with the types of grass that are developed include king grass, napier grass, and odot grass.

The total potential production of HPT from various types of grass and in the areas mentioned above is 3,503.80 tons of dry matter per year.

b) Agricultural crop waste and/ or agricultural by products

Agricultural crop waste in Gunungkidul Regency, Yogyakarta, includes rice straw (rice plant waste), *tebon* (corn straw), *rendeng* (peanut straw), cassava leaves, and cassava peels. Each harvest area as stated by BPS (2018) are lowland rice (59,197.2 ha), cassava (49,487 ha), and maize (48,927 ha). Therefore, feed yields from waste and/or agricultural by-products are calculated based on this area. An example of agricultural waste in large quantities in Gunungkidul can be seen in Figure 4 below:

Figure 4. Rice straw, cassava leaves and cassava peels are the potential for several types of waste in large quantities in Gunungkidul which can be used as animal feedstuff

The total production (in dry matter) of each feed commodity that was found in the study (conversion count in one year) was rice straw (1,128,152.53 tons), cassava peels (33,918.14 tons), and cassava leaves (17,986.88 tons), and *tebon* (1,508,864.23 tons). The mentioned feed stuff was 2,688,921.78 tons DM/ year. The nutritional value of each commodity can be seen in Table 1

Table 1. Nutritional value of waste and/ or agricultural by-products

Samples	DM (%)	OM (%)	Prod DM. (ton/ha)	Prod. OM (ton/ha)
Sample from Ponjong				
Jerami padi var.bagendit	38,28	82,56	2,11	1,74
Jerami padi var. mapan	16,62	83,07	1,53	1,26
Sample from Karangmojo				
Rumput gajah	9,93	86,95	1,14	0,99
Daun ketela	30,04	90,41	0,38	0,35
Kulit umbi Sinkong	12,04	95,87	0,86	0,83
Gaplek	1,25	96,50	3,47	3,35
Tebon jagung	67,15	93,82	30,74	28,84

Results of analysis at the Forages and Pasturee Lab, Faculty of Animal Science, UGM

c) Forages from plantations or integration

Gunungkidul Regency is an area that has a large plantation area, including eucalyptus land. However, at the time of this study, the condition of the area under eucalyptus plantation was dry, so that no weeds or field grass could be harvested or sampled from that location. The image of the location of eucalyptus land at the time of location sampling can be seen in Figure 5 below.

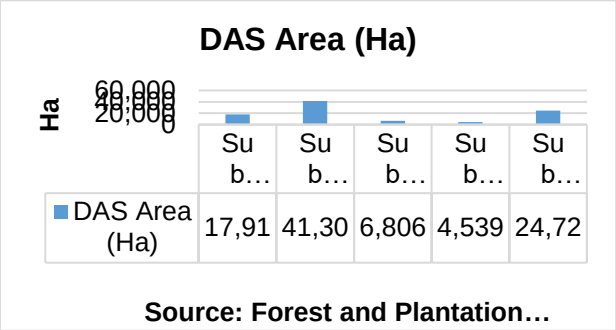
Figure 5. The space under the eucalyptus plantation of Gunungkidul Regency during the dry season

At the time of the study, it was dry season, so there were no weeds or grasses under plantation area. However, in the observation of many farmers who provide their livestock with tree leaves harvested from the area where they live. In local terms, the feed from the leaves of these trees is called *ramban* . The data obtained from the study by considering the number of ruminant livestock (large and small) and the number of farmer households and farm laborers which reached 116,787 (65% owning livestock), the total potential use of ramban feed was 221,662 tons of dry matter per year.

d) Areas along the river watershed (DAS)

The area on either side of the Oya River is a strategic place to be used by farmers to plant grass (regardless the pro and contra of using this area for pasture land). The total area of the Oya River watershed in Gunungkidul is 95,292 ha (Gunungkidul Regency, 2005). The area of the watershed can be seen in Figure 6 below:

Figure 6. Watershed area along the Oya River in Gunungkidul



In this study estimated about 10% of the total area of the watershed able to produce forages for animal so that the potential feed from Oya River watershed was 348,566.94 tons of dry matter per year. The nutritional value of each commodity can be seen in Table 2.

Table 2. Nutritional value of forages from the Oya River watershed in Gunungkidul

Sample	DM (%)	OM (%)	Prod. DM (ton/ha)	Prod. OM (ton/ha)
Napier grass	50,29	85,53	52,03	44,50
King grass	35,92	86,55	24,15	20,91

Results of analysis at the Forages and Pasture Lab, Faculty of Animal Science, UGM

Recapitulation from the four types of feed sources in Gunungkidul from this study is data potential for feed (dry material) from HPT feed sources is 3,503.80 tons (0.11%), waste and/or agricultural by product 2,688,921.78 tons (82.42%), forage from plantations or integration 221,662 tonnes (6.79%), and HPT from the Oya River watershed in Gunungkidul is 348,566.94 tonnes (10.68%). The total of all sources became 3,262,654.25 tonnes. Recapitulation of the potential for HPT from various types of feed sources can be seen in Table 3 below:

Table 3 . Recapitulation of potential feed from various types of feed sources in Gunungkidul

Potential of Feedstuff	Production (ton DM/ year)	Equivalen AU	% Total
HPT	3.503,8	79.581,5	0,11
Waste/ by product	2.688.921,8	50.607,7	82,42
Plantation/ integration	221.662,0	613.909,1	6,79
HPT DAS Oya	348.566,9	800,0	10,68
Total	3.262.654,3	744.894	100,00

Analysis from team Faculty of Animal Sci. UGM

Meet and Match

The population of cattle and goats / sheep in Gunungkidul recpectively is 138,179 head and 182,448 head (BPS, 2013). Base on the population, feed requirement in Gunungkidul can be computed. According to NRC (2000) and the tropical approach in accordance with the opinion of Parakkasi (1999) with a standard requirement of 3% dry matter for cattle; and 4-5% dry matter for goats (Kustantinah, 2016). Total feed demanded is 586,830.85 tons/year. The feed for cattle and goats/sheep in Gunungkidul (dry matter) can be seen in Table 4 below:

Table 4. The animal feed riquired (dry matter) in Gunungkidul

Ruminants	Feed demanded (ton DM/ yr)	% Total
Cattle	497.933,73	84,9
Sheep and goat	88.897,12	15,1
Total	586.830,85	100,0

Analysis from team Faculty of Animal Sci. UGM

If we compare Tabel 6 with the number of potential feed availability in Gunungkidul (Table 3) which is 3,262,654.25 tonnes, it has already met the requirement of 586,830.85 tonnes. In other words, there is no over grazing condition in Gunungkidul, even a residual or excess of the potential feed amounting to 2,675,823.4 tonnes (it equals with 610,919 animal units).

In fact, during the dry season, there always a large supply of feedstuff coming into Gunungkidul. This condition indicates that during dry season Gunungkidul facing lack of feedstuff. This is interesting point, since there was a gap between research finding and factual condition. Data study (during dry season) found that potential feed can meet the requirement (even excessive), but fact

always lack of feed. This point need to be disscussed further. Some of the possibility that make a gap between the data and fact are :

1. This study provides a potential analysis, not on factual availability. It is very possible that the data found there is potential for feed, but in fact some of the feed is not available (exist but not available). Potential of feedstuff (Table 5) will be available as animal feed through a collection process. Rice straw and cassava leaves will become animal feedstuff if at harvest time, farmers collect this agricultural by product in the form of straw and then dry it so that it is not easily broken. Thus, taken to a storage area and will available as animal feed. Likewise with waste or other agricultural by-products.

2. The biggest data as potential feed comes from waste or agricultural by-products which was 82.42% (2,688,921.78 tons). The potential data is not necessarily available in reality. This is probably due to the fact that many farmers does not have time to collect (collection) waste or agricultural by-products for feed. They more focuse on the main product (food). Unfortunnately, harvest time is relatively short and simultaneously in an area. When the farmer has finished managing the main product and wanted to return for waste collection, it was very possible that it was no longer suitable for collection (it has broken) so that it is just left scattered on the land (can not used for animal feedstuff).

   Farmers are almost certain to prioritize taking the main product (food) from their agriculture activities instead of collecting by-products or even agricultural waste for feed. Meanwhile, agricultural waste or *by-products* also have a time limit that expired or is damaged if at a certain time there is no collection and post-harvest treatment (collection, drying, processing, storage). When farmers "fail" to collect feed from waste and/or agricultural by-products, it will significantly impact on the availability of feed for livestock in Gunungkidul, since the portion is very big (82.42%).

3. The types of feed that are almost certain to be a source of feed are forage from HPT, forage from integration (including *ramban*) and forage from HPT DAS Oya River.

   Animal feed in the form of HPT, whether in the form of grass planted on agricultural land, planted in watersheds and *ramban*, will usually be available directly as animal feed without drying and storage process. However, the number of potential source of feed from HPT, forage from integration (including *ramban*) and forage from HPT DAS Oya River is only 17.58% of the total. It was about 573,732.46 tons (Table 5).

   That amount can not meet the feed requirement of 586,830.85 tons (Table 6), or a shortage of 13,098 tons (dry matter per year). The number of 13,098 tonnes (DM) equivalent to 32,746 tonnes/year fresh *tebon* (DM 40%) or 90 tons/day; equivalent to 30 trucks/days (truck capacity 3 tons) for 12 months supply activity, or 60 trucks/day (for 6 months supply activity).

   The total of 13,098 tonnes is equivalent to 21,830.64 tonnes tonnes/year rice straw (DM 60%) or 60 tons/day; equivalent to 30 trucks/days (truck capacity 2 tons) for 12 months supply activity, or 60 trucks/day (for 6 months supply activity).

This analysis needs to be confirmed with a study of feed supply and distribution in Gunungkidul Regency. Things that need to be carried out further studies are related to the supply and distribution of feed in Gunungkidul Regency. This is to verify the analysis of this current study, is it true that at least 30-60 trucks loaded with animal feed enter Gunungkidul Regency every day.

CONCLUSIONS AND RECOMMENDATIONS

Conclusion

The potential sources of animal feedstuff in Gunungkidul at the time of this study (during the dry season) was exceed the demand of feed.

There is no *over grazing* in Gunungkidul Regency regarding the potential for livestock feed and the existing livestock needs, even the potential for feed is still excess to meet livestock equivalent to 1,962 cows or 10,986 goats / sheep.

The biggest number of data potential feedstuff for the livestock was come from agricultural waste or by-product. There is a suspicion that it is not well collected overall potential as animal feed caused by harvest time and at the same time the waste collection and brief so that farmers are more fo c us on the main product only.

Sources of available forage in the form of grass and *ramban* have not been able to meet the needs of livestock during the dry season, so it is estimated that at least 30-60 trucks of animal feed will enter the Gunungkidul Regency area every day.

Recommendation

1. There is a need for a regular study of the potential and capacity of livestock, covering both the rainy and dry seasons.
2. There needs a study of the supply and distribution of feed in Gunungkidul as a whole, both internal potential and come from external.
3. There needs to be Feed Stock movement programe, to optimized the collection of feed from agriculture waste and or by product. This movement should be followed by education and awareness by agricultural extension workers.
4. It is necessary to educate on the processing of animal feed from waste and or agricultural by product, so that it will still remains in good quality and will be longer storage. Thus, it can meet feed requirement during the dry season.

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