



Study of Potential Development of Goat and Sheep in North Labuhanbatu Regency

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Abstract. North Labuhanbatu regency is one of the districts in North Sumatra Province that has the potential in the development of livestock and agriculture sectors. This research aims to find out the potential of agriculture and plantation waste as well as areas that can be used as a development area for goat and sheep livestock in North Labuhanbatu regency. The type of research used is descriptive research to describe the potential of agriculture and plantation waste in determining the development area of goat and sheep livestock using LQ methods combined with livestock density, waste support index, and capacity to increase ruminants livestock population. This reserach was conducted in North Labuhanbatu regency in February – April 2020. The results showed that North Labuhanbatu regency has development potential in supporting North Sumatra Province a producer of goat and sheep livestock. Regional strategy I (distribution area) namely Aek Natas Sub-District, Kualuh Hilir, Kualuh Leidong. Regional strategy group II (strengthening region) namely Na IX-X, Aek Kuo, Kualuh Selatan and Kualuh Hulu sub-districts. Group III strategy (supporting region) namely Marbau sub-district. Alternative strategies for utilizing agriculture and plantation waste in the development of goat and sheep livestock one of them is the integration system in order to use crop waste as a source of animal feed in North Labuhanbatu regency.

Keywords: goat, labuhan batu regency, potential development, sheep

Received [16 September 2020] | Revised [20 November 2020] | Accepted [30 November 2020]

1. Introduction

North Labuhanbatu regency is one of the district in North Sumatra Province that has the potential to develop goat and sheep supported by agriculture waste and plantations as a source of feed. The development of the farm area in accordance with the master plan of the farm that has been made in North Sumatra then divides the area according to the potential in district/city. The potential areas of livestock development in North Sumatra Province are on “Table 1”.

Table 1. Potential area for livestock development in North Labuhanbatu Regency

| Commodity | District / City |
|----------------------|---|
| Beef | Langkat, Labuhanbatu Utara, Asahan, Simalungun, Batubara, Deli Serdang, Serdang Bedagai |
| Dairy Cow | Karo |
| Buffalo | Samosir, Toba Samosir, Padang Lawas, Dairi |
| Goat | Langkat, Serdang Bedagai, Labuhanbatu Utara, Asahan |
| Sheep | Langkat, Serdang Bedagai, Labuhanbatu Utara |
| Chicken Buras | Mandailing Natal, Dairi, Serdang Bedagai, Pakpak Barat |
| Broiler | Serdang Bedagai, Asahan, Langkat, Deli Serdang, Binjai |
| Chicken Breed Laying | Binjai, Asahan, Deli Serdang, Langkat, Serdang Bedagai |
| Duck | Toba, Mandailing Natal, Dairi, Nias, Serdang Bedagai |

Source : [1]

The area of North Labuhanbatu regency in 2020 is 3,545.80 km² / 354,580 ha and about 65.82% (233,402 ha) of the area is food crop land [1]. So, there are food crops in the form of rice straw, corn straw, sweet potato straw, peanut straw, soy straw, green bean straw and cassava shoots that can be used as fodder for goat and sheep.

Seeing the potential and supporting capacity of agriculture waste and plantations as a source of feed, North Labuhanbatu regency can meet the needs in providing feed for a number of goat and sheep populations. This research was conducted to identify the potential of agriculture waste and plantations as a source of sheep feed in each sub-district as well as the ability of each region in North Labuhanbatu regency for the development of goat and sheep.

2. Materials and Methods

2.1. Study Area

This research was conducted in North Labuhanbatu regency, North Sumatera Province. The type of research used is descriptive research used to describe the condition and potential resources of goat and sheep farming in the area of North Labuhanbatu regency.

2.2. Methods of data collection

The data collected is primary and secondary data. Primary data is obtained by conducting surveys as well as observation and field interviews, while secondary data is obtained from the results of previous studies related to the conversion of goat and sheep populations and the production of agriculture and plantation waste. Data included goat and sheep population in the area of North Labuhanbatu regency. In addition, forage feed such as rice straw, corn straw, sweet potato straw, cassava shoots, peanut straw, soybean straw, and green bean straw, plantation waste such as palm oil and cacao pod.

2.3. Analysis of the location quation (LQ)

This method is used analysis the state of the region, wheather an area is a base or no-base sector especially in terms of the goat and sheep population. Thus it can be known that whether the area is balanced or not in the production activities of the farm [2].

$$LQ = \frac{(v_i/v_t)}{(V_i/V_t)}$$

Description :

v_i = goat and sheep population in sub-district

v_t = number of heads of families in the sub-district

V_i = goat and sheep population in the district

V_t = number of heads of families in the district

Criteria :

- $LQ > 1$ means that livestock 'i' in a region already has a comperative advantage (its population exceeds the needs in its area so that it can be sold or exported outside the territory)
- $LQ = 1$ means that livestock 'i' region does not have a comperative advantage (population is only enough for its own consumption)
- $LQ < 1$ means that livestock 'i' in a region canot meet its own needs so it ees supplies from outside the region.

2.4. Analysis of the density livestock

The analysis used to calculate the density of livestock is distinguished into three kinds, namely economic density, farm density and regional density [3].

$$\text{Economic density} = \frac{\text{total of goat and sheep population}}{\text{total population}} \times 1,000$$

$$\text{Agriculture density} = \frac{\text{total of goat and sheep population}}{\text{area of farmland (ha)}}$$

$$\text{Regional density} = \frac{\text{total of goat and sheep population}}{\text{an area (km}^2\text{)}}$$

Criteria :

- Economic density = very dense (>300), dense (100-300), rarely (50-100), low <50
- Agriculture density = very dense (>2), dense (1-2), rarely (0.25-1), low (<0.25)
- Solid region = very dense (>50), dense (20-50), rarely (10-20), low (<10)

2.5. Analysis of Production Potential and Carrying Capacity of Agriculture By Product

To calculated the potential production of agriculture and plantation waste can be obtained from the potential of agriculture waste and plantation sources of animal feed kg/ha. While the carrying capacity of agriculture and plantation waste is the ability of a region to produce feed mainly in the form of forage feed that can accommodate for a number of ruminansia livestock populations (goat and sheep) in the form of fresh or dry material (DM) without going through processing. Index of capacity carrying feed is the ratio between the amount of feed waste available and the number of ruminants livestock populations in a region. Index of capacity carrying feed is calculated from the total feed of each available agriculture and plantation waste

against the amount of feed needs for a number of goat and seep livestock populations in the region. Assumsing one animal unit (1 AU) can consume fresh straw much as 2,555 kg/year [4], then by using the following formula :

$$\text{ICC of Agriculture Waste} = \frac{\text{total agriculture waste production}}{\text{population} \times \text{average fresh consumption 1 AU/year}}$$

The assumption used is that one unit of ruminant 1 unit of livestock for ruminants cattle requires a dry material (DM) of 6.25 kg/day. Then the carrying capacity value of feed waste can be calculated by formula, [5] :

$$\text{CC of Agriculture Waste based on DM} = \frac{\text{DM production (ton/year)}}{\text{need DM 1 AU (ton/year)}}$$

$$\text{CC of Agriculture Wastebased on CP} = \frac{\text{CP production (ton/year)}}{\text{need CP 1 AU (ton/year)}}$$

$$\text{CC of Agriculture Waste based on TDN} = \frac{\text{TDN production (ton/year)}}{\text{need TDN 1 AU (ton/year)}}$$

2.6. Analysis Increase Capacity of Ruminant Population (KPPTR)

Analysis to count the capacity of increasing livestock populations which is an approach to demonstrate the ability of the region's capacity in the provision of livestock feed, by the methods of [6]. In this method the forage used is forage derived from permanent pastures, heavy rice fields, dry land/moors, plantations and forest.

- KPPTR (L) = KTTR – real population (livestock that actually existed at the time)
- KTTR = ((Σ K,Le 15 (ton DM/ha)/year)+ Σ j Li)/2.3 AU
- KPPTR (HH) = number of families x 3 AU/HH
- KPPTR (E) = KPPTR (HH) < KPPTR (L)
- KPPTR (E) = KPPTR (L) < KPPTR (HH)

Description:

- K = coefficient of grass-producing land availability
- Le = grass-producing land (ha)
- J = forage product coefficient
- Li = agriculture wasteland
- 2.3 = every AU/year requires 2.3 tons of DM
- KPPTR (L) = based on forage availability
- 3 AU/HH = each HH is able to maintain 3 AU
- KPPTR (HH) = based on labor
- 15 tons DM/ha/year = average pasture production in Indonesia

3. Result and Discussion

3.1. The base area of development goat and sheep

North Labuhanbatu regency has several sub-district that value LQ > 1 for goat namely Marbau sub-district, Aek Natas, Kualuh Hilir and Kualuh Leidong. As for sheep, the base area of LQ > 1 is Marbau sub-district, Aek Natas and Kualuh Hulu.

Table 2. LQ Value of Goat and Sheep in North Labuhanbatu Regency

| No | Sub-District | Value LQ Goat | Status | Value LQ Sheep | Status |
|----|----------------|---------------|--------|----------------|--------|
| 1 | Na IX – X | 0.66 | NB | 0.67 | NB |
| 2 | Marbau | 1.19 | B | 1.71 | B |
| 3 | Aek Kuo | 0.81 | NB | 0.55 | NB |
| 4 | Aek Natas | 1.11 | B | 1.60 | B |
| 5 | Kualuh Selatan | 0.85 | NB | 0.72 | NB |
| 6 | Kualuh Hilir | 1.70 | B | 0.25 | NB |
| 7 | Kualuh Hulu | 0.68 | NB | 1.63 | B |
| 8 | Kualuh Leidong | 1.62 | B | 0.29 | NB |

- B = Base; NB = Non-base
- Source : results of primary data processing (2020)

3.2. Density area of livestock

Economic density for goat and sheep populations for medium and rare criteria namely Na IX-X, Marbau, Aek Kuo, Aek Natas, Kualuh Selatan, Kualuh Hulu and Kualuh Leidong sub-district. As for the density of goat and sheep farming, the medium and rarely criteria are Na IX-X, Aek Kuo, Aek Natas, Kualuh Selatan, Kualuh Hilir, Kualuh Hulu and Kualuh Leidong. And for regional density all sub-district are on the criteria rarely. This indicates that the sub-district to the livestock area is on moderate criteria and rarely able to support the development of goat and sheep in North Labuhanbatu regency where it is very potential as a producer of animal feed material one of them waste food crops.

Table 3. Population Density of Goat in North Labuhanbatu Regency

| No | Sub-district | Economic Density | Status | Area Density | Status | Farm | Status |
|----|----------------|------------------|--------|--------------|--------|------|------------|
| 1 | Na IX – X | 33.13 | Rarely | 3.54 | Rarely | 0.36 | Medium |
| 2 | Marbau | 74.40 | Medium | 8.24 | Rarely | 3.38 | Very Solid |
| 3 | Aek Kuo | 47.13 | Rarely | 5.92 | Rarely | 2.05 | Very Solid |
| 4 | Aek Natas | 58.61 | Medium | 3.38 | Rarely | 0.14 | Rarely |
| 5 | Kualuh Selatan | 48.07 | Rarely | 8.38 | Rarely | 0.12 | Rarely |
| 6 | Kualuh Hilir | 103.40 | Solid | 8.79 | Rarely | 0.01 | Rarely |
| 7 | Kualuh Hulu | 37.94 | Rarely | 4.28 | Rarely | 0.58 | Medium |
| 8 | Kualuh Leidong | 97.38 | Medium | 8.52 | Rarely | 0.03 | Rarely |

- Economic density : very dense >300, solid 100-300, medium 50-100, and rarely <50
- Regional density : very dense >50, solid 20-50, medium 10-20, and rarely <10
- Farm : very dense >2, solid 1-2, medium 0.25-1, and rarely <0.25
- Source : results of primary data processing (2020)

Table 4. Population Density of Sheep in North Labuhanbatu Regency

| No | Sub-district | Economic Density | Status | Area Density | Status | Farm | Status |
|----|----------------|------------------|--------|--------------|--------|------|------------|
| 1 | Na IX – X | 21.02 | Rarely | 2.24 | Rarely | 0.23 | Rarely |
| 2 | Marbau | 66.44 | Medium | 7.35 | Rarely | 3.02 | Very Solid |
| 3 | Aek Kuo | 19.93 | Rarely | 2.50 | Rarely | 0.87 | Medium |
| 4 | Aek Natas | 52.89 | Medium | 3.05 | Rarely | 0.13 | Rarely |
| 5 | Kualuh Selatan | 25.51 | Rarely | 4.44 | Rarely | 0.06 | Rarely |
| 6 | Kualuh Hilir | 9.48 | Rarely | 0.80 | Rarely | 0.01 | Rarely |
| 7 | Kualuh Hulu | 56.85 | Medium | 6.41 | Rarely | 0.87 | Medium |
| 8 | Kualuh Leidong | 10.85 | Rarely | 0.95 | Rarely | 0.03 | Rarely |

- Economic density : very dense >300, solid 100-300, medium 50-100, and rarely <50
- Regional density : very dense >50, solid 20-50, medium 10-20, and rarely <10
- Farm : very dense >2, solid 1-2, medium 0.25-1, and rarely <0.25
- Source : results of primary data processing (2020)

3.3. Carrying Capacity of Agriculture and Plantation Waste

North Labuhanbatu regency has a carrying capacity of agriculture waste and plantations is about and can accomadate and provide feed for the needs of sheep based on the calculation of dry materials (DM) which is 24,453 AU. The sub-district that has the highest supporting value is Kualuh Hilir sub-district of 14,192 AU.

Table 5. Supporting Capacity of Agriculture Waste and Plantations in North Labuhanbatu Regency

| No | Sub-district | Supporting AU | | |
|-------|----------------|---------------|-----------|-----------|
| | | DM | CP | TDN |
| 1 | Na IX-X | 480.06 | 300.14 | 265.82 |
| 2 | Marbau | 110.07 | 116.56 | 81.16 |
| 3 | Aek Kuo | 88.58 | 89.88 | 64.43 |
| 4 | Aek Natas | 1,179.54 | 673.03 | 625.54 |
| 5 | Kualuh Selatan | 1,565.66 | 882.34 | 834.95 |
| 6 | Kualuh Hilir | 14,192.30 | 7,501.31 | 7,193.85 |
| 7 | Kualuh Hulu | 527.68 | 331.40 | 292.70 |
| 8 | Kualuh Leidong | 6,309.31 | 3,360.38 | 3,297.68 |
| Total | | 24,453.19 | 13,255.04 | 12,756.15 |

Source : results of primary data processing (2020)

3.4. Increase Capacity of Ruminant Population (KPPTR)

The total value of effective KPPTR (E) of North Labuhanbatu regency for goat cattle has the potential to increase the population by 51,494 AU and for sheep cattle by 52,270 AU. The distribution of KPPTR values in each sub-district varies and positif KPPTR values are located in Na IX-X, Aek Kuo, Aek Natas, Kualuh Selatan, Kualuh Hilir, Kualuh Hulu and Kualuh Leidong. This means that the sub-district still allows for the addition of goat and sheep livestock populations according to the availability of existing feed sources. As for the negative mortgage value is located in Marbau sub-district. This is because the population of goat and sheep is more than the availability of small amounts of agriculture and plantation waste. This means Marbau sub-district can no longer increase the population of goat and sheep.

Table 6. Capacity to Increase Goat Population in North Labuhanbatu Regency

| No | Sub-district | Index CC | Real Population (AU) | KPPTR (AU) |
|-------|----------------|-----------|----------------------|------------|
| 1 | Na IX-X | 1,051.32 | 196.00 | 855.32 |
| 2 | Marbau | 241.04 | 293.00 | -51.96 |
| 3 | Aek Kuo | 193.97 | 149.00 | 44.97 |
| 4 | Aek Natas | 2,583.16 | 229.00 | 2,354.16 |
| 5 | Kualuh Selatan | 3,428.71 | 289.00 | 3,139.71 |
| 6 | Kualuh Hilir | 31,081.12 | 339.00 | 30,742.12 |
| 7 | Kualuh Hulu | 1,155.62 | 273.00 | 882.62 |
| 8 | Kualuh Leidong | 13,817.37 | 290.00 | 13,527.37 |
| Total | | | 2,058.00 | 51,494.42 |

Source : results of primary data processing (2020)

Tabel 7. Capacity to Increase Sheep Population in North Labuhanbatu Regency

| No | Sub-district | Index CC | Real Population (AU) | KPPTR (AU) |
|-------|----------------|-----------|----------------------|------------|
| 1 | Na IX-X | 1,051.32 | 125.00 | 926.32 |
| 2 | Marbau | 241.04 | 262.00 | -20.96 |
| 3 | Aek Kuo | 193.97 | 63.00 | 130.97 |
| 4 | Aek Natas | 2,583.16 | 207.00 | 2,376.16 |
| 5 | Kualuh Selatan | 3,428.71 | 153.00 | 3,275.71 |
| 6 | Kualuh Hilir | 31,081.12 | 31.00 | 31,050.12 |
| 7 | Kualuh Hulu | 1,155.62 | 408.00 | 747.62 |
| 8 | Kualuh Leidong | 13,817.37 | 33.00 | 13,784.37 |
| Total | | | 1,282.00 | 52,270.42 |

Source : results of primay data processing (2020)

3.5. Development Area of Goat and Sheep Livestock

North Labuhanbatu regency has livestock growth areas and development status, namely goat and sheep development area group including group I distribution area namely Aek Natas sub-district, Kualuh Hilir and Kualuh Leidong. The group of regions II of strength is Na IX-X, Aek Kuo, Kualuh Selatan, and Kualuh Hulu sub district. While for the group of supporting region III namely Marbau sub-district.

Tabel 8. Area Goat Development in North Labuhanbatu Regency

| Area | Criteria | Sub-district |
|------|---|----------------|
| I | LQ > 1, low livestock area density and KPPTR (E) positive | Aek Natas |
| | | Kualuh Hilir |
| | | Kualuh Leidong |
| II | LQ < 1, low livestock area density and KPPTR (E) positive | Na IX – X |
| | | Aek Kuo |
| | | Kualuh Selatan |
| III | LQ > 1, low livestock area density and KPPTR (E) negative | Kualuh Hulu |
| | | Marbau |

Source : results of primay data processing (2020)

Tabel 9. Area sheep development in North Labuhanbatu Regency

| Area | Criteria | Sub-district |
|------|--|----------------|
| I | LQ > 1, low livestock area density and KPPTTR (E) positive | Aek Natas |
| | | Kualuh Hulu |
| II | LQ < 1, low livestock area density and KPPTTR (E) positive | Na IX – X |
| | | Aek Kuo |
| | | Kualuh Selatan |
| | | Kualuh Hilir |
| III | LQ > 1, low livestock area density and KPPTTR (E) negative | Kualuh Leidong |
| | | Marbau |

Source : results of primary data processing (2020)

For the increase in livestock efforts made for the first time in the development of goat and sheep in North Labuhanbatu regency is an increase in the livestock population, so that the districts that have a positive value of food waste KPPTTR because it has the potential to increase the livestock population and still have forage supplies in the form of food waste crops. This is in accordance with the opinion of the [7] which suggest that the capacity value of a positive increase in ruminants livestock population means the availability of food waste as a source of animal feed is sufficient and can be done in addition to a number of livestock populations.

Sub-district in North Labuhanbatu regency as many 8 sub-district, there are 7 sub-district that have the capacity value of increasing the population of goat and sheep waste food crops that are positive and potentially as development areas. While 1 other sub-district has the value of KPPTTR negative. Negative mortgage values mean that ther is a growing population of goat and sheep reviewed from the availability of agriculture waste and plantations as a souch of feed, so it must use other sources of feed other than food crop waste to adequately need such as grass planting. This is in accordance with the opinion of [8] that areas in negative mortgage conditions can use other sources of feed other than food crop waste to meet the needs of livestock in the region.

The area with the status of development of goats and sheep in North Labuhanbatu Regency based on the potential of the region is a group of distribution areawhere $LQ \geq 1$, low density of livestock area and positive KPPTTR namely Aek Natas Sub-District, Kualuh Hilir and Kualuh Leidong. This area gives meaning that the area has been an area of production of goats and sheep livestock that has a relatively higher cattle population than other sub-districts. This is in accordance with [9] that $LQ \geq 1$ means that a region has a comparative advantage where the population exceeds the needs in its area so that it can be sold or exported outside the region. In addition, the region still has the ability to increase the population of goat and sheep livestock judging by the broad support of the large area to conduct the development of goat and sheep farms as well as the positive KPPTTR value indicating the amount of feed from agriculture waste and plantations is still sufficiently available.

The group of strength areas namely $LQ \leq 1$, kpptr positive and low livestock density are Na IX-X, Aek Kuo, Kualuh Selatan and Kualuh Hulu sub-districts. This means that this area is not a base area with a low population of goat and sheep, so it is necessary to increase livestock because the area and support capacity of agriculture waste and plantations are still able to be done to increase the population of goat and sheep.

Supporting regional group namely $LQ \geq 1$ value, positive KPPTTR and low regional livestock density namely Marbau Sub-district. This means that this area is not a base area and the density of the livestock area is also low, so there is no potential for the addition of goat and sheep because of the supporting capacity of agriculture waste and fewer plantation. This is in accordance with [10] that the plan for the development of livestock population is inseparable from the supporting capacity of the region which includes two things namely the availability of livestock space and the availability of animal feed for its survival.

Table 10. Mapping of Goat Development area in North Labuhanbatu Regency based on LQ Value, Livestock Density and KPPTTR (AU)

| Sub-district | KPPTTR (AU) | LQ | Density Area | Status |
|----------------|-------------|------|--------------|-------------------|
| Na IX – X | 855.32 | 0.66 | Rarely | Strength Area |
| Marbau | -51.96 | 1.19 | Rarely | Support Area |
| Aek Kuo | 44.97 | 0.81 | Rarely | Strength Area |
| Aek Natas | 2,354.16 | 1.11 | Rarely | Distribution Area |
| Kualuh Selatan | 3,139.71 | 0.85 | Rarely | Strength Area |
| Kualuh Hilir | 30,742.12 | 1.70 | Rarely | Distribution Area |
| Kualuh Hulu | 882.62 | 0.68 | Rarely | Strength Area |
| Kualuh Leidong | 13,527.37 | 1.62 | Rarely | Distribution Area |

Source : results of primary data processing (2020)

Table 11. Mapping of Sheep Development Area in North Labuhanbatu Regency Based on LQ Value, Livestock Density and KPPTTR (AU)

| Sub-district | KPPTTR (AU) | LQ | Density Area | Status |
|----------------|-------------|------|--------------|-------------------|
| Na IX – X | 926.32 | 0.67 | Rarely | Strength Area |
| Marbau | -20.96 | 1.71 | Rarely | Support Area |
| Aek Kuo | 130.97 | 0.55 | Rarely | Strength Area |
| Aek Natas | 2,376.16 | 1.60 | Rarely | Distribution Area |
| Kualuh Selatan | 3,275.71 | 0.72 | Rarely | Strength Area |
| Kualuh Hilir | 31,050.12 | 0.25 | Rarely | Strength Area |
| Kualuh Hulu | 747.62 | 1.63 | Rarely | Distribution Area |
| Kualuh Leidong | 13,784.37 | 0.29 | Rarely | Strength Area |

Source : results of primary data processing (2020)

4. Conclusion

Based on the supporting capacity of agriculture waste and plantations in North Labuhanbatu Regency, it produces an area that has the potential to be carried out the development of goat and sheep divided into groups of distribution areas namely Aek Natas Sub-District, Kualuh Hilir and Kualuh Leidong. The group of strength areas is Na IX-X, Aek Kuo, South Kualuh and Kualuh Hulu sub-districts. Supporting group namely Marbau Sub-district. It is expected that the establishment of a goat and sheep development business area in North Labuhanbatu Regency

should be carried out in areas that have the potential in terms of territory, livestock and feed support capacity in the form of agriculture waste and plantations.

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