The study of the potential development of goat and sheep in North Labuhanbatu Regency to support North Sumatera Province as a producer of goat and sheep

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Abstract. North Labuhanbatu Regency is one of the districts in North Sumatera that has potential in the development of livestock. 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 research 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 namely Aek Natas Sub-District, Kualuh Hilir, Kualuh Leidong. Regional strategy group namely Na I, X-X, Aek Kuo, Kualuh Selatan, Kualuh Hulu sub-districts. Group III strategy 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.

1. Introduction

North Labuhanbatu Regency is one of the district in North Sumatera 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 shown in Table 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.
Table 1. Strategic plan of North Sumatera.

| Commodity        | District / City                                      |
|------------------|-----------------------------------------------------|
| Beef             | Langkat, North of Labuhanbatu, Asahan, Simalungun, Batubara, Deli Serdang, Serdang Bedagai |
| Dairy Cow        | Karo                                                |
| Buffalo          | Samosir, Toba Samosir, Padang Lawas, Dairi          |
| Goat             | Langkat, Serdang Bedagai, North of Labuhanbatu, Asahan |
| Sheep            | Langkat, Serdang Bedagai, North of Labuhanbatu      |
| 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: Strategic plan of Sumut Province 2019 – 2023

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. Population and sample
The population in this research is the area of North Labuhanbatu Regency. The survey was conducted to find out the potential of goat and sheep and forage feed in the farm of feed animal and feed waste (rice straw, corn straw, sweet potato straw, cassava shoots, peanut straw, soybean straw, and green bean straw), plantation waste (palm oil and coconut) analysis based on the study results and secondary data. Then the sample related to the region is North Labuhanbatu Regency.

2.3. 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 form the results of previous studies related to the conversion of goat and sheep populations and the production of agriculture and plantation waste.

2.4. Analysis of the location quotient (LQ)
This method is used analysis the state of the region, whether 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].

\[
LQ = \frac{\frac{vi}{vt}}{\frac{Vi}{Vt}}
\]

Description:
vi = goat and sheep population in sub-district; vt = number of heads of families in the sub-district; Vi = goat and sheep population in the district; Vt = number of heads of families in the district

Criteria:
- LQ > 1 means that livestock ‘i’ in a region already has a comparative 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 comparative advantage (population is only enough for its own consumption)
LQ < 1 means that livestock ‘i’ in a region cannot meet its own needs so it needs supplies from outside the region.

2.5. **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].

\[
\text{Economic density} = \frac{\text{total of goat and sheep population}}{\text{total population}} \times 1,000
\]  
\[
\text{Agriculture density} = \frac{\text{total of goat and sheep population}}{\text{area of farmland (ha)}}
\]  
\[
\text{Regional density} = \frac{\text{total of goat and sheep population}}{\text{an area (km}^2)}
\]

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)

2.6. **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 sheep livestock populations in the region. Assuming one animal unit (1 AU) can consume fresh straw much as 2,555 kg/year [4]. 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.

2.7. **Analysis increase capacity of ruminant population (KPPTTR)**

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 [5]. In this method the forage used is forage derived from permanent pastures, heavy rice fields, dry land/moors, plantations and forest.

3. **Results 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.

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 2. LQ value of goat and sheep livestock 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     |

Note: B = Base; NB = Non-base
Source: results of primary data processing

Table 3. Population density of goat cattle 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 |

Note: 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

Table 4. Population density of Sheep cattle 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 |

Rata-rata
Note: 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
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 accommodate 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

3.4. Increase capacity of ruminant population (KPPTR)

Table 6. Capacity to increase goat livestock 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

Table 7. Capacity to increase sheep livestock 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 primary data processing
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 positive 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.

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.

### Table 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, Kualuh Hulu |
| III  | LQ > 1, low livestock area density and KPPTR (E) negative | Marbau |

Source: results of primary data processing

### Table 9. Area sheep development in North Labuhanbatu Regency.

| Area | Criteria | Sub-district |
|------|----------|--------------|
| I    | LQ > 1, low livestock area density and KPPTR (E) positive | Aek Natas, Kualuh Hulu |
| II   | LQ < 1, low livestock area density and KPPTR (E) positive | Na IX – X, Aek Kuo, Kualuh Selatan, Kualuh Hilir, Kualuh Leidong |
| III  | LQ > 1, low livestock area density and KPPTR (E) negative | 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 KPPTR 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 [6] 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 KPPTR negative. Negative
mortgage values mean that there is a growing population of goat and sheep reviewed from the availability of agriculture waste and plantations as a source of feed, so it must use other sources of feed other than food crop waste to adequately meet the needs of livestock 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 area where LQ ≥ 1, low density of livestock area and positive KPPT 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 [8] that LQ ≥ 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 KPPT value indicating the amount of feed from agriculture waste and plantations is still sufficiently available.

The group of strength areas namely LQ ≤ 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.

### Table 10. Mapping of goat livestock development area in North Labuhanbatu Regency based on LQ value, livestock density and KPPT (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

### Table 11. Mapping of sheep livestock development area in North Labuhanbatu Regency based on LQ value, livestock density and KPPT (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

Supporting regional group namely LQ ≥ 1 value, positive KPPT 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 [9] 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. It’s also in the end, it will affect the quality of the meat produced [10,11].

4. Conclusions

Based on the supporting capacity of agriculture waste and plantations in North Labuhanbatu Regency 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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