POTENTIAL AREA PRODUCING FEED SUPPORTING THE DEVELOPMENT OF CATTLE POPULATION IN TANAH LAUT REGENCY

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GRADUATE SCHOOL
BOGOR AGRICULTURAL UNIVERSITY
BOGOR
2011
STATEMENT

I, Lasti Pitriani, hereby state that this thesis entitled:

POTENTIAL AREA PRODUCING FEED SUPPORTING THE DEVELOPMENT
OF CATTLE POPULATION IN TANAH LAUT REGENCY

Are results of my own working during the period of December 2010 until Mei 2011, and that it has not been published before. The content of the thesis has been examined by the supervisory committee and the external examiner.

Bogor, August 2011

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ABSTRACT

LASTI PITRIANI. Potential Area Producing Feed Supporting the Development of Cattle Population in Tanah Laut Regency. Under supervision of TOTO TOHARMAT AND HARRY IMANTHO

Forage has very important role as a ruminant feed that can not be replaced by the concentrate. Almost 90% of ruminant ratio comes from forage. There is a continuing conversion of forage producing areas into other uses resulting in the reduction of forage availability 30%. Remote Sensing (RS) technology and Geographical Information System (GIS) can be used in agricultural mapping to manage natural resources in certain. This study aimed to identify the potential of areas producing feed and determine its availability in supporting the development of cattle population in Tanah Laut Regency. The showed 72,902 ha of the area including pasture (6,324 ha) maize field (25,622 ha), paddy field (40,956 ha) has potential to produce forage of 234,404 tons dry matter per year. One sub district in the regency was classified as moderate CCI area. The RS technology and GIS can be used to calculate feed availability development of cattle population. Tanah Laut regency has a potential capacity to accommodate more cattle population.

Keywords: cattle, carrying capacity, forage, Tanah laut Regency
ABSTRAK

LASTI PITRIANI. Lahan yang Berpotensi Memproduksi Pakan untuk Mendukung Pengembangan Sapi Potong di Kabupaten Tanah Laut. Di bawah bimbingan dari TOTO TOHARMAT DAN HARRY IMANTHO

Rumput mempunyai kedudukan yang sangat penting sebagai pakan ternak yang tidak dapat digantikan seluruhnya oleh pakan konsentrat. Hampir 90% komponen ransum ternak ruminansia berasal dari hijauan. Terdapat kecenderungan alih fungsi lahan sumber hijauan menjadi lahan lain sehingga menyebabkan ketersediaan hijauan berkurang sampai 30%. Teknologi remote sensing (RS) dan geographical information system (GIS) dapat digunakan untuk pemetaan kawasan dan lahan pertanian. Penelitian ini bertujuan untuk mengidentifikasi lahan yang berpotensi sebagai pakan ternak dan menentukan tingkat ketersediannya di kabupaten Tanah Laut. Hasil study menunjukan bahwa luas area yang berpotensi sebagai pakan ternak adalah 72,902 ha yang meliputi pasture 6,324 ha, lahan jagung 25,622 ha, dan lahan padi 40,956 ha. Dari total area tersebut potensi produksi pakan hijauan di kabupaten Tanah Laut sekitar 234,404 ton bahan kering per tahun. Indeks daya dukung dari 11 kecamatan di kabupaten Tanah Laut menunjukan satu kecamatan dengan criteria daya dukung tinggi, dan sepuluh kecamatan dengan daya dukung sedang. Teknologi RS dan GIS dapat digunakan untuk menghitung ketersediaan pakan untuk pengembangan populasi ternak di kabupaten Tanah Laut.

Kata kunci : sapi potong, daya tampung, hijauan, kabupaten Tanah Laut
SUMMARY

LASTI PITRIANI. Potential Area Producing Feed Supporting The Development of Cattle Population in Tanah Laut Regency. Under supervision of TOTO TOHARMAT AND HARRY IMANTHO

Tanah Laut regency is known as cattle-producer areas in South Kalimantan province. Almost 40% of meat in South Kalimantan is supplied from Tanah Laut regency. The predicate of beef cattle produces regency will be achieved if the cattle population is supported by the adequate of feed resources availability including land, labor and cattle population.

Remote sensing (RS) in technique to gather information about the object and its environment from a distance without a physical touch. The main purpose of RS is to collect data on natural resources and environment. This technique usually produces some form of image than can be further processed and interpreted to produce useful data for applications in agriculture, forestry, geography, geology, and archeology. The data obtained from RS can be linked to the various kinds of GIS to manage such as agriculture resources the region.

Land is the main production factor in animal production activity to establish the housing and to produce forage. In order to achieve the optimum production of beef cattle, it is necessary to determine the land capability to produce forage continuously in sufficient quantity and quality.

One of the constrain in the improvement of beef cattle is the reduction of forage producing are. There is continuing land use availability 30%. Tanah Laut in South Kalimantan the largest beef cattle population of 91,026 heads. Dry matter intake of beef cattle was assumed of 20 kg per head per day. Therefore Tanah Laut regency dry forage of 1,820 tones per day or approximately 655,387 tones per year. To ensure the availability of feed in Tanah Laut regency, it necessary to determine the potency of the area in producing feed especially crop, oil by product.

This study aimed to identify the potential of areas in producing feed and determine its availability in supporting the development of cattle population in Tanah Laut regency.

The study was conducted in Tanah Laut regency from December 2010 until May 2011. Secondary data collection and field surveys were conducted in the Tanah Laut regency. Data processing and analysis were performed at the Laboratory of RS and GIS, Master of Science in Information Technology (MIT), Bogor Agricultural University.

This study was commenced processing Landsat TM7 using supervised classification. The data was validated the ground check (ground truth). The results of the classification were used as a reference mapping the potency of areas in producing forage and determine availability for beef cattle in the regency.

Ground check was conducted to verify the classification results, and to measure the errors related to digitally classification based on the radiometric properties of objects. Geometric correction was applied to improve the image distortions. The correction was conducted by the establishment of the relationship
between the actual the image coordinate system with the geographic coordinate system using the sensor calibration data, or ground control point (GCP). Radiometric minimize bias related to digital/pixel brightness values measured on the histogram data channels of spectral imagery. Radiometric correction was based on the minimum histogram method. Image classification used in this study was guided classification by the Likelihood Standard Neighbor classification type. Supervised classification used training areas based on the coordinates of the points taken in the field using GPS. The information in each pixel was obtained with the help of computers, and clustering was done automatically by a computer based on the spectral distribution of the digital number. The areas were classed into grassland, farmlands, forest, settlements, water body. Accuracy evaluation was performed to calculate the amount of landcover classification errors, so it can be determined magnitude of the percentage of accuracy of mapping. Accuracy of analysis was performed by using a confusion matrix/contingency matrix. Accuracy is calculated using user’s accuracy, producer’s accuracy, overall accuracy and kappa accuracy.

Landcover including pastures, paddy and maize fields were obtained from classification of the image. Availability of forage dry matter (DM) from the landcover calculated based on the following formula: (1) pasture = (7.5 x land area x 0.23) tons/year DM; (2) Paddy straw = (2.5 x land area x 0.70) tons/year DM; (3) Maize straw = (6.0 x land area x 0.75) tons/year DM.

Carrying Capacity (CC) and Carrying Capacity Index (CCI) were calculated based on forage availability value and the standard deviation (SD) of CCI were grouped into three categories: (1) low CCI category which had value less than the average minus standard deviation; (2) average CCI category which had values in the rang between the average minus and plus standard deviation; (3) high CCI category which had higher values than the average value of CCI plus of standard deviation.

Fifty seven ground check point coordinates related to landcover consisting of mining, swamps, forest, rubber plantation, palm oil plantation, pasture, maize, paddy field and housing areas were taken 11 sub district. The results of classification and interpretation of landsat TM images of 2010 in Tanah Laut regency indicated that the largest land cover was palm oil plantation (42.25%), while the smallest land cover was the shadow (1.43%). The potential landcover producing feed were maize field 25,622 ha or (6.78%), pastures 6,324 ha or (1.67%), and paddy field 40,956 ha or (10.84%). The overall accuracy of calculation result of 84.3% and kappa accuracy was 80% which were higher the acceptable level of 70%.

Potential area producing forage in Penyipatan, Jorong, Pelaihari and Bumi Makmur sub district was 11,866 ha, 11,029 ha, 9,185 ha and 2,806 ha respectively. The total forage dry matter potentially produced in Tanah Laut regency was 234,403 ton per year. Pastures potentially produced (47,431) tons DM per year, maize field produced (115,299) tons DM per year, and paddy field produced (71,673) tons DM per year.

Carrying capacity of Jorong, Penyipatan, Kintap and Bumi Makmur sub district was (18,742 AU), (13,525 AU), (13,315AU) and (2,168 AU, respectively). The sub district with the highest level of carrying capacity a change to be improved as the center livestock development. Bumi Makmur sub district that has the lowest
carrying capacity of (2,168 AU with beef cattle population of 131 AU could be improved by utilizing the available pasture from other nearby area producing forage.

One sub district was included in high potential area, and ten sub districts were moderate potential area. The region having a high carrying capacity could be recommended as a center for the development of beef cattle and a supplier of feed to other region which low CCI category. Carrying capacity of the regions was associated with their livestock population. Tanah Laut, with the carrying capacity of 102,808 AU and cattle population 57,115 AU allowed the addition of cattle population of 45,692 AU.

The conclusions of the study were: (1) the potential are producing forage in the of Tanah Laut regency (72,902 ha), with the potential forage dry matter production 234,403 tons per year; (2) Tanah Laut regency had one sub district with high potential CCI and ten sub district with moderate potential CCI; (3) Tanah Laut regency had carrying capacity of 102,808 AU, cattle population of 57,115 AU and allowed the additional population 45,692 AU.

It is recommended that to achieve the vision of the livestock development in Tanah Laut as a local resources based beef cattle center and an agribusiness oriented regency, an integrated agriculture supplying other alternative feed sources such as crop products, palm oil by product, and the integration of beef cattle into palm oil and rubber plantation should be applied in the regency.

Keywords: cattle, carrying capacity, forage, Tanah Laut regency
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POTENTIAL AREA PRODUCING FEED SUPPORTING THE DEVELOPMENT OF CATTLE POPULATION IN TANAH LAUT REGENCY

LASTI PITRIANI

A Thesis is submitted for the degree of Master of Science in Information Technology for Natural Resources Management Study Program

GRADUATE SCHOOL
BOGOR AGRICULTURAL UNIVERSITY
BOGOR
2011
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I would like to thanks to all people who have helped and assisted me during the preparation on this thesis.

First of all, I would like to thanks to Prof. Dr. Ir. Toto Toharmat, M. Sc. and Harry Imanto, S. Si. M. Sc., who acted as my supervisor and co-supervisor, for their guidance, helped and supported during my research.

I would like to thanks to Ministry of Agriculture for financial support during two years of my study. Without this support, this research would not be possible.

I would like to thanks also Dr. Ir. Hartrisari Hardjomidjojo, DEA as MIT Program Coordinator, MIT Lecturers, and Staffs, thank you for helping and supporting me.

I appreciate the advice and assistance of my friend and my colleagues.

- Principle School of Agriculture Development Pelaihari, and Staff cooperation
- Head Animal Husbandry Office Province South Kalimantan
- Bapak Sujoni, drh., you’re nice friend
- MIT 99, I really appreciate our togetherness, our spirit of “keep moving”, and know we support each other to finish our study
- Alumni School of Agriculture Development, for their support and prayers.

My parents, my husband, my daughter, my brother, my sister, your love and support was continuous and without limits.

Thank you.

And finally, I wish to thanks to all the other not mentioned individually for their assistance.

Bogor, August 2011

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The author was born in the Hulu Sungai Selatan South Kalimantan on 10 January 1967 from family of Bapak Abdul Khair Sadjali and Ibu Hj. Rosmaliah. The author is the second child of eight children.

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I. INTRODUCTION

1.1. Background

Development of animal husbandry is an integral part of agricultural development and national development in order to improve nutrition, to increase income and welfare of farmers, to provide employment, to conserve foreign exchange and to increase food Security State.

Beef cattle are one ruminant cattle that have the greatest contribution as a producer of meat. Up to now, Indonesia has not been able to meet the needs of domestic beef that tend to increase every year. It is estimated that in 2011 the local meat production is only about 316.1 thousand tons, whereas the estimation of this year reached is 424 thousand tons. To meet the needs of meat, the government will import 140 tons of meat, or about 33% of the total beef demand during 2011 (Direktorat Pangan, 2010).

In order to meet the national needs of meat, the Government of the Republic of Indonesia launched a program of self-sufficient of National Beef in 2005-2010, then another program of Accelerating Achievement of Self-sufficient of Beef in 2008-2010. Because by 2010 the program has not been successful, then the Department of Agriculture re-targets an advanced program to the self-sufficient of beef until 2014. To achieve these targets, the Directorate General of Livestock establishes the policies of: (1) developing a center for breeding and fattening, (2) revitalization of the institutional and functional human resources field, and (3) supporting of facilities and infrastructure. Through the policy, it is expected that the supply of domestic beef will be projected to increase from 67 percent in 2010 to 90 percent in 2014.

The vision of the Animal Husbandry of South Kalimantan Province is towards 2014 South Kalimantan will become a local source of cows and beef cattle as well as self-sufficient of meat (Disnak Tala, 2009). This is supported by the potential of South Kalimantan, which has an area of 3,753,052 ha, mainly consists of lots and
land; there are about 166,604 ha for building, 190,039 ha for plantations, 129,254 ha for fields, and 145,805 hectares for pastures and grazing. By the potential, it can be said that beef cattle population in South Kalimantan in 2008 were 210,633 cows and in 2009 there were 218,065 cows with the growth of 5% per year (Disnak KalSel, 2009). Nowadays, South Kalimantan has been able to meet the adequacy of meat for local people and also has been able to supply the needs of meat, especially beef cattle into the Province of Central Kalimantan and East Kalimantan. Even the Province of Central Kalimantan is very dependent on the supply of meat from South Kalimantan.

Achieving the target and the predicate of beef cattle producer will be realized if it is supported by the resources. Gunadi (1998) explains that in developing livestock sector in a region, it needs to measure the potential of the available resources. These resources include the availability of land, feed, labor and the potential of the developed livestock. The potential is determined by the availability of agricultural land, soil fertility, climate, topography, water availability, and the existing agricultural patterns. Susetyo (1980) adds that in improving livestock production rumination there is the triangular relationship exists between lands, livestock, and livestock feed which is an organic unity. If one of them did not exist then the generated production will not be satisfactory and may cause failure in business. Land is the main capital as a place for rumination cattle to live as well as producing forage. Therefore, it is required quality land in producing forage to achieve the optimal improvement of livestock production.

On the other hand it should be recognized that one of the factors inhibiting the development of beef cattle is increasingly narrowing the area of livestock grazing allotment from time to time whether it is field acreage for grazing or forage crop development and availability of forage feed which is greatly influenced by the seasons. The lack of dry season and the abundant of rainy season cause the availability of forage feed are unstable throughout the year. Not to mention the lack of adequate support facilities to support the availability of food, livestock, and
marketing, can also take a negative influence on the development of animal husbandry. Surely, it is necessary to find appropriate solution.

Feed for ruminants has been obtained and derived from pasture which provides forage of pasture grasses and legume as a source of ruminant feed. The last few years there is a tendency in decreasing productivity of grazing land as a provider of food due to the change of land use. Land as grazing land has been converted into agricultural land for rice fields, plantations and settlements. As a result, pasture ecology as a base for cattle, especially for ruminant livestock, become diminishing (Syamsu, 2006).

The Regency of Tanah Laut is known as cattle-producing areas in South Kalimantan Province. Almost 40% of meat in South Kalimantan is supplied from Tanah Laut. Every week at least 250 cows of Tanah Laut head out the regions in South Kalimantan Province as well as to Central Kalimantan. In 2009 the population of beef cattle reached 80,533 cows as compared to the year 2008 as many as 79,191 cows, and this population continues to be increased to 100,000 cows in the next year (Disnak Tala, 2009).

Based on statistical data of the Regency of Tanah Laut in 2007, the total area of pasture land was 13,755 ha and in 2008 the number was reduced to 13,205 ha (BPS, 2007 and 2008). Thus the potential for grazing land as forage provider is also decreased. If each head of cattle is assumed to require about 20 kg of fodder per day, the need for animal feed is estimated to 1610.66 tons per day and need of 19327.92 tons in a year, not including other ruminants.

The development of beef cattle in the Regency of Tanah Laut in the future faced with the problem of limited natural resources as the basis for the provision of fodder. To ensure the availability of green fodder which remains all year round, then it is needed another alternative such as agricultural waste (rice straw and maize straw) which can be used as a source of livestock feed.
1.2. Scope of Study

Animal feed is all that can be eaten by livestock in a form that can be digested in part or entirely and does not interfere with the respective of animal health. Generally, the ingredients of animal feed can be eaten, but not all the components in the feed material can be digested by livestock. The ingredients of feed consist of crops, crop yields, and also originating from livestock or animal. Almost 90% of the main feed of herbivore cattle comes from forage, includes the remains of agricultural produce such as rice straw, maize straw, rice bran, sugarcane tops, and peanut hay.

This study focuses on identifying areas of potential as a source of beef cattle feed based on carrying capacity.

1.3. Objectives

The goal of this research is to identify the potential land for fodder and to determine the level of availability.
II. LITERATURE REVIEW

2.1. Cattle Feed

Animal feed is all that can be eaten by livestock in a form that can be digested in part or entirely and does not interfere with the respective of animal health. Animal feed is the material that can be eaten, digested, and used by livestock. Generally, the ingredients of animal feed can be eaten, but not all the components in the feed material can be digested by livestock (Tilman et al. 1989).

The ingredients of feed consist of crops, crop yields, and also originating from livestock or animal. (Tilman et al. 1989). Generally, livestock depends on the plant as a source of feed. Almost 90% of the main feed of herbivore cattle comes from forage, includes the remains of agricultural produce such as rice straw, maize straw, rice bran, sugarcane tops, and peanut hay. Grass has a very important position as fodder and cannot be replaced entirely by concentrate (Sutardi, 1980).

Feed has an important role for livestock, either for the growth of young animals and to maintain life and to produce the products of cows (milk, calf, meat) and energy for adult cattle. Another function of the feed is to maintain the immune system and health. In order to grow as expected, the type of feed given to livestock must be of good quality and in sufficient quantities. Food that is often given to livestock work such as: forage and concentrates.

The source of livestock feed depends on the farming sector in a region. In an area that has a farm field food the sources derive from agricultural-by-product, otherwise in the area that has a system of dry land farming or moor animal feed derive from natural grass. So far, most of the feed given to livestock in Indonesia are local grass or natural grass, both originating from grazing land, agricultural waste, and plantation (Prawiradiputra, 2000).
2.2. Land Feed

Land plays an important role in farming systems. Land serves as a place of production activities and is a factor of production in the livestock business, especially as a source of fodder. The interaction of livestock with the land consists of three aspects: (a) biological adaptations of livestock, (b) the ability of land to produce forage, and (c) the patterns of maintenance and capacity of the available area (Suharyanto, 2006).

Land is a major limiting factor for the development of ruminants. Utilization of land for farming is based on the preposition that: (a) the land is a source of animal feed, (b) all types of land is suitable for feed resources, (c) the use of land for livestock is defined as the harmonization effort between the allotment of land with agricultural production systems, (d) the relationship between land and livestock are dynamic (Dirjennak, 1995).

Livestock industry in Asia is highly dependent on soil resources as a major input for the bulk high-crude-fiber feeding forages required can only be supplied economically from local sources (Lasmanawati, 2006). Potential sources of forage land in Indonesia comes from the moor land, land in the rice field, annual crops, fields, land that is overgrown with forage, grassland, and extemporary cultivated land (Nitis, 1995).

Farm are intimately associated with the land, as beef cattle which are highly dependent on the material and feed quality, feed quality livestock forage is largely determined by soil fertility. According to Suratman et al. (1998), based on the needs of land, livestock enterprises can be divided into two operating systems; namely land-based agriculture farm and the non-land-base agriculture farm. Land-base agriculture farm is the cattle with feed component comprise the bulk of forage crops; land is an important factor as the environmental and food advocates.

Land resources which can be exploited by breeders such as: paddy fields, grazing land, forest plantations and the people, with the level of density and intensity depending on the diversity of plants, water availability and types of beef cattle. The area of paddy field, gardens and forests allow the development of livestock-crop
integration pattern which is a process of mutual support and mutual benefit, through the use of cattle to cultivate the soil and manure as organic fertilizer. While the wetland and land produce feed crops of rice straw and crop by-products that can be treated as cattle feed. While the gardens and forests contribute in the form of natural grass and other plant species. Utilization patterns of integration are expected to increase the availability of fodder throughout the year, so it can increase production and productivity of livestock (Riady, 2004).

2.3. Supporting resources

The supporting resources show the magnitude of the carrying capacity of the environment to support animal life, which is stated in the number of union tail of the area. The number of animals, which life can be supported, depends on biomass (the organic plant material) available to the animal (Soemarwoto, 1983).

The levels of forage availability in a region is one of the most important factor influencing population dynamics and contribute in the successful development of livestock, especially cattle herbivores. According to Natasasmita and Murdikdjo (1980), in calculating the potential of a region to develop livestock technically, it is necessary to see the existing livestock population in the region associated with the potential of forage produced by the region concerned.

2.4. Geography Information System

Aranoff (1989) describes the Geographic Information System (GIS) as a computer-based system used to store and manipulate the geographic information. GIS is designed to collect, to store, and to analyze the objects and phenomena where geographic location is an important or critical characteristic to the analysis while Star (1990) defines GIS as an information system designed to work with data spatially referenced or geographic coordinates. Or in the other words, GIS is a database system with special abilities in handling the spatial data referenced; in addition to a set of operations imposed on the data.
GIS as a system composed of several components; namely hardware, software, data and geographic information, and management.

2.5. Remote Sensing

Remote sensing is a technique to gather information of the object and its environment from a distance without physical touch. The main purpose of remote sensing is to collect data on natural resources and environment. This technique usually produces some forms of the image further processed and interpreted to produce useful data for applications in agriculture, archeology, forestry, geography, geology, planning and other fields (Lo, 1995).

According to Lilesand and Keifer (1994) in Wijaya (2005) remote sensing involves two main processes of data collection and data analysis. The elements of the data collection process include: a) source of energy, b) energy traveling through the atmosphere, c) the interaction between energy with the appearance on the earth, d) the sensor aircraft and spacecraft or satellite, and e) the results in the establishment of data and pictorial form or shape numeric. The use of sensors to record a variety of electromagnetic energy emitted and reflected by the appearance on the earth. The process of data analysis involves the testing data by using interpretation tools and observation tools for analyzing pictorial data and computer to analyze sensor data with the numeric data assisted by the reference of the resource studied.

2.6. Remote Sensing and GIS Applications

Needs of remote sensing technology combined with GIS for the purpose of inventory and monitoring is very important, especially when associated with the collection of data quickly and accurately. Besides collecting data by remote sensing technology can reduce or even eliminate the influence of subjectivity. Remote sensing and GIS can be combined to enhance the capabilities in terms of data collection, data manipulation, data analysis and provides integrated spatial information (Wahyunto, 2007).
Application of remote sensing is used to obtain information relating to the condition of vegetation cover and/or current land use obtained by interpretation of satellite imagery. By such process it was obtained the information of distribution and the condition of permanent land cover and vegetation. Remote sensing is a technology that can be utilized to provide the latest maps with time, effort and costs which are relatively smaller for a very wide area (Sulistyo, 2004).

GIS has an important role in various aspects of our recent life. Through GIS, a variety of information can be processed and analyzed and then linked to its location on the earth's surface. GIS can be used to help in managing agricultural and plantation resources such as in expanting the area of plants, trees, or waterways. In addition, GIS could also be used to establish the crop, to develop the rotation of cropping systems, and to perform the calculations on an annual basis against soil degradation occurs due to differences in seeding, planting, or the techniques used in the harvest. GIS is also used for mapping areas and farmland. By the mapping we can detect whether the land is worth to be planted or not.
III. METHODOLOGY

3.1. Time and Location

The research was conducted in Tanah Laut Regency, consisting of 11 counties, from December 2010 up to May 2011. Data processing and analysis performed at the Laboratory of Remote Sensing and GIS Master of Science in Information Technology (MIT), Bogor Agricultural University, while the data collection and field surveys was conducted in the Regency of Tanah Laut.

Tanah Laut Regency, is situated 114°30’20 - 115°23’31 East and 3°30’33- 4°11’38 South and has an area of 3,631.35 km². Average temperature is 20,1°C – 34°C and humidity is 80-83%. The area is dominated by low-sloping plains that stretched from West to East and undulating to mountainous areas in land from the south. Tanah Laut Regency is known as a center for cattle because nearly 40% of meat in South Kalimantan is supplied from this regency.
3.2. Data and Tools

Secondary data was collected from various sources including the Livestock Office of Tanah Laut Regency and South Kalimantan Provincial Livestock Office. Other data used are Indonesia Topographical Map (scale 1: 50,000) and Landsat TM7 imagery of 2010.

The Landsat TM 7 imagery was processed by using ER Mapper 6.4, and visualization of the availability of animal feed using ArcGIS 9.2 (ESRI Inc.). All vector data were projected to the Universal Transverse Mercator (UTM) coordinate system. The 50S zone with the World Geodetic System (WGS) 1984 datum was selected and applied.

Tabel 1. Types and Sources of Secondary Data

<table>
<thead>
<tr>
<th>No</th>
<th>Data Types</th>
<th>Scale</th>
<th>Year</th>
<th>Form Data</th>
<th>Data source</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tanah Laut Regency (RBI Map)</td>
<td>1:50,000</td>
<td>2007</td>
<td>Digital</td>
<td>Bakosurtanal</td>
</tr>
<tr>
<td>2</td>
<td>Landsat TM 7</td>
<td>30x30 m</td>
<td>April 16th 2010</td>
<td>Digital</td>
<td>BTIC-landsat imagery provider</td>
</tr>
<tr>
<td></td>
<td>Livestock population data</td>
<td></td>
<td>2010</td>
<td>Tabular</td>
<td>Animal Husbandry Office of Tanah Laut Regency</td>
</tr>
</tbody>
</table>

3.3. Research Framework

This study was commenced with the processing of Landsat TM7 using supervised classification, and then was validated by using the ground check data. The results were used as a reference for mapping potential areas and determine the level of availability of fodder.
3.4. Methods

3.4.1. Ground Check

Ground check was conducted to verify the classification results, and to measure the errors related to digitally classification based on the radiometric properties of object. Errors could be, caused by the presence of objects that have similar radiometric characteristics but different physical objects on the earth. Infield survey was conducted to capture GCP and information of objects using GPS.

3.4.2. Image Processing

Image processing is a way to manipulate image data or processing an image into an output data in accordance with what we expect. The image-processing used ER Mapper 6.4 Software. Landsat TM 7 imagery was used in this study consisted of six bands of band 1, band 2, band 3, band 4, band 5, and band 7 which was obtained from BTIC. The image processing was consisted of geometric correction, radiometric correction, cropping, supervised classification, and validation of classification results.
3.4.2.1. Geometric Correction

Geometric correction on the image aims to reduce the geometric error, so that the resulting geometric corrected image. In this study, geometric correction is done by a method based on the Ground Control Point (GCP). Reference data used for the selection was Indonesia Topographical Map Tanah Laut Regency, year 2007 of GCP with the scale 1: 50.000. GCP sought is spread evenly and relatively permanent, such as roads, rivers, bridges. Interpolation was performed using nearest neighborhood interpolation method. This method is most efficient and does not change the digital value of the original number. GCP elimination was performed to get Root Mean Squared Error (RMSE) value <1.0 pixels.

RMSE is expressed by the formula:

\[
RMSE = \sqrt{\frac{1}{n} \sum (\delta)^2 \text{ with } \delta = (P' - P)^2 + (L' - L)^2}
\]

Where P' and L' are the estimated coordinates, P and L are the original coordinates of GCP (Jaya, 1997).

3.4.2.2. Radiometric Correction

The aim of radiometric correction to make correction of the bias in the digital/pixel brightness values measured on the histogram data channels of spectral imagery, which is caused by the atmospheric disturbances or due to an error detector response. Radiometric correction to use the minimum histogram method. At a minimum histogram method, the atmospheric disturbance allegedly some of the smallest value measured on each channel plot histograms of multi channel digital image. To eliminate the atmospheric interference from multi-channel data it is done by subtracting the smallest digital value to each digital pixel value measured in each channel image (Lillesand and Kiefer, 1994).
3.4.2.3. Cropping

Study area should be cropped to avoid any disturbance influence of other objects beyond the concern area and to reduce size data processing can be made shorter. The administrative boundary of Tanah Laut Regency was used area of interest (aoi).

3.4.2.3. Supervised Classification

Image classification is useful to obtain landcover from remote sensing imagery. Supervised classification with Maximum Likelihood method. This classification is aimed to classify pixel values in the image into several classes based on the training area. Classes were determined namely pastures, corn fields, forests, settlements, water body, paddy field, palm plantations, and rubber plantations. This process is resulted land cover Tanah Laut regency.

3.4.2.4. Validation Results of Classification

Accuracy evaluation was conducted to calculate the classification errors. Accuracy assessment was performed by using a confusion matrix/contingency matrix. Accuracy assessment includes the number of pixels that are classified into right or wrong classes and misclassified, percentage in each class and the percentage of total errors. The error matrix show in Figure 3. Accuracy is calculated using user's accuracy, procedure's accuracy, overall accuracy, and kappa accuracy. The formula for accuracy as follow:
Kappa Accuracy \[= \frac{N \sum_{k} X_{kk} - \sum_{k} X_{ik} X_{kj}}{N^2 - \sum_{k} X_{kk} X_{jj}} \times 100\%\]

User's Accuracy \[= \frac{X_{ik}}{X_{ik} + X_{ik+}} \times 100\%\]

Producer's Accuracy \[= \frac{X_{ik}}{X_{ik+}} \times 100\%\]

Overall accuracy \[= \frac{\sum_{k} X_{kk}}{N} \times 100\%\]

Where:

- \(N\) = the number of all pixels are used for observation
- \(R\) = the number of rows/column on the error matrix (the number of classes)
- \(X_{i+}\) = the number of all columns in row \(i\) (\(X_{ij}\))
- \(X_{+j}\) = the number of all columns in the lane to-\(j\) (\(X_{ij}\))

<table>
<thead>
<tr>
<th>Training Area Data</th>
<th>Misclassifications</th>
<th>Total Rows (X_{i+})</th>
<th>Producer's Accuracy (X_{ik}/X_{ik+})</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>A</td>
<td>(X_{i+k})</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>…</td>
<td>…</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total column</td>
<td>(X_{i+k})</td>
<td>(N)</td>
<td></td>
</tr>
<tr>
<td>User's Acc</td>
<td>(X_{ik}/X_{ik})</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall Acc</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Jaya (2005)

Figure 3. Error Matrix

To achieve high accuracy of landcover classification using Landsat imagery, not only based spatial data, but also based on ground data and other supporting data. According to Gallego (1995) and Pradan (1999), accuracy above 70% is considered well enough for detection of agricultural land area. The result of image-processing is a land cover map of Tanah Laut Regency.
3.4.3. Potential forage

Based on the classification results from image processing, it obtained a land cover that could potentially as a source of cattle feed such as pastures, rice, corn, and rice fields then area of each was calculated.

Pasture availability is influenced by the season, while paddy straw and maize straw are affected by the cropping pattern in each area/region. Cropping pattern of rice and maize in Tanah Laut Regency is shown in Table 2.

Table 2. Paddy and Maize Planting Patterns in Tanah Laut Regency

<table>
<thead>
<tr>
<th>Wet season</th>
<th>Dry season</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nov</td>
<td>Des</td>
</tr>
<tr>
<td>Paddy</td>
<td>Paddy (terrestrial)</td>
</tr>
</tbody>
</table>

Availibility of forage (dry matter) can be calculated based on the following formula:

No. Land Type  | Formulas
1. Land Pastoral  | \( (7.5 \text{ tons} \times \text{land area} \times 0.23) \text{ tons/year DM} \)
2. Paddy straw    | \( (2.5 \text{ tons} \times \text{land area} \times 0.70) \text{ tons/year DM} \)
3. Maize straw    | \( (6.0 \text{ tons} \times \text{land area} \times 0.75) \text{ tons/year DM} \)

(Source: Santoso, *et al* (1997) and Muller (1974))

Visualization of forage production used ArcGIS 9.2.

3.4.4. The Availability of Forage Level

Identification of the forage availability level was done by calculating the Carrying Capacity (CC) and Carrying Capacity Index (CCI) of forage fodder. CC of forage fodder is the ability of an area to produce the feed mainly forage that can accommodate the needs a number of population of beef cattle in the form of fresh or dry matter, without processing, and any treatment, and are assumed to be used for beef cattle only.
Carrying capacity of feed potential is calculated based on the production of dry material (DM) divided by the needs of one animal unit (1 AU) of beef cattle in one year, where the requirement is 6.25 kg of dry material/day or 2.28 tons/year (NRC, 1984). Livestock population is calculated based on the standard of animal unit (AU). According to Ashari et al. (1999), the standard unit of ruminants are cattle (0.7 AU), buffalo 0.8 AU), sheep (0.07 AU) and goats (0.08 AU). Carrying capacity of feed potential was calculated by using the following equation (Hariyanto et al, 2002):

\[
\text{Carrying capacity (AU)} = \frac{\text{Production of dry material (ton/year)}}{\text{the needs of dry material for livestock (ton/AU)}}
\]

Carrying capacity index (CCI) forage was calculated from the total production of available forage to the needs of forage for ruminant livestock population in some areas. Index of the carrying capacity is calculated based on of the dry ingredients with the following equation (Ashari et al, 1995):

\[
\text{Carrying Capacity Index} = \frac{\text{Carrying Capacity (AU)}}{\Sigma \text{Population of cattle (AU)}}
\]

Based on the average value of CCI and the standard deviation (SD) then the area can be grouped according to three categories of indices, namely:

1. **Category of low-CCI** is less than the average value minus standard deviation CCI (<mean-SD).
2. **Category of average-CCI** is where the CCI value in the range between the CCI average value minus of standard deviation to the average value plus of standard deviation (mean - SD to mean + SD).
3. **Category of high CCI** is more high than the CCI average value plus of standard deviation (> mean + SD).

Visualization of the carrying capacity of the index used Arc GIS 9.2
IV. RESULT AND DISCUSSION

4.1. Ground Check

Fifty seven ground check point coordinates were taken on various object in 11 sub districts. Those objects were consisted of mining, rubber, palm oil, pasture, forest, maize, swamps, paddy and housing. Figure 4 shows the coordinates were taken with GPS overlaid with Image Landsat TM 7. Ground check data can be seen in Appendix 1.

4.2. Landcover

Based on the results of classification and interpretation of Landsat TM 7 in 2010, it was obtained area of landcover as shown in Table 3 and the map presented in Figure 5. Tanah Laut Regency mostly covered by palm oil (159,586.50 ha) or 42.25%
of the total landcover, while the smallest area is shadow with total of 5,419.04 ha (1.43%).

Table 3. The Landcover type in Tanah Laut Regency

<table>
<thead>
<tr>
<th>No</th>
<th>Land cover</th>
<th>Area (Ha)</th>
<th>Area (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Forest</td>
<td>10,665.36</td>
<td>2.82</td>
</tr>
<tr>
<td>2.</td>
<td>Bare land</td>
<td>20,090.30</td>
<td>5.32</td>
</tr>
<tr>
<td>3.</td>
<td>Maize</td>
<td>25,622.01</td>
<td>6.78</td>
</tr>
<tr>
<td>4.</td>
<td>Palm oil</td>
<td>159,586.50</td>
<td>42.25</td>
</tr>
<tr>
<td>5.</td>
<td>Paddy</td>
<td>40,956.04</td>
<td>10.84</td>
</tr>
<tr>
<td>6.</td>
<td>Pasture</td>
<td>6,324.23</td>
<td>1.67</td>
</tr>
<tr>
<td>7.</td>
<td>Rubber</td>
<td>65,658.18</td>
<td>17.38</td>
</tr>
<tr>
<td>8.</td>
<td>Shadow</td>
<td>5,419.04</td>
<td>1.43</td>
</tr>
<tr>
<td>9.</td>
<td>Cloud</td>
<td>25,123.26</td>
<td>6.65</td>
</tr>
<tr>
<td>10.</td>
<td>Water body</td>
<td>18,251.20</td>
<td>4.83</td>
</tr>
</tbody>
</table>

Based on the classification result, the most potential area and become a priority for the feed sources are paddy field lands with an area of 40,956.04 hectares (10.84 %), maize with an area 25,622.01 ha (6.78 %), and pastures with an area of 6,324.23 hectares (1.67 %). In accordance with the statement of Nitis (1995), land the potential area as feed classification as sources are: 1) cropland, 2) plantations, 3) forest, 4) grassland, 5) fallow land, and 6) the critical oil. Data on feed production capability for each of the land is still difficult to obtain, using remote sensing methods we can identify, measure and analyze every object of interest, and classify land of feed resources.
4.3. Validation of the Landcover Classification Results

Base on confusion matrix in Table 4, at all classes can be mapped very well, unless the source of feed pasture (40%) of the procedure’s accuracy. There are three classes sample are removed from pasture (omission) and inserted into another class (commission that is entered into the Land and rubber class. Errors in identifying this possibility because there is some pasture land as open land is barren, while the rubber was due to because rubber plantation is still a young state so it has a pixel color that is almost equal to pasture.

The calculation result shows that the overall accuracy of 84.3% and kappa accuracy 80.0%. According to Gallego (1995) and Pradan (1999), the accuracy of satellite imagery analysis for the detection of the agricultural land area above 70% is considered good enough. To achieve good results in the classification of landcover
using Landsat imagery, it is not only based on spatial data, but also on field data (ground data) and other supporting data.

Table 4. Confusion Matrix of Landcover Classification Result in Tanah Laut Regency

<table>
<thead>
<tr>
<th></th>
<th>Pasture</th>
<th>Paddy</th>
<th>Land</th>
<th>Palm oil</th>
<th>Forest</th>
<th>Swamp</th>
<th>Rubber</th>
<th>Maize</th>
<th>Total</th>
<th>PA (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pasture</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>5</td>
<td>40</td>
</tr>
<tr>
<td>Paddy</td>
<td>0</td>
<td>8</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>10</td>
<td>80</td>
</tr>
<tr>
<td>Land</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>5</td>
<td>80</td>
</tr>
<tr>
<td>Palm oil</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>100</td>
</tr>
<tr>
<td>Forest</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>5</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Swamp</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>100</td>
</tr>
<tr>
<td>Rubber</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>12</td>
<td>3</td>
<td>16</td>
<td>75</td>
<td></td>
</tr>
<tr>
<td>Maize</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>7</td>
<td>8</td>
<td>86.75</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2</td>
<td>8</td>
<td>6</td>
<td>7</td>
<td>3</td>
<td>2</td>
<td>18</td>
<td>11</td>
<td>51</td>
<td></td>
</tr>
<tr>
<td>UA (%)</td>
<td>100</td>
<td>100</td>
<td>66.67</td>
<td>85.71</td>
<td>66.67</td>
<td>100</td>
<td>66.67</td>
<td>63.64</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: UA (user's accuracy), OA (Overall accuracy) and PA (producer's accuracy)

The calculation result shows that the overall accuracy of 84.3% and kappa accuracy 80.0%. According to Gallego (1995) and Pradan (1999), the accuracy of satellite imagery analysis for the detection of the agricultural land area above 70% is considered good enough. To achieve good results in the classification of landcover using Landsat imagery, it is not only based on spatial data, but also on field data (ground data) and other supporting data.

4.4. Potential Feed

4.4.1. Forage Production in Tanah Laut Regency

The total area and production of each feed source in Tanah Laut Regency can be seen in Table 5 and Table 6. The area that has potential as a feed source of the mostly located feeds in Penyipatan sub-district (16.28 %), Jorong sub-district (15.13 %), and Pelaihari sub-district (12.60 %). The smallest area is Bumi Makmur sub-district (3.85 %).

The most extensive area of maize land is Batu Ampar sub-district with an area of 4,554.12 ha, and the smallest is the Bumi Makmur sub-district with an area of...
The most extensive area of pastures land is Jorong sub-district with an area of 2,577.85 ha, and the smallest is Bumi Makmur sub-district with an area of 0.05 Ha. The most extensive paddy field is Penyipatan sub-district with an area of 8,632.29 ha, and the smallest is Bajuin with an area of 558.01 ha.

### Table 5. Forage Area in Tanah Laut Regency

<table>
<thead>
<tr>
<th>Sub-district</th>
<th>Area (Ha)</th>
<th>Maize</th>
<th>Paddy</th>
<th>Pasture</th>
<th>Number</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Batu-bati</td>
<td>1,347.66</td>
<td>2,778.88</td>
<td>178.69</td>
<td>4,305.23</td>
<td>5.91</td>
<td></td>
</tr>
<tr>
<td>Bajuin</td>
<td>3,077.52</td>
<td>558.01</td>
<td>360.75</td>
<td>3,996.28</td>
<td>5.48</td>
<td></td>
</tr>
<tr>
<td>Bumi Makmur</td>
<td>11.58</td>
<td>2,795.08</td>
<td>0.05</td>
<td>2,806.71</td>
<td>3.85</td>
<td></td>
</tr>
<tr>
<td>Batu Ampar</td>
<td>4,554.12</td>
<td>669.24</td>
<td>928.97</td>
<td>6,152.33</td>
<td>8.44</td>
<td></td>
</tr>
<tr>
<td>Jorong</td>
<td>3,130.84</td>
<td>5,320.25</td>
<td>2,577.85</td>
<td>11,029.12</td>
<td>15.13</td>
<td></td>
</tr>
<tr>
<td>Kintap</td>
<td>3,785.84</td>
<td>954.45</td>
<td>1,553.59</td>
<td>6,293.88</td>
<td>8.63</td>
<td></td>
</tr>
<tr>
<td>Kurau</td>
<td>94.06</td>
<td>510.58</td>
<td>4.06</td>
<td>5,199.70</td>
<td>7.13</td>
<td></td>
</tr>
<tr>
<td>Pelaihari</td>
<td>4,325.33</td>
<td>4,666.45</td>
<td>194.01</td>
<td>9,185.79</td>
<td>12.60</td>
<td></td>
</tr>
<tr>
<td>Takisung</td>
<td>924.50</td>
<td>6,645.75</td>
<td>63.85</td>
<td>7,634.10</td>
<td>10.47</td>
<td></td>
</tr>
<tr>
<td>Tab. Ulang</td>
<td>1,529.31</td>
<td>2,833.88</td>
<td>69.49</td>
<td>4,432.68</td>
<td>6.68</td>
<td></td>
</tr>
<tr>
<td>Penyipatan</td>
<td>2,841.25</td>
<td>8,632.29</td>
<td>392.93</td>
<td>11,866.46</td>
<td>16.28</td>
<td></td>
</tr>
<tr>
<td>Number</td>
<td>25,622.01</td>
<td>40,956.04</td>
<td>6,324.24</td>
<td>72,902.29</td>
<td>100.00</td>
<td></td>
</tr>
</tbody>
</table>

### Table 6. Forage Production Potential in Tanah Laut Regency

<table>
<thead>
<tr>
<th>No.</th>
<th>Sub-district</th>
<th>Feed Production (ton/year) DM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Maize</td>
</tr>
<tr>
<td>1.</td>
<td>Bati-bati</td>
<td>6,064.47</td>
</tr>
<tr>
<td>2.</td>
<td>Bajuin</td>
<td>13,848.84</td>
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<td>3.</td>
<td>Bumi Makmur</td>
<td>52.11</td>
</tr>
<tr>
<td>4.</td>
<td>Batu Ampar</td>
<td>20,494.54</td>
</tr>
<tr>
<td>5.</td>
<td>Jorong</td>
<td>14,088.78</td>
</tr>
<tr>
<td>6.</td>
<td>Kintap</td>
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</tr>
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<td>7.</td>
<td>Kurau</td>
<td>423.27</td>
</tr>
<tr>
<td>8.</td>
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<td>19,463.99</td>
</tr>
<tr>
<td>9.</td>
<td>Takisung</td>
<td>4,160.25</td>
</tr>
<tr>
<td>10.</td>
<td>Tambang Ulang</td>
<td>6,881.89</td>
</tr>
<tr>
<td>11.</td>
<td>Penyipatan</td>
<td>12,785.63</td>
</tr>
<tr>
<td></td>
<td>Number</td>
<td>115,299.05</td>
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</tbody>
</table>
The total production of dry matter of feed in Tanah Laut Regency was 234,403.91 tons. Overall, the highest feed production is in sub-districts of Jorong that has 42,733.41 tons of dry matter production or (18.2 %) of the total production of dry feed material in Tanah Laut Regency. This is consist of maize straw as much as 14,088.78 tons (12.22 %), pasture as much as 19,333.88 tons/year (24.57%), and 9,310.75 tons/year of paddy straw (12.99 %) while the rest scattered is in other places. This is because the vast land area of maize, rice, and pasture is much higher compared with other places, while the lowest production of feed resources is in the sub-district of Bumi Makmur with total production reach 4,943.88 tons (2.1 %). This is caused by most area in the sub-district of Bumi Makmur is marshes. There fare the source of feed maize straw (52.11ton/year DM) and pasture (0.38 ton/year DM) is lower than the paddy straw (4,891.39 11ton/year DM).

The distribution of potential feed production in Tanah Laut shows that sub district Jorong, Penyipatan and Kintap have the highest production potential compared with other places. Those area have highest area of feed, especially maize field. The vast area of maize crop in some sub district is because of the availability of facilities and infrastructure such as banking partners to support farmers through the Credit of Food Security and Energy/Kredit Ketahanan Pangan dan Energi, cooperation with the feed mill, and the availability of maize drying machines as well. The potency of pasture production is smaller because the pasture land turned into palm oil plantation and rubber plantation.

Syamsul et al, (2007) the feed source of residual feed of the crop obtained from commodity crops, and the availability influenced by cropping patterns and crop land. Generally, maize farming in Tanah Laut Regency planted three times a year i.e. November to March, April to July, and August to November. However, to avoid the crop failure mean farmers grow maize twice a year and rice is planted once a year. Meanwhile, pasture production is influenced by the seasons. The availability of pasture is not continuous throughout the year because of the lack of drought and an abundance of rain in the rainy season.
By the area of feed land associated with the livestock population it will be known the livestock density in a region. According to Dirjennak and Balitnak (1995), the criteria used for the category are very dense >2, the densely >1-2, moderate 0.25 - 1, and low <0.25. Based on land area associated with livestock feed, Tanah Laut Regency is medium density (0.7 AU/ha) area. There are two sub district with very dense category, i.e. Takisung and Bumi Makmur. Seven sub district with moderate category that consist of Pelaihari, Kintap, Tambang Ulang, Penyipatan, Bajuin, Jorong and Bati-bati. There are two sub district with low category, i.e. Bumi Makmur and Kurau sub district. Region with category moderate and low category shows that farm land managed by farmer’s still support livestock development. Agriculture land has potential as feed source from pastures and agriculture by product.

4.4.2. Availability of Feed

The carrying capacity of feed availability is the ability of a region to produce or to provide feed in the form of pasture forage, paddy straw, and maize straw that can accommodate the needs of a population of beef cattle without any treatment. Analysis of the availability of forage based on the status of forage carrying capacity and Carrying Capacity Index (CCI).

Table 7 shows that the total carrying capacity of feed availability in Tanah Laut Regency was 102,808.70 AU, the population is 57.115.8 AU, stock while the feed requirements were 130.224.02 AU. Overall Tanah Laut Regency was able to meet the needs of livestock feed.

The sub-districts that have the highest carrying capacity were sub-district of Jorong (18,742.72 AU), Penyipatan (13,525.92 AU), Kintap (13,315.13 AU), and the sub-district of Pelaihari (12,756.73 AU) and the areas with the low carrying capacity was sub-district of Bumi Makmur (2,168.36 AU). The sub-districts with the highest level of carrying capacity of feed availability have an opportunity as a center for livestock development. While the feed requirements in Bumi Makmur sub-district that has the lowest carrying capacity of (2,168.36 AU), with a population of livestock (131.6 AU) can be met by supplied from other nearby places.
Table 7. Carrying Capacity Index of Forage Availability Level in Tanah Laut Regency

<table>
<thead>
<tr>
<th>Sub-district</th>
<th>Population (ST)</th>
<th>Dry Matter Needs (Population/ton)</th>
<th>Total feed production. (DM)/ton/year</th>
<th>Carrying Capacity</th>
<th>Carrying Capacity Index</th>
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</thead>
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<td>4,192.69</td>
<td>12,269.69</td>
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<td>Bajuin</td>
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<td>5,886.05</td>
<td>17,530.98</td>
<td>7,689.02</td>
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<td>Bumi Makmur</td>
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<td>300.05</td>
<td>4,943.88</td>
<td>2,168.36</td>
<td>11.53</td>
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<td>Batu Ampar</td>
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<td>28,631.99</td>
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<tr>
<td>Jorong</td>
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<td>2,006.17</td>
<td>9,381.48</td>
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<td>Number</td>
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<td>130,224.02</td>
<td>234,403.91</td>
<td>102,808.70</td>
<td>1.80</td>
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Source: Result supervised classification

To determine the ratio between the feed carrying capacity and cattle population, it is done by the calculation of the index of feed carrying capacity. Index Carrying Capacity Index (CCI) of feed is the ratio between the amounts of feed available (AU) by the number of beef cattle population (AU) in certain area. This value shows the ability of area to increase the number of livestock. Feed CCI is categorized into three criteria: low criteria, which means the area has a relatively low carrying capacity of the feed and the region can no longer increase the number of livestock, moderate criteria means that the region can still increase the number of livestock in the region, and high criteria means the region has a high carrying capacity of the feed and the region is highly recommended to increase the number of livestock.
Based on Figure 6, it is known that the feed CCI with high criteria was Bumi Makmur sub district (11.53). The moderate CCI were located in sub district of Kurau (3.27), Jorong (2.70), Bajuin (2.08), Bati-bati (2.05), Kintap (1.69), Batu Ampar (1.08), Tambang Ulang (1.02), Penyipatan (0.99), Pelaihari (0.97) and Takisung (0.47).

The CCI of Bumi Makmur sub district illustrates that the region has a high feed CC and it can be recommended to increase the number of livestock or as a center for the development of beef cattle in Tanah Laut. Table 8 shows the Bumi Makmur sub district has 131.6 AU, while the CC 2,168.36 AU. Sub district that have high CCI can supply feed to the sub district with medium or low CCI. From the total of the 11 sub district in Tanah Laut Regency, 10 sub district showed the moderate CCI, i.e. Kurau, Jorong, Bajuin, Bati-bati, Kintap, Batu Ampar, Tambang Ulang, Penyipatan,
Pelaihari and Takisung. They are able to increase the number of livestock. In table 7, the sub district Bajuin with feed CC (19,820.71 AU) associated with the livestock population (1,312.00 AU) still allows an increase of population (18,508.71 AU). Generally this explains that the potential feed source in Tanah Laut Regency is sufficient.

Based on the analysis of the CC with cattle population, it is known area that has ability to increase the number of beef cattle population. Tanah Laut Regency with the feed CC of 102,808.70 AU and cattle population of 57,115.8 AU is able to increase the population with addition of 45,692.9 AU.
V. CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusions

The conclusions of this study can be drawn as follow:

a. The potential land and which become a priority for the source of animal feed in Tanah Laut Regency consists of 72,902.29 ha of pasture (6,324.24 ha), maize field (25,622.01 ha), and paddy field (40,956.04 ha). The highest areas for feed source are Penyipatan (16.28%), Jorong (15.13%), and Pelaihari (16.28%). The smallest area Bumi Makmur (3.85%).

b. The highest carrying capacity (CC) was Jorong sub district (18,742.72 AU), Penyipatan (13,525.92 AU) and Kintap (13,315.13 AU). While the lowest CC was Bumi Makmur (2,168.36 AU).

c. Based on the carrying capacity index (CCI) Bumi Makmur was classified as high CCI (11.53), ten sub-districts with moderate criteria (Kurau sub-district (3.27), Jorong sub-district (2.70), Bajuin sub-district (2.08), Bati-bati sub-district (2.05), Kintap sub-district (1.69), Batu Ampar sub-district (1.08), Tambang Ulang sub-district (1.02), Penyipatan sub-district (0.99), Pelaihari sub-district (0.97), and Takisung sub-district (0.47).

d. Tanah Laut Regency with a CC of 102,808.70 AU and cattle population of 57,115.80 AU, it still allows for the addition of beef livestock populations of 45,692.90 animal unit in Tanah Laut Regency.

5.2. Recommendations

The advice can be given in this study are:

a. To achieve the vision of Tanah Laut Regency as a center of local resource-based livestock production and agribusiness-oriented, a number of beef cattle population in some sub district is possible to improve.

b. Availability of crop by products, palm oil by-product during one year period is needed to be evaluated to guarantee the development of beef cattle population in the region.
REFERENCE


di Dua Kabupaten Tingkat II Purwakarta dan Indramayu. LPM UNPAD. Bandung.


### Appendix 1. Coordinate Points of Landcover

Coordinate Points of Landcover, Tanah Laut regency May 28, 2011

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  PROCESSING_SOFTWARE = "LPGS_11.3.0"
  EPHemeris_TYPE = "DEFINITIVE"
  SPACECRAFT_ID = "Landsat7"
  SENSOR_ID = "ETM+
  SENSOR_MODE = "BUMPER"
  ACQUISITION_DATE = 2010-04-16
  SCENE_CENTER_SCAN_TIME = 02:21:00.0891921Z
  WRS_PATH = 117
  STARTING_ROW = 63
  ENDING_ROW = 63
  BAND_COMBINATION = "123456678"
  PRODUCT_UL_CORNER_LAT = -3.3911672
  PRODUCT_UL_CORNER_LON = 114.1393241
  PRODUCT UR_CORNER_LAT = -3.3951556
  PRODUCT UR_CORNER_LON = 116.2906256
  PRODUCT_LL_CORNER_LAT = -5.2750507
  PRODUCT_LL_CORNER_LON = 114.1322291
  PRODUCT LR_CORNER_LAT = -5.2812645
  PRODUCT LR_CORNER_LON = 116.2888635
  PRODUCT_UL_CORNER_MAPX = 182100.000
  PRODUCT_UL_CORNER_MAPY = -375300.000
  PRODUCT UR CORNER_MAPX = 421200.000
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<td>BAND4_FILE_NAME</td>
<td>&quot;L71117063_06320100416_B40.TIF&quot;</td>
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**END_GROUP = PRODUCT_METADATA**

**GROUP = MIN_MAX_RADIANCE**

- **LMAX_BAND1** = 191.600
- **LMIN_BAND1** = -6.200
- **LMAX_BAND2** = 196.500
- **LMIN_BAND2** = -6.400
- **LMAX_BAND3** = 152.900
- **LMIN_BAND3** = -5.000
- **LMAX_BAND4** = 241.100
- **LMIN_BAND4** = -5.100
- **LMAX_BAND5** = 31.060
- **LMIN_BAND5** = -1.000
- **LMAX_BAND61** = 17.040
- **LMIN_BAND61** = 0.000
1. Dianggap bila gaulan areal seluas karya tulis ini tanpa merencanakan dan menegaskan hal-hal yang menjadi penyebab yang menjadi penyebab yang menjadi penyebab yang menjadi penyebab yang menjadi penyebab.

2. Dianggap bila gaulan areal seluas karya tulis ini dalam bentuk opas tanpa tanpa tanpa tanpa tanpa.

\[
\begin{align*}
\text{LMAX_BAND62} &= 12.650 \\
\text{LMIN_BAND62} &= 3.200 \\
\text{LMAX_BAND7} &= 10.800 \\
\text{LMIN_BAND7} &= -0.350 \\
\text{LMAX_BAND8} &= 243.100 \\
\text{LMIN_BAND8} &= -4.700 \\
\text{END_GROUP} &= \text{MIN_MAX_RADIANCE} \\
\text{GROUP} &= \text{MIN_MAX_PIXEL_VALUE} \\
\text{QCALMAX_BAND1} &= 255.0 \\
\text{QCALMIN_BAND1} &= 1.0 \\
\text{QCALMAX_BAND2} &= 255.0 \\
\text{QCALMIN_BAND2} &= 1.0 \\
\text{QCALMAX_BAND3} &= 255.0 \\
\text{QCALMIN_BAND3} &= 1.0 \\
\text{QCALMAX_BAND4} &= 255.0 \\
\text{QCALMIN_BAND4} &= 1.0 \\
\text{QCALMAX_BAND5} &= 255.0 \\
\text{QCALMIN_BAND5} &= 1.0 \\
\text{QCALMAX_BAND61} &= 255.0 \\
\text{QCALMIN_BAND61} &= 1.0 \\
\text{QCALMAX_BAND62} &= 255.0 \\
\text{QCALMIN_BAND62} &= 1.0 \\
\text{QCALMAX_BAND7} &= 255.0 \\
\text{QCALMIN_BAND7} &= 1.0 \\
\text{QCALMAX_BAND8} &= 255.0 \\
\text{QCALMIN_BAND8} &= 1.0 \\
\text{END_GROUP} &= \text{MIN_MAX_PIXEL_VALUE} \\
\text{GROUP} &= \text{PRODUCT_PARAMETERS} \\
\text{CORRECTION_METHOD_GAIN_BAND1} &= \text{"CPF"} \\
\text{CORRECTION_METHOD_GAIN_BAND2} &= \text{"CPF"} \\
\text{CORRECTION_METHOD_GAIN_BAND3} &= \text{"CPF"} \\
\text{CORRECTION_METHOD_GAIN_BAND4} &= \text{"CPF"} \\
\text{CORRECTION_METHOD_GAIN_BAND5} &= \text{"CPF"} \\
\text{CORRECTION_METHOD_GAIN_BAND61} &= \text{"CPF"} \\
\text{CORRECTION_METHOD_GAIN_BAND62} &= \text{"CPF"} \\
\text{CORRECTION_METHOD_GAIN_BAND7} &= \text{"CPF"} \\
\text{CORRECTION_METHOD_GAIN_BAND8} &= \text{"CPF"}
\end{align*}
\]
CORRECTION_METHOD_BIAS = "IC"
BAND1_GAIN = "H"
BAND2_GAIN = "H"
BAND3_GAIN = "H"
BAND4_GAIN = "L"
BAND5_GAIN = "H"
BAND6_GAIN1 = "L"
BAND6_GAIN2 = "H"
BAND7_GAIN = "H"
BAND8_GAIN = "L"
BAND1_GAIN_CHANGE = "0"
BAND2_GAIN_CHANGE = "0"
BAND3_GAIN_CHANGE = "0"
BAND4_GAIN_CHANGE = "0"
BAND5_GAIN_CHANGE = "0"
BAND6_GAIN_CHANGE1 = "0"
BAND6_GAIN_CHANGE2 = "0"
BAND7_GAIN_CHANGE = "0"
BAND8_GAIN_CHANGE = "0"
BAND1_SL_GAIN_CHANGE = 0
BAND2_SL_GAIN_CHANGE = 0
BAND3_SL_GAIN_CHANGE = 0
BAND4_SL_GAIN_CHANGE = 0
BAND5_SL_GAIN_CHANGE = 0
BAND6_SL_GAIN_CHANGE1 = 0
BAND6_SL_GAIN_CHANGE2 = 0
BAND7_SL_GAIN_CHANGE = 0
BAND8_SL_GAIN_CHANGE = 0
SUN_AZIMUTH = 63.7942392
SUN_ELEVATION = 57.2670288
OUTPUT_FORMAT = "GEOTIFF"
END_GROUP = PRODUCT_PARAMETERS
GROUP = CORRECTIONS_APPLIED
STRIPING_BAND1 = "NONE"
STRIPING_BAND2 = "NONE"
STRIPING_BAND3 = "NONE"
STRIPING_BAND4 = "NONE"
STRIPING_BAND5 = "NONE"
STRIPING_BAND61 = "NONE"
STRIPING_BAND62 = "NONE"
STRIPING_BAND7 = "NONE"
STRIPING_BAND8 = "NONE"
BANDING = "N"
COHERENT_NOISE = "Y"
MEMORY_EFFECT = "N"
SCAN_CORRELATED_SHIFT = "N"
INOPERABLE_DETECTORS = "N"
DROPPED_LINES = "N"
END_GROUP = CORRECTIONS_APPLIED

GROUP = PROJECTION_PARAMETERS
REFERENCE_DATUM = "WGS84"
REFERENCE_ELLIPSOID = "WGS84"
GRID_CELL_SIZE_PAN = 15.000
GRID_CELL_SIZE_THM = 30.000
GRID_CELL_SIZE_REF = 30.000
ORIENTATION = "NUP"
RESAMPLING_OPTION = "CC"
SCAN_GAP_INTERPOLATION = 2
MAP_PROJECTION = "UTM"
END_GROUP = PROJECTION_PARAMETERS
GROUP = UTM_PARAMETERS
ZONE_NUMBER = 50
END_GROUP = UTM_PARAMETERS
END_GROUP = L1_METADATA_FILE
END