



The Husbandry Development Potential by using the Agrosilvopastoral Model as Spatial Analysis Approach in West Sumatera

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ABSTRACT

The agrosilvopastoral model is as an application which can utilize a potential in some sub-sector agricultural in a district efficiently and sustainably. In the husbandry development sustainability by using the agrosilvopastoral model which it can have been realized if the husbandry development is regionally oriented and based on a nature source in the district. This study aims to analyze for the husbandry development potential by using it in West Sumatera. This research is a spatial analysis method. The data is quoted from a secondary special data at the Central Statistics Agency in West Sumatera Province. This research will result a nature source readiness to build the farms by using the agrosilvopastoral model to get through the data exploration based on the locations where have been displayed in the Geographic Information System (GIS).

Key words: Husbandry development, Agrosilvopastoral, Spatial analysis

The husbandry is called as a livestock sector; it is an important rule of an economy growth and development, especially in the rural areas in Indonesia. GDP growth also shows a positive trend in sub-sector the husbandry, where it grew about 3.83% in 2017. Yet, the formation for Indonesia's Gross Domestic Product (GDP) as contribution of sub sector the husbandry was 1.57 % only from the National GDP of 2017. Such a “the GDP formation of the agricultural sector in 2017, subsector the husbandry was contributed and expected to 15.87 %. In addition, this sector can also absorb some laborers directly and indirectly. The observation data was from the National Labor Force (Sakernas) namely the Central Statistics Agency that it had employed 3.84 million laborer forces on August 2017, who had been worked in sub-sector the livestock or husbandry Sub-sector the husbandry had been contributed to absorb 11.51 % laborer forces from the agricultural sector. Meanwhile, amount of the national laborer forces and sub-sector the husbandry was contributed 3.17%. That contribution was looked like still small when compared by the public demand for feed from the husbandry products. To get the fresh beef can be fulfilled 60.9% for the beef from a domestic. An availability of the local beef production had

not been sufficient to fulfill national needs in 2018 yet. The availability of the beef cattle and beef for the domestic was about 98 % based on the small holders' breeding.

To fulfill the domestic meat need and it's achievement of a national animal protein sufficiency, by accelerating and increasing to the cattle or buffalo population is really needed. The matter is a certainly opportunity, and also challenging the husbandry development in realizing of the national food secure affair. There have been some efforts and models to be done for them such as” the organic farming system, integrated farming, integrated pest control, and LEISA (Low External Input Sustainable Agriculture) (Salikin 2003). The Agrosilvo pastura is a sustainable agriculture model but it had long been applied in Indonesia. Whereas the agrosilvopastoral system is an alternative model which increases production by utilizing as source energy continuously this is achieved by making a combination of three main components namely forestry, agriculture, and husbandry (Budiasa 2011). The agrosilvopastoral model will strengthen the capacity, productivity and sustainably biodiversity usage in the husbandry sector.

In many agro forestry decades have experienced a significant development recently in Latin America and South America (Soler *et al.* 2018). The traditional agrosilvopastoral system has become an important component of the agricultural and livelihood system of

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thousands of ethnic minorities on the mainland in the Southeast Asia's highlands such as Northern Thailand and Northern Laos (Choocharoen *et al.* 2014). There is a new project promoting into the kind of Agrosilvopastoral practices for raising the husbandry in Mexico. Indonesia, especially in the province of West Sumatra, the Agrosilvopastoral model has long been applied and even become a tradition by the community. As like Minangkabau's proverbs (West Sumatera), *bumi sanang padi menjadi, padi masak jaguang maupia, taranak bakambangbiak*. This means that the community has implemented farming and integrated with agriculture in West Sumatera. They work as farmers, to plant trees on their lands. They use the agricultural waste to feed their husbandries and also use manures to fertilize their agricultural lands. This farmland is surrounded by shady forests. This means that the farming community has already had a local knowledge about the agrosilvopastoral model. This is a great potency for the animal husbandry development in West Sumatera. Therefore a potential development study of the agrosilvopastoral model is needed so much. The government is as a policy maker, it properly needs a spatial analysis to develop the agrosilvopastoral model. The government must know about locations which have the development potentials.

Analysis of the development potential in an area, it is a basic capital to drive a development process in the area (Sjafrizal 2016). To see it in the future development, the spatial approach is needed to answer about the location where the development should be done (Tarigan 2016). That is why so many economists are interested in the location study problems (Krugman 1995).

The government requires the spatial analysis that is equipped with maps to facilitate and strengthen the analysis (Tarigan 2016). One of the trends in this new paradigm is used by a Geographic Information System (GIS). It is very useful for identifying the construction sites and knowing which areas of the development tend to be grouped spatially (Kuncoro 2018). The GIS transforms the data into information and performs the output in order to support a decision taking (Juppenlatz and Tian 1996). The GIS ability is as a tool in storing, analyzing, mapping and modeling which almost has encouraged all knowledge disciplines to use it and also included in the agricultural sector. In the husbandry sector, the regional potential analysis based on the spatial approach is needed. Formulation of a development plan in it is more feasibly and depicted (GIS) geographically, it is really needed. Well-documented information that only can help to develop the husbandry development plan is still lacking in West Sumatra and this study is trying to fill this observation gap.

MATERIALS AND METHODS

This research is a spatial approach study using the Geographic Information System. It is conducted for all districts and cities in West Sumatera. The data are used in this research from the secondary data what obtained by West Sumatera's publication in (West Sumatera Central Statistics

Agency). The variables are observed in this research like the area width of paddy and non paddy fields (the wide plantation areas, fields, and lands are temporarily not cultivated), the plantation land area width, it is planted with the community's forest trees and pasture land. That is the harvest and crop, horticultural production (production of fruits and vegetables) even more as the husbandry consumption and population. This data was collected in the last five years, namely from 2013-2017 for all districts and cities in West Sumatera. 19 districts and cities were consisting of 12 districts and 7 cities in West Sumatera.

The data were analyzed more descriptively, quantitatively and supplemented by the spatial analysis using in the Geographic Information Systems (GIS). A computer system used for acquisition and verification, compilation, storage, change management and exchange, manipulation, calling and presentation, and geographical data analysis. The computer system used to capture, store, examine, integrate, manipulate, analyze, and display data, related to the position on the earth surface. In addition, the Geographic Information System also has the meaning as an information system created to work by using data that belong to the spatial reference or geographic coordinates. The spatial analysis is a spatial based on area part which covers the potential of an area, the types of land is still available and the ecological function of the region and easily accessible through today's communication network.

On this research will be designed a prototype of the Geographic Information System (GIS) which can done for a map more accurately about the husbandry development through the agrosilvopastoral approach in West Sumatera. According to Duran (2003) suggested the steps for designing the prototype in it GIS as follows are:

- Installing supporting tool of Map Server, IDE/Text editor and Installing Applications Quantum GIS
- Doing for the area of observing and researching, especially West Sumatera
- Determining of spatial and non-spatial data in areas in West Sumatera region, such as type of husbandry, a number of livestock and years as supporting for local resources
- Doing for tracking spatial data
- Creating database
- Making and connecting web

RESULTS AND DISCUSSION

The agrosilvopastoral model is one of agricultural development model with the various husbandry industries. For the rural communities in West Sumatera, the husbandries are like buffalo, beef cattle, dairy cows, goats, sheep, ducks, ducks or free-range chickens that have a strategic role because these animals can be used as life savings, laborer sources for buffaloes and beef cattle. The husbandry can also be used as a producer of organic fertilizer that is very good for increasing agricultural production, besides it can also be used in an improving social status. The majority of farmers in West Sumatera have adopted the agrosilvopastoral model. West Sumatera's

Husbandry Development Potential by using the Agrosilvopastoral Model

natural resources have the potential to be developed to the husbandry by using it basically.

West Sumatera has a fairly wide area of the agricultural land. The land is used for the paddy field, garden land, field land and temporary land, each of them is not cultivated. The wide land area is started from the largest land area and being mentioned the word line above. The paddy land area in West Sumatra is 230,098 hectares and it is being started from a South Pesisir an, Agam, Lima Puluh Kota, Solok, Tanah Datar, Padang Pariaman and Pasaman. The farm land area widths are begun from Mentawai Island, South Pesisir, Agam, 50 Puluh Kota, Pasaman, Dharmas Raya and Tanah Datar. Thus the farm land areas of starting from the width of South Pesisir, Solok, Mentawai Island, and West Pasaman. The land area was temporarily not cultivated and started from the width of Mentawai Island, South Solok, and Solok. The largest area of pasture land is Solok, South Pesisir, Sijunjung and 50 Puluh Kota. Based on this condition, it can be concluded that regions that have the potential to develop the agrosilvopastoral model in West Sumatera when viewed from the potential to use of the agricultural lands are South Pesisir, Agam, 50 Kota, Mentawai Islands, Tanah Datar, Padang Pariaman and Solok.

West Sumatera was a producer of paddy 2,824,509 tons of in the last year in 2017. This is produced from areas that started from the highest are Agam, Pesisir Selatan, Solok, Padang Pariaman, Tanah Datar, Pasaman and Lima Puluh Kota. West Sumatra can also be said that it has a lot of enough corn production which was 985 847 tons in the last data 2017 (Fig 1). The corn production of five states is very high such as West Pasaman, Pesisir Selatan, Agam, Solok Selatan, and Padang Pariaman. These states also have the production of soybean, cassava and sweet potato which can be used as animal feed for their wastes.



Fig 1 Geographic Information Systems for Agricultural and Husbandry Production In West Sumatera

West Sumatera also has a great potential for the horticultural crop. The largest horticultural products are fruits, including vegetables and ornamental plants. The vegetable production in West Sumatera is dominated by cabbage, tomato, shallot, chilies and potatoes. Other commodities feel experiences to increase to the tomatoes

productions were (8.35 %), shallots (43.57 %), chili (39.96 %), and cabbage (2.14 %). West Sumatera Province was the most fruit production in 2017 such as banana, orange, passion fruit, avocado, durian, and papaya. If those were compared with the production in 2016, that all those commodities felt that the fruit of durian experienced the largest production increase 69.85 %, also included mangos 47.80 %, and papaya 32.25 %. But the banana production decreased 0.71 %. The horticultural producing areas derived from vegetables are the districts of Solok, Tanah Datar, Limapuluh Kota, South Solok, South Pesisir and Agam. Whereas the districts of the fruit producing are being observed from the largest districts are like Agam, Solok, Padang Pariaman, Lima Puluh Kota. South Pesisir and Tanah Datar (Fig 2).

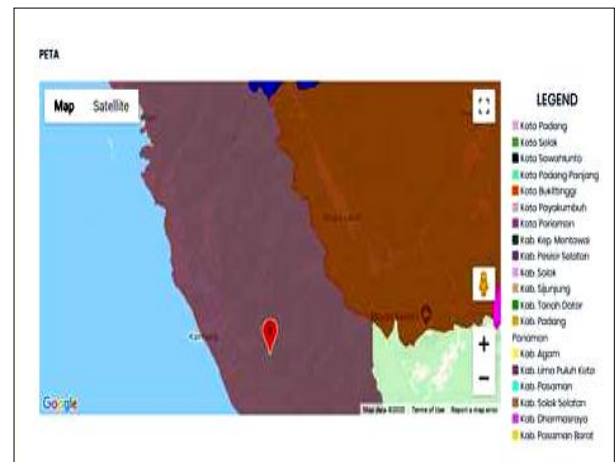


Fig 2 Geographic Information Systems for Agricultural and Husbandry Production in One District

West Sumatera has a large forest area where been protected with the forest area, the nature reserve forest, the limited production and permanent production forest was in 2017 respectively amounted of 769,774 hectares, 782,970 hectares, 227,226 hectares, and 360,677 hectares. The forest was planted with logs with a production of 110,818.11 M3, manau trees 213,000, pine sap 1,187,241 kg and tebu trees 30,000. West Sumatera also has the extensive plantations where their management can be broadly divided into the community plantations, large private plantations, and PNP or PTP plantations. The biggest plantation commodities are the oil palm and rubber in West Sumatera. Both the oil palm and rubber plantations are the most cultivated by the people in Dharmasraya and West Pasaman

West Sumatera has a diverse and the largest husbandry population; it is as the number of beef cattle, goats and buffalo. In 2017, it may be amounted of 393,481 tails, 255,463 tails and 110,236 tails respectively (Figure 3). Poultry meat production in 2017 was recorded at 40.90 thousand tons, an increase to 21.40 % compared to the previous year. The beef production in 2017 decreased to 23.58 % compared to 2016 meanwhile the goat meat production increased, but the buffalo meat decreased

compared to 2016 with an increase in the goat meat to 8.58 % and buffalo meat decreased to 1.15 %.

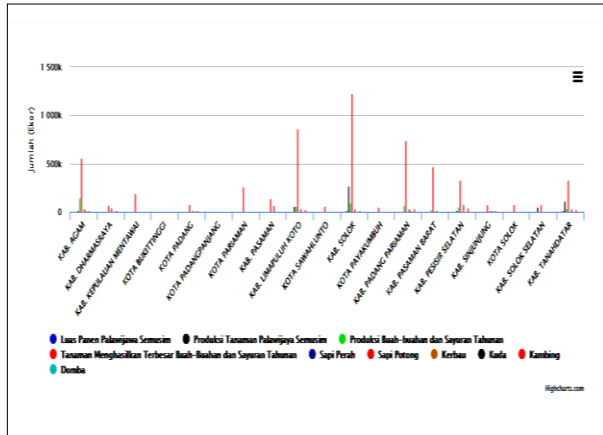


Fig 3 Graph of Agricultural and Husbandry Production in GIS Applications In West Sumatera

The largest beef cattle population is the districts of South Pesisir, Pasaman, Dharmas Raya, 50 Kota, Padang Pariaman, Solok, Agam and Tanah Datar. The most sequential buffalo populations are Agam, Sijunjung, Padang Pariaman, Lima Puluh Kota, and Tanah Datar. The largest number of goats and sheep is the South Pesisir, Padang Pariaman, Tanah Datar, 50 Kota, Padang City, Solok and Agam. The largest population of dairy cows is Padang Panjang, Agam, Padang, Limapuluh Kota, Tanah Datar, Bukittinggi and Padang Pariaman. The highest horse population is in the districts of Solok, Payakumbuh, Bukittinggi, Padang and Agam.

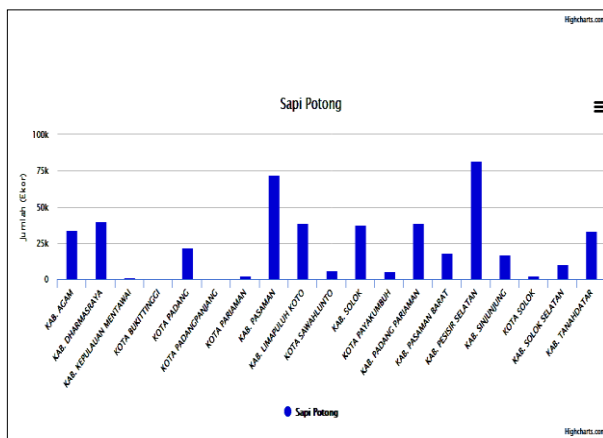


Fig 4 Graph of Beef Cattle Production in GIS Applications in West Sumatera

The largest population of beef cattle, goats and sheep are in the South Pesisir District (Fig 4). If we associate with the agricultural potential in the category of agricultural land usage, it is a real turned out to be the area with the largest agricultural land usage in West Sumatera, especially the extensive usage of paddy fields, and farms. The Use for

grazing land and maize production are the second largest population. From this data can be interpreted that the success of beef cattle, goat and sheep farms in the South Pesisir District is caused by farmers using in the agrosilvopastoral model. The breeders raise cattle, goats and sheep by utilizing the results of agricultural waste originating come from the waste of paddy fields, farms, gardens and pasture fields and corns. But their husbandry businesses are still in small scales where they only keep 1-5 husbandry only. Therefore, the agrosilvopastoral model based on the farms in the South Pesisir, it needed to be improved continuously so that the husbandry population increases to the maintenance of a semi-intensive and extensive system because the pasture is quite extensive.

Yet the contrasting results are obtained from this spatial analysis, both Agam and Solok districts. When viewed from the agriculture potential, this area has the considerable agricultural potential, namely from the categories of agricultural land use and horticultural production. Agam District is an area with a fairly large agricultural land use category that is the second largest paddy field area with the highest population of rice production in West Sumatera. Besides that, it has the largest area of orchards, fields and corn production. Even more Agam district has the highest number 01 of fruit production. But the number of beef cattle, goats and sheep are number 7; this means that the great agricultural potential has not been utilized for the development of beef cattle, goats and sheep yet. However the farming community in Agam has succeeded to develop the buffalos and cows where the buffalo populations are number 1 and dairy cow number 2. Therefore, the agrosilvopastoral application is based on the animal husbandry needs to be greatly improved in Agam district, especially the cattle, goats and sheep farming are with a semi-intensive or full intensive system because its pasture land is quite lacking. It is along with the increase to the buffalo and dairy farming.

The same thing is as also found in Solok district where the agricultural potential in Solok district is quite large but the development of ruminant farms was underdeveloped especially the cattle, goat, sheep and buffalo farms. Solok district has the most vegetable production and the second most fruit production besides quite a lot of rice production. Mentawai district is also an area with the relatively underdeveloped husbandry even though the area of agricultural land is quite large.

Based on the results of spatial analysis also obtained, there are also many cattle populations in Dharmas Raya and Pasaman district. This is supported by the large potential of the oil palm and rubber plantations in the area. 50 Kota and Tanah Datar districts are relatively balanced between the agricultural potential and animal husbandry development. But the improvement is also needed.

South Pesisir district as a district which is successful in the implementing husbandry based on the agrosilvopastoral model where the considerable agricultural potential also offset with the high husbandry development level, especially for cattle, goats and sheep. This is supported by a broad

pasture. Therefore, it is better to develop the husbandry with a semi intensive maintenance system. But the districts of Agam, Solok and Mentawai Island have had the contrasting results. Both of these regions have the considerable agricultural potential but the development of ruminant farms is underdeveloped to the cattle, goat and sheep and buffalo farms especially. Something different is found where the districts of Dharmas Raya and Pasaman have quite a large cattle number, but this is supported to the potential for the large enough oil palm and rubber plantations in the area. Lima Puluh Kota and Tanah Datar districts are relatively balanced between the agricultural potential and husbandry development. But the improvement is also needed. The suggestion are as:

- The government is hoped to give a priority to the animal husbandry development in those areas that have the great potentials for the animal husbandry development based on the agrosilvopastoral model, such as' the district of South Pesisir, Agam, Solok and

the Mentawai Island. Then continue to Tanah Datar and 50 Kota districts. However South Solok district also needs for attention.

- It is necessary to increase the business scale of farmers with the agrosilvopastoral model
- It is necessary to improve the technology of animal feed processing that comes from the agricultural waste, such as the waste rice, the corn, the cassava, especially the vegetable and fruit waste which are still relatively lacking.

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