

A TYPOLOGY MODEL OF POPULATION GROWTH CHARACTERISTICS AND LAND LIMITATIONS IN REGENCY AND CITY, WEST SUMATRA PROVINCE - INDONESIA

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ABSTRACT: The objectives to be achieved through this study are to 1) Analyze the limitations of land for the cultivation of regencies and cities in West Sumatra Province; 2) Model regional typologies based on indicators growth of population with limited district and city land in West Sumatra Province; and 3) Attract the implications of the typology of the region on population policies in West Sumatra. This study uses descriptive analytical methods and the nature of this research is explained which aims to test various indicators in the study. From the results of the study, it was explained that the high rate of growth population was caused by the high fertility rate in West Sumatra as a result of the pressure on the land or the reduced land index. The existence of pressure on the land and a low land index (insufficient) will have an impact on the ratio of the number of poor people in the regency/city in West Sumatra as happened in Solok city, Bukittinggi city, Padang Panjang city and Payakumbuh city. The implication of population policy for the city of Sawahlunto and Pariaman is how to maintain low population growth, while other cities how to reduce the rate of population growth.

Keywords: *Land index, Poor population, Total Fertility Rate (TFR), Regional typology.*

1. INTRODUCTION

West Sumatra Province is located between 0°54' North Latitude to 3°30' South Latitude and 98°36' to 101°53' East Longitude, has an area of 42,297.30 Km² with a population of 4,846,909 million in 2010. The administration is divided into 12 (twelve) regencies and 7 (seven) cities. The Province of West Sumatra has various forms of landscapes, ranging from coastal landscapes, lowlands, hills, to mountainous highlands [1-3]. Where the shape of the region is divided into: flat area of 578,000 ha (13.41%), flat wavy area of 186,000 ha (4.31%), wavy area of 316,000 ha (7.33%), hilly area of 964,000 ha (22.36%), and has an area of 2,267,000 ha (52.59%). More than half the land area is the plateau of the Bukit Barisan mountain range which divides the Province in the north-south direction [4-6].

[4] [7] added that land use for cultivation development in West Sumatra Province was relatively limited. Land with slopes of more than 40% reaches an area of 1,650,918 ha (39.03%). The area of the forest reaches 2,599,386 ha (61.46%) which is divided into protected forest areas covering an area of 1,756,608 ha and production forest covering an area of 842,778 ha. The total area of protected areas in West Sumatra Province reaches an area of 1,910,679 ha (45.17%). Only 54.83% of the land in West Sumatra

Province can be cultivated including production forest areas. In his research [7] [8] although cultivation land in West Sumatra province was limited but population growth in several census periods showed an increase with a fluctuating growth rate. If in 1971 there were 2,793,196 people, in 2010 it was nearly double that of 4,846,909 million people.

One reason is the high fertility rate. The fertility rate of West Sumatra based on the *Indonesian Doctors Competency Standard* (SKDI) 2007 is 3.4 while the national average is 2.6 [9]. Although one of the people's behaviours is the culture of migrants, but with high fertility rates while the area of cultivated land, especially for agriculture, is increasingly limited, it will cause higher population pressure on land in the future. This is important because the majority of the population with livelihoods in the agricultural sector in the West Sumatra Province is still dominant. Including in urban areas the population with livelihoods in the agricultural sector is still significant in number [10] [11].

The background of this research is to model regional typology based on indicators of conditions of limited land for aquaculture and population development in the regency and city of West Sumatra Province. Furthermore, identifying the implications for population policy and program priorities with the objectives to be achieved in this

study are as follows: 1) Analyzing the limitations of land for cultivation activities of regency and city in West Sumatra Province; 2) Modeling regional typologies based on indicators of population development with limited regency and city land in West Sumatra Province; and 3) Attract the implications of the regional typology on population policies in West Sumatra.

2. RESEARCH METHODS

This research is based on available secondary data. The indicators in this study are: 1) The population growth rate of West Sumatra Province obtained by analyzing population census data from 2000-2010. In areas which were divided in the span of the year population data were used starting from the time of division; 2) Characteristics of the population identified, i.e: *Total Fertility Rate* (TFR) and the ratio of the number of poor population; 3) Limited land is measured by the standard of availability of land for cultivation activities. Availability of land is the area of land that can be utilized by residents for certain activities. Adequacy the availability of land is measured by the land availability index which is a comparison between the land area that can be utilized with the population in the sector that uses the land [12] [13]. From the land availability index, it can be seen the limitations of land use and pressure on land due to population growth. Because the population and the dominant land area are in the agricultural sector and small portion of mining, the population counted is the population working in the agricultural and mining sectors and the calculated land area is the cultivation area. The regional typology based on indicators of population growth, population characteristics and land availability are made by making a matrix of relationships between indicators and attracting categorization of problems [14] [15].

3. RESULTS AND DISCUSSION

3.1 Population Pressure Against Land

Each region has carrying capacity, namely the maximum capacity of the environment to be empowered by humans or in other words, a population that can be supported indefinitely by an ecosystem without damaging the ecosystem [13] [14]. There is a maximum number of residents that can be accommodated so that the area can support life. Indicators that can show how population pressure against land is associated with limitations or constraints on the number of lands that can be cultivated in West Sumatra Province.

3.1.1 Net population density

Net population density is the total population divided by the total area. From the table, it can be seen that the population density from 2000 to 2010 has increased with a ratio of 1 to 1.14. This means that if in 2000 an area of 100 ha of land in West Sumatra Province was inhabited by 100 residents then in 2010 it would increase to 114 people living in an area of 100 ha. this indicates that there was an increase in population pressure on land in 2010 compared to 2000, with an increase in the population of 14 people on every 100 ha of land.

3.1.2 Population density agriculture

With the characteristics of farming land constraints due to limited cultivated land in the province of West Sumatra then if viewed by density clean or agrarian population density (population divided agrarian sector of agricultural cultivation land area) in 2000, namely 1.82 (mean 100 ha of agricultural land to accommodate 182 people who are active in the agricultural sector). This is almost double if we compare it to the gross or gross population density of West Sumatra (the total population of West Sumatra is divided by the area of West Sumatra). The population density of the agricultural sector in 2010 increased to 2.08. Increasing the population density of the agrarian sector in West Sumatra Province more clearly shows the increasing population pressure on land in West Sumatra Province.

3.1.3 Carrying capacity regional index

Based on the characteristics of the area of West Sumatra Province, where most of the population works in agriculture, it can be seen that the population pressure on the land is getting higher. If you use the Sumarwoto concept [16] [17]. From the Sumarwoto formula, the amount of carrying capacity of the region of West Sumatra Province is obtained, with the limited space available, which can only accommodate 4,638,102 people. Assuming that the majority of the population moves in the agricultural sector and there is no transformation of population activities from primary to secondary and tertiary, then when compared with the population of 2010 which numbered 4,827,973 people, there has been an excess capacity in the West Sumatra Province. This means that there is an increasing population pressure on the land.

3.1.4 The relationship between limited land and poverty level

The larger population with limited land available causes less distribution of land received by the population resulting in population poverty. Some regencies such as Solok regency, Pasaman regency, Pesisir Selatan regency have a very small proportion of cultivation areas, i.e less than half

the administrative area, which are 17.91%, 16.12%, and 41.34% respectively. If it is associated with the number of poor families in this regency, it is

high, which are respectively 11.74%, 10.97%, and 10.22% above the average of West Sumatra Province which is equal to 9.44% (Table 1).

Table 1. The condition of the regency/city based indicators growth population, TFR, and land availability index

No	Regency/ City	The number of poor population (%)		The growth of population (%)		TFR 2008		Land index		The conclusion of regional conditions
Regency										
1	Kepulauan Mentawai	19,77	T	2,25	T	3,69	T	16,00	T	% High poverty rate; High growth population; High TFR; and high land index
2	Pesisir Selatan	10,22	R	0,91	R	2,73	R	2,47	T	
3	Solok	11,74	T	0,81	R	3,2	T	0,85	R	
4	Solok Selatan	11,11	T	2,02	T	*	T	4,83	T	
5	Sijunjung	10,45	R	1,92	T	2,86	T	2,60	T	
6	Dharmasraya	10,57	T	3,07	T	*	T	5,64	T	
7	Tanah Datar	6,9	R	0,33	R	2,63	R	1,19	R	
8	Padang Pariaman	11,86	T	0,71	R	2,95	T	1,27	R	
9	Agam	9,85	R	0,91	R	2,86	T	2,15	T	
10	Limapuluh Kota	10,48	R	1,10	R	2,69	R	5,34	T	
11	Pasaman	10,97	T	1,23	R	3,29	T	1,43	R	
12	Pasaman Barat	9,59	R	2,32	T	*	T	3,28	T	
Regency		10,48		1,23				2,95		
City										
1	Padang	6,31	R	1,56	T	2,14	R	1,11	R	% High poverty rate; High growth population; High TFR; and high land index
2	Solok	7	T	2,11	T	2,76	R	4,04	T	
3	Sawahlunto	2,48	R	1,10	R	2,58	R	3,23	T	
4	Padang Panjang	7,59	T	1,58	T	2,49	R	1,78	R	
5	Bukittinggi	6,82	T	1,91	T	2,58	R	3,20	T	
6	Payakumbuh	10,58	T	1,77	T	2,48	R	0,73	R	
7	Pariaman	5,9	R	1,34	R	2,59	R	1,12	R	
City		6,67		1,38				1,39		
West Sumatra		9,44		1,33		2,79		2,85		

Source: Results of research analysis from Agency of Statistic Center (BPS).

Although population poverty is influenced by various other factors such as the level of economic development or isolation, but there is a tendency for patterns of relations between limited land and population poverty.

3.2 Characteristics of Population Development and Land Limitations in Regency and Cities

This section will describe the regency and city typologies based on indicators of the number of poor people, growth population rates, TFR, and land availability index (indicating the availability of land calculated based on the area designated as agricultural cultivation divided by the total population of agriculture). Assessment indicators are as follows:

- 1) For the autonomous regions, the figure is expected to follow the district TFR parent before the separation.
- 2) Rate category of high-low TFR popularity ratings than the average of West Sumatra Province.
- 3) Evaluation of the category of high and low number of poor people, growth population based on assessment compared to the average regency or city to see its relative comparison with the characteristics of the same area.
- 4) Land index based on the availability of land for cultivation. Height: The average tenure of farmers Less (<2 ha) Low: The average farmers' land ownership Fair (≥ 2 ha).

To see more clearly the regional grouping based on indicators of the following will be presented typology matrix linking between the two

indicators. From the grouping based on visible grouping patterns, findings can be drawn.

3.2.1 The relationship between the land index and regency/city growth population

From regency grouping (Table 2), the findings that can be drawn are:

- 1) The area with the availability of cultivated land are still wide/sufficient with high growth population there is in the area that became centres of plantations such as Mentawai District, Solok Selatan, Sijunjung, Dharmasraya, Pasaman Barat. Although the land is still insufficient to meet the needs of aquaculture but future land pressures will be higher.
- 2) The areas with limited/inadequate cultivation land availability with low growth population are found in Solok, Tanah Datar, Padang Pariaman, and Pasaman. There is a balance between land availability and growth population.
- 3) The area with the availability of cultivated land are still wide/sufficient but with a low growth

population contained in Pesisir Selatan regency, Agam, and fifty cities. There are other factors that the explanation for this phenomenon as the level of economic development. Regions that are relatively well-established and advanced general growth population relatively rapidly.

From cities grouping (Table 3), the findings that can be drawn are:

- 1) Because of the function of the city in the field of non-agriculture, the correlation between the availability of agricultural cultivation land and growth population is weak. However, some things need to be a concern
- 2) Solok and Bukittinggi cities that have extensive agricultural land have high growth population so that the threat to the conversion of agricultural land is high. This will have an impact on the life of the farmer's family. Likewise, the city of Padang, Padang Panjang and Payakumbuh although agricultural land is not too extensive but still will have an impact on family farmers.

Table 2. The relationship between land index by regency growth population

		Cultivation land availability index	
		High (land is still sufficient for agricultural cultivation)	Low (insufficient land for agricultural cultivation)
Regency growth population	High	High potential land pressure: Mentawai, Solok Selatan, Sijunjung, Dharmasraya, West Pasaman	-
	Low	Medium land pressure: Pesisir Selatan, Agam, Lima Puluh Kota	Medium land pressure: Solok, Tanah Datar, Padang Pariaman, Pasaman

Source: Results of research analysis

Table 3. The relationship between land index with the city growth population

		Cultivation land availability index	
		High (land is still sufficient for agricultural cultivation)	Low (insufficient land for agricultural cultivation)
Comparison of city growth population against West Sumatra	High	High potential land pressure: Solok, Bukittinggi	High land pressure: Padang, Padang Panjang, Payakumbuh
	Low	Medium land pressure: Sawahlunto	Medium land pressure: Pariaman

Source: Results of research analysis

3.2.2 The linkages between TFR and regency/city growth population rates

From regency grouping (Table 4), the findings that can be drawn are:

- 1) TFR with the rate of population growth in the district area is alleged to be positively correlated. However, from the data, there are negative correlation findings, namely high TFR but low growth population rates such as those

in Solok, Padang Pariaman, and Agam. It is possible that there are out-of-migration factors as explanations.

- 2) For urban areas, the factor of population migration seems to be important to explain the rate of growth population. This can be seen from the data generally city has a low TFR but high growth population rate.

Table 4. The linkage between the TFR with the regency growth population

		Comparison of regency TFR against West Sumatra Province	
		High	Low
Comparison of regency growth population against West Sumatra	High	The positive correlation: Mentawai, Solok Selatan, Sijunjung, Dharmasraya, Pasaman Barat, Pasaman	-
	Low	The negative correlation: Solok, Padang Pariaman, Agam	The positive Correlation: Pesisir Selatan, Tanah Datar, Lima Puluh Kota

Source: Results of research analysis

Table 5. The linkage between the TFR with the city population growth

		Comparison of city TFR against West Sumatra Province	
		High	Low
Comparison of city growth population against West Sumatra	High	-	The negative correlation: Padang, Solok, Padang Panjang, Bukittinggi, Payakumbuh
	Low	-	The positive correlation: Sawahlunto, Pariaman

Source: Results of research analysis

3.2.3 The linkages between TFR and regency/city land availability index

From regency/city grouping (Tables 6 and 7), the findings that can be drawn are:

- 1) TFR with an index of availability of cultivated land which shows that land is still insufficient / not for agricultural cultivation activities in the regency area will positively correlate. High TFR is thought to correlate with a high land
- 2) High TFR and low land availability index found in Solok, Padang Pariaman and Pasaman.
- 3) Low TFR with a high land availability index found in Pesisir Selatan and Limapuluh Kota.
- 4) For the city, there is no correlation. This is due to the livelihoods of more city residents in the non-agricultural sector.

Table 6. The linkages between TFR and regency index of land availability

		Comparison of regency TFR against West Sumatra Province	
		High	Low
Index availability of land cultivation	High: (the land is still sufficient for agricultural cultivation)	The positive correlation: Mentawai, Solok Selatan, Sijunjung, Dharmasraya, Agam, Pasaman Barat	The negative correlation: Pesisir Selatan, Limapuluh Kota
	Low: (insufficient land for agricultural cultivation activities)	The negative correlation: Solok, Padang Pariaman, Pasaman	The positive correlation: Tanah Datar

Source: Results of research analysis

Table 7. The linkages between TFR and city index of land availability

		Comparison of City TFR against West Sumatra Province	
		High	Low
Index availability of land cultivation	High: (sufficient land for agricultural cultivation)	-	Solok, Sawahlunto, Bukittinggi
	Low: (insufficient land for agricultural cultivation)	-	Padang, Padang panjang, Payakumbuh, Pariaman

Source: Results of research analysis

3.2.4 The linkages between percentage of poor population and regency/city availability index

From regency/city grouping (Tables 8 and 9) the findings that can be drawn are:

- 1) The percentage of poverty with an index of availability of cultivated land is expected to be negatively correlated. If one indicator is high, the other indicators will be low and vice versa. However, there is an unexpected grouping.
- 2) There are districts with a high percentage of poor people but also have a high land

availability index, which means that the land is still sufficient to accommodate population cultivation activities. This is found in Mentawai, Solok Selatan and Dharmasraya. Possible factors that can explain this phenomenon are the factors of territorial isolation because these three regions are located in the outer regions of West Sumatra Province.

- 3) For the correlation city is weak. This is because the poor population of the city is not only livelihood but also non-agricultural agriculture.

Table 8. The linkages between Percentage of poor population and Regency availability index

		Percentage of the poor regency	
		High	Low
Cultivation land availability index	High: (sufficient land for agricultural cultivation)	Mentawai, Solok selatan, Dharmasraya	Pesisir Selatan, Sijunjung, Agam, Limapuluh Kota, Pasaman Barat
	Low: (insufficient land for agricultural cultivation)	Solok, Padang Pariaman, Pasaman	Tanah Datar

Source: Results of research analysis

Table 9. The linkage between Percentage of Poor Population and City land availability index

		Percentage of urban poor	
		High	Low
Cultivation land availability index	High: (sufficient land for agricultural cultivation)	Solok, Bukittinggi	Sawahlunto
	Low: (insufficient land for agricultural cultivation)	Padang Panjang, Payakumbuh	Padang, Pariaman

Source: Results of research analysis

Based on the model above indicators value in each region may be made typology of Regenvy and City area which combines indicators of the

availability/limitations of the land with the characteristics of the growth population problem as shown in Table 10 below.

Tabel 10. Typology of regency/city region in West Sumatra Province

Typology	Characteristics	Regional
Regency		
I	<u>Pressure on land and high population problems.</u> Low land index (inadequate land), high TFR, low population growth, high percentage of poor people	Solok, Padang Pariaman, Pasaman
II	<u>Potential pressure on land and high population problems.</u> High land index (land is still sufficient), high TFR, high growth population. Percentage of poor people in some areas is high.	Mentawai, Solok Selatan, Sijunjung, Dharmasraya, Pasaman Barat
III	<u>Potential pressure on land and moderate population problems.</u> High land index (land is still sufficient), high TFR, low growth population, low percentage of poor population.	Agam
IV	<u>Potential pressure on land and population problems are low.</u> High land index (land is still sufficient), low TFR, low growth population, low percentage of poor population.	Pesisir Selatan, Limapuluh Kota
V	<u>Potential pressure on land and population problems are low.</u> Low land index (inadequate land), low TFR, low growth population, low percentage of poor population.	Tanah Datar

Typology	Characteristics	Regional
City		
I	<u>Pressure on land is high, a high percentage of poor people</u> High population growth, low-high land index, high percentage of poor people	Solok, Bukittinggi, Padang Panjang, Payakumbuh
II	<u>Pressure on high land, the low percentage of poor people</u> High growth population, low-high land index, low percentage of poor people	Padang
III	<u>Potential pressure on land is low</u> The growth population is low, low-high land index, low percentage of poor people	Pariaman, Sawahlunto

Source: Results of research analysis

From the two tables above, for the City of Sawahlunto and Pariaman the policy implications are how to maintain low growth population, while other cities how to reduce the rate of growth population.

4. CONCLUSIONS

From the above research it can be concluded that cultivation land in West Sumatra province is limited but population growth in several census periods shows an increase with a fluctuating growth rate. This is due to the high level of fertility in the Province of West Sumatra. As a result of the high level of fertility and the limited area available, it results in population pressure on the land. Pressure of population on land is increasingly apparent and high based on the level of agricultural density of population because the majority of the population in West Sumatra has livelihoods in the agricultural sector. The excess capacity of the area in West Sumatra Province also shows the high pressure of population on the land. In addition, the large population, while the available land is limited, will have an impact on the share of the population which results in the occurrence of poor people. Areas with high pressure on land, high percentage of poor people High population growth, low land index, high percentage of poor people found in Solok, Bukittinggi, Padang Panjang, and Payakumbuh. Whereas for regions with potential land pressure and population problems, the land index is high (land is still sufficient), TFR is low, population growth is low, the percentage of poor people is low in the Pesisir Selatan and fifty cities.

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