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EFFECT OF ELEVATION AND SLOPE ON FOOD AVAILABILITY IN THE POVERTY AREA IN LEBAK REGENCY, BANTEN PROVINCE

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ABSTRACT

The availability of food in a region is the most important thing for human development. Food is a major problem in poor families. Lebak Regency is a pocket of poverty located in Banten Province. The objectives of the study analyzed (1) spatial pattern of food availability level in Lebak Regency; (2) the relationship between elevation and slope to the area of food availability in Lebak Regency; (3) the relationship of food available to poor families. The method of analysis used in this study is spatial analysis and statistical analysis (Chi-Square). The results conclusion that: first, the high availability of food surplus area spread outside the capital of Lebak Regency. Second, the elevation and slope had no effect on food availability; Third, the poor rural families are concentrated in the southern part of Lebak Regency, while urban poor located in the northern part, especially in the capital of Lebak Regency; Fourth, the relationship between food availability and the percentage of poor families is not significant at $\alpha = 0.05$.

Keywords*: availability of food, elevation and slope, poverty*

A. INTRODUCTION

Food is the primary human need to survive. Therefore, food problems are a top priority in human development. Food availability is the ability of an area to produce its food. Potential resources owned by each region vary, there is a center of food crops while other areas into centers of horticultural crops, plantations, and others. This potential difference in agricultural production is undoubtedly strongly related to particular soil, climate and weather conditions in each region (Food Agriculture Organization, 2000; Rahaviana et al., 2014). Elevation and Slope factors can also influence the planting and production area of rice and crops (Naijia et al., 2017). Food is everything that comes from nature that is processed by a human for the necessities of life.

Food availability measured from the ratio between normative food consumption and the availability of food produced by a region. Normative food consumption obtained by assuming per capita consumption per day is 300 grams per person per day (Munim, 2016). The ratio between normative food consumption and availability is at once a

measure indicating the proportion of the available used for consumption. Because the central portion of daily caloric needs comes from carbohydrate food sources, which is about half of the energy needs per person per day. It used in the analysis of food sufficiency, namely carbohydrates derived from the production of staple food, such as rice, corn, cassava and sweet potato used to understand the level of food sufficiency at the provincial and district levels (Food Agriculture Organization 2000, Suhartono, 2010).

Lebak Regency is a poverty-stricken area located in Banten Province, consisting of 28 districts, divided into 340 villages and five urban villages, the number of low-income families continues to increase. Based on data from BPS in 2010, approximately 50% of all villages classified as poor villages. All villages that are poor are more than 50% of families are poor. Livelihoods dominated by farmers that are> 70% of all the working population (Susilowati, MHD, 2010, 2011, 2012 and 2013). Based on the issue from Susilowati in 2013 the main problem in low-income family (Lim et al., 2014; Purwanto, 2005) environment in Lebak Regency is a food problem. Food availability in this paper assessed from the production of rice, maize, cassava and sweet potatoes to normative consumption. The Government as the party making the decision requires appropriate and accurate data and environmental information to take the policy in handling this food problem efficiently and adequately (Astuti & Musiyam, 2009; Astika, 2010; Blum, 2011).

Insufficient food availability saw in the form of statistical data, but about regional development, the distribution aspect in the space dimension becomes essential. The space dimension of distribution of food insecurity in a location indicated in a geographical position on the surface of the earth often called spatial information, presented in map form. Spatial data and attribute data processed with Geographic Information System (GIS) in digital form, the analysis that can use is spatial analysis and attribute analysis. Spatial data is data related to spatial locations in the form of maps (O'Sullivan & Unwin, 2003; Harley, 2001; Yunus, 2010).

Based on the background then the author wants to analyze; (1) spatial pattern of food availability in Lebak Regency; (2) the relationship between elevation and slope to the area of food availability in Lebak Regency; (3) the

relationship of food available to low-income families.

B. METHODS

1. Research Framework

Lebak Regency is a pocket of poverty located in Banten Province, which has various physical and socio-economic conditions. The main problem in a low-income family environment in Lebak Regency is food. The variables used to achieve the objectives are height, slope, food availability and percentage of low-income families. Normative per capita consumption ratio and food production (rice, maize, sweet potato, cassava) are indicators of food availability in this study.

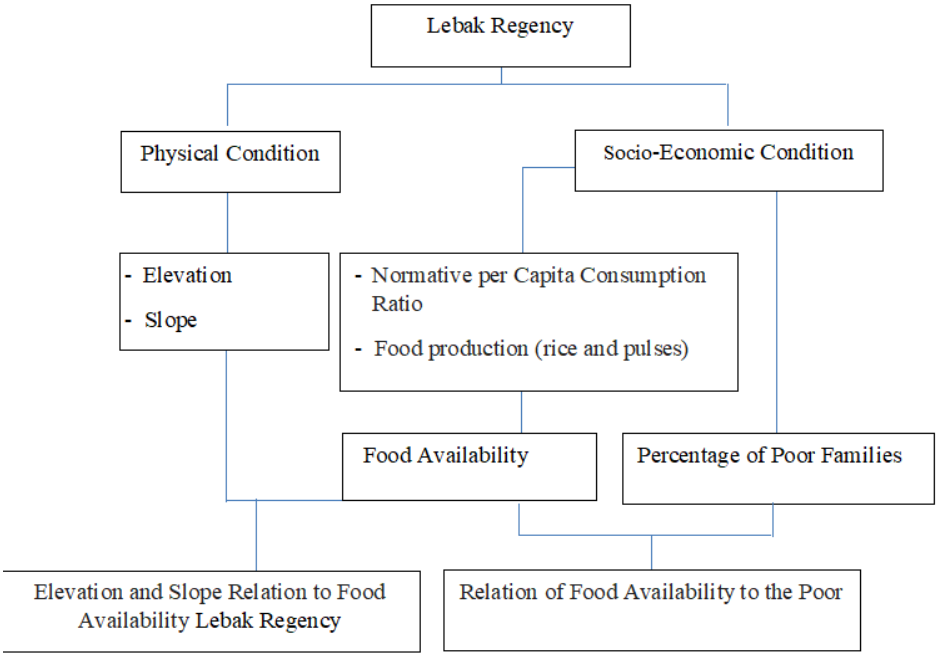

Figure 1. Research Framework

2. Data collection

In this study used: (1) physical data include; elevation and slope; (2) socioeconomic data covering food products such as rice, maize, cassava, and cassava; the number of poor people.

Table 1. Types and Data Sources

Condition	Data Source	Data Type
Physical	Elevation	SRTM
	Slope	SRTM
Socio-Economic	Production of Rice, Corn, Sweet Potato, Cassava	The government of Lebak Regency
	Number of Poor Families	The government of Lebak Regency

3. Data processing

Data processing is done by (a) classifying data into two groups, namely quantitative and qualitative data; (b) processing spatial and tabular data with Geographic Information System (GIS) technology; (c) the correlation of quantitative data processed by SPSS (Statistical Product and Service Solutions) program, the correlation (CC) is obtained from SPSS output and interpreted according to theory.

Food availability uses normative consumption indicators per capita on food availability (rice, sweet potato corn, cassava) or consumption to net cereal ratio availability. The availability of food per capita calculated by dividing the total availability of sub-district food materials by the number of population. To obtain the same unit with daily normative consumption in this research used the net availability data converted to grams and per day.

$$K = \frac{PR + PC + PSP + POC}{\text{Number of Population} \times 360}$$

K : Food Availability gram/people/day
PR : Production of Rice
PC : Production of Corn
PSP : Production of Sweet Potato
POC : Production of Cassava

$$KK = \frac{300 \text{ gram/people/day}}{K}$$

KK: Availability of normative consumption

4. Data analysis

The method of analysis used in this study is spatial analysis (spatial analysis) and statistical analysis (chi-square). Spatial analysis with map overlay method, during statistical analysis with the chi-square method. The correlated variables are; (1) the height and slope of food rage; (2) the correlation between food availability and the percentage of low-income families.

$$X^2 = \sum \frac{(O - E)^2}{E}$$

$$CC = \sqrt{\frac{X^2}{X^2 + N}}$$

X^2 = *Chi-Square*
O = Observed Frequency
E = Expected frequency
CC = *Contingency Coefficient*

Sunyoto, 2010)

C. RESULTS

1. Physical Condition of Lebak Regency

Lebak Regency located at 6º18'-7º00 'South Latitude and 105º45'-106º30' East Longitude, with an area of 330,576 Ha consisting of 28 Districts with 340 villages and five villages. The most widespread subdistrict is Cibeber District, and the most narrow area is District Kalanganyar. In 2006 the number of villages in Lebak Regency as many as 315 villages and five villages. Along with the increasing number of population and the volume of government activities, development, and empowerment of village communities, then issued Lebak Regency Regulation No. 1 of 2008 on the split of 25 villages in Lebak Regency, which in the end number of villages as many as 340 villages and five villages.

The northern part of Lebak Regency is lowland, while the southern part is mountainous, with the peak of Mount Halimun at the southeastern end is bordered by Bogor Regency and Sukabumi Regency.

a. Elevation

Lebak Regency has varying elevations, ranging from the lowlands in the north and south coast to the highlands in the mountains to the east. Lebak Regency dominated by the elevation <500 msl which is 266,295 ha (80.6%). Based on the classification of elevation divided into 5 elevation areas; (1) the elevation between 0-100 msl, scattered in the northern part (Maja District, Rangkasbitung, Kalanganyar, Cimarga) and southern coast (Malingping, Wanasalam, Bayah) and some areas in the west (District Banjarsari, Cileles); (2) elevation between 100 - 200 msl, spread in District of Gunungkencana, Cileles, Bojongmanik, Sajira, Leuwidamar; (3) the elevation between 200 - 500 msl, most of the central area (Cirinten, Gunungkencana, Cijaku, Cigemblong), and the southern part (Panggarangan, Cilograng, and Bayah; (4) the height between 500-1,000 msl, spread in Cibeber, Sobang, and Cigemblong, (5) the elevation of more than 1,000 meters above sea level, is located in the eastern part of Cibeber, Cipanas, Lebakgedong, Muncang and Sobang districts. The area is part of Halimun Mountain National Park with the peak of Mount Halimun (1,929 msl) (**Figure 2**).

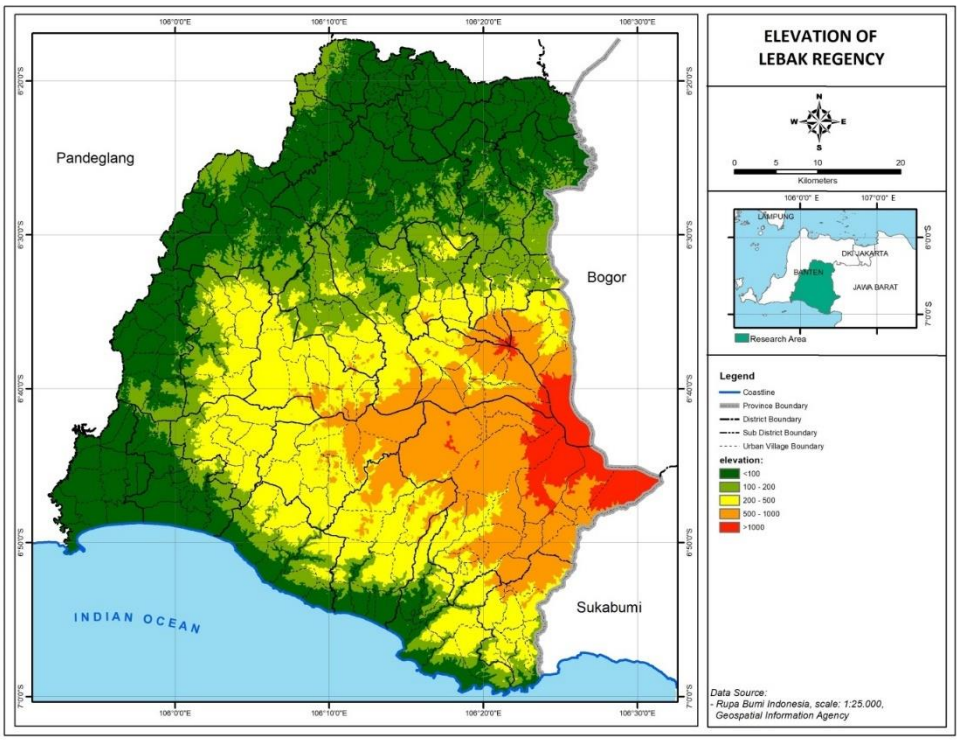

Figure 2. Elevation Area in Lebak Regency

b. Slope

Based on the slope map and the results of data processing can see that the Lebak Regency dominated by the slope <15% that is 221,869 ha or 67.11% of the district area. The area scattered in the north and south around the District Rangkasbitung, Banjarsari, Wanasalam, and Malingping. While the slopes > 15% area of 108717 ha or 32.89%, dominating eastern part, such as District Cibeber, Lebakgedong, Cilonggrang. Based on slope classification refers to land rehabilitation and soil conservation, the <8% slope is the most comprehensive area of 135,772 ha or 41%, while the narrowest slope > 40%, of 12,170 ha or 3.7% of Lebak Regency (**Figure 3**).

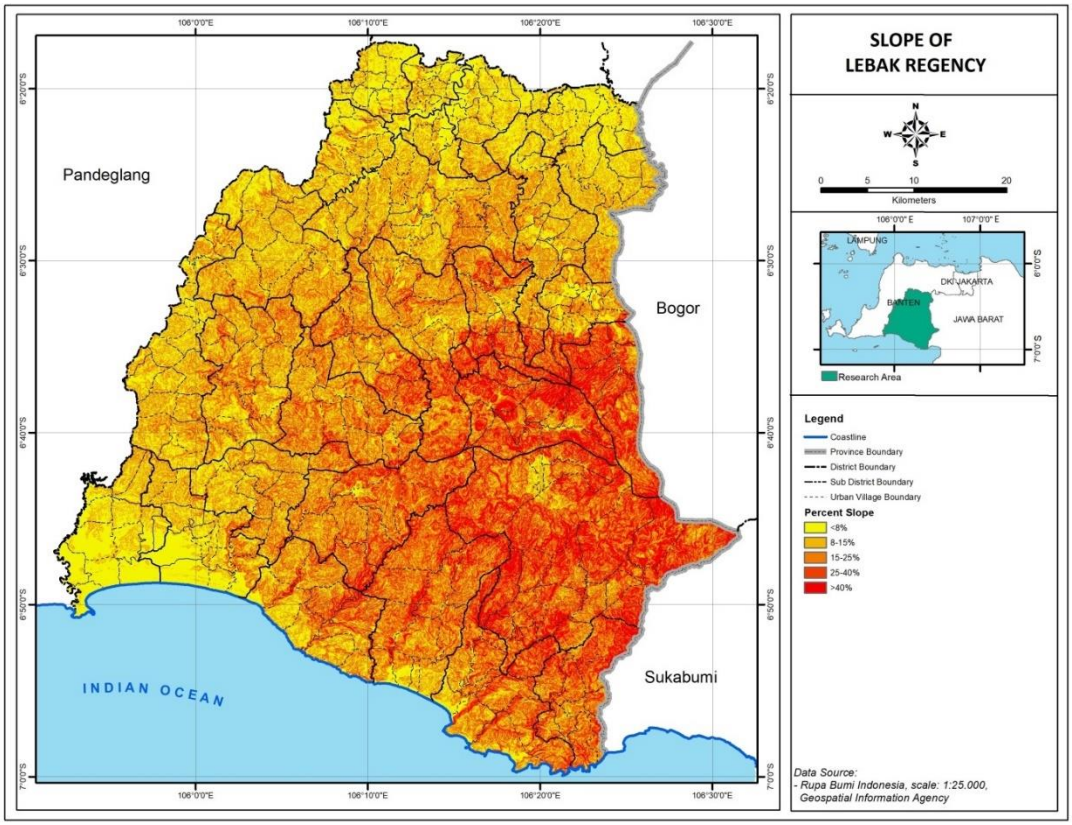

Figure 3. Slope-Area in Lebak Regency

2. Food Availability Areas in Lebak District

a. Production of Rice and Palawija in Lebak Regency

Food crop production data (rice and palawija) is one indicator of food availability. If the value of rice and palawija production (maize, sweet potato, cassava), then the food availability is also high and is expected to meet the needs of food, thus minimizing imports. If the value of rice and palawija production is low, the food availability is also low, so it needs to be the government's attention in taking policy so that there is no shortage of food. Based on Table 2, it can see that the highest food production is Manasalam District (59,934 tons) and the lowest in Kalanganyar Sub-district (7,391 tons).

Table 2. Food Production (Rice and Palawija) in Lebak Regency

No.	District	Rice Field (ton)	Rice Lea (ton)	Cassava (ton)	/eet (ton)	Potato	Corn (ton)	Food Production (Ton)
1	Malingping	44,882	209	704	500		16	46,311
2	Wanasalam	56,245	2,098	496	1,044		51	59,934
3	Panggarangan	25,490	2,946	700	117		18	29,271
4	Cihara	19,996	1,288	417	44		0	21,745
5	Bayah	32,316	598	928	308		15	34,165
6	Cilograng	23,571	2,085	525	201		0	26,382
7	Cibeber	55,993	1,826	33	32		0	57,884
8	Cijaku	16,212	14	986	20		0	17,232
9	Cigemblong	14,185	147	253	170		0	14,755
10	Banjarsari	28,652	1,852	2,070	109		28	32,711
11	Cileles	19,395	819	440	108		0	20,762
12	Gunungkencana	11,859	802	2,325	0		8	14,994
13	Bojongmanik	8,538	111	76	2		3	8,730
14	Cirinten	11,995	76	219	17		0	12,307
15	Leuwidamar	9,999	2,329	662	53		28	13,071
16	Muncang	19,813	62	389	43		14	20,321
17	Sobang	14,894	40	141	45		41	15,161
18	Cipanas	29,362	0	543	111		0	30,016
19	Lebak Gedong	14,801	0	12	3		0	14,816
20	Sajira	24,556	48	1,330	5		0	25,939
21	Cimarga	18,008	484	120	34		5	18,651
22	Cikulur	24,439	0	87	5		0	24,531
23	Warunggunung	16,842	0	58	6		0	16,906
24	Cibadak	12,799	0	43	22		0	12,864
25	Rangkasbitung	12,836	15	253	111		18	13,233
26	Kalanganyar	7,385	0	2	4		0	7,391
27	Maja	13,534	331	4,250	254		75	18,444
28	Curugbitung	18,625	379	2,275	165		60	21,504
	Kab. Lebak	607,222	18,559	20,337	3,533		380	650,031

Source: Government of Lebak Regency, 2016

b. Food Availability by Normative Consumption

The availability of food in this paper calculated from the normative consumption requirement on the availability of food/cereal (consumption to net cereal availability ratio). The calculation of this ratio is to measure the level of consumption of population and the ability of a region (district) in providing food to meet the needs of the population (Table 3). If food availability is higher than the amount of consumption, then the area is considered a food surplus. If food availability is lower than consumption, then the area is

considered a deficit. Based on the distribution of food availability data according to normative consumption can be classified as follows:

≥1 : Deficit
0.7-<1 : Low Surplus
0.4-<7 : Surplus Medium
<0.4 : High Surplus

Sub-districts belonging to the deficit area are only one sub-district, namely Rangkasbitung. This condition can see from the number of low food production and the population of many. Rangkasbitung District is the capital of Lebak Regency; agriculture activity is relatively small compared to other districts.

Lebak Regency dominated by high surplus areas covering 24 districts or 85.7% of all districts in Lebak Regency (**Figure 4**). This district condition has high food production, and wide food farm area is relatively full compare with District Rangkasbitung, Cibadak, Kalanganyar. The dense population density in the northern sub-districts, while rarely is mostly located in the southern sub-districts that are relatively far away from the district capital. A rare population density indicates the availability of land for agricultural activity is relatively broader than densely populated densities.

Table 3. Food Availability

NO.	District	Food Production (gram)	Population (man)	Food Supplies/Family/ day	Normal Consumption	Food Availability
1	Malingping	46,311,000,000	60,802	2,115.7		0.14
2	Wanasalam	59,934,000,000	25,564	6,512.4		0.05
3	Panggarangan	29,271,000,000	34,359	2,366.4		0.13
4	Cihara	21,745,000,000	26,877	2,247.4		0.13
5	Bayah	34,165,000,000	42,058	2,256.5		0.13
6	Cilograng	26,382,000,000	29,925	2,448.9		0.12
7	Cibeber	57,884,000,000	46,075	3,489.7		0.09
8	Cijaku	17,232,000,000	24,620	1,944.2		0.15
9	Cigemblong	14,755,000,000	16,458	2,490.3		0.12
10	Banjarsari	32,711,000,000	57,957	1,567.8		0.19
11	Cileles	20,762,000,000	48,929	1,178.7		0.25
12	Gunungkencana	14,994,000,000	33,305	1,250.6		0.24
13	Bojongmanik	8,730,000,000	21,417	1,132.3		0.26
14	Cirinten	12,307,000,000	23,842	1,433.9		0.21
15	Leuwidamar	13,071,000,000	51,499	705.0		0.43
16	Muncang	20,321,000,000	33,442	1,687.9		0.18
17	Sobang	15,161,000,000	47,880	879.6		0.34
18	Cipanas	30,016,000,000	46,934	1,776.5		0.17

19	Lebak Gedong	14,816,000,000	18,085	2,275.7	0.13
20	Sajira	25,939,000,000	52,716	1,366.8	0.22
21	Cimarga	18,651,000,000	63,555	815.2	0.37
22	Cikulur	24,531,000,000	46,724	1,458.4	0.21
23	Warunggunung	16,906,000,000	45,500	1,032.1	0.29
24	Cibadak	12,864,000,000	58,766	608.1	0.49
25	Rangkasbitung	13,233,000,000	121,961	301.4	1.00
26	Kalanganyar	7,391,000,000	32,192	637.8	0.47
27	Maja	18,444,000,000	52,043	984.4	0.30
28	Curugbitung	21,504,000,000	30,389	1,965.6	0.15
	Kab. Lebak	6,500,31E,+11	1,193,874	1,512.4	0.20

Source: Data Processing 2018

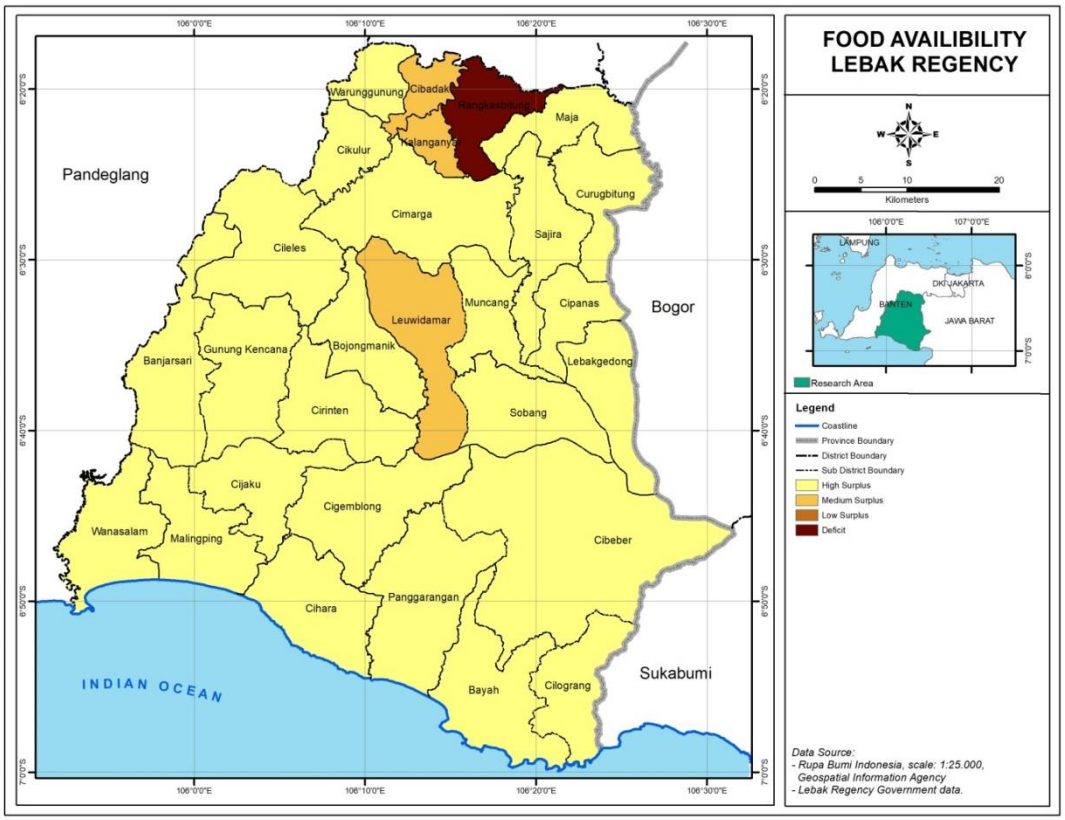

Figure 4. Food Availability Lebak Regency

3. Distribution of Poor Families in Lebak Regency

The poor in this paper use indicator for the percentage of low-income families in each sub-district in Lebak Regency. All sub-districts in Lebak Regency have the percentage of poor families above 30%, sub-districts with the highest percentage are Cigemblong (81%), and the lowest district is Bayah (31%). Based on the distribution of percentage data of low-

income families per district, it can classify into four classes, namely:

30-<40: Low
40-<50: Medium
50-<60: Height
≥60: Very High

Based on Figure 5, the sub-districts included in the classification of impoverished households are 13 sub-districts or 46.4% covering Cihara, Cigemblong, Bojongmanik, Cirinten, Leuidamar, Muncang, Sobang, Lebakgedong, Cimarga, Rangkasbitung, Kalanganyar, Maja and Curugbitung sub-districts. While the district that belongs to the percentage of low-income families is high as many as eight districts or 28.6% and low classification only three districts or 10.3%, i.e., District Cileles, Bayah, and Malingping. The rural low-income families are concentrated in the southern sub-districts, while the urban poor is in the north, especially in the Lebak Regency Capital.

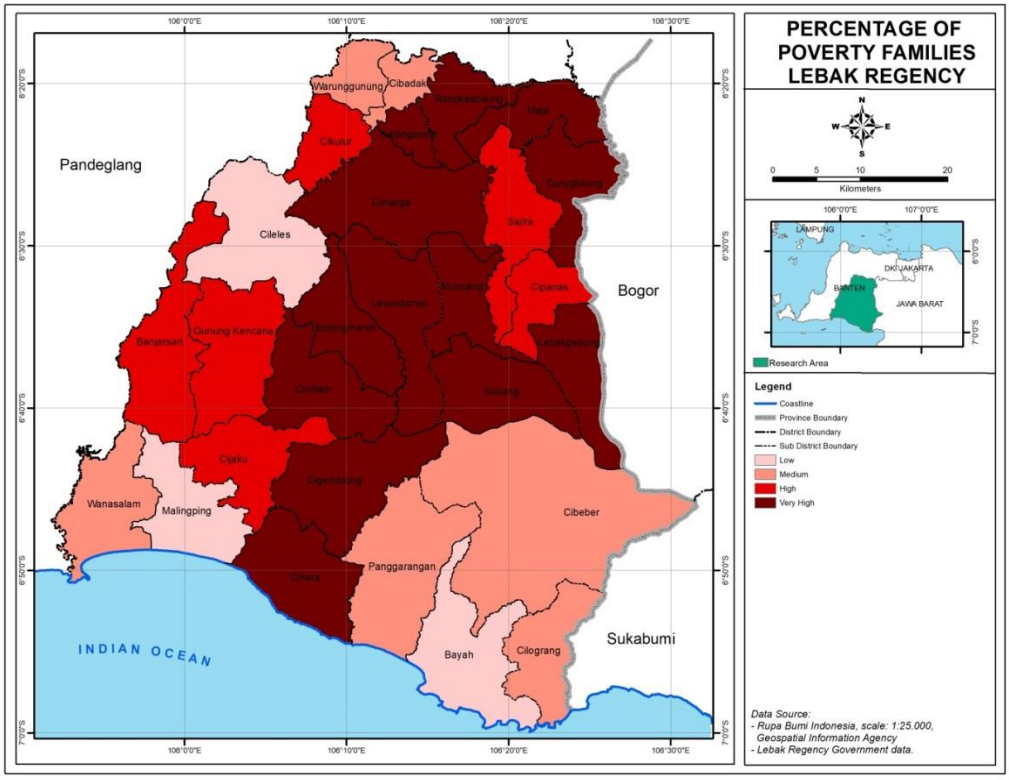

Figure 5. Percentage of Poor Family of Lebak Regency

4. The Impact of Elevation on Food Availability in Lebak Regency

Based on spatial analysis with map overlay indicates that the area of high surplus food availability found in various elevation areas. While the availability of food deficit only found in one District of Rangkasbitung, which

located in the lowlands <500 msl. The districts include the classification of Low Surplus, medium Surplus, Hight Surplus concentrated in the lowlands <500 msl of 24 districts or 85.7%. Thus supported by chi-square statistical analysis indicating that there is no significant correlation at α = 0.05. The amount of correlation between variables is relatively small that is between the height of the food availability area of CC = 0.164. Food supply programs by Lebak Regency government have been implemented in various sub-districts, although not yet entirely successful for the village level.

Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Contingency Coefficient	.164	.855
N of Valid Cases		28	

5. Effect of Slopes on Food Availability in Lebak Regency

Based on spatial analysis with slope map overlay and the availability of food indicates that the area of high surplus food availability found in various slope areas. While the areas of food availability deficit, low surplus, medium surplus, high surplus, and very high cover 23 subdistricts or 82.1% located on slope <15%. They supported by chi-square statistical analysis which shows that there is no significant correlation at α = 0.05. Moreover, the magnitude of the correlation between these variables is relatively small, i.e., CC = 0.187

Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Contingency Coefficient	.187	.798
N of Valid Cases		28	

6. The Effect of Food Availability on Poverty in Lebak Regency

Based on spatial analysis with an overlay of food availability map and the percentage of low-income families shows that the area of high surplus food availability is not always in a low percentage of low-**income** families. Districts in Lebak Regency mostly include high food surplus areas and spread in various areas of poor, middle, high or very high percentage of poor, This supported by chi-square statistical analysis indicating that there is no significant correlation at $\alpha = 0.05$ and the correlation between the food availability area and the percentage of poor families is CC = 0.427. Program of food supply and poverty alleviation by Lebak Regency government has been implemented in various sub-districts, although not yet entirely successful for village level.

Symmetric Measures

		Value	Approximate Significance
Nominal by Nominal	Contingency Coefficient	.427	.715
N of Valid Cases		28	

D. CONCLUSION

This results conclusion that: first, the high availability of food surplus area spread outside the capital of Lebak Regency. Second, the elevation and slope have no effect on food availability; Third, the poor rural families are concentrated in the southern part of Lebak Regency, while urban poor located in the northern part, especially in the capital of Lebak Regency; Fourth, the relationship between food availability and the percentage of poor families is not significant at $\alpha = 0.05$.

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