DAERAH ISTIMEWA YOGYAKARTA TRENDS OF LAND-USE TRANSFER FOR SUSTAINABLE FOOD SECURITY ZONING

Rochmat Martanto
Senthot Sudirman
Lego Karjoko
Said Gunawan
I Gusti Ayu Ketut Rachmi Handayani

DOI: https://doi.org/10.37178/ca-c.23.1.019

Rochmat Martanto, *Departement of Land, Sekolah Tinggi Pertanahan Nasional-Yogyakarta-Indonesia*
Email: rochmatmartanto@stpn.ac.id

Senthot Sudirman, *Departement of Land, Sekolah Tinggi Pertanahan Nasional-Yogyakarta-Indonesia*

Lego Karjoko, *Departement of Law, Faculty of Law, Universitas Sebelas Maret-Indonesia*

Said Gunawan, *Departement of Adminisrative Law, Faculty of Law, Universitas Bandar Lampung- Indonesia*

I Gusti Ayu Ketut Rachmi Handayani, *Departement of Law, Faculty of Law, Universitas Sebelas Maret- Indonesia*

Abstract

The purpose of this study was to examine the patterns of transfer of land use from agricultural land to non-agricultural land and to draw up a zoning map for DIY for sustainable food security. The approach used in this study was a survey in which all populations were taken as a sample with a population consisting of all sub-districts in DIY that in 2009-2019 witnessed the conversion of land use from agricultural land. The land-use conversion and population rate were estimated using LANDSAT satellite imagery. Of the total population of all sub-districts, 63 sub-districts are (78 sub-districts). The findings showed that for all districts/cities, the patterns of land-use transfer from agricultural land to non-agricultural land were clustered, while the total conversion rate was 1286.83 ha/year. Overall, there were 14 rural sub-districts, 28 buffer zone sub-districts, and 21 sustainable agriculture districts. This study concluded that the zoning of food security was aimed at preserving food safety limits with agricultural land conditions of 42240.01. There was a food (rice) shortage to satisfy a population of 61568 people. The suggested improvement in food security is to increase the productivity of food (rice) and to increase the Family Planning programme.

Keywords: Sustainable land, clustered pattern, food surplus

I. INTRODUCTION

Land-use conversion is a problem that frequently happens in human life today, and this occurs because people often need land to sustain housing in addition to having food.[1] Humans' carrying out all their activities is the need for land as part of the space for housing on earth. The land is crucial both biotically and biologically for sustainable growth (abiotic) for human life.[2] As living beings, humans need land as a place to grow plants to meet food needs and housing, food, and shelter needs. As housing needs often erode food security, these are two competing variables in land needs (housing). To meet the food needs of 258.7 million people in Indonesia in 2017, the current agricultural land for food crops, especially rice fields, is very crucial, while the population increases by about 3.4 million people per year, and the conversion of land use from agricultural land to non-agricultural land at a rate of about 96,500 ha.[3] Demand for land for different purposes, including food production, is also growing, in line with the rise in population size, which is very large in Indonesia. Uncontrolled competition for land use in different sectors, including the agricultural industry, has resulted in high population pressure and rising economic and industrial growth.[4]

Agricultural land resources provide a broad number of socio-economic and environmental benefits. The loss of agricultural land as a result of the conversion to non-agricultural land use will therefore have an effect on different aspects of production. It is possible to broadly split the benefits of agricultural land into two categories: 1) indirect benefits and 2) direct benefits. Indirect benefits involve numerous activities that have been developed, even though they are not meant to be used by landowners.[5-7] The protection of biodiversity, or the presence of certain types of plants whose direct benefits are not yet understood, is one example, but it will be beneficial in the future to meet human needs (natural and environmental sustainability). It is also possible to refer to the direct benefits as use-values. These benefits are produced by the exploitation or agricultural activities of agricultural land resources so that the area's socio-economic life can be represented. The human desire to better economic life, however, does not mean that human beings will forfeit natural sustainability.[5]

The safest direct land use is agricultural agriculture (land productivity), as it can sustain environmental habitats and prevent emissions from the atmosphere. For regional growth, many ecological constraints need to be taken into account to bring about sustainable results. To improve food security, the mitigation of environmental change in land-use conversion is required to minimize urbanization. Lack of jobs in rural areas as farmers can promote urbanization, and it also creates various socio-economic problems in urban areas.[7] Rapid development and a high population growth rate are the driving forces for the increase in the need for land both in urban and rural areas, which will decrease food security in that area. Several studies indicate that land-use conversions from agricultural land to non-agricultural land are affected by the decline in food security, indicating that the more land-use modifications occur, the more food security decreases.[8]

One component of regional spatial planning is a land-use transfer from agricultural land to non-agricultural land, eventually deciding food security. Indonesia's land-use transition from agricultural land to non-agricultural land appears to be a clustered trend. Most land-use transformations from agricultural land to the non-agricultural ground are contagious or clustered. Food protection substantially affects the conversion of land-use from agricultural land to non-agricultural land with the clustered pattern.[8] Compared to the clustered trend, the land-use transfer from agricultural land to non-agricultural land, which is random and frequent, appears to have specific food security. In general, as a result of growth, the land available in urban and rural areas is increasingly limited. Urban and rural land issues have resulted, including a rise in land prices and an unregulated decrease in food security, and disputes of different interests. The need for land for industry and various economic activities is in line with the growing demand for land for housing.[2]

The development rate in DIY affects the conversion of land use, especially from agricultural land to non-agricultural land. The climate is identical with the property. According to [9], human activities can not be isolated from the ground for agricultural production, housing, and industry. Human activities tend to fulfill food needs, so the critical consideration island for agricultural cultivation, but land-use conversion often occurs on the ground for agricultural cultivation.[5] The government's proclaimed development plan is an attempt to actively and wisely enforce the management of natural resources and the environment, hoping that any human activity will not cause environmental harm. The agricultural land-use conversion, however, has an unfavorable impact on the ground, which result in a decrease in food security[2, 10] Natural resources in the form of existing land and water can be used by extension and intensification to obtain agricultural productivity, especially rice. By extension, DIY does not increase agricultural production because the DIY population is a very densely populated area (National Land Security of the Republic of Indonesia, 2009). Intensification of agricultural productivity in DIY is the most likely initiative, one of which is by paying attention to rural land use plans and rural food crop cultivation management. Agricultural land ownership does not guarantee that farmers can help their families, so many farmers sell the land because it has a high value. Because of the high land value, many farmers change their occupations, and buyers tend to turn their agricultural land into non-agricultural land.[11] Some opinions suggest that land-use conversion from agricultural land to non-agricultural land is a sequential process of transformation. If there is a land-use conversion in a location, many subsequent modifications are accompanied by clustered trends. There is a negative relationship between the change of land-use from agricultural land to agricultural land. The greater the conversion of land use from agricultural land to non-agricultural land, the lower the food security.[12]

The rise in population every year is one of Indonesia's development issues, including in DIY. This issue indirectly caused the patterned land-use conversion because of the population's land needs. Growing population growth increases housing and industrial development. Due to the land-use conversion from agricultural land to non-agricultural land, housing and industrial growth would reduce food security. This study examines the pattern of land-use transfer from agricultural land to the non-agricultural ground in DIY, having said the above context and deciding the zoning for DIY food security.

II. METHOD

Daerah Istimewa Yogyakarta (DIY) was a province chosen to be the research area. Also, satellite imagery is needed to determine the research population. It used Satellite Imagery LANDSAT 2009 and 2019, which has a spatial resolution of 30 meters and is useful to map the land use on the earth's surface of 1: 25,000.[13] The population was all sub-districts in DIY that have undergone a land-use conversion from 2009 to 2019. This study considered that DIY has a relatively high land-use conversion from agricultural land to non-agricultural land. In addition to being an urban development on the island of Java, it is also one area with many tourism objects in Indonesia. This study's sampling was a survey (census), where all the research population was observed as a sample (research unit) because each population or sample has almost the same degree and qualifications, so all models have the opportunity to be a sample.[14]

The agricultural areas in DIY have a strategic role in supporting food productivity in Indonesia. Agricultural land in DIY also has complex characteristics in physical land, socio-economic conditions, and society. The data used in this study were classified into 2 (two) groups based on the research objectives as follows:[10]

Patterns of land-use conversion

The land-use conversion pattern from agricultural land to non-agricultural land in this study was analyzed at the district/city level because spatial planning in Indonesia is usually carried out and started at the district/city level. It was obtained by calculating the distance at each land-use conversion location through land-use conversion maps resulting from the Satellite Imagery LANDSAT's interpretation and analyzed using Continuum Nearest Neighbor (CNN). The land-use conversion was only differentiated from agricultural land to non-agricultural land in 2009 and 2019 (for ten years). This CNN was used to determine the distribution pattern of land-use conversion, whether it follows a clustered, random or regular pattern indicated by the considerable Z value or Z-score. The analytical method used in this study was a quantitative approach using nearest neighbor analysis with several stages, namely collecting the data needed for the task, determining the boundaries to be studied, changing the object distribution pattern into a point distribution pattern, providing serial numbers for each point to facilitate analysis, and providing the closest distance (i.e., the space in a straight line between one point and another point which is the closest neighbor and the amount of that distance is recorded). Furthermore, data analysis with the nearest neighbor analysis method was used to determine the residential patterns with the following formula

$Z = \frac{\bar{j}}{\bar{j}}$ ……………………………………………….. (1)

Z : Nearest neighbor spread value

$\bar{j}_u$: the average distance measured between one point and the point of its closest neighbor

$\bar{j}_h$: the average distance obtained when all the points have a random pattern=$\frac{1}{2\sqrt{p}}$

p: the density of points in each km^{2n} (the number of points (n) are divided by the area in km^2 (*A*)), thus it becomes $\frac{\sum n}{A}$

The results of the calculation of the Z value according to Novio et al. (2020) are interpreted by Continum Nearest Neighbor Analysis as presented in Table 1.

Table 1

Classification of the distribution of land-use conversion from agricultural land to non-agricultural land based on the Z value

No.	Pattern	Z
1	Cluster	< -1.65
2	Random	≥-1.65 – < 1.65
3	Regular	≥ 1.65

To make it easier calculating the pattern of land-use conversion for each district, the Formula 1 in ArcGIS was used.

2. Sustainable food security

This study used interrelated calculations to determine food security, such as the rate of land-use conversion from agricultural land to non-agricultural land and the rate of population growth since the population needs land for daily food consumption.

a. The rate of land-use conversion was obtained using LANSAT Satellite Imagery. It indicates the land-use conversion from agricultural land to non-agricultural land in each district.

b. The rate of population growth will result in land needs due to population growth as a result of land producing food for population consumption. The most dominant factors in food security due to food consumption by residents are land availability, population size, and land productivity of rice fields proposed by Martanto and Handayani (2020) is formulated as follows:

c.

$$P = \frac{\text{land production in one year (kg/th)}}{\text{average rice consumption per population in one year (kg/person/th)}}$$

Atau

$$P = \frac{(L \times Pr \times Pl \times R)}{K} \quad \text{.........(2)}$$

P = number of population (people);
L = land area (ha);
Pr = land productivity (kg/ha);
Pl = number of rice planted in a year;
R = rice yield (in 1/100);
K = average rice consumption per person in a year (kg/person/th).

The stage of estimating food security was carried out by constructing mathematical predictions based on past observations. The reason behind the use of prophecy in this study was land-use planning towards sustainable land (food security). The prediction of the variable area of agricultural land, land productivity, and rice self-sufficiency in this study was carried out using the time series analysis method. Time series is a set of observations formed sequentially based on a specific time. It can forecast future values for both long and short term based on past time observations.

The reduction in rice field area was permanent, and this led to food security problems caused by land-use conversion during a specific period in a time series (0 to n years) would be cumulative. The increase in population or population density required land to meet the food needs (agricultural land) and a place to live (non-agricultural land). It is expected that food self-sufficiency can be fulfilled (food security); however, if it is not sufficient, it can be imported from other regions. Land-use conversion rate and population growth rate are mutually reinforcing factors or variables towards land narrowing. In short, the land-use conversion rate and population growth rate have a causal relationship, meaning that land-use conversion affects population density, and population density also affects land-use conversion. This study's results related to land-use conversion rate and population growth rate in the DIY showed a limit on food security that could be made in each papulation (district) in the study area.[10]

This study made food security directives following the food security limit into three zones (districts) to create a food security zoning in a grouping pattern of regencies/cities, such as 1) residential zones (the zones directed towards regional development or urban zones); 2) buffer zones (the zones between residential zones and zones for food security); and 3) zones for sustainable agriculture (perennial agriculture). The zoning is divided by the following criteria for determining food security limits, as presented in Table 2.

Table 2

Criteria for determining food security limits

No.	Zone	Criteria
1	Residential	The food security limit originating from the intersection points or coordinates (X, Y) of the population growth rate (Y = aX + C) and land-use conversion rate from agricultural land to non-agricultural land (Y = aX + C) has negative X and Y values (-)
2	Buffer	The intermediate zone (a zone between the residential zone and the sustainable agriculture zone). The food security limit originating from the intersection points or coordinates (X, Y) of the population growth rate (Y = aX + C) and land-use conversion rate from agricultural land to non-agricultural alnd (Y = aX + C) has negative X (-) and positive Y (+)values or vice versa (positive X (+) and negative Y (-)values).
3	Sustainable agriculture	The food security limit originating from the intersection point or coordinates (X, Y) of the population growth rate (Y = aX + C) and the land-use conversion rate from agricultural land to non-agricultural land (Y = aX + C) has positive X and Y values (+)

Directions for land use based on food security limits in the areas of the DIY were then drawn up for food security. It is expected that food security zoning can maintain or increase food productivity through sustainable agricultural land.

III. RESULTS AND DISCUSSION

The land-use conversion from agricultural to non-agricultural land was determined by overlapping the Map of Land Use 2009 and Map of Land Use 2019 from the Satellite Imagery LANDSAT 2009 and 2019 results.

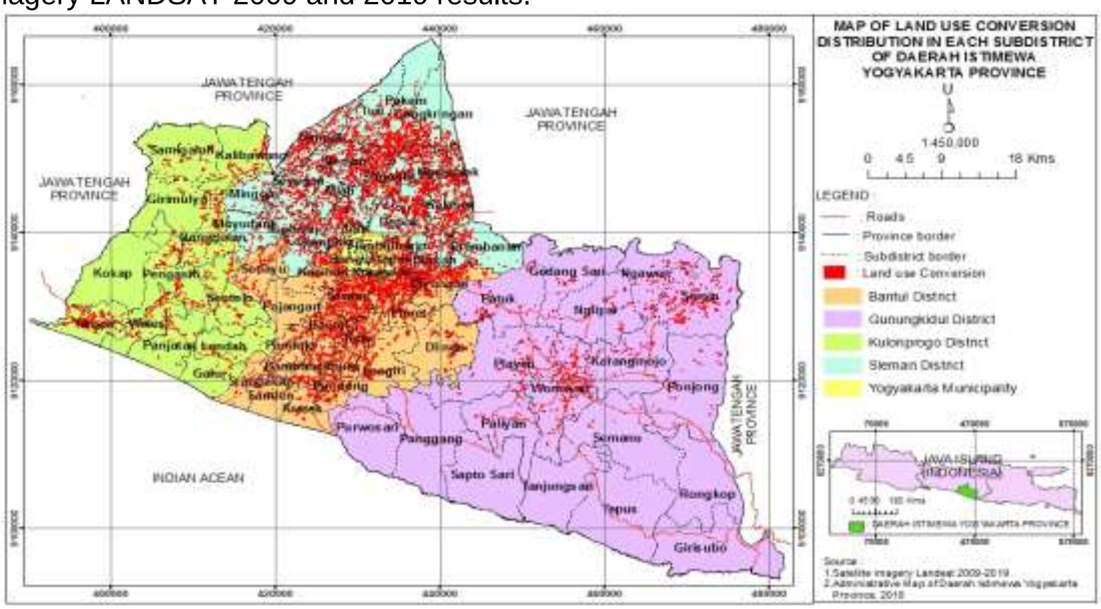

Figure 1. Map of land-use conversion distribution in each sub-district of DIY

The patternS of land-use conversion from agricultural land to non-agricultural land at the district/city level using the Satellite Imagery LANDSAT 2009 and 2019 as presented in Figure 1 shows an illustration of regional spatial planning in DIY. Based on the calculations in Formula 1 and ArcGis, the results are presented in Figure 2.

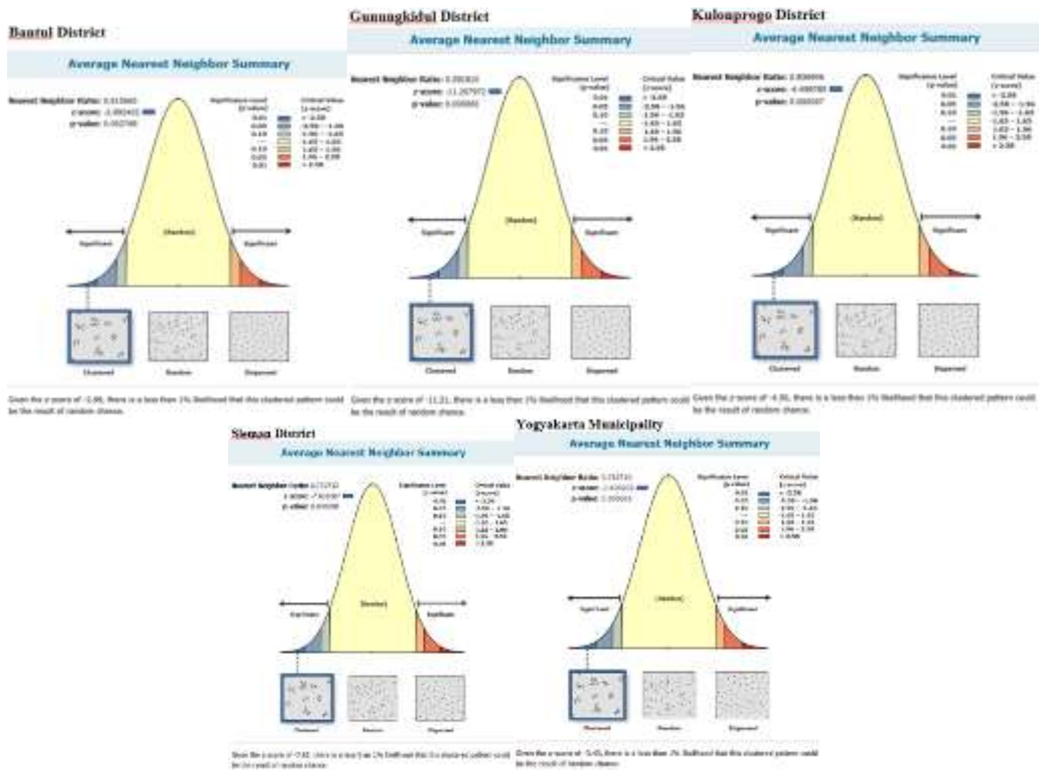

Figure 2. Graph of the pattern of land-use conversion from agricultural land to non-agricultural land in each district/city of DIY

The pattern of land-use conversion from agricultural land to non-agricultural land in all districts and cities of DIY is presented in Figure 2 using Formula 1 and the processing with ArcGIS. Therefore, according to the clustering in Table 1 (Z-value), each district/city is a part of cluster with the following results.

Table 3

Results of clustering the distribution of land-use conversion from agricultural land to non-agricultural land based on the Z-value

No.	District/City	Pattern	Z
1	Bantul	Cluster	-2.99
2	Gunungkidul	Cluster	-11.21
3	Kulonprogo	Cluster	-4.50
4	Sleman	Cluster	-7.63
5	Yogyakarta	Cluster	-3.43

Based on Table 3, the land-use conversion from agricultural land to non-agricultural land for all districts/cities in the Special Region Yogyakarta is a clustered pattern, meaning that once there is a land-use conversion on agricultural land, it shows the cluster and the number is increasing.[6, 15] This clustered land-use conversion shows that there is no spatial planning that refers to the rules for land-use conversion, so this will lead to a decrease in food security. This study was analyzed using Formula 2 to determine food security in the study area with the following conditions:[3]

1. Total population of DIY in 2019 .... (P);
2. Average rice consumption of 97.6 kg/capita/year [16] .... (K);
3. Yield of milled dry grain in Indonesia: 64.02% [17] …………….…..... (R);
4. Average land productivity in 2019 in DIY ……….. (Pr); and
5. Crop patterns in DIY: 2 times a year .... (Pl).

The results are presented in Table 4.

Table 4

Food security limits in each sub-district/city of DIY

No.	District	Agricul-tural land (rice fields) (ha) 2019	Popula-tion rate (people)	Land produc-tivity (Kg/ha)	Landneeds due to population (ha)	Land rate due to population growth based on Formula 2 (ha)	Land-use conversion rate based on Formula 2 (ha/year)	X-time (month)	Y-land (ha)
1	2	3	4	5	6	7	8	9	10
1	Playen	2319.90	759.00	4060	1151.33	14.25	15.00	-18757.7	-21123.70
2	Patuk	963.24	457.11	4060	646.80	8.58	9.68	-3462.37	-1829.44
3	Sanden	1004.82	256.11	5761	423.03	3.39	5.81	-2884.05	-391.40
4	Tegalrejo	13.24	249.00	5182	546.67	3.66	1.42	-2857.97	-325.66
5	Semin	3422.49	902.56	4060	1072.97	16.95	27.63	-2637.88	-2652.03
6	Ngawen	1193.88	388.33	4060	659.32	7.29	9.86	-2501.61	-860.60
7	Girimulyo	699.65	357.22	5834	328.06	4.67	6.76	-2131.93	-501.16
8	Moyudan	1366.11	310.33	5379	477.22	4.40	9.45	-2111.38	-296.55
9	Wonosari	3017.77	991.22	4060	1645.96	18.61	26.83	-2002.43	-1459.50
10	Nanggulan	1234.55	416.78	5834	404.91	5.45	10.70	-1894.08	-454.62
11	Kotagede	2.45	351.00	5182	504.71	5.16	1.28	-1551.07	-162.66
12	Samigaluh	900.02	422.00	5834	372.10	5.51	9.68	-1520.34	-326.47
13	Mantrijeron	7.93	462.89	5182	521.21	6.81	0.36	-954.62	-20.46
14	Gondomanan	0.19	217.00	5182	220.38	3.19	0.01	-829.52	-0.27
15	Gondokusuman	1141.04	-275.00	5182	629.84	-4.05	0.34	-1397.75	1101.03
16	Wates	971.74	587.11	5834	643.87	7.67	12.12	-883.43	79.13
17	Sentolo	1262.46	663.44	5834	659.77	8.67	17.44	-824.17	64.42
18	Kretek	875.18	188.89	5761	408.36	2.50	10.74	-680.17	266.70
19	Kalibawang	781.32	427.78	5834	400.49	5.59	12.49	-662.31	92.01

20	Kokap	85.50	618.44	5834	479.39	8.08	0.84	-653.23	39.52
21	Prambanan	1193.64	787.89	5996	685.83	10.02	19.51	-641.80	150.13
22	Godean	1941.57	451.00	5740	928.91	5.99	26.87	-582.05	638.41
23	Turi	1171.98	463.67	5583	508.91	6.33	23.31	-468.62	261.69
24	Gedangsari	527.58	485.22	4060	744.09	9.11	3.26	-444.00	407.02
25	Temon	1090.44	552.78	5834	384.74	7.22	32.22	-338.71	180.88
26	Seyegan	1237.90	657.33	5517	704.16	9.08	30.11	-304.65	473.59
27	Sedayu	880.23	355.11	5761	630.42	4.70	14.94	-292.69	515.82
28	Bambanglipur o	934.48	505.56	5761	554.13	6.69	26.42	-231.34	425.17
29	Tempel	1394.42	559.22	5841	709.21	7.30	43.24	-228.75	570.10
30	Cangkringan	833.70	345.33	5640	423.15	4.67	27.89	-212.13	340.64
31	Pundong	698.14	471.22	5761	475.11	6.23	20.27	-190.65	376.05
32	Pandak	820.85	479.89	5761	688.21	6.35	15.72	-169.90	598.31
33	Pakem	1057.52	324.33	5463	524.47	4.53	57.57	-120.59	478.99
34	Jetis	988.98	806.00	5761	774.69	10.66	32.18	-119.50	668.48
35	Berbah	921.35	444.67	6090	685.77	5.57	32.26	-105.91	636.65
36	Piyungan	977.23	408.11	5761	692.44	5.40	37.72	-105.75	644.85
37	Ngemplak	1364.56	387.44	5919	804.08	4.99	74.65	-96.55	763.93
38	Kalasan	1392.84	678.78	6025	1040.81	8.59	55.14	-90.74	975.88
39	Sleman	1215.65	749.78	5862	903.87	9.75	51.18	-90.31	830.49
40	Imogiri	966.92	-297.44	5761	840.75	-3.94	15.57	-77.62	866.21
41	Bantul	794.58	3898.67	5761	851.64	51.58	28.76	-30.00	722.69
42	Dlingo	538.94	448.11	5761	523.13	5.93	12.62	-28.37	509.11
43	Pleret	633.78	544.56	5761	637.36	7.21	23.14	2.70	638.98
44	Ngaglik	1106.06	-543.44	5848	1264.30	-7.08	77.63	22.42	1251.07
45	Pengasih	669.18	803.11	5834	684.69	10.49	16.23	32.43	713.05
46	Sewon	843.25	-506.78	5761	1320.59	-6.71	50.79	99.63	1264.92
47	Mlati	812.47	-994.22	5836	1202.73	-12.99	27.46	115.79	1077.43
48	Banguntapan	539.07	-895.56	5761	1481.32	-11.85	74.81	130.48	1352.48
49	Depok	330.00	-6576.11	5493	1697.22	-91.26	30.50	134.75	672.47
50	Gamping	631.25	-363.44	5888	1211.09	-4.71	29.75	201.95	1131.91
51	Kasihan	435.31	-816.00	5761	1369.81	-10.80	27.47	293.03	1106.16
52	Nglipar	718.10	435.56	4060	630.97	8.18	4.90	318.63	848.10
53	Semanu	1585.71	946.22	4060	1131.25	17.77	1.58	336.87	1629.96
54	Ponjong	1396.58	770.22	4060	1065.20	14.46	3.77	371.87	1513.33
55	Umbulharjo	43.74	-761.78	5182	1028.02	-11.21	6.23	677.30	395.56
56	Karangmojo	1824.95	903.44	4060	1068.27	16.96	7.68	978.68	2451.65
57	Minggir	7.46	369.11	5420	458.27	5.19	10.47	1023.86	901.19
58	Panjatan	1278.63	633.44	5834	510.85	8.28	3.71	2018.05	1902.71
59	Srandakan	575.82	294.00	5761	413.06	3.89	3.03	2274.56	1150.40

60	Paliyan	1599.24	447.22	4060	621.60	8.40	3.25	2277.91	2215.49
61	Galur	1216.42	439.22	5834	432.13	5.74	2.32	2750.41	1747.47
62	Pajangan	296.71	354.22	5761	476.86	4.69	5.32	3418.16	1811.90
63	Lendah	817.10	565.00	5834	542.65	7.38	6.95	7617.58	5228.87
Jumlah		61567.82	18761.89	341237	46523.18	285.17	1286.83	-183.64	41875.34

Annotation:

: Residential Zone

: Buffer Zone

: Sustainable Agricultural Zone

There are 78 sub-districts out of all DIY sub-districts, but 63 districts are those that meet the population criteria (see Table 4). This may be because certain samples in the study area did not follow the requirements because they did not have agricultural land (rice fields) and were all located in the district of Gunungkidul. The intersection points (X, Y) of the population growth rate (Y = aX + C) and the land use transfer rate from agricultural land to non-agricultural land (Y = aX + C) are shown on the basis of table 4. The coordinates (X, Y) are food safety limits, which means that only rice can reach the food safety limits of that area/district (zone). In its food security, it is not a surplus and not a minus region. Food protection limits on negative X (-) and negative Y (-) suggest that the zone is a minus zone, indicating that it has low food security in terms of land and time (graph), so that the zone will become a residential zone with 14 sub-districts for the entire population (Table 4).[18] The positive X (+) and negative Y (-) food protection limits, or vice versa, suggest that the zone is a buffer zone, indicating that it has a mild food security in terms of land and time, so that the zone may become a residential zone or a sustainable agricultural land that is in accordance with local circumstances, situations and local policies. In this region, 28 sub-districts exist (Table 4). In the meantime, the food security limits on positive X (+) and positive Y (+) confirm that there is sufficient food security in terms of land and time so that this region can become a productive agricultural area, and that there are 21 districts in this area (Table 4). Figure 3 presents the food safety graph for each location (section).

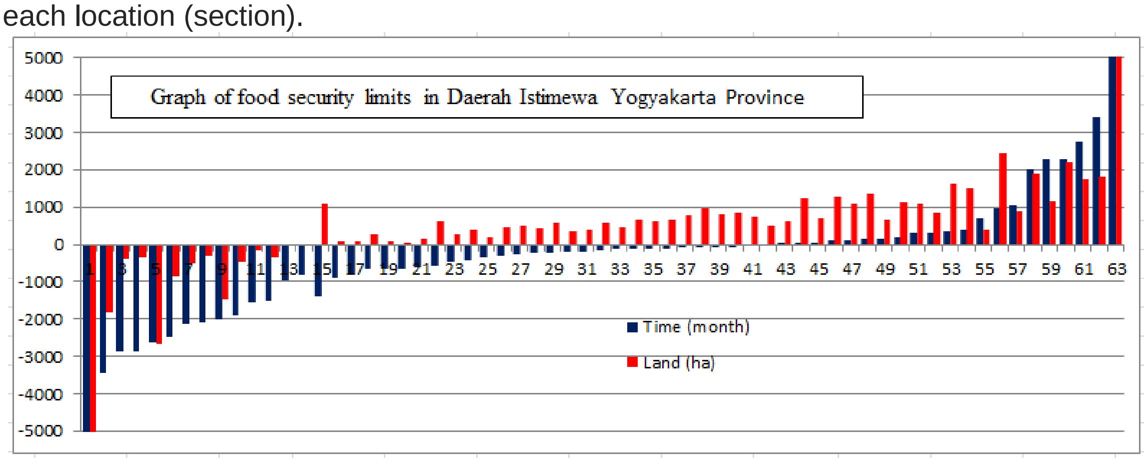

Figure 3. Graph of food security limits in each district/city of DIY

Figure 3 illustrates food security in each sub-district/city as shown in number 1 to 63 according to the number of the sub-district/city in Table 4. Based on food security zoning in Figure 3, a zoning map was made for each sub-district/city of DIY according to the criteria for determining the food security limits as presented in Table 2. The results are shown in Figure 4.

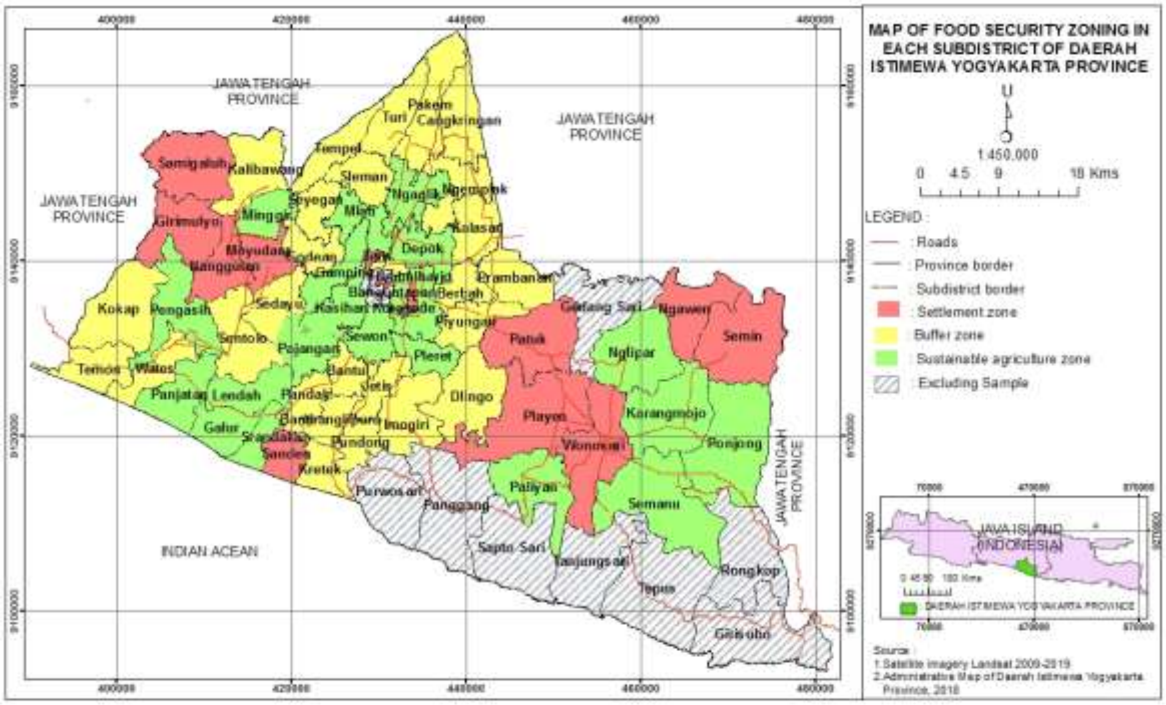

Figure 4. Map of food security zoning in each sub-district/city of DIY

These limits on food security could be identified by looking at the coordinates of the total number of districts (-183.64, 41875.34). The coordinates indicate that food security in DIY occurred 183.64 months ago with 41875.34 ha of established property. It means that, because of the existing population, the current land is unable to fulfill its food needs, so that they have to get food (rice) from other regions.[11]

Figure 4 still indicates that a sustainable agricultural zone exists in the DIY region. The local government must have a policy of preserving this sustainable agricultural zone, with strict sanctions specifying that land use can not be changed from agricultural land (rice fields) to non-agricultural land. Food availability in DIY can, therefore, be well achieved. As well as strict penalties against land-use conversion actors in sustainable agricultural land zones, clear treatment is also required for rural land buffer zones to become sustainable agricultural land zones. In some areas, however, because of national interests, the buffer zones are not required to be converted. Increasing agricultural production by intensifying and increasing population growth through the 'Family Planning' policy is another potential treatment for increasing food safety.[12]

IV. CONCLUSION

The average land-use conversion rate from agricultural land (rice fields) to non-agricultural land (non-rice lots) in DIY reaches 1286.83 per year. The land-use conversion pattern for all districts/cities is a cluster, which indicates that there is no adequate spatial layout. Regarding food security zoning based on food security limits, there were 14 sub-districts included in residential zones (zones for agricultural land can be converted), 28 sub-districts in buffer zones, and 21 sub-districts of sustainable farm zones. Food security zoning based on food security limits can maintain the current food security condition in which there are 42240.01 agricultural lands. Therefore, it lacks foodstuffs to fulfill a population of 61568 people and should get the foodstuffs (rice) from other regions.

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