SPATIAL PATTERN LANDUSE CHANGES AND SUBURBANIZATION PROCESS IN JABOTABEK AREA AT 1992-2000 PERIOD

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Abstract

The population growth in Jabotabek region has impact on the suburbanization process, that is the increase of people in fringe of Jakarta significantly. However, in the center of the city has decrased. The concequence is land convertion in the suburb area. Spatial pattern of urban landuse and population density accured by suburbanization will be assessed empirically by assuming Monas as a center of Jabotabek. Between 1992 to 2000, decreasing pattern of population density is seen until to dinstance 10 km from Monas. However, urban land ratio increase. Meanwhile the density and urban ratio shows increasing pattern from the distance of 10 to 45 km. People migrate to fringe area where suburbanization process strongly influents urban land development. Comparison between rate of urban ratio and rate of population density is 1.57. This value indicates land convertion to urban is not proportional, that is over supplied to the need of housing and common infrastructure.
This research was carried out in 3 stages : remote sensing data processing, GIS analysis, modeling and analizyng by use regression model to describe suburbanization prosess especially land aspect.

***Key words** : Spatial pattern, land urban ratio, suburbanizatios, and gradient.*

Introduction

Background

Jakarta represent metropolitan town in Indonesia, as governance center, education, industrial, service, commerce, political, life cultural etc. Its impact become center of requirement of labour. The characteristic influences the amount of population, that is incoming urbanization current to Jakarta. Population density will cause pressures land use for settlement to fringe area (suburban), which progressively increase, because progressively as narrow as space and is costly of land value in Jakarta. Resident tends to look for settlement land use farm to fringe area but still can work in Jakarta. This phenomena could happen because area of suburban have adequate infrastructure. Its impact significant to land use conversion in suburb area (Rustiadi, 1998).

Land use conversion means land use change by human being from certain usage become other usage able to be permanent and also tentative. If rice field land change over function become settlement land or industry so that land conversion become permanent, but if rice field land change over function become plantation land usually tentative. Grigg (1996) in Firman (1997), expressing other factor which strengthen current convert from side owner of land, is because land use for the urban activity have more value than others rent.

According to Van of den Berg (1996) in Artawan (1998), suburbanizes represent step where a[n town expand and influence surrounding area and promise prosperity, so that resident of fringe area inhaled to centre of activities in town. Suburbanization also represent a process growth of fringe area which quicker systematically compared to its town, and existence of life style influencing everyday activity as commuter (penglaju) to work in town (Rustiadi and of Panuju, 2000). Suburbanization process have quickened process land use change in Jakarta and its surroundings.

Data of Landsat used to know growth urban land use of year 1992 until year 2000. According to Rangoowale (2001), can be done up to correctness 92 %. Change of urban land use area and population density will study to describe process of suburbanization. This Study conducted with spatial modeling by assuming Monas as center growth of Jabotabek (Rustiadi, 1999).

Objective

Objective of this research is:

1. To describe instruct growth of urban land use Jabotabek of year 1992 up to 2000.
2. Developing empirical pattern model and is fast spatial urban land use change in Jabotabek area in 1992 - 2000.
3. Obtaining relevant information of spatial pattern of population growth with urban land use pattern in Jabotabek.

Hypothesis

1. Urban land use tend to increase while non urban land use will be decreasing pursuant to distance of Monas.
2. Urban land use ratio to fringe area bigger than population density.

Materials And Method

Location and Time

Research location is existing Jabotabek region start year 1992 up to year 2000 with concentration on boundary of countryside.

Appliance and Materials

Data processing use GIS software (ARC View Ver. 3.1), Image Processing ERMAPPER (ver. 6.1), Imagine (ver.8.2), Dekstop Mapping Mapinfo / autocad (ver.2000), and software of Statistica (ver.5.0). needed materials consist of :

Image of Landsat date 30 July 1992 and 17 June 2001, Digital land use map, topography Map with scale 1:25.000, Jabotabek Administration map and population data.

Method

Digitation Regional Boundary of Administration

Regional Vector border line of countryside obtained from result of digitation topography map scale 1: 25.000 using Autocad 2000 software. Its result converted to Arcinfo format with build process, and clean to develop polygon and repair of polygon, like excess of line which needn't. Formed polygon load information area that represents countryside area. Process hereinafter is data conversion to format of Arcview so that can be conducted by analyst functions in GIS.

By exploiting tables data can be woke up by ID from each polygon as well as giving the name of each countryside by relate to name of countryside exist in topography map and also with administration map. Process hereinafter use geoprocessing function, that is dissolved to make district polygon vector and also sub-province exist in Jabotabek.

Acquirement Land Use Data

Land use data obtained from data processing of Landsat with the following steps.

Election of Channel of Spectral

Et al Chavez (1995) in Sitanggang (1998), using is Optimum Index Factor (OIF), that is determining highest ranking of combination three channel of spectral from 7 Landsat spectral like equation algorithm (1).

$$OIF= \frac{\sum_{k=1}^{3} Sk}{\sum_{j=1} Abs(rj)} \quad \ldots\ldots\ldots\ldots\ldots(1)$$

Where,

Sk : Standard deviation channel spectral k value.

Abs(rj) : Absolute value of combination correlation 2 from 3 channel.

Geometric Correction

Existence of distortion of geometric satellite data of Landsat during image akuisisi like influence of curvature earth, earth giration, effect of panoramik position cause each object in image unlike geographical position surface of earth (Lillesand and Keifer, 1994). Correction to the distortion done by two phase, that is determining transformation function and do image resampling. The needed is ground control point (GCP) get from topography map or from Global Positioning System (GPS).

Classification Data of Landsat

Classification is a process in which all the pixels in an image that have similar spectral signatures are identified become certain class (Gonzalez, 1977). There are some is technics of classification, one of them Unsupervised Method with approach of ISODATA (Iterative Self-Organizing Data of Analysis). This Method load algorithm which testing pixel-pixel which not yet been known and group them into class based on clustering. The Result of classification represent class which not yet been known its identity, because relied on grouping base on parameter that give like amount of class, standard maximum deviation, minimum distance between class mean. Users have to give identity constructively reference and or with field survey.

Classification system that used for class name is system modification of Malingreau because referred many by consumer using remote sensing data (Malingreau, 1981). From 24 land use class at level of III in Malingreau system , to re class become 5 class, that is :

1. Urban class consist of farm of settlement land, industrial, road, railway, electrics, airport, port of sea.
2. Rice field class represent irrigation rice field.
3. Upland crops/*tegalan* class represent land use which low vegetation until medium, consisting of upland crops/non irigated dry field, mix garden, *belukar*,*semak*, seagegrass grass, open farm, wet ricefield dependant to rain.
4. Forest class represent land use of close vegetation and plantation, consist of dry farming forest, wet farm forest and plantation.
5. Body territorial water class, land use which is its majority of water. In class of III consist of lake/accumulating basin, fishpond, swamp and river.

Management Data of SIG

Data management component in SIG is including dig function and is depository [of] data (Barus, 2000). The data dug from various processing and is then kept into format of Arcview. Dig of data is countryside parameter data.

Data of countryside polygon vector changed to raster form to overlay process with landsat raster classification data. Equation of format into form of raster better, because can eliminate nature of generalizing that happened at vector data . Result of this process is type and land use area. Urban land ratio determined by dividing urban area with countryside area. Parameter apart countryside of center can be determined by using measurement function analysis. Point center is co-ordinate of kartesian Monas and point center countryside represent polygon emphasis. Distance Countryside to Monas determined by calculating distance both of point. Podes data loading information population/ population density could be join with previous countryside parameter.

Spatial Pattern Analysis

Spatial pattern landuse also population compared with different year by using eksponensial regresi model. Gradien from function represent indicator in depiction of relation from each parameter to a center in spatial context . In urban land ratio, if progressively lower gradien densitas at t1 compare with (t0), can indicate the existence of degradation of sentralization and at the same time increasing suburbanisasi. Jordan (1998), using exponensial regresi model in explaining process of suburbanisasi that happened some town in USA like shown at equation (2).

$$D_{(i,t)} = D_{(0,t)} e^{\gamma_t r_i + \varepsilon} \qquad \ldots\ldots\ldots\ldots(2)$$

where,

- $D(i,t)$: urban land ratio in countryside i in the year t.
- $D(0,t)$: urban land ratio in center (Monas)
- γ_t : gradien function in the year t.
- r_i : countryside distance i from center.
- ε : error.

Comparison of value of gradien at any time perception can depict there is or inexistence suburbanization process.

Result And Solution

Set of Research

Set of research is countryside/sub-district of Jabotabek. Polygon made from digitation of topography map scale 1:25 000 and verification with administration map every sub-province. There are 1488 countryside in 2000 while in 1992 counted 1410.

Land Use Jabotabek

Land use data of Jabotabek in 1992 and 2000 done by data processing of the following Landsat.

Election Of Channel of Spectral Landsat

From statistical analysis of data Landsat 2000, obtained by value of IOF each combination three channel. Assess biggest IOF is 106.6 with channel 2,4 and 5, so that data of Landsat the processed is channel 2 4 and 5.

Geometrik Correction

With polinomial transformation conducted by election to point of GCP available, that is throwing away point of GCP having RMS (Root Mean Square) big and maintain point with small RMS (<0.5 pixel). Besides value of RMS, the consideration so that point of GCP selected spread over at all research area. This process got 16 ponit of GCP with small RMS error. Afterthat transformation of resampling image with input point of GCP to get image corected.

Land Use Classification

Both data of Landsat classification become five land use class (*Lampiran 1*). Result of classification show Jakarta is more urban class , while Bogor, Tangerang and of Bekasi predominated by farm/non irigated dry field class. Growth of biggest urban happened in Bekasi that is equal to 23.254,5 ha, Tangerang 19.432,4 ha, Jakarta equal to 17.950,6 ha and Bogor 16.302,2 ha. So that all natural growth of urban in Jabotabek equal to 76.939,7 ha during year 1992 up to 2000.

Growth of urban also mean the happening of land conversion. Conversion pattern differ in each region. From 53.672,7 ha urban area in Jakarta in the year 2000, equal to 66,6 % is urban land use in 1992, the rest represent conversion of non-urban, that is 24.3 % coming from farm / non irigated dry field, 7.2 % rice field, and territorial water body 1.9 %. Bogor owning urban area 34.810,1 ha in 2000, 53.1 % represent urban land use in 1992. 46.9% again is to represent non-urban land use, that is : 35.9% non irigated dry field, 8.38% from rice field , territorial water body 1% and forest 1,2 % in 1992. Tangerang having urban area 36.759,9 ha in 2001, 47% representing urban in 1992. Others, 27% representing rice field, farm/non irigated dry field 24,3%, and territorial water body 1%. Region of Bekasi having urban land use area 35.961,8 ha in 2001, 35.3% represent urban landuse in 1992, others represent rice field 45,3%, farm/non irigated dry field 19,0%, and territorial water body 0,3%.

In general convertion pattern in Jakarta and Bogor more coming from farm/non irigated dry field, while region of Bekasi and Tangerang more from rice field.

Population Growth Jabotabek

Tables 1 showing growth of resident is each region in Jabotabek of year 1992 until year 2000. There are different growth pattern at four region. Mean population growth regional per year in Jakarta for 1992 until 2000 only 1.04%. Region of BOTABEK which geographically its close to DKI fringe have big enough population growth , especially Tangerang with growth 5.09%, Bekasi 3.16%, and Bogor 2.48%. This number depict accretion of population in Jabotabek of room facet or region in fact affect at process the happening of suburbanization, that is expanding Jakarta outskirt that fast enough which administrationly become part of BOTABEK.

Tables 1. Population Growth at Jabotabek in 1992 to 2000

Region	Amount of population in the year		Growth (%/year)
	1992	2000	
Jakarta	7.228.654	7.832.895	1.04
Bogor	3.849.052	4.922.638	2.48
Tangerang	2.389.605	3.555.173	5.09
Bekasi	2.094.839	2.624.647	3.16

Source: Processed from data of Podes Jabotabek Year 1992 and 2000

GIS

Usage of GIS analsys function addressed to get countryside parameter, that is: countryside area, countryside distance to monas, land use area and population parameter that get from podes data.

Spatial of Population Analysis in Jabotabek

Dynamics Spatial of Population

Picture 1 showing density gradation each countryside pursuant to center distance and Tables 2 is density mean pursuant to distance level. In distance < 5 km, seen pattern degradation of big density in 2000, about 1600 head/km^2. In distance 5-10 km show pattern which smaller, that is about 340 head/km^2. people have migration to other place that avoid center and its urban turn into other urban function. High standard deviasi express high variety of density, its meaning in this part of its countryside population very crowded but in others population are rarely. Countryside population which rarely in Monas sorround represent white colars area, commercial center and business, while smaller settlement land use.

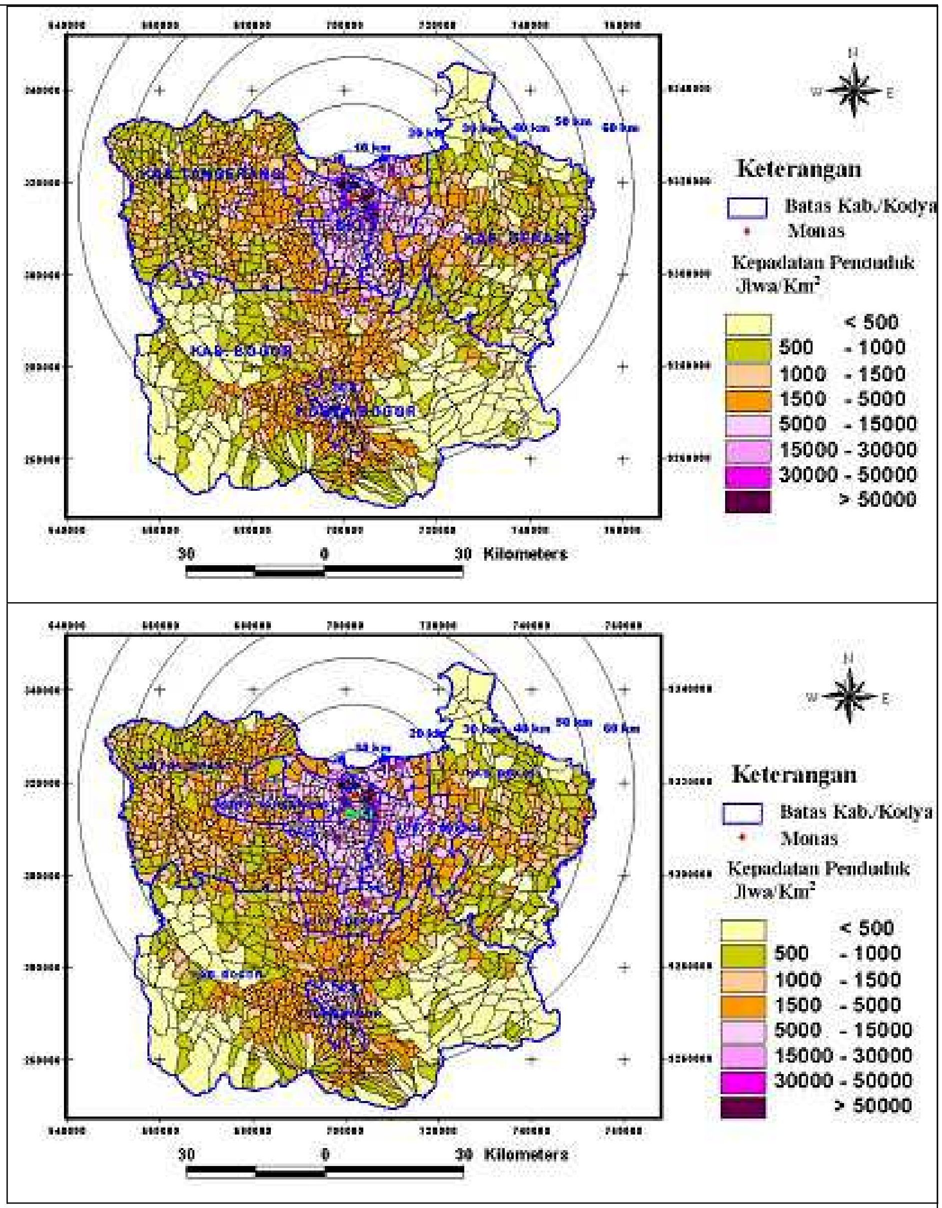
Pattern increase of population happened to start 10 km until 30 km, that is around 1000 head/km^2. Regional most residing in boundary of Jakarta up to region which is very expand in Botabek, that is Town of Tangerang, Serpong, Ciputat, Pamulang, Town of Depok, Town of Bekasi, Pondok Gede, Bantaran Gebang, Cibitung and Tambun. In radius 30-45 km of center happened lower increase if compared to previous radius, that only about 600 head/km^2. The Regional not in kodya area in Jabotabek, and represent sub-province region. Administrationly the regional is Pasar Kemis, Cikupa, Tigaraksa, Parung, Cibinong, Cileungsi, Cikarang and Sukatani. Part of this regional are big enough development of industry which indirectly influence growth of population around. In radius hereinafter , that is above 45 km of center do not have increasing of population which is signifikan in 2000.

Gradien Density

Gradien of countryside density function of Jabotabek to distance of monas tested in two model of exponensial the following.

Model 1 : D (i,t) = D (0 t) exp (a - i x b)

Lampiran 2 showing density distribution of population density base on countryside distance from center in 1992 and 2000. Exponential model in Tables 3, where R^2 (1992=0.54) and R^2(2000)=0.59, showing there is influence apart countryside from center with density, that is countryside sorround monas have high density and progressively far its density smaller.



Picture 1. Gradation Density of Monas (to the: 1992, under : 2000)

Tables 2 Mean Density Pursuant to Distance Level.

Distance (km)	1992		2000	
	Mean of Population Density	Standard Deviation	Mean of Population Density	Standard Deviation
<5	35.000,1	20.326,2	33.385,2	19.595,2
5 - 10	19.487,7	14.666,2	19.146,7	14.811,9
10 -15	8.958,5	4.871,5	11.828,7	4.612,06
15 -20	4.675,9	3.176,9	6.433,8	4.400,4
20 - 25	4.078,4	2.610,8	5.549,9	3.042,4
25 - 30	2.151,8	2.049,3	3.540,3	2.755,7
30 - 35	1.483,8	1.044,6	2.167,7	1.794,1
35 - 40	1.070,1	1.426,5	1.688,8	1.136,2
40 - 45	2.094,1	1.936,1	2.593,8	1.414,7
45 - 50	3.687,4	1.643,7	3.660,5	2.030,4
50 - 55	1.871,2	1.045,9	2.475,2	1.653,8
55 - 60	1.294,7	969,8	1.159,4	1.169,8
> 60	723,2	652,1	863,2	622,1

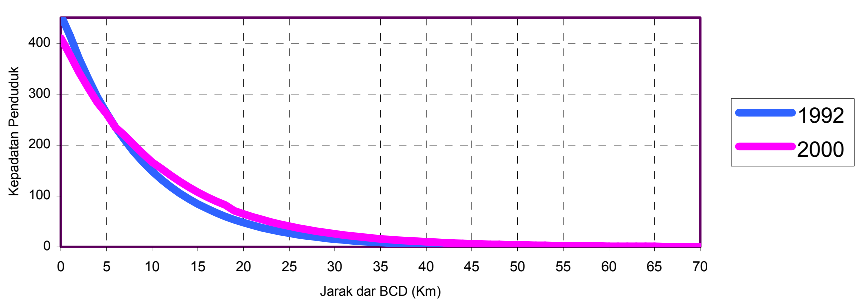
Picture 2, showing pattern of population density in 1992 and 2000. Value of D0 (1992) equal to 14.93 and D0 (2000) equal to 13.55 expressing degradation of density town, that is equal to D0 (1992) - D0 (2000 = 1.38 head / ha or 138 [head / km2. Precipitous of function (gradien) in 1992 equal to - 0.114 and year 2000 equal to - 0.093, indicate existence degradation pattern of density in town and progressively high toward boundary with difference of gradien equal to 0,021 in range of time.

Model 2 : D(i,t) = D (0t) exp (a-ixb-ix c2)

Function density model pursuant to distance of monas shown by equation in Tables 4.

Tables 3. Function Density To Distance with Model-1 Year.

Year	Model	R^2	p-level
1992	$D_1 = 14.93 \exp(3.437 - 0.114 x_i)$	0.59	a = 0.001 b =0.001
2000	$D_2 = 13.55 \exp(3.431 - 0.093 x_i)$	0.53	a = 0.001 b =0.001



Picture 2. Pattern Change of Density Year 1992 and Year 2000

Tables 4. Function Density To Distance with Model-2.

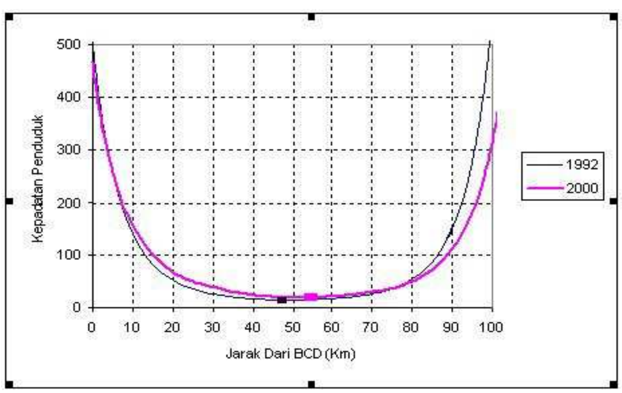
Year	Model	R^2	p-level
1992	$D_1 = 14.93 \exp (3.512 - 0.143 x_i + 0.00144 x_i^2)$	0.56	a=0.01, b=0.001, c=0.05
2000	$D_2 = 13.55 \exp (3.520 - 0.124 x_i + 0.00120 x_i^2)$	0.53	a=0.01, b=0.001, c=0.05

With approach of exponensial model 2 such as those which shown by Picture 3, density pattern much the same to with posed pattern at model 1. Its difference that at 2 model is there are point of kulminasi under co-ordinate (46, 15) in 1992 and (54 , 20) in 2000. Its happened because the function represent quadratic function with discriminat (D > 0). This value indicate process suburbanisasi that happened with phenomenon shift regional boundary because effect of influence suburbaniation process from distance 46 km up to radius 54 km with increase of density from 15 head/ha or 1500 /head/ km2 in 1992 becoming 20 head/ha or 2000 head/km2. Regional in the radius represent countryside at sub-province region and outside Municipality exist in Jabotabek (except town of Bogor)

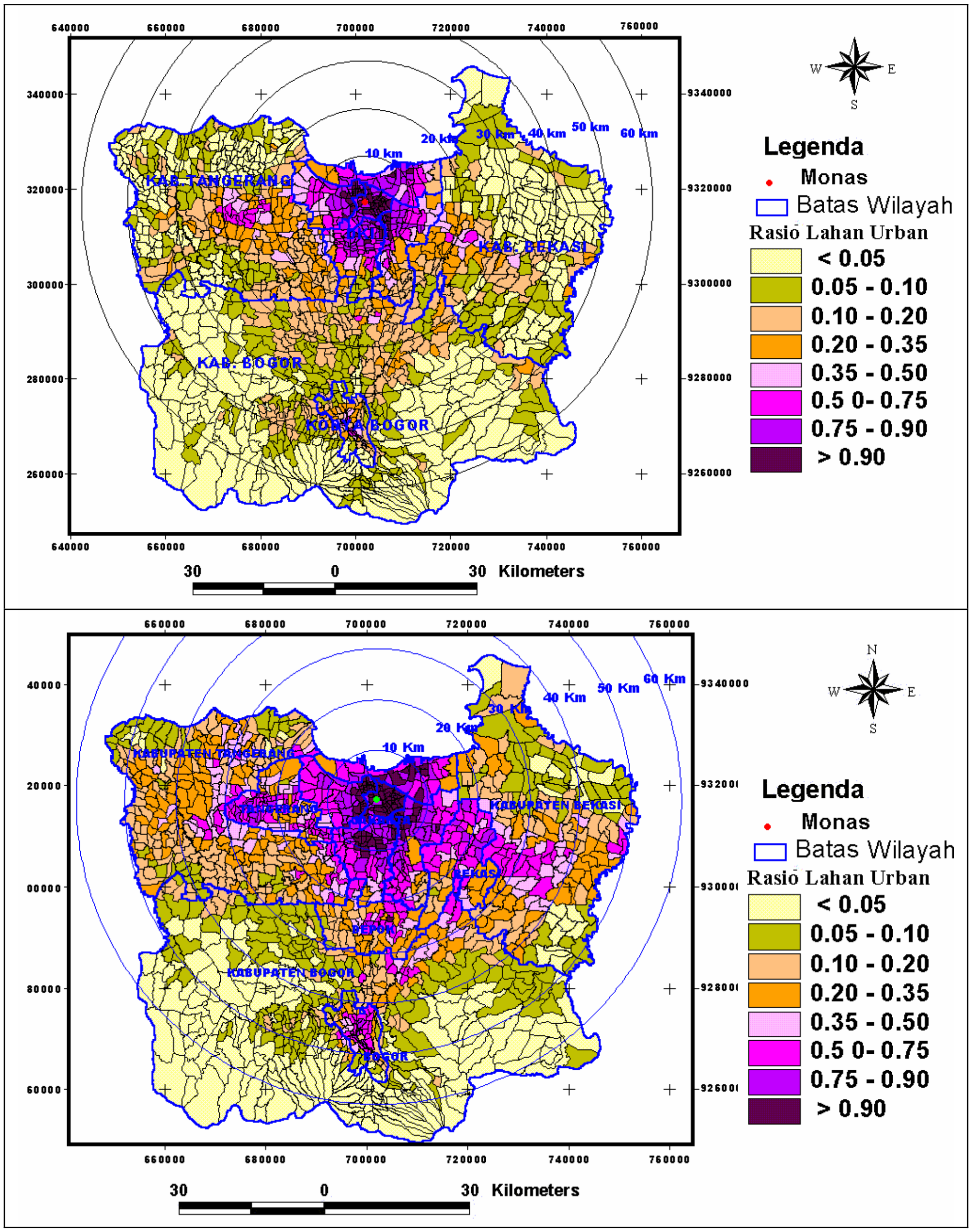
Spatial Analysis Urban land Use Ratio in Jabotabek

Dynamics Spatial of Urban Land Use

In line with growth of population will affect at growth urban land use. Picture 4 showing gradation urban ratio pursuant to distance of monas, and Tables 5 representing mean of urban ratio pursuant to distance level. In general happened increasing urban ratio in Jabotabek in 2000. Around distance or monas 0 - 10 km there are increasing small of urban ratio , only about 0.04. Its happened because area in this radius start from 1992 representing high settlement region, white colars, and function of other urban. High increasing urban ratio start from distance 10 km up to distance 35 km, that is increase about 0.22. Region in this radius some still reside in region of DKI, that is outside Jakarta Center. Most outside DKI including town of Tangerang, town of Depok, town of Bekasi and regional sub-province which is very expand for the settlement of industry and like Serpong, Ciputat, Parung, Cibinong Cileungsi, Cibitung, Tambun, Cikarang etc. In distance 35 - 45 km start to see degradation of urban ratio in comparison with previous radius that is about 0.12. Hereinafter at radius above 45 km show pattern which downhill progressively. Region at the radius is countryside outside municipality exist in Jabotabek.



Picture 3. Density Pattern with Approach of Model 2 (r = 100 km)



Picture 4. Gradation Urban Land Ratio in Jabotabek from Monas (up: 1992, down:2000)

Tables 5 Mean Ratio of Urban Pursuant to Storey;Level Apart from Monas.

Distance (km)	1992 Mean Urban Ratio	1992 Standard Deviation	2000 Mean Urban Ratio	2000 Standard Deviation
<5	0.945	0.059	0.96	0.06
5 - 10	0.799	0.056	0.89	0.09
10 -15	0.451	0.093	0.66	0.10
15 -20	0.213	0.106	0.46	0.19
20 - 25	0.189	0.152	0.39	0.23
25 - 30	0.132	0.133	0.32	0.21
30 - 35	0.107	0.102	0.26	0.17
35 - 40	0.16	0.12	0.29	0.15
40 - 45	0.17	0.14	0.28	0.17
45 - 50	0.127	0.10	0.2	0.11
50 - 55	0.063	0.062	0.08	0.07
55 - 60	0.04	0.028	0.044	0.03
> 60	0.025	0.024	0.027	0.008

In general standard of deviation in 2000 bigger than 1992 which is indicate the happened land use urban growth almost in all countryside of jabotabek and very heterogeneous. Standard deviation at distance below 15 km relative, while its high ratio express all countryside in this radius represent urban land use and homogeneous relative. While at distance above 50 km have low urban ratio and standard deviation. Its show that the countryside have low urban ratio and homogeneous relative.

Gradien Urban Land Ratio.

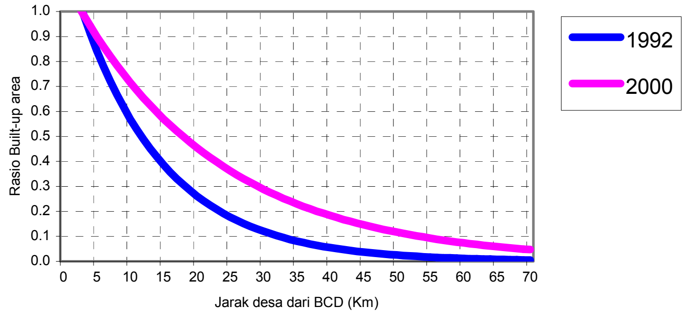
Model 1 : R (i,t) = R (0 t) exp (a - i x b)

Ratio urban function with distance shown at Tables 6 while pattern increasing urban land use in 2000 compared to year 1992 shown in Pictures 6. Assess R2 1992 = 0.79 and R2 2000 = 0.64, showing downhill progressively influence apart to urban growth in 2000. Urban Growth in BOTABEK in 2000 have high growth, such as : white colars, settlement, industi, service and others which is not irrespective Jakarta.

Difference of ratio urban gradien in 1992 with 2000 is equal to 0,033, where in 1992 more precipitous from year 2000. This value show pattern of urban land use growth ever greater toward to fringe area in 2000. Comparison between land use ratio difference of urban and of gradien density in the range of time is 0.033/ 0.021 = 1.57. This value indicate urban growth exceed requirement of population reality for settlement, other infrastructure.

Tables 6. Function Ratio farm of Urban To Distance with Approach of Model-1 Year.

Year	Regretion Model	R^2	p-level
1992	R_1 = 0.91 exp (0.325 – 0.078 x_i)	0.79	a=0.01, b=0.01
2000	R_2 = 0.97 exp (0.277 – 0.045 x_i)	0.64	a=0.01, b=0.01



Picture 5. Pattern Growth Of Ratio Farm of Urban of Year 1992 to Year 2000 with Approach of Model-1.

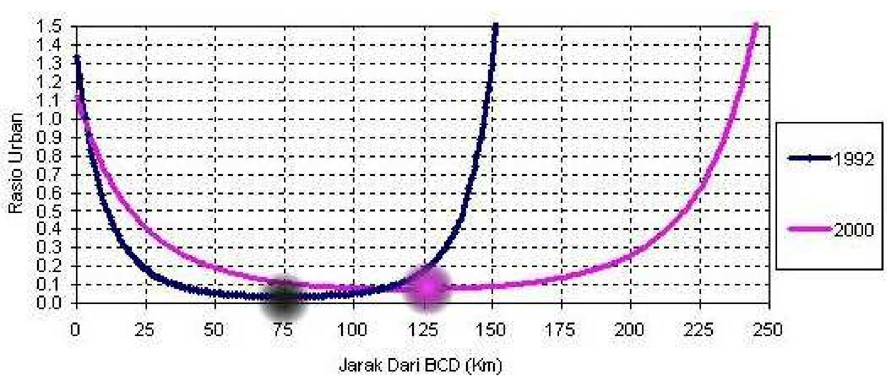
Model 2 : R(i,t) = R(0t) exp (a-ixb-ixc2)

Function with approach shown in model-2 at Tables 7 . Value of R^2 from both function, that is 0.82 in 1992 and 0.65 in 2000 indicating that influence apart countryside from center to urban growth is decreasing, same as posed indication at model 1.

Picture 6 representing land ratio relation of urban start from monas reach outside Jabotabek. Point of Kulminasi under 1992 function residing in point (75,0.05), while in 2000 have shifted to point (125,0.09). This friction describing influence boundary of suburbanisasi that happened have shifted from distance 75 km in the year 1992, so that year 2000 coming up with distance 125 km. Besides friction of influence of suburbanisasi, also happened increasing urban ratio 0.05 in 1992 becoming 0.09 in 2000. Distance 125 km have outside Jabotabek,that is: to westside Sub-Province Serang, South Sub-Province of Sukabumi and West of Kabupaten Karawang.

Tables 7. Function Ratio farm of urban to distance with approach of Year model-2.

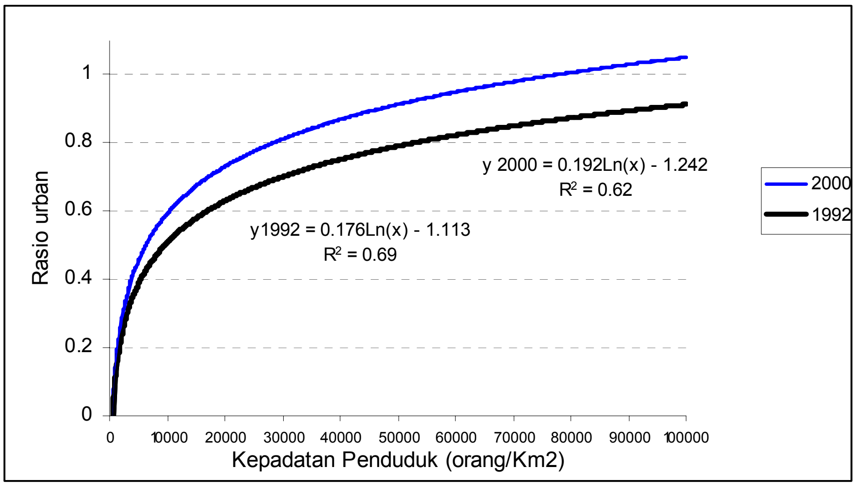
Year	Model	R^2	p-level
1992	$R_1 = 0.91 \exp(0.395 - 0.0692\, x_i + 0.000645\, x_i^2)$	0.82	a=0.01, b=0.01, c=0.05
2000	$R_2 = 0.97 \exp(0.226 - 0.045\, x_i + 0.000019\, x_i^2)$	0.65	a=0.01, b=0.01, c=0.05



Picture 6. Pattern Ratio Farm of Urban Year 1992 and Year 2000 (Model 2)

Model Requirement Land Use for Population in Jabotabek.

Picture 7 showing density relation with land use urban ratio in Jabotabek at 1992 and 2000. Seen $R^2 = 0.69$ (1992) bigger than R^2 (2000) = 0.62. Its depict the existence of degradation of correlation urban growth and population growth. In countryside with density under 1000 head/km2, seen urban ratio in 2000 bigger than 1992. Its gyration is countryside which far from town that have small urban growth , landuse urban ratio consist housing of population, public facility and roadway. High difference urban ratio there are at density start 2000 head/km2, where this region represent countryside residing in marginal town until Jakarta or distance < 30 km of Monas. This Pattern indicate requirement of urban land use larger ones in 2000 because requirement of high urban land use besides for housing.



Picture 7. [Relation/Link] Ratio Farm of Urban with Density of Jabotabek.

Conclusion

1. Growth of population at Jakarta in 1992 until 2000 only 1.04%/year, Bekasi (3.16%), Bogor (3.48%), and Tangerang (5.09%). Seen population growth in Jabotabek affect suburbanization process , that is increasing of population in boundary of Jakarta.
2. Pattern of urban land use effect growth of DKI and Bogor most coming from farm/non irigated dry field while Bekasi and of Tangerang from rice field.
3. In range of time 1992 until 2000 strarting Monas apart 10 km there is pattern degradation of density but urban land ratio is increasing. Density pattern and also urban ratio go up significant at 15-40 km, location is target of migration.
4. Difference of Gradient year density 1992 bigger 0.021 from 2000, pattern indicate degradation of density in town and crowded progressively toward boundary. There are friction boundary of suburbanisasi in distance 46 km at 1992 becoming 54 km in 2000 with increasing density from 1500 becoming 2000 head/km^2.
5. Difference of Gradien ratio of urban year 1992 bigger 0,033 from year 2000.

Compare with difference gradient urban ratio 0.033 / 0.021 = 1.57. This matter indication that land conversion become urban is not proportional, that is exceeding requirement of population reality for settlement and others infrastructure.

6. Land use urban growth in 2000 mounting very fast because of development not merely for the settlement function, but very high for industrial function, service/commerce, town infrastructure and also other [common/public] facility.

Suggestion

Fast growth of urban toward boundary of Jakarta cause land conversion become urban are high BOTABEK region. Need furthermore study about influence of the suburbanisasi to problem land physical, like degradation of ground water absorpsion, anticipatory floods and etc. Beside that also social impact study, economics and culture.

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