

# Study of physical environment based on land system map of Kabupaten Bandung

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**Abstract.** *The environmental damage in Kabupaten Bandung is critical. To solve the environmental problems, the integrated spatial data of the physical environment is required. Land system data as the integrated spatial data which describes the characteristics of land are useful for the analysis and evaluation of the environmental conditions. The objective of the study is to describe the characteristics of the physical environment of Kabupaten Bandung based on the land system map for the input of decision-making in achieving sustainable development. The study used the spatial analysis and descriptive analytical method. The land system data was obtained from the Badan Informasi Geospasial (BIG). The results show that the landforms in Kabupaten Bandung are dominated by volcanic and fluvial landforms. The volcanic landforms has morphology dominated by mountainous areas with the slope steepness more than 45% and the soil types of andosols. The land capability of these mountainous areas belongs to grade 7 (for conservation areas). The fluvial landforms are lacustrine plains, which are prone to flood due to inundation. From this study, it is concluded that the land utilization in Kabupaten Bandung, particularly in mountainous areas, is not in accordance with the land carrying capacity. To achieve the sustainable development, the land utilization should consider the regulation of spatial planning, by which the lands with slope steepness more than 40% are categorized as protected areas.*

**Keywords:** *Land system, land characteristics, landform, sustainable development*

## 1. Introduction

The environmental problems in Kabupaten Bandung is difficult to be solved because of many causes, such as many land function changes, disappearance of water catchment areas, and low law enforcement (Tamsil, 2019). These environmental problems certainly threaten the sustainable development. To achieve the sustainable development requires the integrated thematic land resource spatial data such as land system map. The concept of land systems introduced by Christian & Stewart (1968) based on ecological principles by assuming there is a connection between the types of rocks, hydroclimates, landforms, soils, and organisms. The similar characteristics of land system will has the same combination of ecological or environmental factors. Therefore, the land system is not something unique for one place, but can be found anywhere with the same environmental characteristics.

It is further argued that a land system consists of one combination of source rocks, soils, topography, and it reflects similarities the similarities of its potential and the restrictions of its factors (Suharta, 2007).

The land system in Indonesia is widely known through the map of RePPProT (Regional Physical Planning Program for Transmigration), which is an activity conducted between 1984 – 1990 and in 1980, in order to support the development of Transmigration. The activity is collaboration between the *Direktorat Bina Program, Dirjen Penyiapan Pemukiman, Departemen Transmigrasi* with Land Resources Department of ODNRI-ODA. Since then, the land resource mapping activities were started for all of Indonesia on a scale of 1:250,000, with a total of 414 land systems. The mapping activities which became known as the RePPProT project which is implemented the concept of land system that is sourced from the concept of CSIRO (Commonwealth Scientific and Industrial Research Organisation) land system.

Land system map is important to reinforce sustainable development in Indonesia. Based on Pearce & Tunner (1990), the meaning of sustainable development lies in the issue of how the natural environment should be treated in order to play a role in economic sustainability as a resource for improving living standards. So far, the land system data of Kabupaten Bandung has not been utilized to see if land use is in accordance with the characteristics of the land. This study will describe the characteristics of the physical environment of Kabupaten Bandung based on the land system map for the sustainable development. It is hoped that the results of the study are useful for the input of the decision making for the spatial land use planning in Kabupaten Bandung.

## 2. Methodology

### 2.1. Location of Study

The location used in this study is Kabupaten Bandung. Geographically, Kabupaten Bandung is one of regencies in West Java province. Topography in most of the Kabupaten Bandung is a mountainous or hilly area with a height above sea level which varies from 500-1,800 m. Kabupaten Bandung is located at 6° 49 '7° 18' S and between 107° 14'-107° 56' E with total area of 176,238.67 hectares..

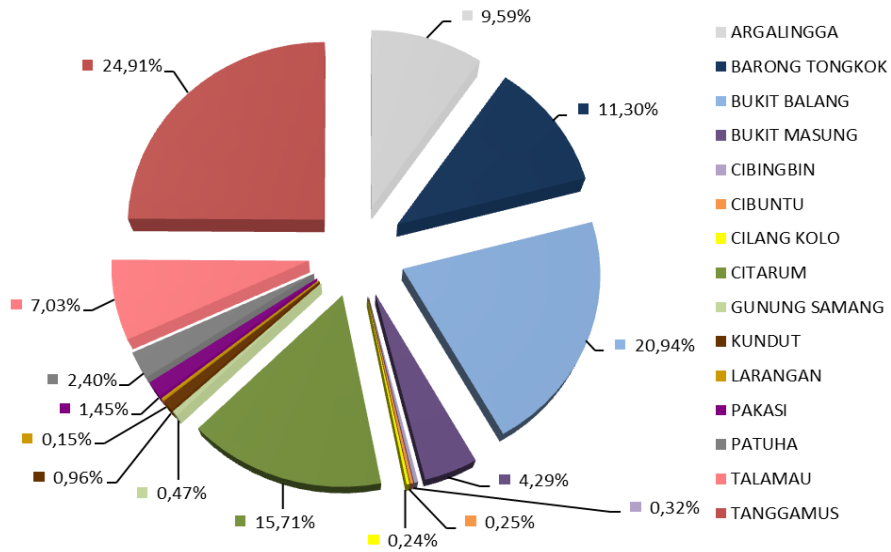
### 2.2. Method of Analysis

The research method used are spatial analysis and descriptive analytical method. Physical environment characteristics variables are land system name, land type, lithology, soil texture, soil domain, soil association, drainage condition, drainage density, class of slope, slope length, morphology, land suitability, and land capability will be grouped into a land system. In this study, spatial analysis used for interpreting physical environment of land systems map and land use map from *Badan Informasi Geospasial* (BIG) to investigate the relationship between both maps. After that, we used descriptive analysis to explain the data. According to Surakhmad (1982), the descriptive method of analytics is a descriptive investigation that is fixed in a way to solve a problem that exists today, including relating and interpreting existing data, classify, compiled, explained and analyzed.

## 3. Result and Discussion

### 3.1 Land Characteristics

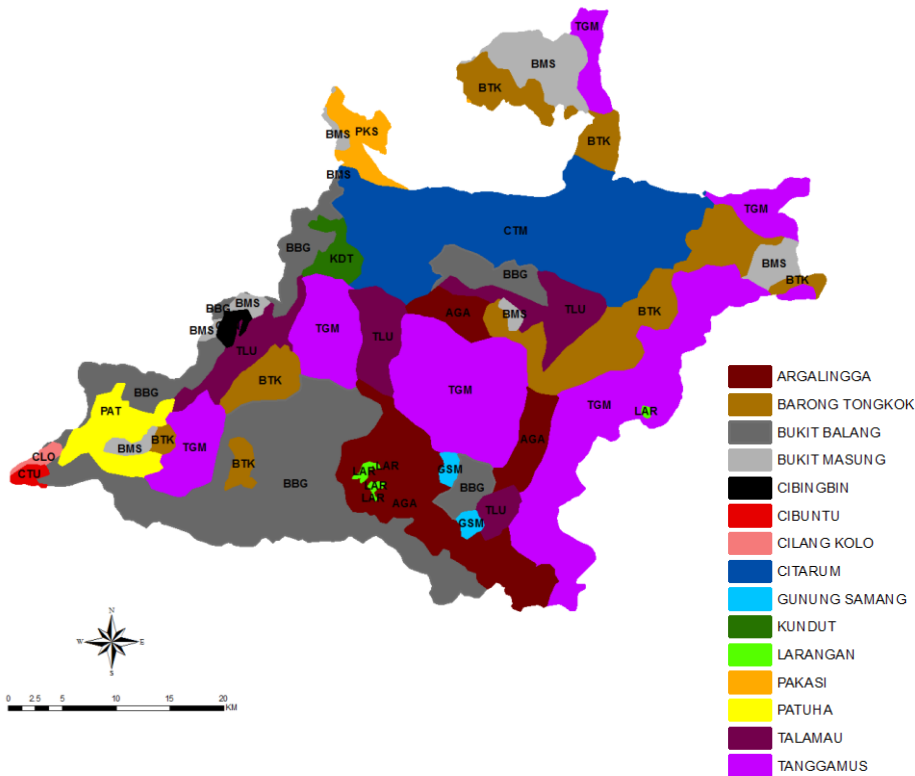
The characteristics of five dominant lands in Kabupaten Bandung were described based on the aspects of geomorphology. Geomorphology is the study of landform which consists of three related material objects, namely morphology/relief as a result of interaction between the composition material of land form and geomorphological process that works on it; compiler material aterial of land form consisting of basic material and surface cover material of land form; and geomorphological processes that change the land form over time. Five of the dominant land in Bandung Regency (figure 1) is the land system of Tanggamus (TGM) with 24.91%; the land system of Bukit Balang (BBG) with 20.94%; the land system of Citarum (CTM) with 15.71%; the land system of Barong Tongkok (BTK) with 11.3%; and the land system of Argalingga (AGA) with 9.59% of the total area.



**Figure 1.** Percentage of Land System in Kabupaten Bandung  
 Source: Data Processing, 2019

*a. Morphology*

Morphology (relief) is the result of interaction between the constituent materials of land form. Morphology is morphogrphy aspect of an area which formed by its morphometry include the color, texture, structure, consistence, thickness, and arrangement of the various soil layers in the soil profiles (Lytle, 1968). Morphology is the main aspect of land-form characterizing. The morphology of an area will affect the surface of the groundwater, as the ground water level follows the topographical pattern (Verstappen, 1975).



**Figure 2.** Map of Land System in Kabupaten Bandung  
 Source: Badan Informasi Geospasial

The following table is data from the land system in Kabupaten Bandung. Table 1 explain about the morphological characteristics of each land system.

**Table 1.** Characteristics of Land System Morphology in Kabupaten Bandung

No.	Symbol	Land System Name	Land Type	Area (km <sup>2</sup> )	Area (%)
1	AGA	Argalingga	Moderately dissected lava flows in highland areas	169,94	9,59
2	BTK	Barong Tongkok	Moderately dissected lava flows	200,05	11,29
3	BBG	Bukit Balang	Irregular mountain ridges on intermediate basaltic volcanic	370,82	20,98
4	BMS	Bukit Masung	Very steep ridges on basaltic volcanics	75,91	4,29
5	CBN	Cibingbin	Hillocky plains intermediate/basic volcanic rocks in highland	5,63	0,32
6	CTU	Cibuntu	Dissected crystalline tuff sheets	4,37	0,25
7	CLO	Cilang Kolo	Strongly dissected tilted plateau on tuffaceous sediments	4,28	0,24
8	CTM	Citarum	Slightly dissected lacustrine plains	278,22	15,71
9	GSM	Gunung Samang	Moderately steep hills on basaltic volcanics	8,30	0,47
10	KDT	Kundut	Slightly dissected gentle lahar slopes	16,93	0,95
11	LAR	Larangan	Linear hillocky ridges on mixed sedimentary rocks in dry area	2,72	0,15
12	PKS	Pakasi	Rolling acid volcanic tuff plains	25,71	1,45
13	PAT	Patuha	Recent lahar and lava flows (from Gunung Patuha)	42,55	2,40
14	TLU	Talamau	Moderately steep and dissected lahar slopes	124,52	7,03
15	TGM	Tanggungamus	Young stratovolcanoes on basic volcanics	441,17	24,91
<b>Total</b>				1.771,14	100

Continued from **Table 1**

No.	Symbol	Land System Name	Slope Class	Slope Length	Terrain
1	AGA	Argalingga	16-25%	101-200m	Rolling, hillocky
2	BTK	Barong Tongkok	16-25%	101-200m	Rolling, hillocky
3	BBG	Bukit Balang	41-60%	101-200m	Mountainous
4	BMS	Bukit Masung	41-60%	101-200m	Hilly
5	CBN	Cibingbin	16-25%	50-100m	Hillocky
6	CTU	Cibuntu	26-40%	<50m	Hillocky
7	CLO	Cilang Kolo	41-60%	50-100m	Hilly
8	CTM	Citarum	<2%	<50m	Flat
9	GSM	Gunung Samang	16-25%	201-500m	Hilly
10	KDT	Kundut	9-15%	50-100m	-
11	LAR	Larangan	16-25%	50-100m	Hillocky
12	PKS	Pakasi	9-15%	201-500m	Rolling
13	PAT	Patuha	16-25%	<50m	Hillocky
14	TLU	Talamau	16-25%	50-100m	-
15	TGM	Tanggungamus	41-60%	>5.000m	Mountainous

Source: *Badan Informasi Geospasial*

Table 1 describes various morphological characteristics in Kabupaten Bandung. The most dominant land system is the land system of Tanggamus (TGM) which is purple color in figure 2 located in the east to the southeast and central Kabupaten Bandung with an area of 441.17 km<sup>2</sup> or 24.91% of the total

area. The land system of Tanggamus has a young stratovolcano on basic volcanics land type that has a slope of 41-60% with a morphology of mountains with a slope length of > 5.000 m, it indicates that there is prone to erosion in this region due to the high and long upper slope triggers the amount of water flow energy.

The second largest land system is the Bukit Balang (BBG) land system which is dark gray color in figure 2 located in the south to the west of Kabupaten Bandung with an area of 370,82 km<sup>2</sup> or 20,94% of the total area. The land system of Bukit Balang has an irregular mountain ridges on intermediate basaltic volcanic land type that has a slope of 41-60% with a morphology of mountains with a slope length of 101-200 m, it indicates that there is prone erosion to this area because of the steep and long upper slopes precipitate the magnitude of water flow energy.

The third largest land system is the Citarum Land System (CTM) which is dark blue color in Figure 2 located in the south of Kabupaten Bandung with an area of 278,22 km<sup>2</sup> or 15,71% of the total area. The land system of Citarum has a slightly dissected lacustrine plains land type with a slope of < 2% with morphology in the form of a flat plateau with a slope length of < 50 m, it indicates that there is prone to flooding due to sedimentation in the lower slope.

The fourth largest land system is the land system of Barong Tongkok (BTK) which is brown color in figure 2 located in the east and southwest of Kabupaten Bandung with an area of 200,05 km<sup>2</sup> or 11,3% of the overall area. The Tongkok Barong land system has a moderately dissected lava flows land type that has a slope of 16-25% with morphology of rolling and hilly with a slope length of 101-200 m, it indicates that the vulnerable erosion of the region due to the slightly steep and long middle slopes triggering the amount of water flow energy.

The fifth largest land system is the land system Argalingga (AGA) which is maroon color in figure 2 located in the southeast to the south of Kabupaten Bandung with an area of 169,94 km<sup>2</sup> or 9,59% of the total area. Argalingga's land system has a moderately dissected lava flows in highland areas land type that has a slope of 16-25% with morphology of rolling and hilly with a slope length of 101-200 m, it indicates that the vulnerable erosion of the region due to the slightly steep and long middle slopes triggering the amount of water flow energy.

#### b. Land Forming Material

Material is a constituent of land form consisting of basic material and surface covering material of land form. The material is lithology, lithology is geological term to describe types of rocks formation namely, sedimentary, metamorphic and igneous (Guo, 2019). Lithology provides information about the type and characteristics of rock and its compiler minerals that will affect the formation of land form. The following table 2 will explain about the land forming material characteristics of each land system.

The most dominant land system is Tanggamus (TGM) with a hard-textured volcanic rock or igneous rocks. This land system has a soil domain humitropepts, hydraridepts and the soil association is dystrandeps which is a type of andosol. Andosol is formed from volcanic ash source material. The soil has a high organic content, has a deep solum, moderately erosion resistant, has high organic matter content, moderate fertility rate with good drainage (Sukarman et al, 2015). The Andosol soil is a volcanic soil, suitable for tea plantations, coffee, tobacco, and fruits.

The second largest of the land system is the Bukit Balang (BBG) with a hard-textured volcanic rock or igneous rocks. This land system has the soil domain humitropepts, tropohumults and the soil association is dystropepts which is a type of soil inceptisol-ultisol commonly called the latosol. Latosol has a slightly thick to thick soil solum, ranging around 130 cm to more than 5 meters, has organic material about 3% to 9%, has a clay texture, soil structure in general is crumb with a loose consistency (Fatma, 2016). Latosol soil is moderately erosion resistant, and its purity is moderate to high with good drainage. Latosol soil or inceptisol which is a type of mineral soil is quite suitable for planting various types of crops such as nutmeg, sugarcane and cocoa.

The third largest area of the land system is the Citarum (CTM) with soft textured sedimentation or sedimentary rocks. This land system has a soil association of fluvaquents which is a type of alluvial soil. alluvial soil contains organic material from low to high, many contain sand and clay, has a pH level of < 4, so it is difficult to cultivate (Subardja, 2016). Alluvial soils are often the cause of flooding due to poor drainage and sedimentation. The fourth largest area of the land system is the field system of Barong Tongkok (BTK) with a hard-textured volcanic rock or igneous rocks. This land system has the

soil domain eutropepts, tropudalfs and soil association dystropepts which is a type of inceptisol-alfisol soil commonly called mediteran soil. Mediteran soil comes from a karst frozen rock, containing many high carbonate compounds. The soil also contains many minerals such as iron, water, aluminum, and other organic compounds that help nourish the soil (Subardja, 2016). This soil is generally used to plant rice because it has good drainage.

**Table 2.** Characteristics of Land Forming Material in Kabupaten Bandung

No.	Symbol	Land System Name	Lithology	Indurat	Soil Domain	Soil Association	Drainage
1	AGA	Argalingga	Volcanic	Hard	Various	Eutrandepts	-
2	BTK	Barong Tongkok	Volcanic	Hard	Eutropepts, Tropudaifa	Dystropepts	Well Drained
3	BBG	Bukit Balang	Volcanic	Hard	Humitropepts, Tropohumults	Dystropepts	Well Drained
4	BMS	Bukit Masung	Volcanic	Hard	Tropudults, Troporthents	Mod.	Well Drained
5	CBN	Cibingbin	Volcanic	Hard	Eutrandepts	Eutropepts	Well Drained
6	CTU	Cibuntu	Volcanic	Hard	Troporthents	Eutrandepts	Well Drained
7	CLO	Cilang Kolo	Sedimentary	Hard, soft	Paleudults	Dystropepts	Well Drained
8	CTM	Citarum	Sedimentary	Soft	-	Fluvaquents	Imperfect, Poor
9	GSM	Gunung Samang	Volcanic	Hard	Eutropepts	Tropudults	Well Drained
10	KDT	Kundut	Volcanic	Soft	Eutropepts	Paleudults	Well Drained
11	LAR	Larangan	Sedimentary	Hard	Haplustalfs, Dystropepts	Paleustults	Well Drained
12	PKS	Pakasi	Volcanic	Soft	Dystrandepsts, Haplorthox	Dystropepts	Well Drained
13	PAT	Patuha	Volcanic	Hard	-	-	-
14	TLU	Talamau	Volcanic	Soft	Eutropepts	Dystrandepsts, tropudults,	Well Drained, Imperf
15	TGM	Tanggamus	Volcanic	Hard	Humitropepts, Hydraridepts	Dystrandepsts,	Well Drained

Source: Badan Informasi Geospasial

The fifth largest area of the land system is the Argalingga (AGA) with a hard-textured volcanic rock or igneous rocks. This land system has a variety of soil and the soil association is eutrandepts which is a type of andosol soil. Andosol is formed from volcanic ash material. The soil has a high organic content, has a deep solum, moderately erosion resistant, has high organic matter content, moderate fertility rate with good drainage (Subardja, 2016). Andosol is a volcanic soil, quite suitable for tea plantations, coffee, tobacco, and fruits.

### c. Geomorphological Processes

Geomorphological processes are changes both physically and chemically that result in modifications to the surface of the earth (Thornbury, 1970). Land form have process of changing during the geomorphological process of working on the form of land. Working force called geomorphological energy, which is all of natural media capable of scraping and transporting materials on the surface of the Earth, this power can be in the form of flowing water, groundwater, waves, currents, tsunami, wind, and glaciers. Based on the process of working on the surface of the earth is known by the process of volcanic, structural, fluvial, solutionally, denudational, aeolin, marine, glacial, organic and anthropogenic (Verstappen, 1985). The following table 3 explain the lithology of each land system. Lithology can explain the geomorphological process that occurs in each land system. The dominant geomorphological process in Kabupaten Bandung is the volcanic land process that occurs on 12 land systems, namely the land system Argalingga (AGA), Barong Tongkok (BTK), Bukit Balang (BBG), Bukit Masung (BMS), Cibingbin (CBN), Cibuntu (CTU), Gunung Samang (GSM), Kundut (KDT), Pakasi (PKS), Patuha (PAT), Talamau (TLU), and Tanggamus (TGM). Volcanic land form is a form of land that is a good volcano that is composed of volcanic material that has come out to the surface of the Earth (extrusion) and is frozen in the surface of the earth (instrusion) (Setyawati, 2017). The form

of the volcanic land in general has a steep slope with the characteristic of having a crater, hole and conical extinction. Materials that can be found in the form of volcanic land of the peak is a soft-to-medium material (volcanic ash/tuff), and on the middle slopes until lower slope is a volcanic deposition (tephra).

**Table 3.** Lithology of Kabupaten Bandung

No.	Symbol	Land System Name	Lithology
1	AGA	Argalingga	Volcanic
2	BTK	Barong Tongkok	Volcanic
3	BBG	Bukit Balang	Volcanic
4	BMS	Bukit Masung	Volcanic
5	CBN	Cibingbin	Volcanic
6	CTU	Cibuntu	Volcanic
7	CLO	Cilang Kolo	Sedimentary
8	CTM	Citarum	Sedimentary
9	GSM	Gunung Samang	Volcanic
10	KDT	Kundut	Volcanic
11	LAR	Larangan	Sedimentary
12	PKS	Paksi	Volcanic
13	PAT	Patuha	Volcanic
14	TLU	Talamau	Volcanic
15	TGM	Tanggamus	Volcanic

Geomorphological process that occurs in three other land systems namely Cilang Kolo (CLO), Citarum (CTM), and Larangan (LAR) is a process of form of fluvial land. The form of land from fluvial according to Suharsono (1988) in Heru Pramono et al., (2013) is produced by the flow of river work, in this case especially in the deposition areas such as large river valleys and alluvial plains. The process of river flow that produces the form of fluvial land includes three connected parts, namely erosion, transportation, and sedimentation (Charlton, 2008). Due to each other, these three processes are often called the triple stages of a single activity. The stage in this process begins with erosion, then carriage, and sedimentation. When the slope or discharge of the surface flow is smaller, the speed and energy flow is also small. Thus, at this stage there is sedimentation because the energy to transport erosion material is also reduced. Morphology of the form of fluvial land is generally flat, the composition of aluvium sedimentation, the drainage is blocked so often flooded, prone to flood, shallow ground water, texture of fine soil, depth solum > 1 m, and alluvial soil type (entisol/inseptisol).

### 3.2 Land Use

After we analyse the characteristics of each land system, we can classify the land suitability and land capability to investigate the relationship between land system and land use. One of the principles of sustainable development is the preservation of ecology by utilizing mixed land as much as possible, paying attention to the existence of green open space, transportation and development systems that are mutually integrated and limiting excessive urban expansion. By understanding land suitability and land capability we can see whether sustainable development in Bandung Regency has been implemented or not.

#### a. Land Suitability

The land suitability class is a group of land that represents the match level of the plot of land for a particular conception (Ritung, et al., 2007). Structure of land suitability classification according to the FAO (1976) can be distinguished by its level, namely Order, Class, Subclass and Unit. The assessment of land suitability class is essentially a selection of land suitable for certain plants, which is done by interpreting the detailed land survey data in relation to its suitability for various plants and its management. The land suitability class consists of four classes consisting of 3 suitable classes and 1 class is not suitable. Kabupaten Bandung has variety classes of land suitability from N, S1, S2, to S3. The following table 4 explain the land suitability of each land system.

**Table 4.** Land Suitability of Kabupaten Bandung

No.	Symbol	Land System Name	Land Suitability
1	AGA	Argalingga	N
2	BBG	Bukit Balang	N
3	BMS	Bukit Masung	N
4	CLO	Cilang Kolo	N
5	PKS	Pakasi	N
6	CTM	Citarum	S1
7	TLU	Talamau	S2
8	BTK	Barong Tongkok	S3
9	CBN	Cibingbin	S3
10	CTU	Cibuntu	S3
11	GSM	Gunung Samang	S3
12	KDT	Kundut	S3
13	LAR	Larangan	S3
14	PAT	Patuha	S3
15	TGM	Tanggamus	S3

Source: *Badan Informasi Geospasial*

The land system of Citarum (CTM) belongs to the S1 class (very suitable) that the land does not have a significant or tangible barrier factor against sustainable use, or the limiting factor is minor and will not affect the productivity of land in real life. The land system of Talamau (TLU) belongs to the S2 class (quite suitable) that the land has a boundary factor, and this limiting factor will affect the productivity, requiring additional inputs.

The land system of Barong Tongkok (BTK), Cibingbin (CBN), Cibuntu (CTU), Gunung Samang (GSM), Kundut (KDT), Larangan (LAR), Patuha (PAT), and Tanggamus (TGM) belongs to the S3 class (according to marginal) that the land has a heavy limiting factor, This barrier will greatly affect the productivity, require more input than the land that belongs to S2. To overcome the limiting factor in S3 requires high capital, so it is necessary to help or intervention government or private company. The land system of Argalingga (AGA), Bukit Balang (BBG), Bukit Masung (BMS), Cilang Kolo (CLO), and Pakasi (PKS) belongs to the class N (not suitable) that is not suitable because it has a very heavy barrier factor and/or difficult to overcome.

#### b. Land Capacity

**Table 5.** Land Capability of Kabupaten Bandung

No.	Symbol	Land System Name	Land Capability
1	PKS	Pakasi	3
2	CTM	Citarum	3
3	KDT	Kundut	3
4	AGA	Argalingga	4
5	TLU	Talamau	4
6	BTK	Barong Tongkok	4
7	CBN	Cibingbin	4
8	GSM	Gunung Samang	4
9	LAR	Larangan	4
10	PAT	Patuha	4
11	CTU	Cibuntu	6
12	BBG	BUKIT BALANG	7
13	BMS	BUKIT MASUNG	7
14	CLO	CILANG KOLO	7
15	TGM	TANGGAMUS	7

Source: *Badan Informasi Geospasial*



Classification of land capability class is a grouping of potential land for the use of various agricultural systems in general without explaining the regulations for certain types of plants and its management. The aim is to classify the land that can be cultivated for agriculture based on its potential and restrictions in order to produce sustainable production. The USDA's (1973) land capability class differentiated into eight land capability classes. The intensity and choice of land use decreased as the size of the class number (Setiawan, 2018). Kabupaten Bandung has 4 types of land capability class which is grade 3, 4, 6, and 7. The following table 5 will explain the land capability of each land system. The land system of Pakasi (PKS), Citarum (CTM), Kundut (KDT) is included in grade 3 land which has severe constraints that reduce the choice of land use or require special conservation or both. The lands in grade 3 have heavier delimiters than land grade 2 and if used for plants that require soil processing, necessary conservation is usually more difficult to implement and maintain. The lands in grade 3 can be used for seasonal crops, grazing, production forests, protected forests and wildlife sanctuary.

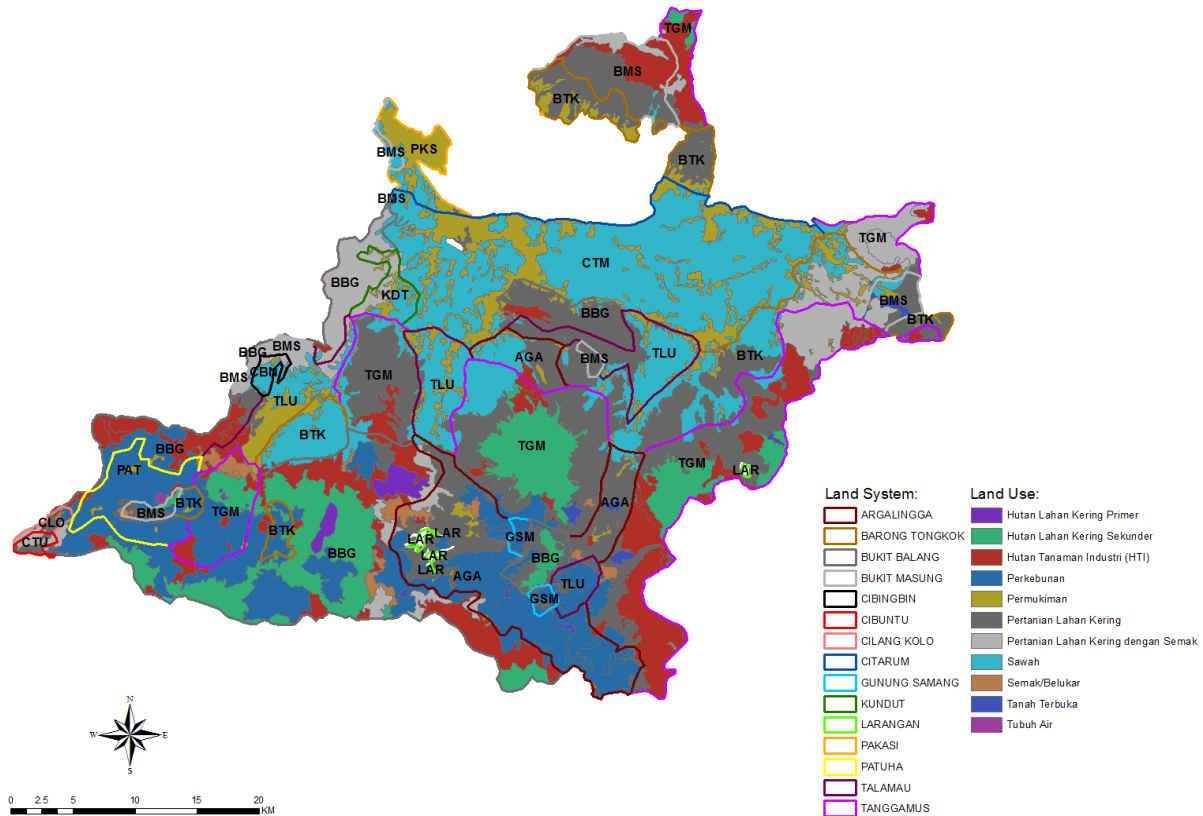
The land system of Argalingga (AGA), Talamau (TLU), Barong Tongkok (BTG), Cibingbin (CBN), Gunung Samang (GSM), Larangan (LAR), and Patuha (PAT) are belongs to the grade 4 land that has severe constraints, so that limiting land use options or require very careful management or both. The inhibitory factor and danger of damage to the soils within the grade 4 land are heavier than those of the land in grade 3 so that the use of the options is also more limited. If used for seasonal crops, this land requires more careful management and conservation that is more difficult to implement and maintain. The land in the grade 4 can be used for seasonal crops and agricultural crops, grazing fields, production forests, protected forests/nature sanctuary.

The land system of Cibuntu (CTU) belongs to the grade 6 land that has a heavy barrier so that these lands are not suitable for farming. The use of this land is limited to grassland, grazing, production forest, protected forest and protected reserve. The land of this class has a constant damage hazard such as steep slopes, rocky, to unsupportive climates. The land system of Bukit Balang (BBG), Bukit Masung (BMS), Cilang Kolo (CLO), and Tanggamus (TGM) are included in grade 7 land that has a heavy barrier so that it is not suitable for agriculture and its use is very good for grassland, production forest and nature sanctuary. The land on this class had some damage hazards such as steep slopes, shallow ground, rocky, and extreme climate.

### c. Land Use

Land use refers to the relation between humans and land, how physical world is adapted, modified, or utilized for humans (ILC, 2010). Land use is a method of how the utilization of space in a region will be used based on the potential and natural resources that are available. Land use can be divided by function and type. Land use according to its function can be divided into two, namely: built-areas (housing and village, trade services, roads, and industry) and non-built areas (technical fields and non-technical rice fields, fields, gardens, forests, special land use and other: rivers, roads) (Arrashid, 2014).

The result of the classification of land capability and land suitability indicates that land utilization in Kabupaten Bandung is not in accordance with the regulations, such as in land capability is grade 6 and 7; and in land suitability in class S3 and N which should be used as grassland, production forest, nature sanctuary and has limiting factor. Small part of the land system of Bukit Masung (BMS), Bukit Balang (BBG), Cibuntu (CTU), Cilongko (CLO), and Tanggamus (TGM) that mostly have >40% slope is converted into agricultural land (figure 3) that could potentially cause the movement of soils (landslide), erosion and sedimentation as well as increasing critical land in Kabupaten Bandung. According to Keppres 32 of 1990, a land is determined as a protected area if it has a slope of more than 40%.



**Figure 3.** Land Use Map in Kabupaten Bandung  
Source: Data Processing, 2019

The result of the classification of land capability and land suitability indicates that land utilization in Kabupaten Bandung is not in accordance with the regulations, such as in land capability is grade 6 and 7; and in land suitability in class S3 and N which should be used as grassland, production forest, nature sanctuary and has limiting factor. Small part of the land system of Bukit Masung (BMS), Bukit Balang (BBG), Cibuntu (CTU), Cilongko (CLO), and Tanggamus (TGM) that mostly have >40% slope is converted into agricultural land (figure 3) that could potentially cause the movement of soils (landslide), erosion and sedimentation as well as increasing critical land in Kabupaten Bandung. According to *Keppres* 32 of 1990, a land is determined as a protected area if it has a slope of more than 40%.

The high conversion of land from agriculture to settlements also caused the disruption of irrigation and drainage network systems. Small side of the land system of Bukit Balang (BBG) and Tanggamus (TGM) was changed into a settlement (figure 3). The impact of land changes in the Kabupaten Bandung is the occurrence of puddle and flood at some point, especially the settlement area as in the land system of Citarum (CTM). Due to the large number of land use that are not in accordance with regulations, the ecological principle in sustainable development in Kabupaten Bandung has not been applied well.

#### 4. Conclusion

The morphology of the Kabupaten Bandung consists of flat area, hills and mountains. The dominant area in Kabupaten Bandung is located on a flat area and most of the soil in Kabupaten Bandung is a soil that has a moderate to high fertility rates due to the volcanic process of land so it is quite good for agriculture. The dominant land system in Kabupaten Bandung are land system of Tanggamus (TGM) with 24.91%; the land system of Bukit Balang (BBG) with 20.94%; the land system of Citarum (CTM) with 15.71%; the land system of Barong Tongkok (BTK) with 11.3%; and the land system of Argalingga (AGA) with 9.59% of the total area. Some land use in Kabupaten Bandung does not comply

with the regulations, especially in Bukit Masung (BMS), Bukit Balang (BBG), Cibuntu (CTU), Cilogko (CLO), and Tanggamus (TGM) land system that mostly have >40% slope that suitable for protected areas instead used for agricultural land that can caused landslides and erosion. Small side of the land system of Bukit Balang (BBG) and Tanggamus (TGM) is also changed into a settlement that can caused flood in settlement area such as land system of Citarum (CTM). Based on that, the sustainable development in spatial planning in Kabupaten Bandung has not been applied well.

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