Chapter 8
Integrated Criteria for Flood Disaster Mitigation in Indonesian Urban Masterplan; Housing and Settlement Suitability Case in Palu Urban Masterplan

Rifai Mardin and Zhenjiang Shen

Abstract The growing number of urban residents in the world urges some governments including Indonesia to provide an ideal housing and settlement by considering climate change factors that impact the occurrence of floods in their urban areas. This study aims to integrate housing and settlement planning within the Indonesian Urban Masterplan (RTRW-Kota) with flood mitigation system by identifying spatial planning criteria related to housing and settlement planning and disaster mitigation within the Indonesian regulations. The criteria are then incorporated to integrated criteria in the modelling suitability area for housing and settlement planning. The method is using content analysis to identify these criteria and then model them in GIS environment. This study found 10 standard criteria for housing and settlement planning with disaster management, 7 related to spatial planning and other 3 related to disaster mitigation respectively.

Keywords Integrated criteria · Flood disaster · Housing and settlement · Urban planning

8.1 Introduction

Integrating of disaster risk reduction within all sectors including urban planning is very important (UNISDR 2015). As one of the most significant type of disaster, flood hazard is a thoughtful devastating, challenging economic damage, and threats human lives especially in urban area (Ran and Nedovic-Budic 2016;

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Tingsanchali 2012). Housing and settlement planning as a part of the urban planning hold an important key to reduce the disaster risk. The integration of disaster mitigation and spatial (urban) planning could lead to disaster resilient communities (Francesch-Huidobro et al. 2015; Kornakova and March 2013). Moreover, learning from Rotterdam, Guangzhou and Hongkong, integrating flood disaster mitigation with urban development and economic growth still remains a challenge (Francesch-Huidobro et al. 2015). This research is to answer the challenge by promoting integrated criteria of flood disaster mitigation and housing-settlement suitability in urban planning.

Land-use suitability analysis is an important step in an urban/regional environmental planning process (Liu et al. 2014; Malczewski 2004). The land-use suitability can be construed as a guidance value of urban land-use function to be accepted. The suitability process gives a value for each land feature, when the value is high, then the land is more likely to attract human activities. The result of the land-use suitability analysis will define which area of the land is valuable to be developed (Kii and Nakamura 2017; Malczewski 2004).

In the 1950s, the single-objective decision tools lost their advantage in a decision-making process. This was a result of the complexity in the real world which cannot be adopted only by using a simple decision-making process. Slowly, the simple decision tools are replaced by multiple criteria analysis (MCA), combine with the decision making process (MCDA) (Rebecca Barnes and Ashbolt 2006). Started in the 1950s, as development invitations in scientific fields, GIS-modelling has developed into varied fields including suitability analysis. Now, GIS and MCDA have evolved to become a handful tool for decision analysis in evaluating alternatives for spatial planning and suitability land-use planning (Kain and Söderberg 2008; Malczewski 2004, 2006; Mardin 2009). The MCDA is a method which evaluates alternatives based on a set of criteria. These criteria are closely linked to the policy objectives and are developed to provide a functional appraisal of selecting the best alternatives related to all the potential cost and benefit effects (Liu et al. 2014; Mardin 2009).

Worldwide urban inhabitants by 2050 in projected 70% of the world's populations, are estimated that 1.5 million people migrate to the cities every week (Wilson Center 2017). With an average growth rate of 4.2% between 1993 and 2007, this rapid population growth also occurred in Indonesia. The urbanization process makes Indonesia as one of the most urbanized countries in Asia, with 51% urban populations in 2011, and by 2025, the projection of urbanization will increase to 68% (World Bank 2013). Population growth in urban area is also highly related to the increasing of disaster risk (Caparros-Midwood et al. 2015; Kita 2017).

For the case study in Indonesia, the flood is not something extraordinary as a routine flooding occurs throughout Indonesia. According to National Board for Disaster Management (*BNPB-Badan Nasional Penanggulangan Bencana*) from September 2011 to May 2016, there were more than 1.211 flood disasters appeared throughout Indonesia and these impacted millions of people and thousands of houses (BNPB 2016). This problem pushes Indonesia to realize the importance of disaster mitigation in the spatial planning process. Therefore, Indonesia Government has authorized and enacted Act Number 24/2007 on *Disaster Management*. The law is intended to provide a strong legal basis for disaster management at the district or city, provincial and national levels. The Indonesian government also revised the spatial law draft of 1992 by a new law, Indonesian Act No 26/2007 on *Spatial Planning*. The Act No 26/2007 stated that, all the spatial planning process through Indonesia cities should incorporate risk reduction in their spatial plan document (RTRW). As an operational document of spatial planning, Indonesian urban masterplan (RTRW-Kota) regulates three important aspects in the urban area; land-use, urban infrastructure, and strategic area. To regulate these aspects, every municipality should determine their goals, policies and strategies in advance. Later, all the three aspects will be regulated by using guidance and control provisions for urban land-use.

As part of the cultivated area (*kawasan budidaya*), housing and settlements are important factors for a holistic city planning. In Indonesia, the policy of housing and settlements development are directed to meet the needs of decent and affordable housing in a healthy and safe environment. According to Act 1/2011 about *Housing and Settlement Area*, the good housing and settlements have to be supported by public infrastructures, public utilities and other facilities on a sustainable basis. The planning should also accordance with the spatial land-use arrangement.

The housing and settlements as a part of the Indonesian urban masterplan and Disaster Mitigations look completing each other, including the regulatory and operational explanation guidelines, but these spatial regulations on the level of implementation seem very far from the reality (Birkmann et al. 2014). It means that although the regulations are available, it has not provided a clear method that can link disaster mitigation and settlements in spatial planning. The aim of this study is to integrate the criteria of flood disaster mitigation and housing settlements in urban masterplan by answering these 2 objectives. The first objective is to define the related criteria in both disaster mitigations and housing-settlement planning regulations, and the second is to build a suitability model in the study area using the identified criteria.

8.2 Method

To answer the objective of the study, two different methods are constructed in 2 stages. First is finding criteria for the guidelines of housing and settlements planning. The found criteria are used to reconstruct housing and settlements planning in municipality masterplan that is adaptive to flood disaster in the second stage.

8.2.1 Finding Criteria for Settlement in Indonesian Urban Masterplan and Flood Disaster Management – A Content Analysis

Content analysis of spatial regulation documents and disaster mitigation regulation documents is used to find the criteria for housing and settlements planning and flood disaster mitigation. To identify the relevant documents, Abedinnia et al. (2017) defined 5 steps including: a. Initial search, b. First refinement, c. Second refinement,

d. Snowball search and, e. Final assessment. Because the material in this research is not as complicated as the research which carried out by Abedinnia et al., this research modifies the process only into 4 steps where the refinement process is done at one step. The steps can be stated as follows:

1. *Initial search*; As mentioned, the regulations on disaster mitigation and spatial planning come from 2 different roots which are Act No 26/2007 and Act No. 24/2007. By using this two Act group, the research process found 11 regulations highly related to spatial planning and 3 regulations related to disaster mitigation.
2. *Refinement*; The process comes to the next step where the refinement process is carried out. This process is to limit the content of regulations which are discussed; "housing and settlement" and "disaster mitigation". The process found 5 regulations on spatial planning and 2 regulations from disaster mitigations.
3. *Snowball search*; this is the backward and forward process to check the relevant references that could complete the required criteria. This step adds 2 more regulations.
4. *Final assessment*; all documents which are selected from previous steps are completely read to access their relevance and to conclude the criteria.

8.2.2 Modeling the Integrated Criteria of Flood Disaster Mitigation with Housing-Settlement in Indonesian Urban Masterplan

8.2.2.1 Criteria

As to answer the second question, this research moves to the second phase, which is measuring housing and settlements suitability area using Multi-criteria Decision Analysis (MCDA) in GIS environment. The criteria that had already been found in the first phase are extracted into spatial data in the form of map layers and then it is analyzed by ArcGIS platform (ArcGIS 10.0).

There are two categories of criteria where all criteria/factors for evaluation/analysis of land-use suitability fall within these two categories. The categories are the opportunities (benefit) criteria and constraint criteria. Opportunities criteria which some scholars also defined as benefit (from cost and benefit analysis term) is the favourable condition where the criteria are most likely to be chosen as desirable conditions, while constraint criteria are where the allocated land cannot be chosen because the location is prohibited to be developed such as water body, protected forest, etc.

8.2.2.2 Analytical Hierarchy Process (AHP) Weighting

AHP is chosen as criteria weighting tools because it can help determine the best choice that involves many criteria based on intuition and perception while keeping consistency (Saaty 1990). AHP provides the possibility for decision makers to represent the interaction of sustainable factors in complex and unstructured situations. This analytical tool helps decision makers to identify and simultaneously prioritize based on their intended goals, existing knowledge, and experience for each of the problems faced (Saaty 1990). The weight factors only applied for opportunity criteria and not applied for constraint criteria, since the constraint criteria are strict requirements.

8.2.2.3 Suitability Mapping

The suitability map is an outcome from calculating every criteria map score. A composite map developed by overlaying the opportunity map and the constraint map. The result reflects the degree of opportunity (or suitability) with ranked values allocated to all mapping units. The mathematic equation for the opportunity criteria can be found in the following formula

$$T_{opp} = \sum_{n}^{i=1} a_i j_i = a_i j_i + a_2 j_2 + \ldots + a_n j_n \tag{8.1}$$

Where T_{opp} is the total opportunity value, a_i is the score of opportunity of i-th criteria, j_i is the weight of opportunity i-th criteria, and n is the number of the criteria

The mathematic equation for the constraint criteria is described as;

$$T_{cons} = \sum_{n}^{i=1} c_i \tag{8.2}$$

Where T_{cons} is the total constraint value, c_i is the value of constraint of i-th criteria, and n is the number of the criteria.

The suitability equation is symbolized as;

$$S = T_{opp} - T_{cons} \tag{8.3}$$

8.2.2.4 Material for Mapping the Suitability Models

In reconstructing of residential area planning in accordance with RTRW directives, it needs some indicator maps which have become the standard in settlement planning according to the direction of spatial regulation in Indonesia. Criteria are converted into thematic maps that will be spatially analyzed with GIS software. In addition to the above theme data, basic maps and supporting maps in the spatial analysis process are also needed to determine the settlement areas that are suitable for the purpose of this study. The data preparations for the analysis in this research are rectification of map and digitization of the raster data. The process are as follows

(a) Standardize the coordinate system of the existing map into a uniform system. A common problem obtained in the spatial mapping system in Indonesia is the unavailability of the same basic map. All maps will use Transverse-Mercator projection system, WGS 1984, and UTM Zone 50S.

(b) Digitizing Raster Maps. All raster maps data should be converted to vector maps and this process is manually carried out by digitizing process. The process itself uses a scale of 1: 20,000 to produce detailed 1: 50,000 scale maps in accordance with RTRW standard maps.

As much as possible, all maps used are the same maps with 2009 RTRW-Kota document. Some of maps that are available in the RTRW-Kota document in particular and disaster maps related to disaster mitigation regulation can be taken from other accountable source.

8.2.3 Study Area

8.2.3.1 Palu

According to the *President Regulations No 88/2011,* Palu is the capital city of Central Sulawesi Province, Indonesia, which is defined as one of the national local centers to serve the international, national and regional scale activities. The region consists of five dimensions of mountains, valleys, rivers, bays and oceans. Astronomically, Palu is located between 0°, 36’ to 0°, 56’ south latitude and 119°, 45’ to 121°, 1” East longitude. It lies almost on the Equator line and altitude of Palu is between 0–700 m above sea level. The area of Palu reaches 395.06 km^2 and it is divided into eight districts (kecamatan) and 44 Village (kelurahan) (Palu Statistic Bureau 2016) (Fig. 8.1).

Since the 70s, in general, the development of the settlement in Palu has shown a concentrated form on the core of the city, part of river banks and very close to Palu estuary. However, there is a distinct physical development on the periphery urban of the city (Mardin 2011).

In 2015, the estimated population of Palu was 368.086 inhabitants, consisting of 185.105 males and 182,981 females. The estimation of the population density was 932 people/km^2. Based on the village’s administration, the population density in the city center was higher when compared to the fringe area (Palu Statistic Bureau 2016).

8.2.3.2 Flood in Palu

The development of Palu city started with agriculture process in the fertile area, especially on the floodplain area around the main rivers. Over time, these areas began to grow into a city center. The new function of city center directly makes this area the most densely populated area (Mardin 2011) and the floodplain landform brings the consequences of flood disaster. In reality, Palu had bad history of the flood disaster and this is also worsened by the position of the tidal surge along the northern part of the city.

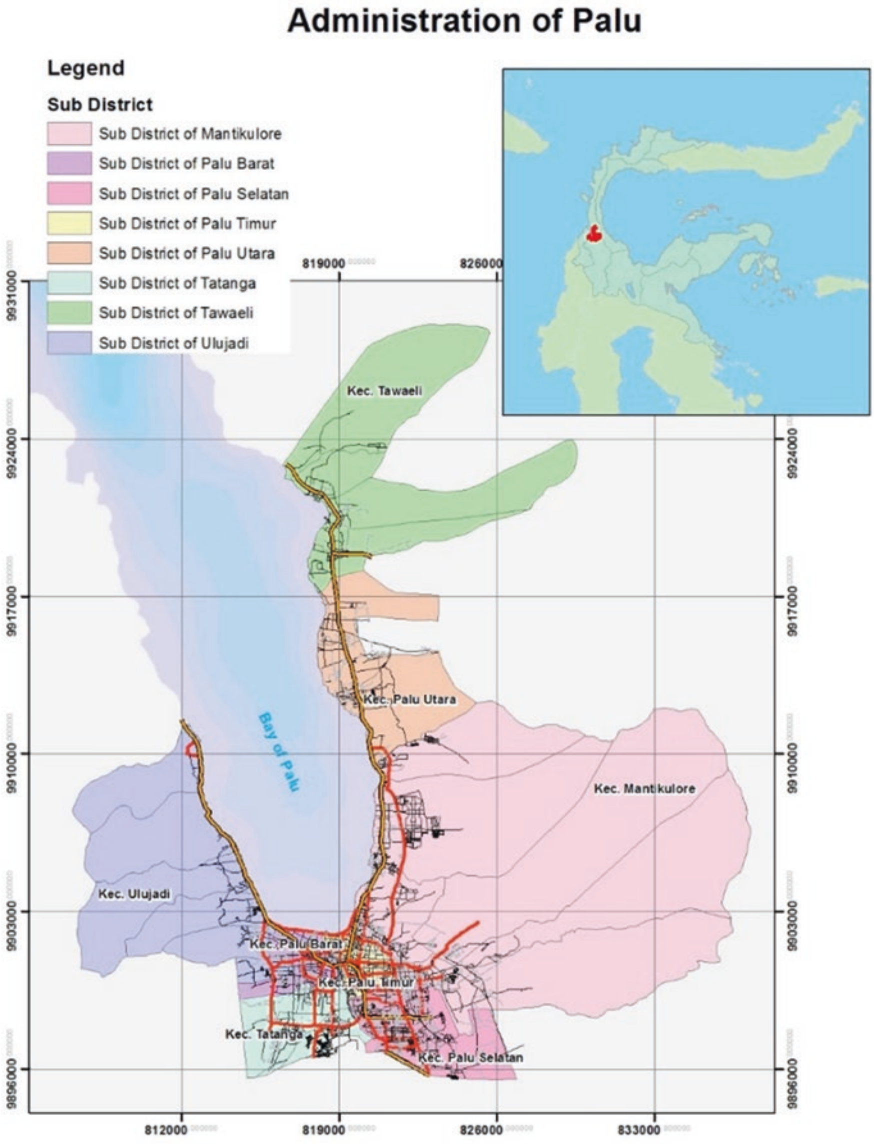


Fig. 8.1 Administration map of Palu

All rivers in Palu area, including the main river (Palu River), have a longitudinal profile and large slope gradient. When a flood occurs, the current is strong and very destructive. However, the flooded area is relatively narrow and the flood time is relatively short. Since the type of flood is a flash flood, it makes difficult for the people to be displaced into safety area (Municipality of Palu 2014). Flooding in Palu is a routine recurring event between 1–3 years during the heavy rain. It has a devastating impact on society, especially for people who live in city center area (Palu Barat District). As an example, in 2011, the total area impacted by the flood was 756 Ha (submerged) with 300 people displaced. There were no casualties, but the loss was estimated to be more than 560 Million Rupiah. The flood occurred in two districts: Palu Selatan District and Palu Barat District. Although the submerged area in Palu Barat District is only 50Ha, due to the dense population, the loss in this area is very high, with around 500 Million Rupiah estimated (Municipality of Palu 2011).

8.2.3.3 Housing and Settlement in Palu Urban Masterplan

Other than floods and other natural disasters, the Municipality of Palu also has various problems in their spatial planning including complying the demands of sustainable urban development, and being enforced by the spatial regulation especially Act 26/2007. Palu Municipality developed their urban masterplan in 2009 and this plan is one of the first urban planning regionally created by using the latest rules. As a pioneer in municipality masterplan, this urban planning product is very important to be reviewed to gain valuable lessons about the housing and settlements planning process.

Like most municipality masterplan in Indonesia, Palu urban masterplan is made to follow the standard of planning which has been established by law. This masterplan was made in 2009, 2 years after Act No 26/2007 launched, then officially this masterplan was designated as a Palu spatial guideline in 2011 with a validity period of 20 years until 2021.

The existing Palu urban masterplan consists of several sections. However, in this study, the main concern is directed to the housing and settlement planning of landuse. Based on the existing urban plan data and map, the total area of settlement is 9104.08 Ha where it is divided into 3 categories which are; (a) low-density settlement areas (271.40 Ha); (b) medium-density settlement areas (517.40 Ha); and (c) high-density settlement areas (8314.82 Ha). Figure 8.2 shows the distribution of the settlement and area of each district.

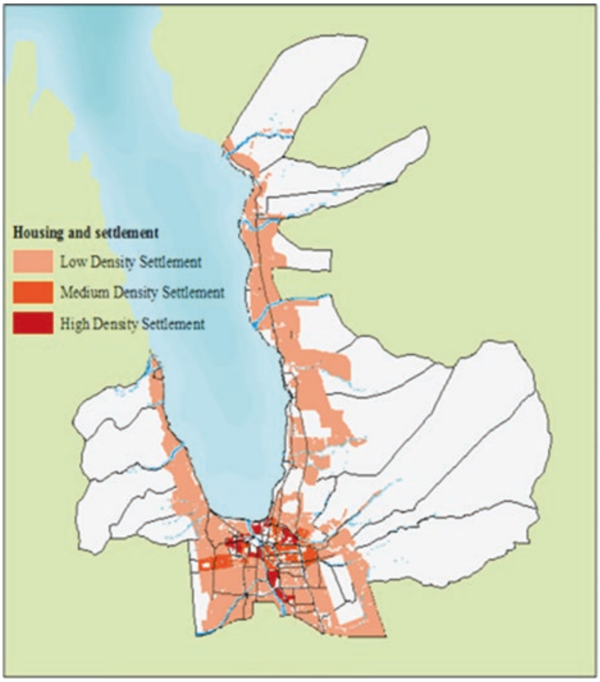
The map (Fig. 8.2) is clearly shown the distribution of high-density settlement in the core of the city along the Palu River through the estuary, while the low density is distributed to other part designated as a cultivated area outward from the core of the city.

8.3 Results

8.3.1 *The Criteria*

8.3.1.1 Criteria for Housing and Settlement in Spatial Planning

Based on the Content Analysis process (see Sect. 8.2.1), several criteria and indicators could be defined related to housing and settlement planning. The operational level criteria could be found in five Regulations, which are;



District	Density	Ha
Mantikulore	Low Density	2,308.52
	Medium Density	125.70
	High Density	-
Palu Barat	Low Density	194.61
	Medium Density	179.69
	High Density	96.02
Palu Selatan	Low Density	1,270.18
	Medium Density	-
	High Density	85.38
Palu Timur	Low Density	-
	Medium Density	212.46
	High Density	90.00
Palu Utara	Low Density	1,465.46
	Medium Density	-
	High Density	-
Tatanga	Low Density	1,129.92
	Medium Density	0.01
	High Density	-
Tawaeli	Low Density	732.96
	Medium Density	-
	High Density	-
Ulujadi	Low Density	1,213.17
	Medium Density	-
	High Density	-
Total	Low Density	8,314.82
	Medium Density	517.86
	High Density	271.40
All		9,104.08

Fig. 8.2 Map of housing and settlement area. (Source: Municipality of Palu 2009)

(a) Minister of PW Regulations Reg. No 20/2007 about Technical Guidance on Physical & Environmental, Economic and Socio-Cultural Aspects in RTRW Preparation
(b) Minister of PW Regulations Reg. No 41/2007, about Guidelines for Spatial Planning in Cultivated Area
(c) Minister of PW Regulations Reg. No 15, 16, and 17/2009, about RTRW Masterplan
(d) Minister of Public Housing Regulations Reg. No 10/2014, about, Natural Disaster Mitigation Guidelines for Housing and Settlement Areas
(e) SNI 03-1733-2004 – Indonesian Standard for Housing planning procedures in urban areas

From these documents, the research found at least there are 8 very important criteria discussed including: slope condition, availability of fresh water sources, avoiding disaster prone, surface drainage, not in protected area, not in agricultural area, not in irrigated rice field, and distance from other reserve area. The source regulations and the criteria can be seen in Table 8.1 below.

1. Slope (Topography);

Settlement area developed best on a flat terrain as the flat landform can reduce the cost of construction of the housing and for the settlement infrastructures.

Table 8.1 Criteria for housing and settlement area

No	Suitability Criteria from Spatial Planning Guidelines	Sources a*	b*	c*	d*	e*
1	Slope conditions	□	■	□	□	■
2	Available sources of fresh water	□	■	■	□	■
3	Not in prone disaster areas (landslide, flood, erosion, abrasion);	□	■	□	■	■
4	Good soil drainage	□	■	□	□	■
5	Not in a Protected area;	■	■	■	■	■
6	Not located in agricultural area	■	■	■	□	□
7	Not located in Irrigated Rice Field	□	■	□	■	□
8	Not in the dangerous distant from other reserve area (*sempadan*)	□	■	□	■	□

■ Indicated □ Not indicated

Sources:
a*Minister of PW Reg. No 20/2007
b*Minister of PW Reg. No 41/2007
c*Minister of PW Reg. No 15, 16, and 17/2009
d*Minister of Public Housing Reg. No 10/2014
e*SNI 03-1733-2004 – Indonesian Standard for Housing planning procedures in urban areas

The important for topography is highly discussed on Minister of PW Reg. No 20/2007 and SNI 03-1733-2004 – Indonesian Standard for Housing planning procedures in urban areas, and indicated in other 3 regulations. In Regulation No 20/2007, the housing and settlements should be fitted in landform slope between 0–25%, while it is mentioned in SNI that the best slope for housing and settlement is in between 1–8%, then followed by slope of 8–15%.

Based on the above consideration, the slope criteria will be classified into 5 score class that can be seen in the following Table 8.2.

2. Fresh Water/Groundwater Source

Availability of fresh water is an important indicator on finding housing and settlement locations. That is why Reg. No 20/2007 and SNI 03-1733-2004 indicate the importance of this aspect as indicator to be considered. Similar to the slope indicator, other regulations do not significantly mention about this indicator.

Water is one of basic human need and the ability to access water will greatly facilitate the development of residential areas. Locations with abundant raw water sources will get the best value, while the less likely to have water, become less favor for housing and settlement area. The classification of groundwater source for housing and settlement can be found in the following Table 8.3.

3. Not in Disaster Prone Area

The prone disaster area is discussed within the 4 out of 5 regulations including: Reg. No 41/2007, Reg. No 10/2014, Reg. No 15, 16, and 17/2009 and SNI

Table 8.2 Criteria for slope indicator

Criteria	Slope (%)	Score
Flat	0–8	5
Considerably flat	8–15	4
Moderately sloping	15–25	3
Steep	25 – <45	2
Very steep	>45	1

Table 8.3 Criteria for groundwater source

Criteria	Class	Score
Very high productivity	High suitability	5
High productivity	Suitable	4
Medium productivity	Medium suitability	3
Low productivity	Low suitability	2
Very low productivity	Not suitable	1

Table 8.4 Criteria for disaster prone area

Criteria	Class
Disaster prone area	Not suitable
Not disaster-prone area	Very suitable

03-1733-2004. The indicator about prone disaster area for housing and Settlement are not detailed, and it refers to “other related regulations”.

In Reg. No 41/2007, Reg. No 10/2014, Reg. No 15, 16, and 17/2009 and SNI 03-1733-2004, the classification of disasters prone area is not explained in detail. In general, disaster-prone disaster class only divided into 2 classes: Disaster Prone Area and not Disaster-Prone Area. The following table shows the criteria and the score of each criterion (Table 8.4).

4. Soil Drainage

Soil drainage appears only in regulations. No 10/2014, and SNI 03-1733-2004 while other 3 regulations do not indicate this as a very important indicator.

Soil drainage indicates the speed of water to be absorbed into the soil. Surface soil drainage reflects a land in conditions always damp or inundated by water. For most housing and settlement, the best (very suitable) class are in 1 and 2 grades. Grade 2, 3 and 4 are suitable, while 5,6 and 7 are not suitable for the purpose. Identification of surface soil drainage levels can be done through field surveys by conducting observations in each terrain unit. The soil drainage class is presented in the following Table 8.5.

Table 8.5 Criteria for soil drainage

Criteria	Grade	Class	Score
Excessively drained	1	High suitability	5
Somewhat excessively drained	2	Suitable	4
Well drained	3	Medium suitability	3
Moderately well drained	4	Low suitability	2
Somewhat poorly drained – very poorly drained	5	Not suitable	1

Table 8.6 Criteria for not in protected area

Criteria	Class	Score
Not in protected area	Very suitable	5
In protected area	Not acceptable	0

Table 8.7 Criteria for not in agricultural area

Criteria	Class	Score
In agricultural area	Suitable	5
Not in agricultural area	Not suitable	0

5. Not in Protected Area

The Protected Area is a designated area with the primary function of protecting the environment which includes natural resources and artificial resources. Because of the importance of this factor, all the regulations mention this indicator as one of the basic rules for housing and settlement planning in Indonesia.

Same as disaster prone area indicator, indicator for Protected Area only has two class: suitable and not acceptable. All the protected area should be free from housing and settlement functions, following table explains the class and value (Table 8.6).

6. Not located in agricultural area

The idea of this indicator is to assure the Sustainable Agriculture Land in Indonesia. Population growth, economic and industrial development resulted to degradation of agricultural land. This has threatened the national carrying capacity in maintaining food self-sufficiency, resilience and sovereignty.

From 5 regulations, 3 regulations mention this indicator, while other two regulations (Minister of Public Housing Reg. No 10/2014 and SNI 03-1733-2004) do not mention about it. Thus, the classification of this indicator is only divided into 2 classes: Suitable and Not Suitable and it can be described as the table above (Table 8.7).

7. Not located in Irrigated Rice Field

Similar to the agricultural issue, rice field faces enormous problems and challenges, especially the high transfer of rice field to non-agricultural functions as a result of population growth. The classification can be expressed in Table 8.8 below.

8. Not in the dangerous distant from other reserve areas (Buffer distance-*sempadan*)

Table 8.8 Criteria for not in agricultural area

Criteria	Class	Score
Not in irrigated rice field	Suitable	5
In irrigated rice field	Not suitable	0

Table 8.9 Criteria for buffer distance

Criteria	Class
Not in buffer distance	Very suitable
In buffer distance	Not acceptable

In Indonesia, buffer distance of spring water, river and beach is a protected area for maintaining the preservation of ecosystem functions and all of its resources as well as used to avoid the threat of natural disasters. The buffer distance area is allocated for public space and public access including open space, tourist area and other settlement support areas. Depending on their characteristic, buffer distance for river inside urban area is set from 3 to 30 m. In case of spring water, buffer distance is 200 m. Meanwhile, it reaches 100 m from the highest tide in case of beach. Buffer distance also applies for Flight Operational Safety Area (*KKOP*). This indicator is highly mentioned in the Reg. No 15, 16, and 17/2009 as well as SNI 03-1733-2004, while other 3 regulations do not indicate it (Table 8.9).

8.3.1.2 Flood Disaster Mitigation Criteria for Spatial Planning

As mentioned in Sect. 8.1, there are two regulations on disaster management that meet the criteria of spatial planning, which are BNPB regulation No 21/2008 and BNPB Regulation no 2/2012. After the content analysis brought into the two documents, it is clear that BNPB Regulation No 21/2008 discussed mainly about *Implementation of Disaster Management* which means flood disaster is not specifically discussed. The discussion of flood disaster only is mentioned as part of multi-disasters that should be counted in Indonesian spatial planning.

Later, in the Head of National Board for Disaster Management (BNPB) Regulation No 2/2012 about *General Guidelines of Disaster Risk Assessment,* flood disaster criteria are discussed. According to flood disaster management, the disaster risk is based on multi factors ranging not only physical but also social, economic and ecological (BNPB 2012; Cutter et al. 2000; Evers et al. 2016). To measure the disaster risk, Wisner et al. (2003) proposed a pseudo-equation as follows:

$$R = H\,x\,V$$

Where:

R: Disaster Risk

H: Hazard Threat – The frequency (possibility) of a particular disaster tends to occur in a certain intensity at a particular location

V: Vulnerability – The expected loss (impact) in an area in a particular disaster case occurs with a certain intensity. The calculation of these variables is usually defined as exposure (population, assets, etc.) multiplied by the sensitivity for the specific intensity of the disaster.

Considering community and government capacity factors in reducing disaster risk, BNPB Indonesia has adopted the disaster risk pseudo-equations and then added capacity factors on measuring disaster risk reductions (BNPB 2012).

$$R = H\,x\,\frac{V}{C}$$

Where:

C: Adaptive Capacity – capacity available in the area to recover from a specific disaster.

Based on this understanding and the content analysis process, the Criteria for mitigation planning consist of **Hazard Threat**, **Vulnerability** and **Capacity**. The schematic relations between the criteria of disaster risk can be drawn as shown in the following diagram (Fig. 8.3);

1. Hazard Threat

Hazard threat is the composite value of physical/geomorphologic of flood prone area which has been already validated with flood history. The data were collected by fieldwork and the model simulation using SRTM data, the results then were validated with flood hazard history. The Criteria can be seen in the following table (Table 8.10).

Fig. 8.3 Disaster risk indicator diagram. (Source: BNPB Regulation no 2/2012)

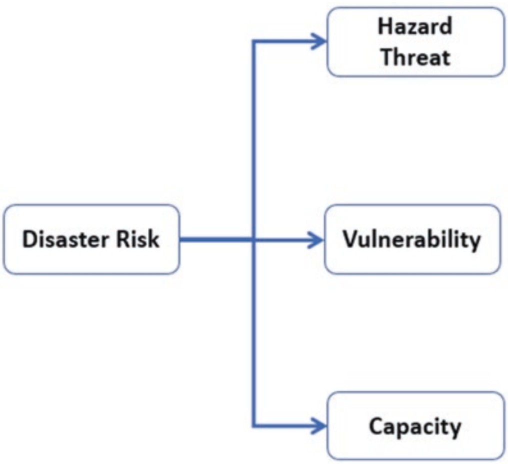


Table 8.10 Hazard thread criteria

Hazard index	Class index			Weight
	Low	Medium	High	
Disaster prone map from flood model using (SRTM) validated with history	<0.76 m	0.76–1.5	>1.5	100%

2. Vulnerability

The vulnerability criteria are highly related to social factors and social economic factors. The studies about social vulnerability are related to the number of populations, gender, age, education level, social status and economic. It also discussed the access to public health and employment (Kita 2017).

Vulnerability criteria consist of 4 composite factors which are; (a) social vulnerability (based on criteria of Population and Vulnerable groups), (b) Economic Vulnerability (based on GRDP and Land-use) (c) Physics vulnerability (buildings and infrastructures) and (d) Environmental Vulnerability (ecology).

Similar to the previous criteria, each indicator gives class index which is Low, Medium and High. It depends on the precondition in the location. The value of the class index and the weight can be found in the following Table 8.11.

3. Capacity

The third important factor that contributes to hazard risk is the capacity, where capacity itself consists of 5 criteria (a) regulation on disaster management, (b) early warning and disaster risk assessment, (c) People Knowledge on Disaster preventions, (d) Reduction of Risk Factors and (e) Development of Preparedness in every sector. The capacity is divided by 3 different class indexes which are Low, Medium and High. It depends on the availability of each criterion. The detail can be found in the following Table 8.12.

8.3.1.3 Integrated Indicator for Housing and Settlement Planning and Disaster Mitigation Planning

The integrated indicator should consider the previous two groups criteria. In the first housing and settlement group, the (flood) disaster is already incorporated into the criteria but it is not detailed enough. While in the group of disaster mitigation, the criteria of disaster management are elaborated in more detail and clearer.

This research proposed indicator for "disaster prone area" that is replaced by three criteria from disaster management, which are Hazard Threat, Vulnerability, and Capacity as described in Fig. 8.4 below.

From all of the housing and settlement criteria, we can see that there are 3 groups. First is the group with full scale score listed from 1–5, these criteria will be easily adapted to the MCDA model and the second group are criteria with a very limited choice like criteria of disaster prone area and criteria of rice field, the given option

Table 8.11 Vulnerability criteria

Vulnerability Index	Class Index			Weight (%)
	Low	Medium	High	
Social vulnerability				**40**
Population density	<500 pop/km^2	500–1000 pop/km^2	>1000 pop/km^2	60
Venerable groups (disable person/children/older groups)	<20%	20–40%	>40%	40
Economic vulnerability				**25**
Gross regional domestic product (GRDP)	<Rp 100 million	Rp 100–300 million	>Rp 300 million	40
Productive land area	<Rp 50 million	Rp 50–200 million	>Rp 200 million	60
Physic vulnerability				**25**
Building vulnerability (number of house)	<Rp 400 million	Rp 400–800 million	>Rp 800 million	40
Public facility	<Rp 500 million	Rp 0.5–1 billion	>Rp 1 billion	30
Critical facility	<Rp 500 million	Rp 0.5–1 billion	>Rp 1 billion	30
Environmental vulnerability				**10**
Protected forest	<20 Ha	20–50 Ha	<50 Ha	30
Natural Forest	<25 Ha	25–75 Ha	<75 Ha	30
Mangrove/mangrove forests	<10 Ha	10–30 Ha	<30 Ha	10
Shrubs	<10 Ha	10–30 Ha	<30 Ha	10
Swamp	<5 Ha	5–20 Ha	<20 Ha	20

Table 8.12 Capacity criteria

Capacity index	Class index			Weight
	Low	Medium	High	
Local regulation on disaster management,	Capacity index level 1–2	Capacity index level 3	Capacity index level 5	100%
Early warning and disaster risk assessment,				
People knowledge on disaster preventions,				
Reduction of risk factors				
Development of preparedness in every sector				

is only limited by two scores, which are value (score) 0 for not suitable class and value 5 (the highest score) for the suitable class.

The third group is criteria with very strict regulation. The settlement area should never fall into Buffer distance or protected area. The model will automatically remove all the possibility of the land on this area to be selected. The third group is clearly considered as constraint criteria. The following table shows all criteria and their score (Table 8.13).

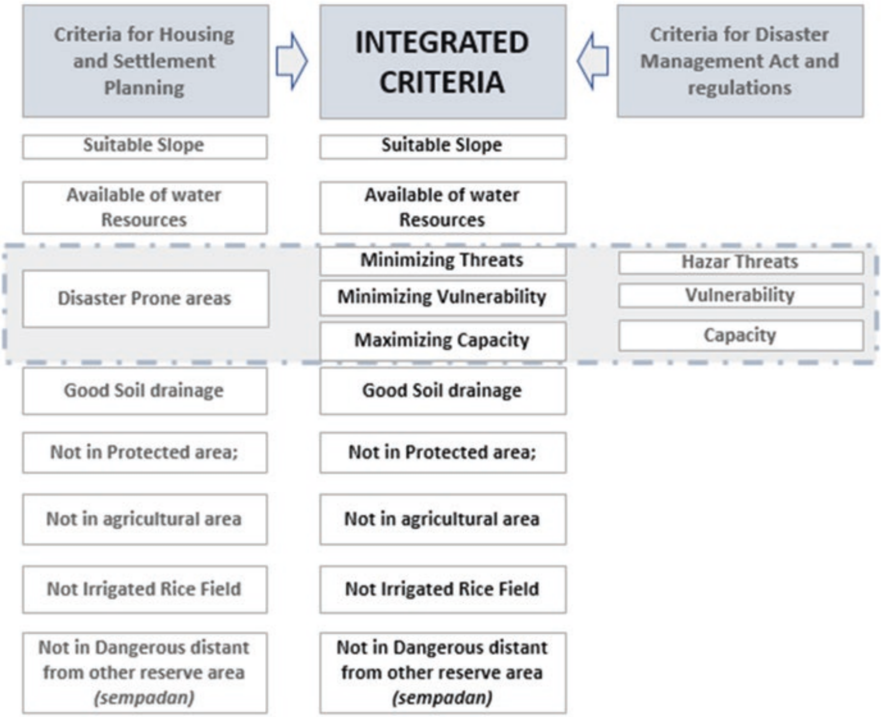


Fig. 8.4 The indicator and criteria scheme

Table 8.13 Integrated criteria and the score class

No	Integrated criteria	Score class				
		5	4	3	2	1
1	Suitable slope	0–8%	8–15%	15–25%	25 – <45%	>45%
2	Availability of water resources	High suitability	Suitable	Medium suitability	Low suitability	Not suitable
3	Minimizing threats	High suitability	Suitable	Medium suitability	Low suitability	Not suitable
4	Minimizing vulnerability	High suitability	Suitable	Medium suitability	Low suitability	Not suitable
5	Maximizing capacity	High suitability	Suitable	Medium suitability	Low suitability	Not suitable
6	Good soil drainage	High suitability	Suitable	Medium suitability	Low suitability	Not suitable
7	Not in a protected area;	Constrain criteria				
8	Not located in agricultural area	Not in agricultural area		Not applicable		
9	Not located in irrigated Rice field	Not in irrigated Rice field area		Not applicable		
10	Not in the dangerous distant from other reserve area (*sempadan*)			Constrain criteria		

The 8 opportunity criteria are weighted using AHP, the process using the AHPcalc version 04.05.2016. As the result of this process, the integrated criteria showing "Minimize Hazard Threat Area" are the strongest criteria (with a weight of 42.7%) followed by the "Maximizing Capacity" criteria with 23.9%, and the indicator "Minimize Vulnerability"(16.0%) in the third place. The weakest criteria are "Good Soil drainage" (1.2%) in the lower place followed by "Available of water source" (1.6%) in the 7th place. Table 8.14 and Fig. 8.5 about AHP Matrix for housing and settlement Criteria below show the full results of the weight according to the Analytical Hierarchy Process.

Table 8.14 AHP result for housing and settlement criteria

Criterion		Comment	Weights (%)	Rank
1	Slope	Relatively flat slope	2.8	6
2	Source of water	Available sources of fresh water	2.0	7
3	Soil drainage	Good soil drainage	1.2	8
4	Agriculture area	Not located in agricultural area	4.7	5
5	Irrigated Rice field	Not located in irrigated Rice field	9.0	4
6	Hazard threats	Minimize hazard threat area	42.7	1
7	Capacity	Maximizing capacity	23.9	2
8	Vulnerability	Minimize vulnerability	13.7	3

Matrix		Slope *1*	Source of Water *2*	Soil Drainage *3*	Agriculture area *4*	Irrigated Rice field *5*	Hazard *6*	Capacity *7*	Vulnerability *8*	**normalized principal Eigenvector**
Slope	*1*	1	5	7	1/6	1/7	1/9	1/8	1/7	2.8%
Source of Water	*2*	1/5	1	5	1/7	1/8	1/8	1/5	1/5	2.0%
Soil Drainage	*3*	1/7	1/5	1	1/7	1/8	1/8	1/7	1/7	1.2%
Agriculture area	*4*	6	7	7	1	1/9	1/8	1/6	1/5	4.7%
Irrigated Rice field	*5*	7	8	8	9	1	1/7	1/7	1/9	9.0%
Hazard	*6*	9	8	8	8	7	1	8	9	42.7%
Capacity	*7*	8	5	7	6	7	1/8	1	9	23.9%
Vulnerability	*8*	7	5	7	5	9	1/9	1/9	1	13.7%

Fig. 8.5 AHP Matrix for housing and settlement criteria

8.3.2 Urban Housing and Settlement Suitability Model in Palu Municipality Masterplan (RTRW Kota Palu) Using Integrated Criteria

The reconstruction process of suitability location for housing and settlement in this research is to find the best location for housing and settlement planning using newly proposed integrated criteria and indicators from spatial planning regulations and disaster mitigation regulation as mentioned in Sect. 8.3.1.1. The result is then used for reviewing the Housing and Settlement Planning in RTRW-Kota Palu.

8.3.2.1 Source of the Data

1. Spatial Planning maps

The data for this model were taken from the existing theme maps in the RTRW-Palu 2009 document. The map sources can be seen as follows

(a) Map for Protected Area theme, collected from Land-use Map RTRW-Kota Palu 2009
(b) Map for Dangerous Distance – Buffer (*Sempadan*), developed from river map and coastline map of RTRW-Kota Palu 2009
(c) Thematic map for Slope, derived from 3-dimension TIN map of RTRW-Kota Palu 2009
(d) Thematic map for Source of Water, taken from Water Aquifer Map RTRW-Kota Palu 2009
(e) Map for Not Irrigated rice field, collected from Land-use Map RTRW-Kota Palu 2009 (which has no Irrigated rice field found in it)
(f) Soil drainage map RTRW-Kota Palu 2009
(g) Map for Not Agricultural Land, collected from Land-use Map RTRW-Kota Palu 2009 (which has no Agricultural-land found in it)

Other than the above thematic maps, this research also uses the map from Palu BAPPEDA (Development Planning Agencies of Palu) office and housing and settlement map from RTRW-Kota 2009. The maps are:

(a) Administration Boundary from Management Information System (SIM) Kota Palu, BAPPEDA Palu 2013
(b) Existing Road from Management Information System (SIM) Kota Palu, BAPPEDA Palu 2013
(c) Housing and settlement map for Palu (Municipality of Palu 2009)

2. Disaster Map

Palu had already built their flood hazard map in 2009, the vulnerability map and the capacity map had already been included in these flood hazard maps. These maps were already verified by the flood history in this area. Produced in a cooperation between Palu Municipality, UNDP and SC-DRR Program, these maps had been prepared based on the rules set by the Indonesian regulations. These maps are shown in the following Figs. 8.6, 8.7, 8.8, and 8.9.

8.3.2.2 Suitable Location for Housing and Settlement

Getting all the desired criteria and indicators, this research overlays all the criteria maps using the MCDA process to produce the suitability map for housing and settlement. All criteria scores are divided into 5 classes except for 4 criteria (Protected Area, Not in Agricultural, Irrigated Rice Field, buffer distance Indicator) which only have 2 classes. For protected area and buffer distance (sempadan), criterion will be used as the constraint factors which will delete all the value within its area.

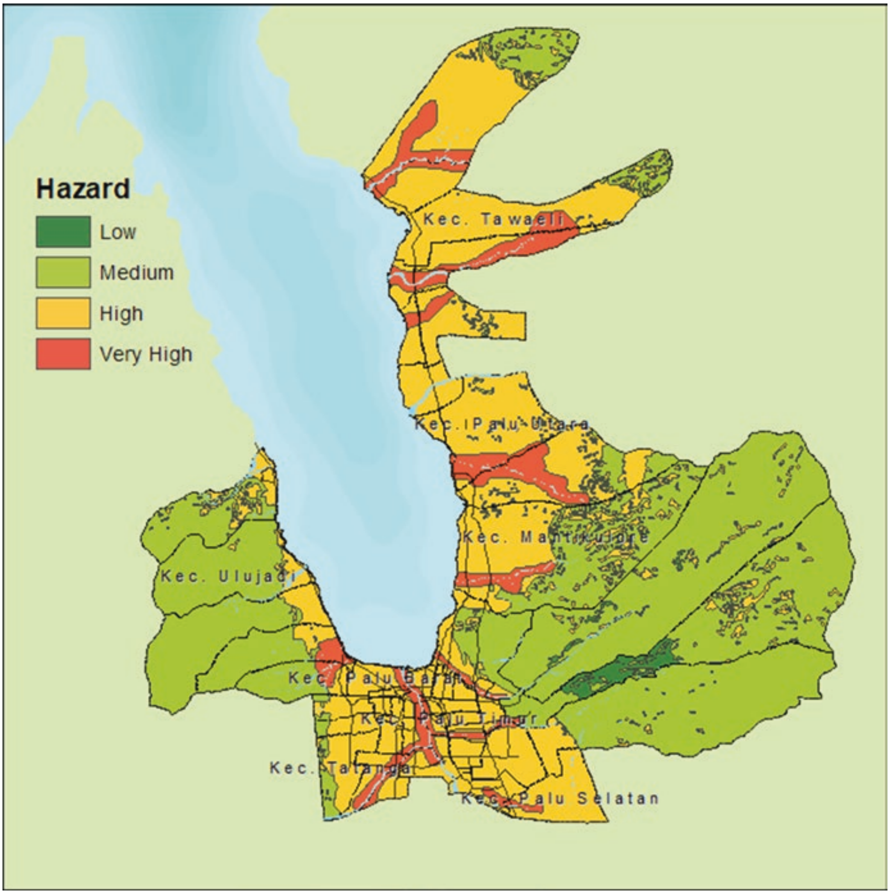


Fig. 8.6 Hazard threat map. (Source: SC-DRR 2009)

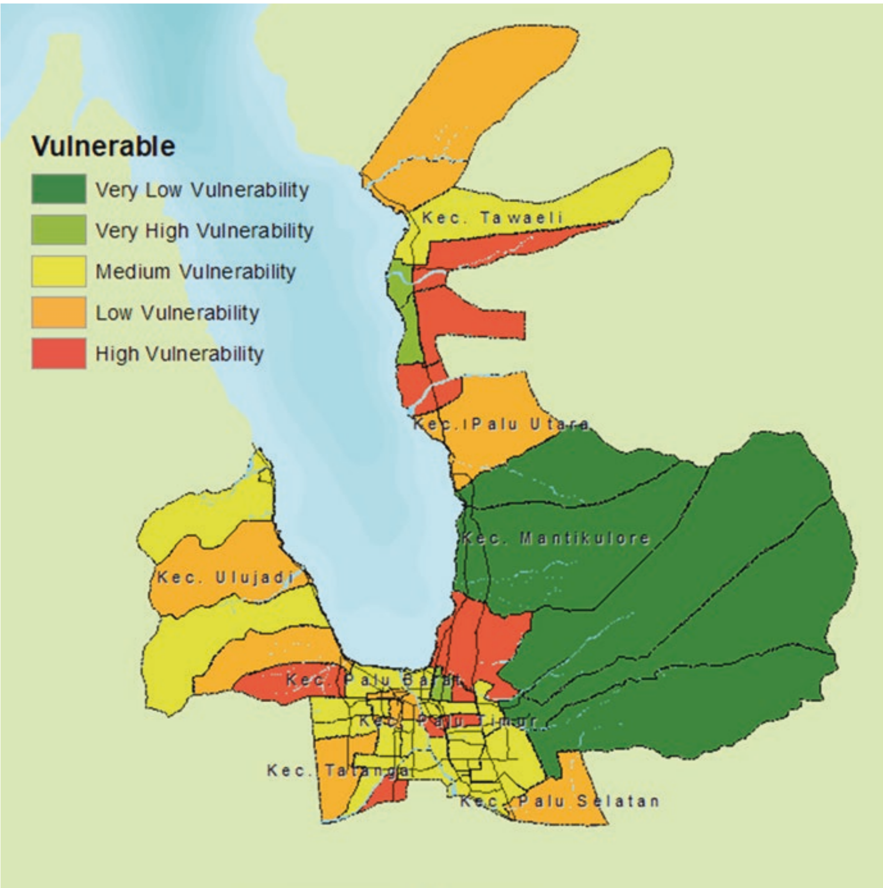


Fig. 8.7 Vulnerability map. (Source: SC-DRR 2009)

Not in Agricultural and Irrigated Rice Field criteria are not available in Palu. There is no policy that supports Rice Field and Agriculture in the RTRW Map. Therefore, this research will remove these two criteria.

For Hazard threat, Vulnerability, and Capacity maps, this research will use the given SC-DRR map to complete the analysis. The class for these maps will use 5 grades. The lowest grade (1) is an undesirable condition whereas the highest-grade (5) in the criteria is a favorable condition. The example for the hazard threat class is that the higher the hazard threat value, the farther from the flood prone.

Specifically, for Hazard threat criteria, the highest score gets a value of 4 based on existing data (SC-DRR map), the entire city of Palu is an area potential to get a flood disaster (with a class range of 1–4).

To gain the most suitable locations for housing and settlement, each criteria class and its weight in this research are then multiplied as in the Eq. 8.1 (see Sect. 8.2.2.3). The results find 5 suitability classes (using Jenks Natural Break in ArcGIS) and after

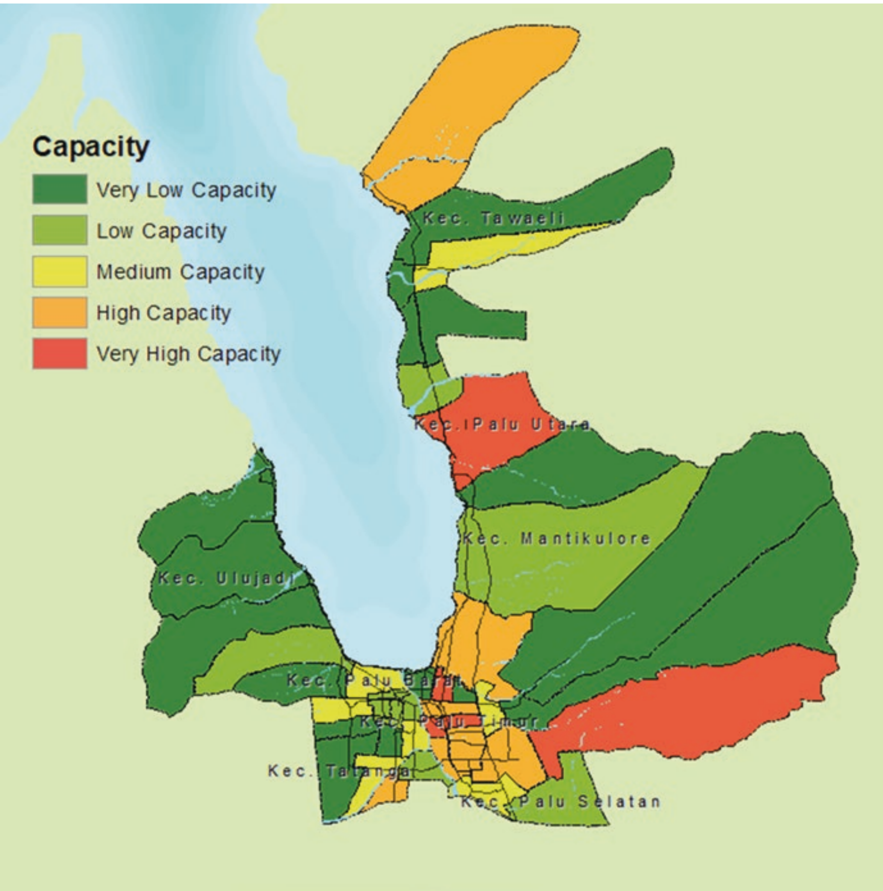


Fig. 8.8 Capacity map. (Source: SC-DRR 2009)

reducing protected area and buffer distance area (Eqs. 8.1, 8.2, and 8.3), the outcome shows that 2955.13 Ha is in very suitable class, 3592.52 Ha is in suitable class, and 2126.12 Ha is highly unsuitable. The result is shown in the following tables and map (Tables 8.15 and 8.16).

Base on Table 8.16 and Table 8.15 and Suitability map (Fig. 8.10. Suitability map for Housing and Settlement), it can be seen that most of the region with very suitable class are on flat slope areas and the very suitable class is within *Mantikulore, Palu Timur* and *Palu Selatan* District, and some parts in *Palu Utara* and *Tatanga*. The medium and suitable classes of this model still show the same performs. Majority of these types of suitability class are in the relatively flat terrain, and away from the river/coastline. In other words, the majority of these suitability classes are within *Palu Selatan, Palu Barat,* and *Palu Utara* administration.

The highly unsuitable areas are majority in the hilly area with a fair slope. In the city center, the highly unsuitable area also appears along the river and the coastline, and some of this highly unsuitable area falls inside the "buffer distance (sempadan)" area.

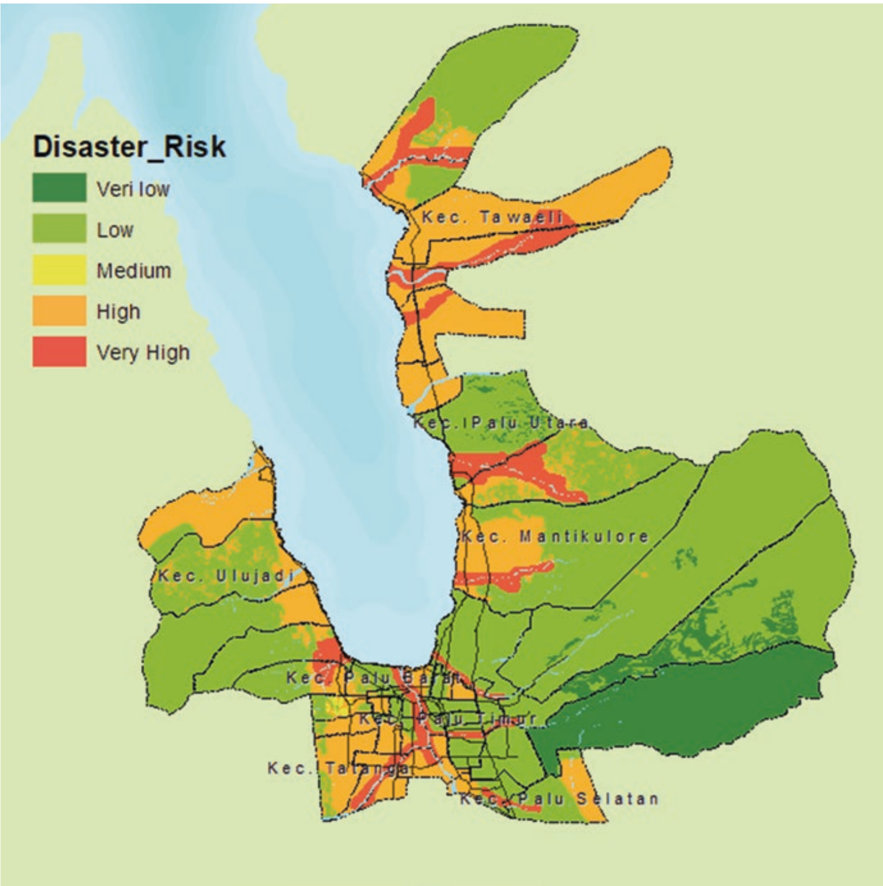


Fig. 8.9 Disaster risk map. (Source: SC-DRR 2009)

The result shows that the suitability class on the model are mostly driven by 3 criteria which are; the impact of **flood disaster threat**, the **capacity** of the local government and the community to counter his threat, and the **vulnerability** of the community in this area. The **buffer distance (Sempadan)** and **Protected Area** criteria are also important to reduce the risk of flood disaster in the populated area.

8.4 Conclusion

Several important regulations have been issued by Indonesian Government regarding the issue of spatial planning and disaster mitigation. From these regulations, we can draw some key criteria and indicators that can be integrated into the spatial planning especially housing and settlement planning with disaster mitigations.

Table 8.15 Suitability area on each district

District	Suitability class	Area (Ha)	District	Suitability class	Area (Ha)
Mantikulore	5	1189.69	Palu Timur	5	342.31
	4	340.38		4	41.01
	3	548.15		3	70.42
	2	1349.63		2	91.73
	1	1358.41		1	17.98
Palu Barat	4	220.92	Palu Selatan	5	823.47
	3	234.68		4	304.82
	2	147.78		3	727.07
	1	49.18		1	38.87
Palu Utara	5	484.86	Tatanga	5	114.8
	4	921.63		4	246.79
	3	971.16		3	321.27
	2	217.63		2	513.22
	1	152.82		1	73
Tawaeli	4	1382.98	Ulujadi	4	133.99
	3	931.21		3	228.84
	2	1054.01		2	642.52
	1	245.17		1	190.69

Table 8.16 Suitability area

Suitability (Jenks Natural Break)	Class		Area (Ha)
3.62–4.22	***5***	*Very suitable*	2955.13
3.22–3.61	***4***	*Suitable*	3592.52
2.95–3.21	***3***	*Medium*	4032.80
2.63–2.94	***2***	*Unsuitable*	4016.52
1.67–2.62	***1***	*Highly unsuitable*	2126.12
Total			16,723.09

This research listed 10 criteria and indicators that have been mentioned in the regulations where 7 criteria come from Spatial Planning and 3 criteria come from Disaster Mitigation regulations. The criteria are; 1. Suitable Slope, 2. Availability of Water Resources, 3. Minimizing Threats, 4. Minimizing Vulnerability of hazard, 5. Maximizing Capacity from hazards, 6. Good Soil drainage, 7. Not in a Protected area, 8. Not located in the agricultural area, 9. Not located in Irrigated Rice Field, and 10. Not in the dangerous distant from other reserve area (sempadan).

Using these criteria and weighted in AHP, the model that had been carried out in the second phase, shows that the group of disaster mitigations held the most important factor to be reconsidered on housing and settlement planning. The models of the full criteria weight can be seen as follows (Table 8.17):

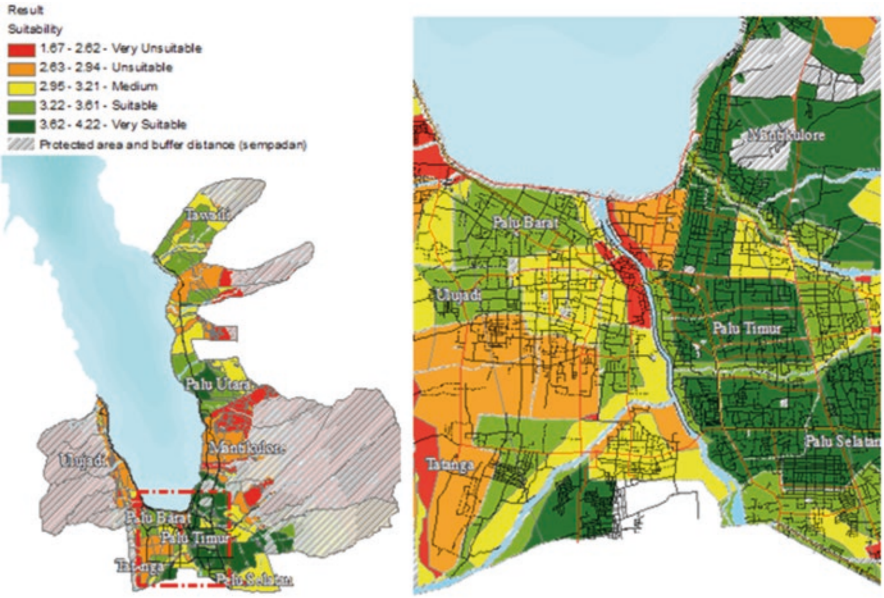


Fig. 8.10 Suitability map for housing and settlement

Table 8.17 The result of the integrated criteria

No	Integrated criteria	Regulation Source	Categories	AHP weights %
1	Suitable slope	Spatial planning	Opportunity criteria	2.8
2	Availability of water resources	Spatial planning	Opportunity criteria	2.0
3	Minimizing threats	Disaster mitigation	Opportunity criteria	42.7
4	Minimizing vulnerability	Disaster mitigation	Opportunity criteria	13.7
5	Maximizing capacity	Disaster mitigation	Opportunity criteria	23.9
6	Good soil drainage	Spatial planning	Opportunity criteria	1.2
7	Not in a protected area	Spatial planning	Constrain criteria	
8	Not located in agricultural area	Spatial planning	Opportunity criteria	4.7
9	Not located in irrigated Rice field	Spatial planning	Opportunity criteria	9.0
10	Not in the dangerous distant from other reserve area (*sempadan*)	Spatial planning	Constrain criteria	

8.4.1 Limitation of the Research

The development of spatial planning document (RTRW-Kota 2009) in Palu does not merely use only flood disaster analysis, but also consider more complex factors including multi-hazard criteria, existing settlement condition, community perception (during Focus Group Discussion), and city government strategy in achieving its development objectives. Based on these reasons, the result of this research does not carried out any further analysis which complements the above-mentioned limitations.

Another limitation is on the preparation of weighting process. The AHP phase only used the subjective opinion of the researcher, the more relevant stakeholder is strongly needed to be included in the weighting process.

8.4.2 Further Research

This research only puts the initial stages of further research. Based on the findings, it is very interesting if the operational research process undertaken by the municipal of Palu can be reviewed to gain the advantages and disadvantages of their process in the development of their RTRW-Kota document. It will also be interesting if the further research has considered overall disaster factors including evacuation systems in disaster prone areas as mentioned in the regulations.

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References

Abedinnia H, Glock CH, Schneider MD (2017) Machine scheduling in production: a content analysis. Appl Math Model 50:279–299. Retrieved http://www.sciencedirect.com.ezproxy.utp.edu.co/science/article/pii/S0307904X17303335

Barnes R, Ashbolt N (2006) Review of decision tools and trends for water and sanitation development projects. In: 32nd WEDC international conference, Colombo, Sri Lanka: Sustainable development of water resources, water supply and environmental sanitation

Birkmann J, Garschagen M, Setiadi N (2014) New challenges for adaptive urban governance in highly dynamic environments: revisiting planning systems and tools for adaptive and strategic planning. Urban Clim 7:115–133. Retrieved https://doi.org/10.1016/j.uclim.2014.01.006

BNPB (2016) Portal data Indonesia – Data.go.id. Retrieved 26 April 2017. http://data.go.id/dataset/data-bencana-banjir-2

BNPB, National Disaster Management Agency of the Republic of Indonesia (2012) Regulation of the head of national disaster management agency of the republic of Indonesia number 2 year 2012 on general guidance on study of disaster risk

Caparros-Midwood D, Barr S, Dawson R (2015) Optimised spatial planning to meet long term urban sustainability objectives. Comput Environ Urban Syst 54:154–164. Retrieved https://doi.org/10.1016/j.compenvurbsys.2015.08.003

Cutter SL, Mitchell JT, Scott MS (2000) Revealing the vulnerability of people and places: a case study of Georgetown county, South. Source Ann Assoc Am Geogr 90(4):713–737. Retrieved http://www.jstor.org/stable/1515440%5Cnhttp://www.jstor.org/page/

EM-DAT (2016) 2015 Disasters in numbers (1):2. Retrieved http://www.emdat.be

Evers M, Jonoski A, Almoradie A, Lange L (2016) Collaborative decision making in sustainable flood risk management: a socio-technical approach and tools for participatory governance. Environ Sci Policy 55:335–344. Retrieved https://doi.org/10.1016/j.envsci.2015.09.009

Francesch-Huidobro M, Dabrowski M, Tai Y, Chan C, Stead D (2015) Governance challenges of flood-Prone Delta cities: integrating flood risk management and climate change in spatial planning. Prog Plan. Retrieved https://doi.org/10.1016/j.progress.2015.11.001

Kain JH, Söderberg H (2008) Management of Complex Knowledge in planning for sustainable development: the use of multi-criteria decision aids. Environ Impact Assess Rev 28(1):7–21

Kii M, Nakamura K (2017) ScienceDirect ScienceDirect ScienceDirect Development of a Suitability Model Development of a Suitability Model for Estimation of Global Urban Land Cover for Estimation of Global Urban Land Cover. Transport Res Procedia 25:3165–3177. Retrieved https://doi.org/10.1016/j.trpro.2017.05.358

Kita SM (2017) Urban vulnerability, disaster risk reduction and resettlement in Mzuzu. Int J Disaster Risk Reduct 22:158–166. Retrieved http://ac.els-cdn.com/S2212420916306719/1-s2.0-S2212420916306719-main.pdf?_tid=1d3d85de-1944-11e7-a99f-00000aab0f27&acdnat=1491316779_caee83e49a634cedf7a102afb2dd9f34

Kornakova M, March A (2013). Finding appropriate participation in Urban planning for reduction of disaster risks. 1–12. Retrieved http://www.soacconference.com.au/2013-conference/wp-content/uploads/2013/12/Kornakova-Environment.pdf

Liu R, Zhang K, Zhang Z, Borthwick AGL (2014) Land-use suitability analysis for Urban development in Beijing. J Environ Manag 145:170–179. Retrieved https://doi.org/10.1016/j.jenvman.2014.06.020

Malczewski J (2004) GIS-based land-use suitability analysis: a critical overview. Prog Plan 62(1):3–65

Malczewski J (2006) GIS-based multicriteria decision analysis: a survey of the literature. Int J Geogr Inf Sci 20(7):703–726. Retrieved http://www.tandfonline.com/doi/abs/10.1080/13658810600661508

Mardin R (2009) Collaborative decision making in railway planning, a multi criteria evaluation of JOGLOSEMAR project, central java – Indinesia. Enschede, ITC (1)

Mardin R (2011) Analisis Perkembangan Fisik Kota Palu Dengan Citra Landsat. Ruang 3:45–54

Municipality of Palu (2009) RTRW Kota Palu 2009

Municipality of Palu (2011) Laporan SLHD Kota Palu Tahun 2011

Municipality of Palu (2014) Laporan SLHD Kota Palu Tahun 2014

Palu Statistic Bureau (2016) Statistik Daerah Kota Palu 2016

Ran J, Nedovic-Budic Z (2016) Integrating spatial planning and flood risk management: a new conceptual framework for the spatially integrated policy infrastructure. Comput Environ Urban Syst 57:68–79. Retrieved https://doi.org/10.1016/j.compenvurbsys.2016.01.008

Saaty TL (1990) How to make a decision: the analytic hierarchy process. Eur J Oper Res 48(1):9–26

Tingsanchali T (2012) Urban flood disaster management. Procedia Eng 32:25–37. Retrieved https://doi.org/10.1016/j.proeng.2012.01.1233

UNISDR (2015) Sendai framework for disaster risk reduction 2015–2030. In: Third world conference on disaster risk reduction, Sendai, Japan, 14–18 March 2015. (March):1–25

Wilson Center (2017) URBAN PERSPECTIVES: climate change, migration, planning and financing A NEW GENERATION OF IDEAS 2017. Retrieved https://www.wilsoncenter.org/publication/urban-perspectives-climate-change-migration-planning-and-finance-new-generation-ideas

Wisner B, Blaikie P, Cannon T, Davis I (2003) At risk: natural hazards, people's vulnerability, and disasters 2. J Homel Secur Emerg Manag 2(2). Retrieved (http://www.degruyter.com/view/j/jhsem.2005.2.2/jhsem.2005.2.2.1131/jhsem.2005.2.2.1131.xml).

World Bank (2013) City planning labs a concept for strengthening city planning capacity in Indonesia