

# **THESIS**

## **THE LIVELIHOOD ANALYSIS IN MERAPI PRONE AREA AFTER 2010 ERUPTION A CASE OF STUDY IN KALITENGAH LOR, KALITENGAH KIDUL AND SRUNEN HAMLET**

Thesis submitted to the Double Degree M.Sc. Programme, Gadjah Mada  
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UNIVERSITY OF TWENTE  
2013**

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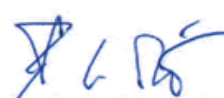
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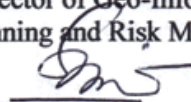
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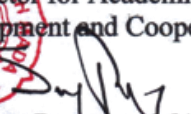
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## **DISCLAIMER**

This document is part of a programme of study at the Double Degree International Programme of Geo-Information for Spatial Planning and Risk Management – a Joint Programme of International Institute of Geo-Information Science and Earth Observation (ITC), The Netherland and Universitas Gadjah Mada, Indonesia. Although I had involved others, personal and institutions, in preparing this document, all the content of it is my original work.



Susy Nofrita

## **Abstract**

As stated in Regent Regulation No. 20 Year 2011 about Merapi Volcano Disaster-Prone Area, Merapi eruption in 2010 affected larger area than before. Kalitengah Lor, Kalitengah Kidul and Srunen hamlet now was categorized as prone area zone III or the most dangerous area related to Merapi volcano hazard and was forbidden to live at. But its local people agreed to oppose the regulation and this area had been 100% reoccupied.

This research examined about the existing livelihood condition in Kalitengah Lor, Kalitengah Kidul and Srunen that had been changed and degraded after 2010 great eruption. The grounded based information found that 80% of households sample were at the middle level of welfare status, meanwhile the high and low were at 13% and 7% respectively. Each status represented different livelihood strategy in facing the life in prone area with no one considered the Merapi hazard, but more economic motivation and assets preservation. The diversity in strategy was found in diversification of livelihood resources which were dominated by sand mining, farming and dairy farming.

Keywords: Merapi prone area, livelihood, livelihood strategy, Kalitengah Lor, Kalitengah Kidul, Srunen, sand mining, dairy, farming

## **Intisari**

Berdasarkan Peraturan Bupati Sleman No. 20 Tahun 2011 tentang Kawasan Rawan Bencana Gunungapi Merapi, dampak erupsi Merapi tahun 2010 lebih besar dibanding erupsi-erupsi sebelumnya. Dusun Kalitengah Lor, Kalitengah Kidul dan Srunen kini berada dalam kawasan rawan bencana kategori III atau daerah paling berbahaya yang dilarang untuk dihuni. Tetapi 100% penduduk ketiga dusun tersebut telah sepakat untuk tetap tinggal dan menolak regulasi tersebut.

Penelitian ini mengaji mengenai perubahan kondisi penghidupan di Kalitengah Lor, Kalitengah Kidul dan Srunen akibat erupsi besar di tahun 2010. Saat ini ditemukan bahwa 80% rumahtangga berada pada level penghidupan menengah, 13% telah sejahtera dan 7% berada dalam kondisi di bawah sejahtera. Tiap kondisi memiliki beragam strategi penghidupan yang uniknya tidak mempertimbangkan bahaya gunungapi, namun lebih ke motivasi ekonomi dan perlindungan asset. Difersifikasi mata pencarian penduduk didominasi oleh tambang pasir, pertanian dan peternakan sapi.

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Yogyakarta, March 2013

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## 1. Introduction

### 1.1 Background

Merapi volcano is the second most active volcano in Indonesia and one of the most active volcanoes on earth. In Indonesia this stratovolcano of 2965 meter elevation located on Java Island is well known as a dangerous volcano. It has erupted 61 times since the 15<sup>th</sup> century, with an average repose of 3.5 years (Thouret, Lavigne et al. 2000).

According to both Thouret, Lavigne et al. (2000); (Barrett, Reardon et al. 2001) some 60% of Java's population lives around active volcanoes. Also the slopes of Merapi are occupied by a dense population. The Merapi area supports 300 villages, with 440.000 people living in the area prone to volcanic hazards, most of them in large extended families. There are 1.1 million people living in the wider area around Merapi, with high-intensity and low-technology agriculture as the dominant landuse (Thouret, Lavigne et al. 2000). Research by Voight, Constantine et al. (2000) and Young, Voight et al. (2000) about the activity of Merapi volcano shows that its impact on human culture and land use activities is by now ten times larger than it was about 100 years ago.

Tephra/ash fall is a major problem for people living in a wider area around active volcanoes. Moreover, many people that are living even closer to a volcano crater, in the direct hazard prone area, also need to worry about *pyroclastic flows*, *landslides*, and *lahar* hazards. When an eruption occurs on Merapi pyroclastic material and lahars can flow more than 8 and 20 km respectively through its slope (Esperanza, Luisa et al. 2008).

In the 2006 Merapi eruption 12.000 people were evacuated or got homeless. This eruption, furthermore, destroyed for about 3.000 ha of agriculture land and forced farmers to sell their livestock at lower price (Lavigne, De Coster et al. 2008). The 2006 eruption also impacted on agriculture and infrastructure in more structural manner. It influenced agricultural practices crop cultivation and livestock breeding more in particular, affected soil fertility in agriculture fields and had an effect on the water system, building structures and the transportation infrastructure (Wilson, Kaye et al. 2007). The agriculture sector was mostly impacted by ash fall because volcanic ash remains for long time to cover plant leaves, or damage maturing fruit and vegetables skin (Wilson, Kaye et al. 2007).

In response to the effect of volcanic eruptions many households near Merapi have established a mechanism of both on-farm and off-farm activities. Almost all people in rural areas around Merapi diversify their income sources, assets and activities (Sagala, Okada et al. 2009) and (Sagala, Okada et al. 2009). It is one of

the ways to reduce risk and respond to crisis. And the decision to diversify into a non-farm job can be a form of risk management and coping strategy with frequent shocks (Barrett, Reardon et al. 2001).

People living in the neighborhood of Merapi volcano realize the potential danger they face, but Merapi also always had positive sides for them. Agricultural production and soil fertility are typically related to livelihoods around volcanoes. There are theories about the positive effect of eruptions on soil fertility. Soon after eruption, there is deposition of tephra that cover farm land and cause fertility reduction. But it will be eroded and the soil is getting more fertile as time passes (Wilson, 2007). Esperanza et al. (2008) state that volcanic eruptions as such have positive effects since they enrich the soils. According to Wilson, Kaye et al. (2007) people who live on Merapi area used to extensively produce vegetables. Agriculture and land fertility are used to relate to livelihood around volcanoes. There are theories about the effect of eruption on soil fertility. Soon after eruption, there is deposition of tephra that cover farm land and cause fertility reduction. But it will be eroded and the soil is getting more fertile as time passes (Wilson, 2007). Esperanza, Luisa et al. (2008) states that volcanic eruption gave positive effect since it enriches soil nutrition. Meanwhile, according to research of Suriadikarta, et al. (2011), soil Ph after 2010 eruption is 5.5 that is enable a plant to grow. Soil permeability in Balerante, at south of Srunen, and Selo that located in the north of Merapi, is low. It makes soil lack of water content. But a land that has this condition still can be planted with grass for fodder and some annual and timber plants for example Sengon, Mahoni and Fruit jack which are indigenous vegetation in Cangkringan. This condition is seen in Kalitengah Lor, Kalitengah Kidul and Srunen. In rural area, it is important to consider land fertility, access to water for agriculture field, and other resource like forest and the needs for transportation facility (Gottret, 2002).

After eruption in 2010, Sleman local government issued a Sleman Regent Regulation No. 20 Year 2011 about Merapi Volcano Disaster-Prone Area. In chapter three, there is a statement about disaster-prone area zone III which only located for development activities for disaster management, utilization water resources, forests, dry land farming, conservation, science, research, and nature. It is not for occupancy and Land Coverage Ratio of no more than 5% (five percent). The danger zone III covers 4672 acres in Turi, Pakem, Cangkringan, and Ngemplak Sub-Districts.

There are nine hamlets that are located in disaster-prone area category zone III; Pelemsari, Pangukrejo, Kaliadem, Petung, Jambu, Kopeng, Kalitengah Lor,

Kalitengah Kidul, and Srunen. Three of them are still occupied, which are Kalitengah Lor, Kalitengah Kidul and Srunen in Glagaharjo village. They are refused to be relocated and their people keep doing their daily activities there. Bappeda of Sleman Regency reported that 100% of its area was affected that make them categorized as prone area zone III that is under the authority of central government (Bappeda, 2011).

Another advantage is its cold lahar that contains of stone and sand that flow along the Kali Opak and Kali Gendol. They are now in huge deposit and shallowing the river (Bale, 2011). Since Merapi eruption make uncertainty condition for farming, even though there are adjustments in farming system, but many farmers turned their activity into sand mining, that located surround Merapi area (Pamungkas, 2011). Technically, it can help the shallowing process in rivers and economically, it can be an alternative of income resource of people that got eruption impact on their farming area (Bale, 2011)

## **1.2 Research Problem**

Merapi supports people who live around it, with agriculture as livelihood source (Wilson, Kaye et al. 2007). Considering the repose period of the Merapi eruptions, there is a high potential loss and vulnerability in Merapi prone area.

After the 2010 eruption, all occupied areas, that is located in danger zone category III (according to Sleman Regent Regulation No. 20 year 2011), had to be relocated. In fact, unlike the other hamlets, people in Kalitengah Lor, Kalitengah Kidul and Srunen re-occupied their house soon after the eruption in 2010, choose to live in the disaster prone area although it can be endangering their life. The reasons for living there could be related to the knowledge about the hazard they face or the existing condition in the area and the advantages they get. Those make not only a contradictive condition between potential risk of Merapi volcano and advantages of it as livelihood resource of people, but also the curiosity about the livelihood assets and components related to the existence of this area without government's support.

Field survey showed that those hamlets were not affected by lahar in 2010 eruption directly. The physical and economic condition is starting to improve now, including the agriculture field as the main livelihood resource before. In optimizing the livelihood utilization, people diversify their livelihood from both on-farm and off-farm resources. It is important to analyze the livelihood strategy of people in order to find out the possibility for improving the livelihood system in Merapi prone area.

### **1.3 Objectives and Research Questions**

This research wants to analyze and develop recommendations to improve the livelihood system in Merapi prone area. The objectives of this research are defined as follows:

- 1) To assess the existing land use condition after 2010 Merapi eruption in Kalitengah Lor, Kalitengah Kidul and Srunen as prone area zone III.
  - How are livelihood components in reconstruction phase in Kalitengah Lor, Kalitengah Kidul and Srunen?
  - What make people keep living there?
  - How are people and their livelihood resource affected by eruption?
- 2) To assess the livelihood strategies occurring Kalitengah Lor, Kalitengah Kidul and Srunen related to volcanic activities.
  - What is the change in household's livelihood resources?
  - How people adaptation in their livelihood practices related to Merapi?
- 3) To develop recommendations of improvement for an appropriate livelihood based on the analysis of resource used, and in the context of volcanic hazard in the Merapi area.
  - What is the strategy that could intensively increase people's income?
  - How could alternative systems be introduced to deal with living problems in Merapi prone area?

### **1.4 Limitation of the Research**

This research is based on Sleman Regent Regulation No. 20 Year 2011 about Merapi Volcano Prone Area. It limited the study area to inhabited area that considered as prone-area zone III of Merapi volcano which are Kalitengah Lor, Kalitengah Kidul and Srunen hamlet. Those had been re-occupied soon after 2010 eruption over meanwhile other six hamlets included in this category; Pelemsari, Pangukrejo, Kaliadem, Petung, Jambu and Kopeng, were relocated. This condition was special and specifies in one category; inhabited prone area, which have certain reasons and strategy that differ from others.

Livelihood analysis related to framework (see in subtitle 2.2 Livelihood Strategy) of DFID (1999) involves culture in transforming process to sustainable livelihood which will be revealed by in-depth interview about local culture and the way of thinking that influences the livelihood strategy. Information and data in this research is at household level in one house. There was found that in one house lived more than one family, for example parents and married-children that work together and depend on each other. The reason for combining them in one group is

the decision in choosing livelihood considers the needs of all family members, furthermore the livelihood assets were recognized as family assets that can be used together.

### **1.5 Benefit of the Research**

The research provides several benefits as follows:

1. Providing information about livelihood condition in prone area after eruption in 2010.

The interview revealed some changes and impacts that people got on their farming area, natural resources, access and facilities in Kalitengah Lor, Kalitengah Kidul and Srunen as prone area. It

2. Providing information about livelihood activity.

The post-disaster condition affected people activity and influenced their choice in utilizing livelihood assets and choosing livelihood resources after 2010 eruption.

3. Obtaining information about people opinion in facing Merapi hazard potency. Prone area reoccupation indicated the differences in risk perception between government and local inhabitant. This perception and personal opinion were gained in this research including the coping mechanisms in dealing with volcanic hazard.

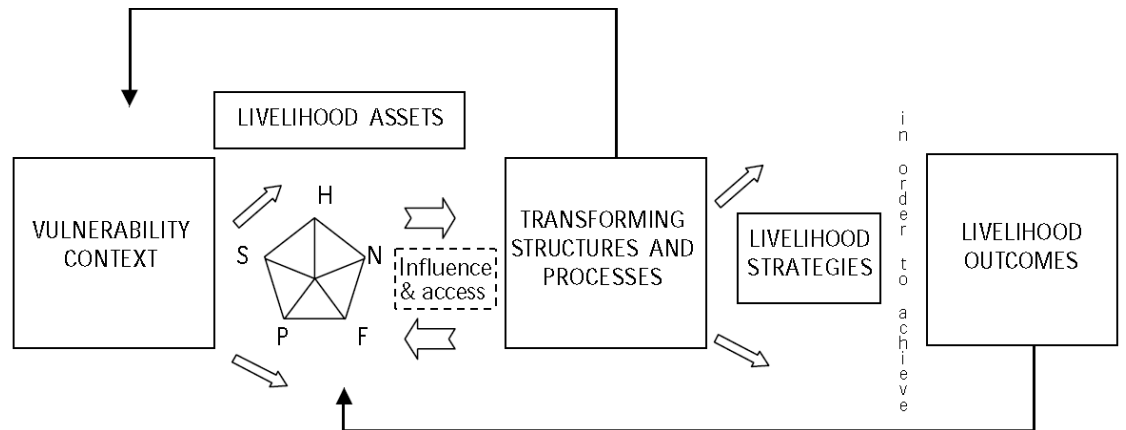
4. Producing recommendations for improved land use that can be a consideration for people in adapting land use practices, and government in implementing programs.

## 2. Literature Review

### 2.1 Livelihood

#### 2.1.1 Livelihood Assets

DFID Sustainable Livelihood Guidance Sheet (1999) provide a framework of livelihood assets that have vulnerability conditions and determine the strategy in dealing with the dynamic condition of livelihood resource as shown in figure 2.1.



**Figure 2. 1 Sustainable Livelihood**

(source: DFID, 1999)

The change in structure, process and livelihood assets affects each other, whereas people as center of it, and those determine the livelihood strategy. All activities aim for outcomes which are; increasing in income, well-being, food security, sustainability and reducing in vulnerability.

There are five basic components of livelihood which are:

1. Human Capital; describes quality, ability and potency of people in achieving their objectives.
2. Social Capital; refers to any value relationship among community. It can be in the form of network, social group member or relatives.
3. Natural Capital; refers to all resources that exist naturally, for example land, water, etc. and those used to be a basic form livelihood resources.
4. Physical Capital; as a supporting assets for livelihood, for example road access, information devices, shelter, and any other equipments that help in achieving and utilizing other assets.
5. Financial Capital; refers to available inventory and/or money we have.

Vulnerability can effect on existence and loss of assets, meanwhile transforming structure and process influence access to them. There is a relationship among assets, livelihood strategies and livelihood outcomes; the more the assets the more

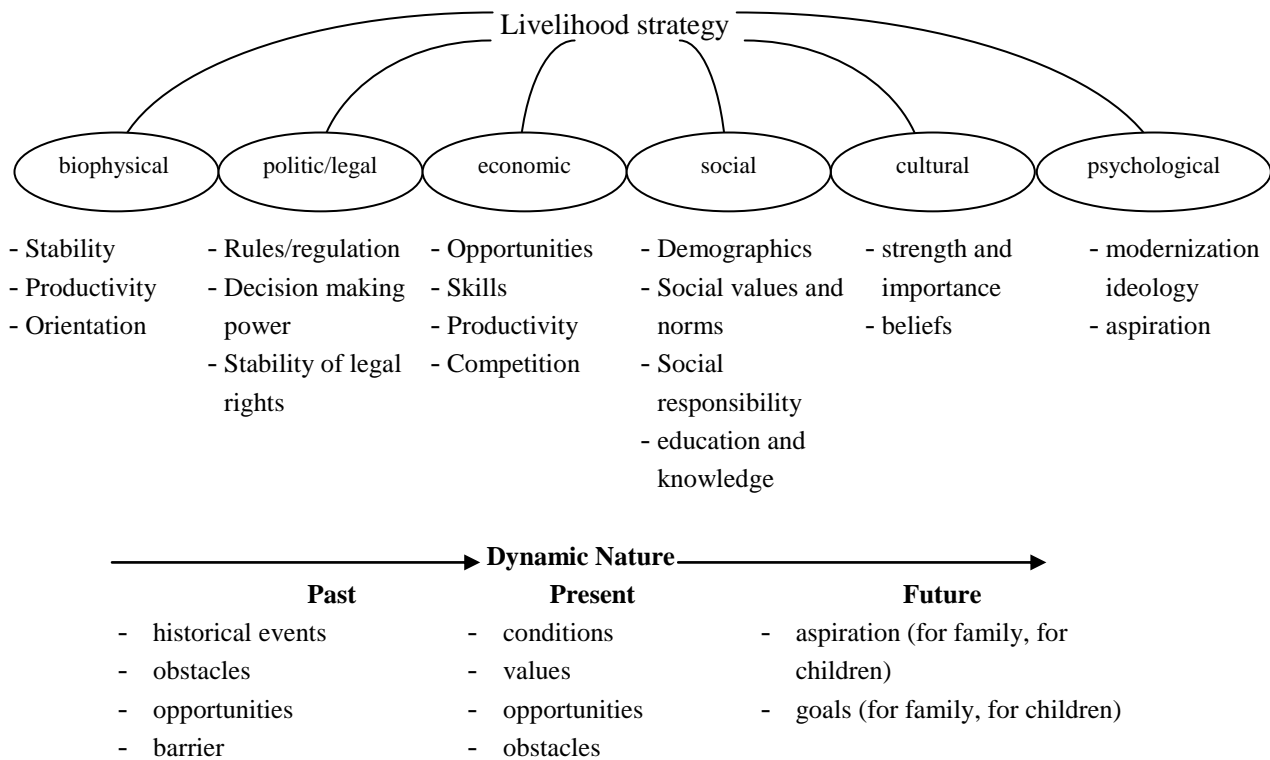


the option and ability in determining livelihood strategy. The diversifications of assets and strategy implies on livelihood outcomes in positive relationship (DFID, 1999).

### 2.1.2 Livelihood Strategy

“A livelihood strategy is an organized set of life-style choices, goals and values, and activities influenced by biophysical, political/legal, economic, social, cultural and psychological componenets.” (Walker et al. 201)

There are six component related to livelihood strategy as shown in figure 2.2.



**Figure 2. 2 Schematic representation of livelihood strategy approach**

(source: Walker et al, 2001)

Every household has different ability in gaining the livelihood. It depends on:

- kind of access; it has a very large opportunity since people can access to anybody's resources by borrowing, renting, etc.
- diversity of asset; it makes the main resource has back up.
- amount of assets; the more the asset the better.

- balance between assets; it is important that people do not have great dependency on certain asset/source.
- quality of assets; it determines the result both in quantity and quality, and related to level of productivity and income.

### **2.1.3 Livelihood Diversification**

Most of people around Merapi are farm households that use intercropping system which is a combination of agricultural crops that yield annually, seasonally and daily. This system can adjust to the condition of household level (Peter and Runge-Metzger 1994). There are some strategies that ever applied to household in Yogyakarta, for example agriculture diversification, non-agriculture diversification and household member empowerment (Ritohardoyo, 2000).

Barrett, Reardon et al. (2001) state “Diversification is the norm”. Since people tend to have more than one livelihood source in gaining welfare. “Diversification patterns reflect individual’s voluntary exchange of assets and their allocation of assets across various activities so as to achieve an optimal balance between expected returns and risk exposure conditional on the constraints they face”.

There are two factors that contribute to the decision for diversification:

- Push factor; for example risk reduction, labor excess due to lack of planning, self provision of needs, crisis/constraints overcome.
- Pull factor; for example complementary activities to optimize assets, maximize the advantages of technology and skills.

The diversity of resource affects household’s income related to agro-ecosystem of the area. Generally, there are two groups of income source of household level in village; on-farm and off-farm. On-farm income can be from farming, husbandry and wages of agriculture’s laborer. On the other hand, activities and wages out of those are considered as off-farm income (Nurmanaf, 2004).

According to Barrett, Reardon et al. (2001), livelihood activities can be classified into three categories:

- Primary; activities on mining, agriculture and other extractive
- Secondary; refers to manufacturing activity
- Tertiary; related to service activity

The term of farm and nonfarm is based on those categories; agricultural or farm income recognize as a result of gathering unprocessed product from natural resources, meanwhile nonagricultural or nonfarm income is from activity that related to processing, transporting, trading of the product. In case of the fail of assets of natural resource that consider as farm income, households will allocate

their labor to off-farm activity. Other motivation in diversifying livelihood in hazard prone area could be as risk reduction and coping with shocks. Even more, the research reveal that nonfarm activities take a bigger part in household income and welfare.

Livelihood activities as household income resource in Kalitengah Lor, Kalitengah Kidul and Srunen is from both farm and nonfarm. For measuring whether the level of income filled the minimum standard of needs, Yogyakarta provinve government has issued the minimum wage for Yogyakarta in 2012 in Rp. 892,660.00 ([www.nakertrans.jogjaprovo.go.id](http://www.nakertrans.jogjaprovo.go.id)) that become a standard in categorizing households in Kalitengah Lor, Kalitengah Kidul and Srunen that have already met minimum wage and have not.

Income represents the welfare of a household. For those who cannot meet the minimum wage standard, but at least they can fulfill their survival needs, Susenas (The National Social Economic Survey) stated rural households expenditure for this category at Rp. 218,042.00 (Purwantini, 2007).

## **2.2 Livelihood Condition in Merapi Prone Area Before 2010 Eruption**

Before 2010, people who lived in Kalitengah Lor, Kalitengah Kidul and Srunen considered their life relatively safe because the pyroclastics flow never impact these areas as described in figure 2.3.

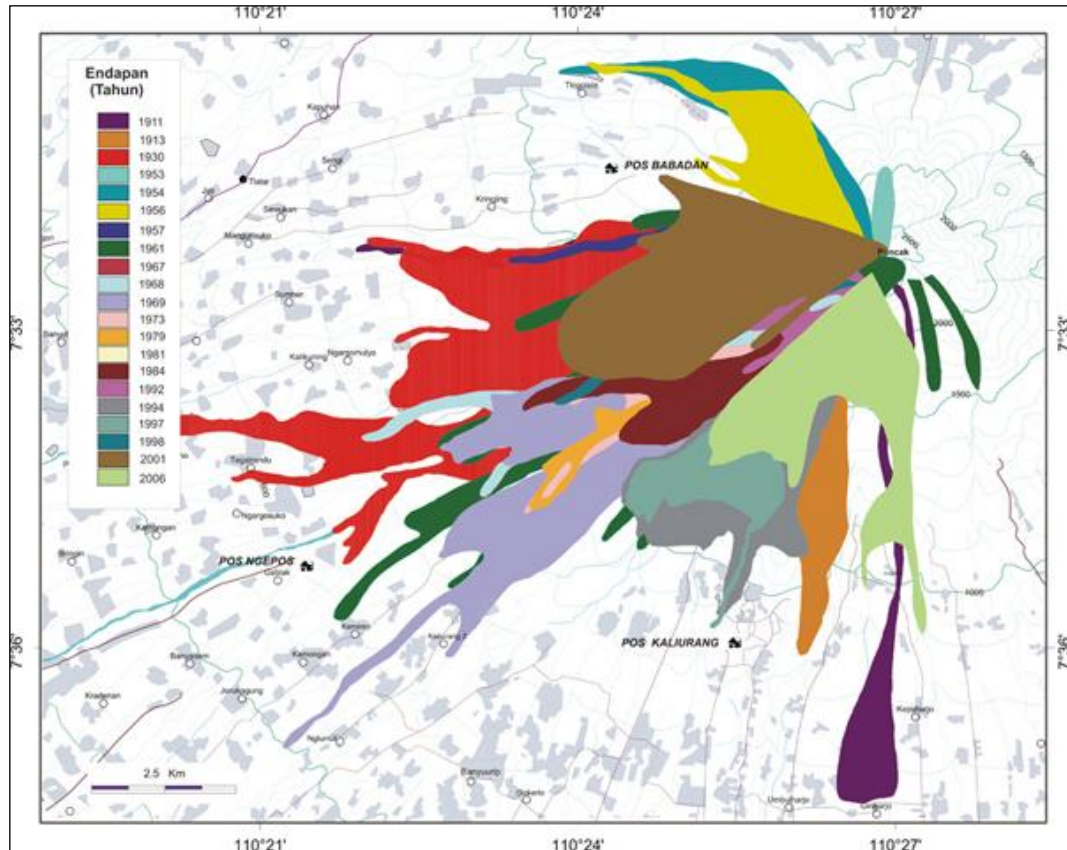
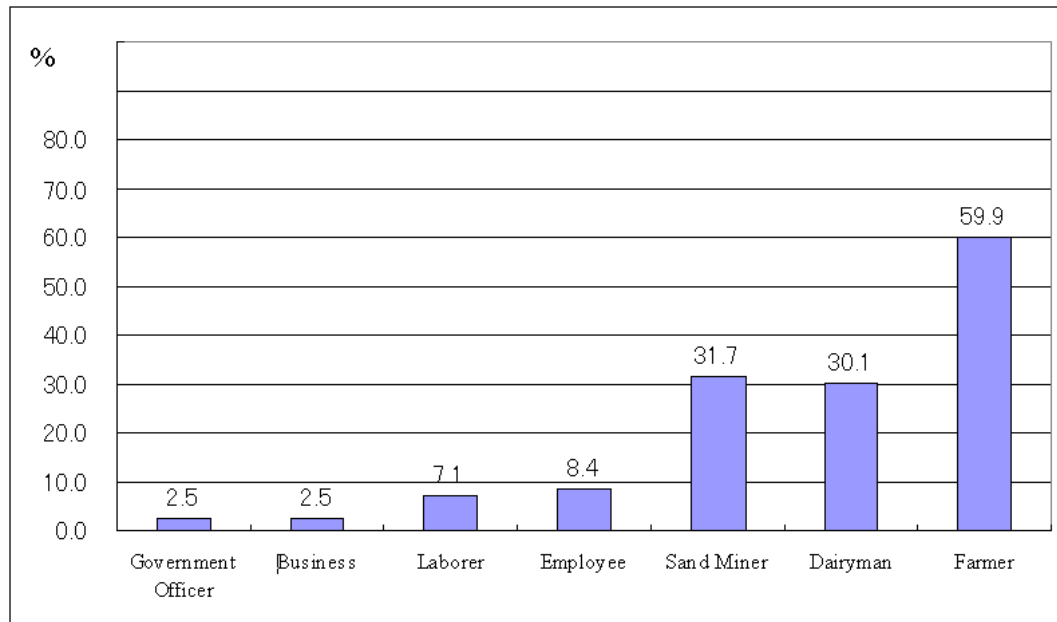


Figure 2. 3 Area Affected by Pyroclastic Flow from 1911 – 2006

(Source: <http://www.belantaraindonesia.org>)

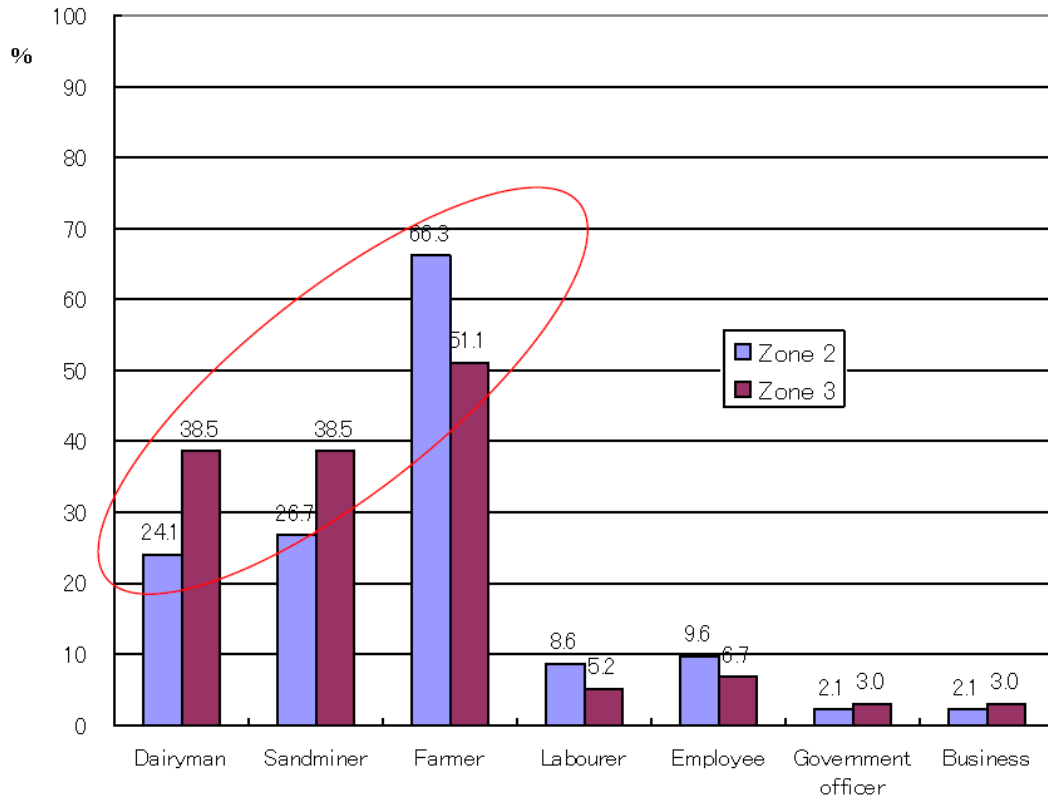
A research that conducted in Pakem and Cangkringan districts by Sagala (2008) categorized occupation in those areas into seven fields; government officer, business, laborer, employee, sand miner, dairyman and farmer. He found that the livelihood was dominated by farmer, followed by sand miner and dairyman respectively as shown in the next figure.



**Figure 2. 4 Percentage of Occupation in Pakem and Cangkringan district after 2006 Merapi Eruption**

Kalitengah Lor, Kalitengah Kidul and Srunen hamlet located in Cangkringan district were in zone 2 of hazard in 2006. The dominant livelihood in this zone was still the same with zone 3 but with higher percentage of farmer, in contrast with the amount of dairyman and sand miner as described by figure 2.4. The dependence of people to condition provided by Merapi was also showed since those livelihoods related to the fertility of land, cold temperature and material eruption which were provided by Merapi volcano (Sagala, 2008).

THE LIVELIHOOD ANALYSIS IN MERAPI PRONE AREA AFTER 2010 ERUPTION  
A CASE OF STUDY IN KALITENGGAH LOR, KALITENGGAH KIDUL AND SRUNEN HAMLET



**Figure 2. 5 Livelihood in Two Hazard Zone of 2006**

Based on Sagala (2008), the dominant livelihood in zone 2 after 2006 eruption, where Kalitengga Lor, Kalitengga Kidul and Srunen located at that time, was still farming.

### 3. Research Area

#### 3.1 Location

Merapi volcano is located at  $110^{\circ} 26' 30''$  E and  $7^{\circ} 32' 30''$  S or at the boundary of two provinces in Java Island, Indonesia as shown in figure 3.1.

Yogyakarta Special Province is in the south of Merapi and at northern slope is Magelang reGENCY of Central Java. The research took place in three hamlets on the southern slope of Merapi which are still occupied even though in prone area zone III.

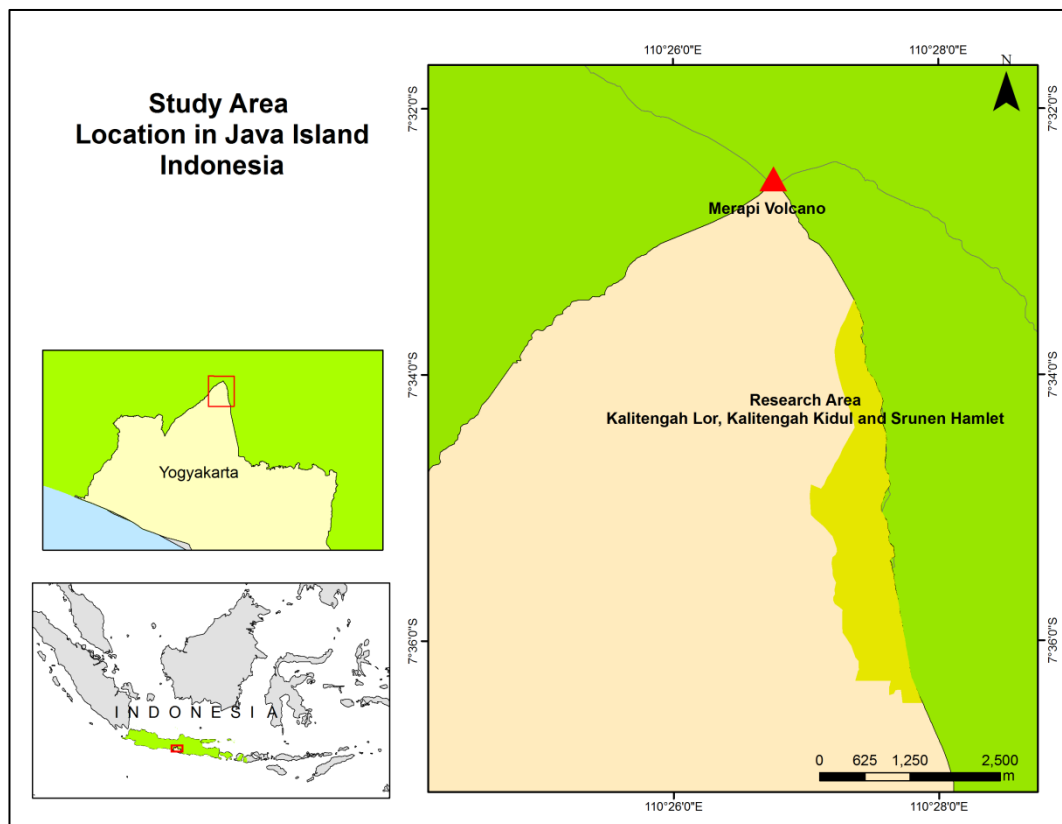


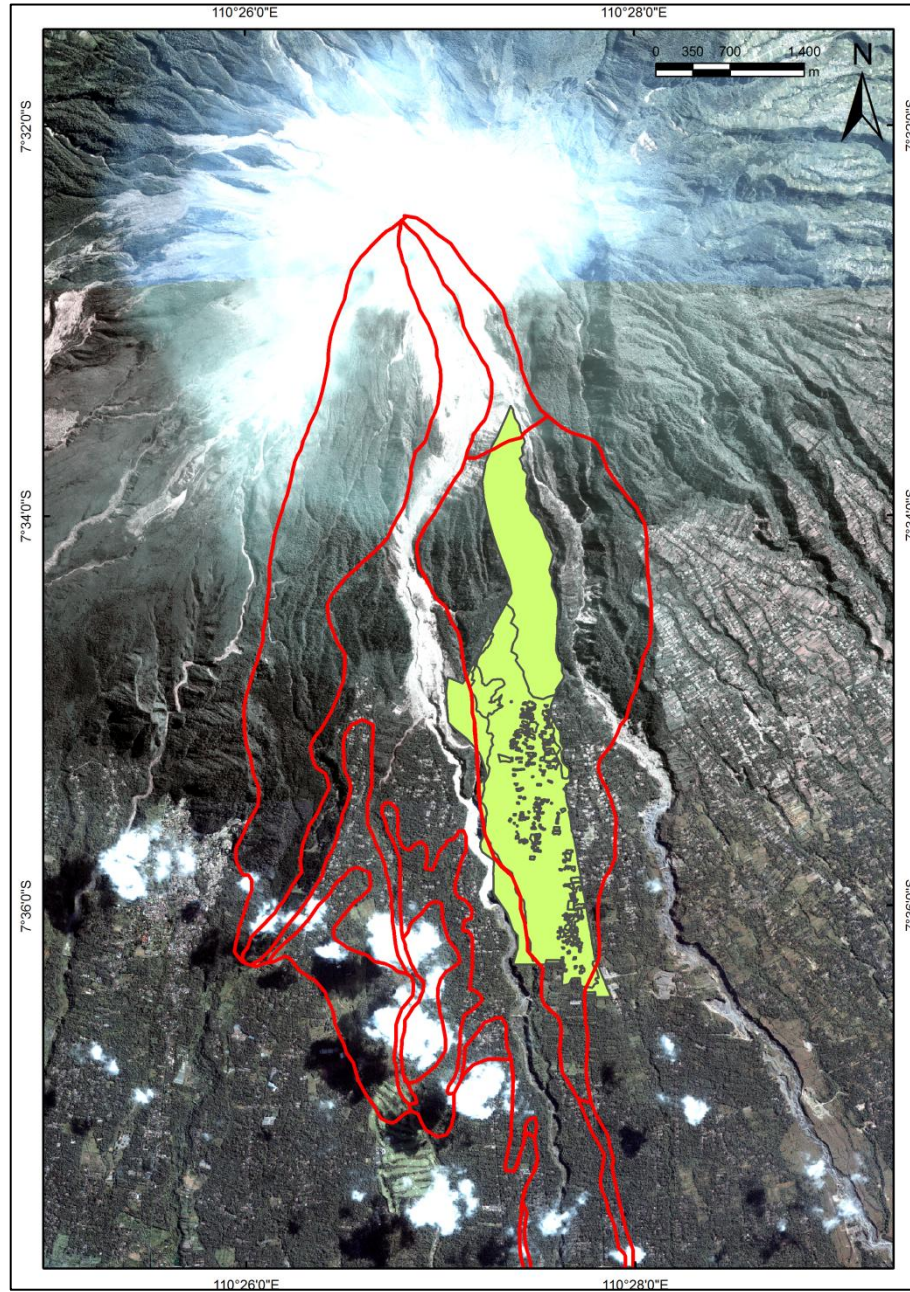
Figure 3. 1 Location of Study Area

The research area is Kalitengah Lor, Kalitengah Kidul and Srunen hamlet that located in Glagaharjo village. It is in Cangkringan district of Sleman Regency in Yogyakarta province. This area is at  $110^{\circ}27'0''$ - $110^{\circ}28'30''$  E and  $7^{\circ}33'30''$ - $7^{\circ}36'30''$  S, 1000-1100 m above sea level and has  $18^{\circ}$ - $32^{\circ}$ C temperature in range of rainy season and drought ([www.kecamatan.slemankab.go.id/cangkringan/](http://www.kecamatan.slemankab.go.id/cangkringan/)).

Those three hamlets have boundaries as follows:

- North with Klaten Distric in Central Java,
- East with Balerante village in Klaten regency of Central Java,
- South with Singlar hamlet, Kepuharjo village in Cangkringan district,

- West with Gendol River in Kepuharjo village.



**Figure 3. 2 Research Area Position Related to Pyroclastics Flow in 2010 Eruption**  
(pyroclastics flow source: Darmawan, 2011)

In 2010, all area was affected by the pyroclastic flow as shown in figure 3.2. Therefore, it was included in the most dangerous area now. The distance from the crater of Merapi to the nearest house in Kalingah Lor is only 4.95 km.



Geospatial composite 321 true color 2011 image interpretation presented the area that had been recovered as presented in figure 3.3 which provide information about landcover in research area based on image interpretation and field observation.

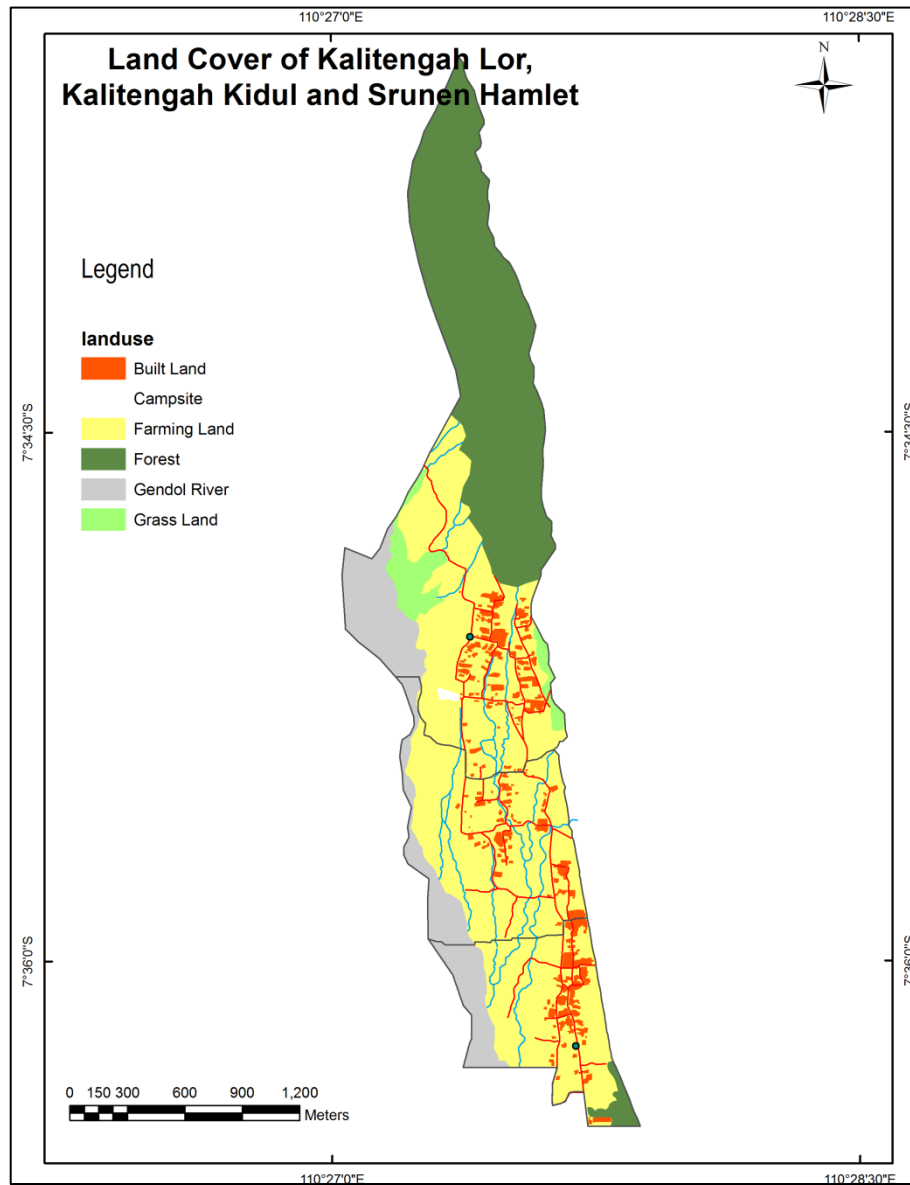


Figure 3. 3 Land Cover Map of Kalitengah Lor, Kalitengah Kidul and Srunen 2011

The large of area present in next table;

**Table 3. 1 Land Cover of Kalitengah Lor, Kalitengah Kidul and Srunen Hamlet**

Land Cover type	Area Coverage (Ha)
- Built-up Land	15.4
- Farming Land	182.55
- Forest	106.31
- Grass Land	11.41
- Gendol River (sand abundant)	39.42
- Campsite	0.53
<b>Total</b>	<b>355.66</b>

The built-up land dominated by houses and livestock cages since the main livelihood in this area is farming, both cultivating and raising livestock. Farming land is the biggest part of landcover that commonly planted with corn, cassava and vegetables. Some area is not cultivated and covered by grass for livestock feeding.



**Figure 3. 4 The grass land and farming land**

Most of area is cultivated or grown something except the campsite area in Kalitengah Kidul that was used to be recreation area but now abandoned and covered by sand. Meanwhile the huge sand abundant in Gendol River and its surround, as shown in figure 3.5., becomes alternative livelihood resource as local sand mining now. In Bappeda report in 2011, 2010 eruption spread 130 billion m<sup>3</sup> materials. This condition is described in the next figure.



**Figure 3. 5 Campsite and Sand Mining Location**

### 3.2 Demography

100% of population in Kalitengah Lor, Kalitengah Kidul and Srunen had reoccupied their land after 2010 eruption. Table 3.2 presents population density base on the latest data of hamlet's archive.

**Table 3. 2 Population Density in Kalitengah Lor, Kalitengah Kidul and Srunen**

<b>Hamlets</b>	<b>Area (Ha)</b>	<b>Population (people)</b>	<b>Number of Households</b>	<b>Population Density (people/Ha)</b>
Kalitengah Lor	213.95	517	167	2.4
Kalitengah Kidul	60.83	330	110	5.4
Srunen	80.85	449	139	5.5

According to head of hamlet opinion, people who are above 60 years old and the children that are under 6 years are considered as high risk category related to Merapi hazard exposure.

**Table 3. 3 The Amount of High Risk Category People in Prone Area Zone III**

<b>Hamlets</b>	<b>Elderly People</b>	<b>Children</b>	<b>% of High Risk Category</b>
Kalitengah Lor	70	36	20.5
Kalitengah Kidul	40	35	22.7
Srunen	56	30	19.2

(Source: interview with heads of hamlet)

There is no complete information about education of population since the related documents were burnt in 2010. Table 3.4 provided data based on head of hamlets explanation.

**Table 3. 4 Education Level in Kalitengah Lor, Kalitengah Kidul and Srunen Hamlet**

<b>Hamlets</b>	<b>Education</b>				
	<b>University (bachelor/associated)</b>	<b>Senior High</b>	<b>Junior High</b>	<b>Primary</b>	<b>Uneducated</b>
Kalitengah Lor	0/0	8	35	80	No data
Kalitengah Kidul	2/0	21	32	185	55
Srunen	2/8	50	60	280	33

Two persons, who are university graduated in Srunen, are veterinary and there are two more persons work as government official, and the rest of most households in Kalitengah Lor, Kalitengah Kidul and Srunen hamlet are farmer.

## 4. Methodology

This chapter provides an overview of the methodological approach applied for this research project. First a flowchart with a graphical overview of methodological steps is presented. Next, the different methodological steps are described in details in the number of sections and subsections.

### 4.1 Data and Source

Data was collected in primary and secondary type which was from fieldwork and government institutions respectively.

**Tabel 4. 1 Research Data**

Research Question	Data Requirement	Data Type		Sources
		Primary	Secondary	
To assess the existing condition after 2010 Merapi eruption in Kalitengah Lor, Kalitengah Kidul and Srunen as prone area zone III.	Administrative map		V	Government
	Merapi hazard map	V		Faculty of Geography UGM
	<i>Rupabumi</i> Indonesia map		V	Bakosurtanal
	Ikonos image 2007	V		Bakosurtanal
To assess the change in livelihood strategy in Kalitengah Lor, Kalitengah Kidul and Srunen related to volcanic activities.	WorldView 2010	V		Bakosurtanal
	Geoeye 2011	V		Bakosurtanal
	Livelihood resources	V		Interview, Fieldwork
To make a model of improvement for an appropriate livelihood base on the analysis of resource used, and in the context of volcanic hazard in the Merapi area.	Livelihood strategy	V		Interview
	Demographic data	V	V	Government, Interview
	Land fertility	V	V	Interview, Literature
	Livelihood resources	V		Interview, Fieldwork
To make a model of improvement for an appropriate livelihood base on the analysis of resource used, and in the context of volcanic hazard in the Merapi area.	Livelihood assets	V		Interview
	Applicable		V	Literature, Expert
	livelihood system			Opinion, Government

All the primary data in table 4.1 was provided by fieldwork from both interview and survey, except imagery data from Ikonos, WorldView and Geoeye, that were obtain in raster format, were issued in stated year by Bakosurtanal (National Coordinating Agency for Survey and Mapping). The same institution that produced *Rupabumi* Indonesia Map in year 2000 which was obtained in jpeg format, with 1:25,000 in scale. Meanwhile the secondary data, excluding literature, were provided by government reports or document.

## 4.2 Instruments

Tabel 4. 2 Research Instruments

<b>Instruments</b>	<b>Function</b>
1. Notebook	As processing device
2. Global Positioning System receiver	Mapping the participants
3. Digital Camera	Documentations
4. Recorder	Record the interview
5. Microsoft Office Software	Writing and analyzing tool
6. Arc GIS Software	Analyzing spatial data

## 4.3 Research Design

Steps in collecting data based on Creswell (1994) are; state the boundary of study, determine the information that will be gained through interview, documenting and observing and establishing the recording procedure, had been designed in analyzing livelihood in Merapi prone area which was divided into three main stages as present in the next figure.

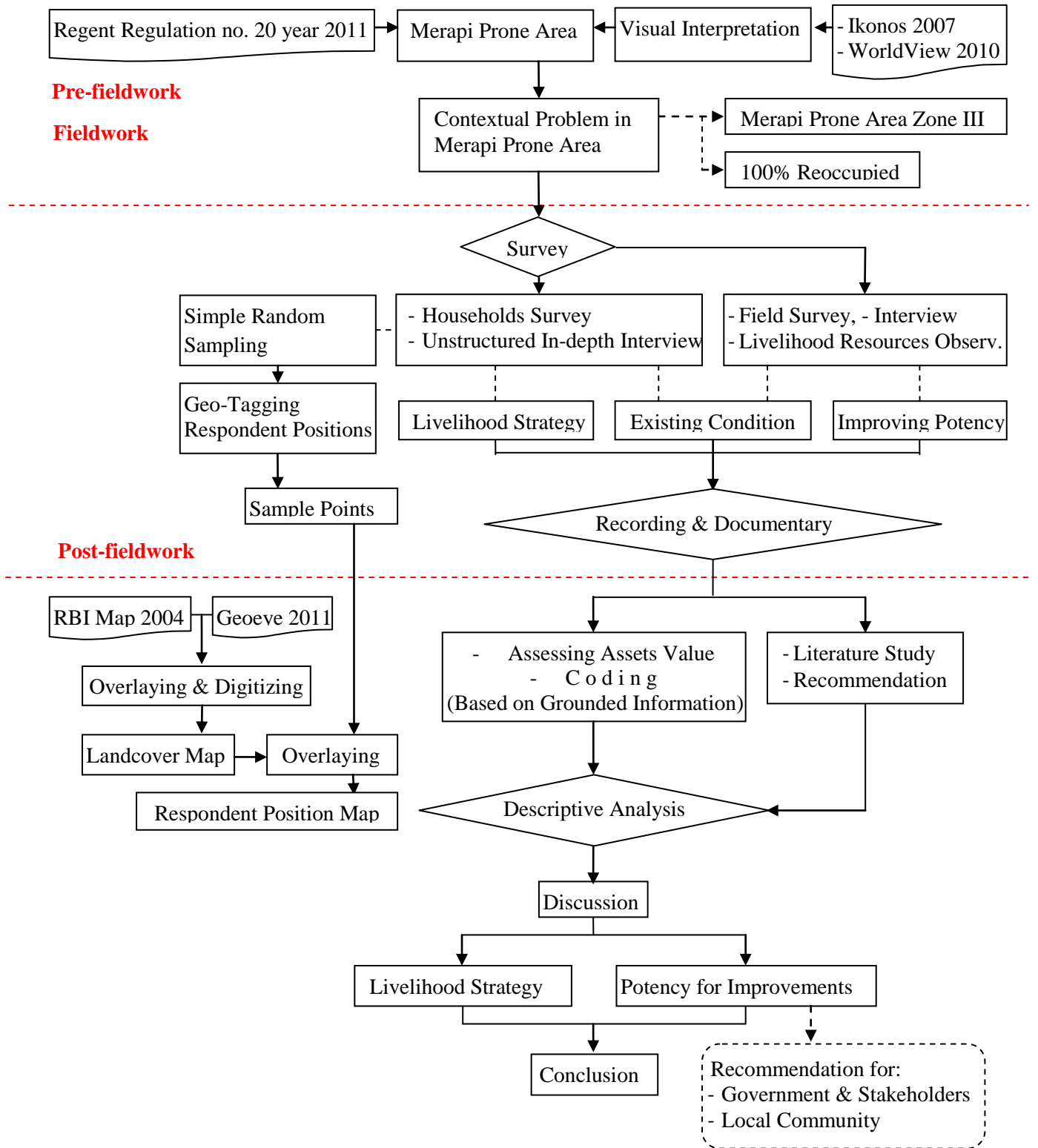


Figure 4. 1 Research Design

#### 4.4 Fieldwork Preparation

Deciding the research area based on the government regulation about Merapi prone area after 2010 eruption ( Sleman Regent Regulation No. 20 Year 2011). This was supported by image interpretation that use Merapi image Ikonos 2007 and WorldView 2010 in describing the condition before and after eruption. Ikonos 2007 image showed dense population in research area before eruption in 2006, and the landuse was dominated by farming land. Compared to image in 2010 after eruption that showed the damaged area due to pyroclastics flow, the area was covered by eruption material.

The research objectives came from the contextual problem that Kalitengah Lor, Kalitengah Kidul and Srunen hamlet was 100% reoccupied after the 2010 eruption even though the regent regulation had positioned Kalitengah Lor, Kalitengah Kidul and Srunen hamlet as Merapi danger zone III which cannot be occupied. More over the damaged area must impact on household's livelihood.

#### 4.5 Fieldwork Activity

Primary data which were in table 4.1; livelihood resources, livelihood strategy, demographic data, land fertility, livelihood resources and livelihood assets were collected by doing in-depth interview. It was open format questions that allowed respondents to answer the questions without guidance and make respondents more specific and detail in answering the question and describing the change in livelihood and its strategy due to Merapi eruption. The whole process was recorded and documented. The method was *grounded theory* that considers the information from field/participant (Creswell, 2010).

Base on data collection basic types which are observations, interviews, documents and audio visual material (Creswell, 1994), this research was *complete observer type* which means the researcher observes without participating. It was *face-to-face or one-to-one in-person interview type*. There was lack of information gained since the research was conducted at hamlet level that has inappropriate data base. Therefore the only information available about demography was from head of hamlet and field survey.

The survey was divided into two sections. The first was household survey by using unstructured in-depth interview for obtaining information about livelihood strategy and the existing condition after 2010 eruption. The next was field survey and livelihood resources observation to assess the improving potency. The literature study and programs in other places can be a recommendation and/or comparison.



#### 4.5.1 Population and Sampling

Population of the research area can be generated as farmer households that have core activity related to farming, even activity like collecting grass which is considered as off-farm job, is aimed for livestock farming. The occupation in Kalitengga Lor, Kalitengga Kidul and Srunen hamlet related to natural base resources. Every household has more than one livelihood resource that has been well organized according to capability. And the decision that not all of household members worked on farm is as part of livelihood strategy. Related to Merapi volcano existence and hazard, they have similar livelihood and get similar impacts on their life. In general, this pattern applied on every household that make the population in Kalitengga Lor, Kalitengga Kidul and Srunen hamlet is in the same category. It was also as the reasons for sampling randomly. All the number of buildings that represent households will be put on table of random numbers and then selected randomly (de Vaus, 2002).

Building identification and numbering was the groundwork for sampling determination. The availability of population was provided on map of hamlet which was validated by field checking for ensuring the chosen number represented a household. All the number of buildings that represent households will be selected randomly. Prior to interview, the target respondents had been surveyed to make sure the availability and capability of them. The sampling locations were geo-tagged by using GPS and displayed in respondents position map.

The respondent's characteristics, distribution and position are spatially described in table 4.3 and figure 4.2.

**Tabel 4. 3 Respondents Characteristic**

<b>Characteristics</b>	<b>N</b>	<b>%</b>
<b>Sex</b>		
- Male	21	70
- Female	9	30
<b>Age (in year)</b>		
- ≤30	3	10
- 31 – 50	17	57.7
- >50	10	33.3

Base on the table, the respondent was dominated by male, 21 out of 30, which was represented the name of the head of the household in the archive. But the interview used to involve the other family members which was present at that time. On the other hand, the female respondents, which is only 30%, did the

interview by themselves for some cases like unmarried woman or inability of the head of the household for presence at interview time. Most of the respondent were in 31-50 years old that represented a range of productive age. But the elder respondents were also accompanied by the other family member while interviewing. Transportation facility was good enough in this area where the housings were connected at least by pathway, so the respondent's location was all reachable by motorcycle.

The number of population in Kalitengah Lor, Kalitengah Kidul and Srunen is 1296 people in 416 household that represented by 30 respondents for in-depth interview about livelihood in Merapi prone area after 2010 eruption. Each respondent represented their household. The decision to have 30 respondents was base on Pamungkas (2011) that stated 20 samples for in-depth interview was acceptable, but the exact number of respondent can be adjusted to field condition. Identifying livelihood strategy was based on 30 opinions from in-depth and unstructured interview method. Interview process was conducted in both Bahasa Indonesia and Jawa language; some cannot speak in Bahasa at all that need an interpreter. To give a good impression, we need to introduce ourselves and give a brief description about what we want to do. The hospitality is important as an indication of a good intention. As a way to familiarize ourselves, it was important to start a conversation with general issue, for example weather or health. In this case, there was an external issue that became a problem in doing research fieldwork; for about two months before there was a robbery in Singlar hamlet that make people beware of stranger. Regarding their productive time that was sacrificed, the appreciation was given in amount of money (Rp. 20,000.00/₹ 2.07) at the end of interview.

Interview started with gaining information about the experience of respondent in 2010 Merapi eruption that can lead to their knowledge about hazard they face and their risk perception. The main interview took time 21 – 53 minutes for each respondent. A whole interview activity takes 987 minutes.

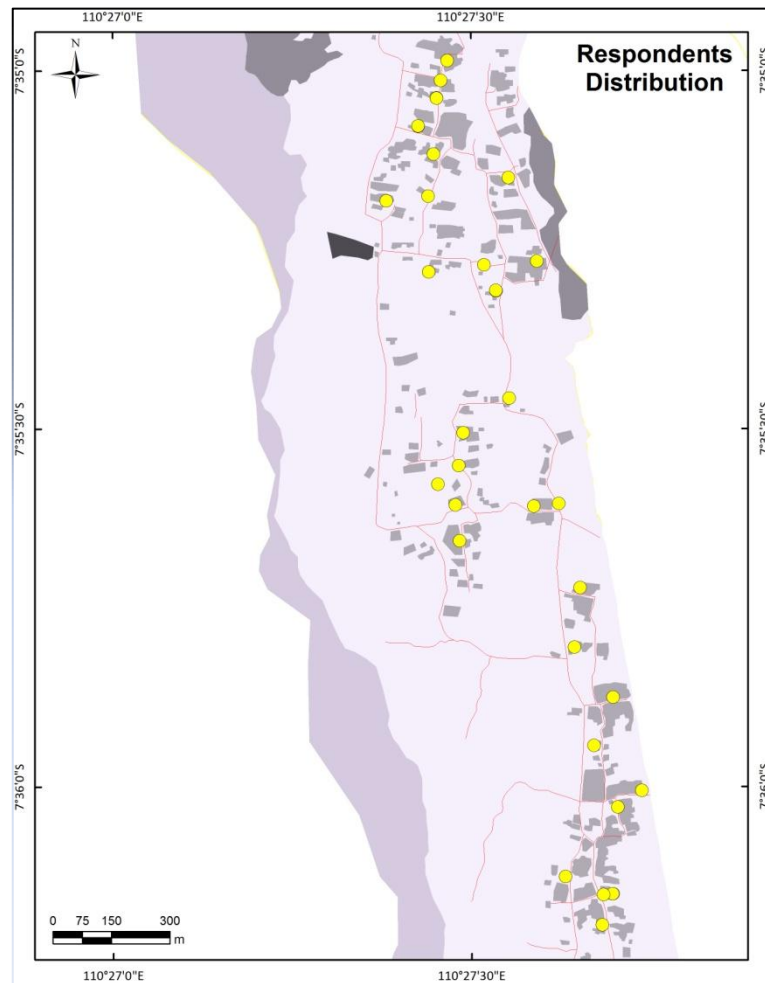
#### **4.6 Data Analysis Based on Grounded Theory Strategy**

The collected data was about the livelihood condition and strategy. The qualitative analysis used descriptive method that based on interview at household level meanwhile the quantitative data, for example amount of income that was obtained from on-farm and off-farm activities as livelihood sources were presented statistically in graphs, percentage and tables in order to support qualitative analysis.

#### 4.6.1 Map Presentation

Rupabumi Indonesia Map year 2004 and Geoeye Image of Merapi 2011 were the input data for making landcover map. By using ArcGIS software, both of them was overlaid and digitizing to create landcover map in research area.

The sample points were added to landcover map to make respondent position map. The following map was based on respondents geo-tagged position by using GPS.



**Figure 4. 2 Respondents Distribution Map**

The map above showed the built area and roads to explain respondent positions in Kalitengah Lor, Kalitengah Kidul and Srunen.

#### 4.6.2 Coding Analysis

In understanding the grounded theory strategy, this research used coding analysis that build an argumentation and described the real condition which was divided into open coding, axial coding and selective steps (Creswell, 2010);

The open coding step was undertaken by creating categories based on field information from indepth interview that had been recorded. The keyword or important information that were told by respondents need to be underlined and put into certain category, for example the opinion about Merapi repose period, evacuation preparation, etc.

Subsequent to open coding step was axial coding that gave the options to certain category which was based on the responses of respondent. Those can be put in sub-category of coding, for example the category of reason for refusing relocation was divided into sub-categories of relatives, livelihood resources, etc.

The last step is selective coding which was done by arranging the association from the established categories. As the result of the analysis, beside the livelihood strategy in Merapi prone area, the potency of area for improvement was revealed and proposed to local community and government.

#### 4.6.3 Valuing Household Livelihood Assets

Regarding to the livelihood asset of household, this research used the scoring system in Bishop (2005) that divided the value into low, middle and high category. The scoring system for low value was up to 2 point, 3 for middle value and 4-5 for the highest value. Each of asset consisted of factors that contributed to value. The next table shows assessing of human value in a household that its head is male, 40 years old and has a problem with his knee but still can earn for living together with his wife.

**Tabel 4. 4 Scoring System in Valuing the Human Asset**

<b>Characteristics</b>	<b>Score</b>
- Household head age	4
- Household head sex	4
- Household size	2
- Productive Member	3
- Education	3
- Skill	3
- Training	2
- Health	3
Total	24

The same scoring system was applied to all livelihood assets, and total score determined the welfare level based on household assets. The livelihood condition and strategy was related to the value of livelihood assets of a household.

The discussion about livelihood strategy and potency for improvements used descriptive analysis which was supported by statistical data in graphs and tables.

The result of this research could be a recommendation for government and stakeholders in addressing and responding the problem in Merapi prone area.

## **5. Existing Condition in Merapi Prone Area Zone III**

### **5.1 Introduction**

Merapi eruption in 2010 was one of the greatest that forced people in Kalitengah Lor, Kalitengah Kidul and Srunen hamlet to evacuate longer than they used to be. Most of them stayed in shelters for at least 6 months before reoccupied their houses. Furthermore, total damaged on farming land, houses and facilities make it more complicated since they have to rebuild it all. Two years after the eruption, the physical and economic condition had been starting to improve as indication that people have the livelihood strategy in prone area even though without government support. All the information based on interview and field observation. The respondents were co-operative, but it was a little hard to make them talk about income, assets, problems and opinion about government.

To find out about the existing condition in Merapi prone area, the discussion focused on the livelihood components that had been changed due to 2010 eruption. Those were presented in descriptive analysis that was based on in-depth interview with 30 people that were affected by 2010 eruption.

### **5.2 Livelihood Components after 2010 Eruption**

The research field work focused on the change in components that influence the livelihood strategy as an adjustment to the condition in prone area. Information about livelihood components covered biophysical, legal, economic, social, culture and psychological. Those also related to people and livelihood condition which got Merapi eruption impact.

#### **5.2.1 Biophysical Component**

Biophysical component refers to the resources availability, utilization and access that could affect the livelihood strategy of local community.

##### **- Decreasing in farming activity due to farming land availability**

In general, people in Kalitengah Lor, Kalitengah Kidul and Srunen have primary livelihood activity which is farming and sand mining. But based on the fieldwork, farming activity which was used to be the main livelihood was decreasing in productivity due to the impact of eruption. This was described by many of farming land which was only planted partially. The condition impacted on 76.67% respondents. The others were not affected since they did not cultivate their land and had another sources as main livelihood, even one of the respondents did not have farming land at all. Next statements represented the condition that was experienced by most people there;

*“My daughter takes responsibility in farming but now the land is not fertile since it is still covered by post-eruption sand” said respondent 9.*

Respondent 12 said,

*“I am not afraid of Merapi, on the other hand it gives advantages such as sand mining and fertile soil. But first, we have to move the sand on our farming land. It is a hard work, that’s why we cannot plant on our land yet”*

After two years of last eruption in 2010, the sand is still remain on some farming land and affected the livelihood of households. Next picture show the condition of farming land which is abandoned.



**Figure 5. 1 Farming Land Covered by Eruption Material (sand)**

- **Increasing in sand mining activity**

Due to the condition above, farming cannot give optimal yield that make some people turned into sand mining activity which was available everywhere. There were only eleven households out of thirty that got advantages from sand mining. Actually, this activity was not a new livelihood resource for people surround Merapi and had been there since 1994 as informed by respondent 1. All the respondents agreed that sand mining had become important livelihood nowadays as respondent 4 and 27 said respectively.

*“There is a change in livelihood strategy since sand mining exists”*,  
and,

*“it (Merapi eruption)provides sand which is becoming regular income these days”*

As shown in figure 6.4, sand mining activity had the highest percentage of household income, which became favorable livelihood source. The change in livelihood as strategy of living was perceived automatically as utilization of available resources.

- **Limitation access to beneficial resource**

Access, as the important factor of biophysical component, to sand mining resources was limited since the existence of machines that can work faster and in

24 hours had made people lost their opportunity. Due to the lack of opportunity, this resource cannot be exploited by everyone. It was informed by 4 respondents, as the next statements that were quoted from respondent 13 and 30;

*“I have not gone to Kali for sand mining for one month due to no place for me. There is a system that requires a group, but I was not a part of any group.”*

*“I sometime work as “doker” (person who flatten the sand on truck) at night in kali Gendol, I do not go there at noon since it is time for Srunen. There is no declaration about that rule, but it happens”*

There was an indication about informal rule that roles the right and management in sand mining. When the information was confirmed to head of hamlets and some local people (not respondents), nobody admitted the existence of the rules. They said that anything there (resources) was available for everybody, no preferential treatment. And the reason for only some people involved in it or was dominated by Srunen people could be the distance from sand mining area that is closer to Srunen hamlet. But the fact from interview, the household member who works on sand mining is dominated by Srunen people, from eleven household respondents who work on sand mining, 70% of them were from Srunen.

### **5.2.2 Political/Legal Component**

This component of livelihood related to the regulation and program that was issued by government. The legal component which is the regulation about Merapi prone area had positioned Kalitengah Lor, Kalitengah Kidul and Srunen in danger zone III. It really affected people in some other way, as the person who live in danger zone; it affected the personal opinion and feeling about government. Based on interview, there were conditions related to legal component in this area.

#### **- Government opposition**

Their refusal to be relocated had made people think they against the government. All respondents in Kalitengah Lor, Kalitengah Kidul and Srunen agreed with their commitment to live there. The next statement was just a sample for what they judge the government.

Respondents 7 said,

*“Government only helped when I was in the refugee camps, such as gave groceries. It seems like Kalitengah Kidul is government’s stepson now because we refused to be relocated.”*

*“The life in Kalitengah Kidul is going well, and not affected by Merapi’s activity. We feel safe and not threatened, peaceful and comfort, because*



*we are already at home. If the government does not force the regulation to relocate us, people will be calm. I only would please to be relocated if I am dead.”*

He believes that he is a representation of all people in those three hamlets that did not want to be relocated. Moreover, people had signed the statement about refusing relocation which was informed by respondent 10.

*“I had signed the memorandum for not to relocate.”*

The government tends to focus on relocation problem and ignore some conditions of local people, for example livelihood availability and comfortable feelings. It is also realized by the chief of BNPB (Indonesia’s National Bureau for Disaster Countermeasure), Syamsul Maarif stated that there are four strategies in Disaster Risk Reductions which is not only relocation; but can be as keeping residents away from the disaster site, keeping disaster away from citizens, support living in harmony, and using the local wisdom (TEMPO.CO)

Compare to Balerante village in Kemalang district in Klaten regency, Central Java province, which is next to this research area and in the same category of danger, the regional regulation is more cooperative. In Regional Regulation of Klaten Regency no. 11 year 2011, the area in danger zone III of Merapi which got direct impact are not allowed for settlement; but for areas that was not directly affected by eruption will not be developed for housing; the infrastructure is limited only to facilitate the settlements which are already and still there; not allowed the sand mining activities; the existing settlements should not be allowed for further developed; allowed conservation and substation control of Merapi, and the area was prepared to be responsive to the disasters, in infrastructure and community behavior and institutional.

Klaten government offered independent relocation program after failed to relocate the local community; only 31 families out of 165 that were ready, after 2010 eruption. Meanwhile the regulation in Sleman regency is still continuing the relocation program, and 2013 is the limit time in doing it. Bappeda (Regional Planning and Development Agency) of Sleman informs that there were no developing programs applied in Kalitengah Lor, Kalitengah Kidul and Srunen except rehabilitation and reconstruction of area.

- **No government facilities**

*“Medical services such as puskesmas and midwife are outside the hamlet, in Singlar, for about 1 km. The primary school building is not used. Government facilities are inactivated after 2010 eruption.”*

As stated by respondent 4, government buildings and officers were not active since the Regent Regulation about Merapi danger zone issued. Field checking showed that all the official buildings had been emptied. It affected the life of local people as represented by respondent 6.

*“My older child is in Cangkringan junior high school, and the youngest is in temporary school at Balai Desa, and live in Klaten since she needs to be shuttled that I cannot do because I have to take care of my livestock.”*

The inexistence of school had forced him living apart from his family, which was for farming as his livelihood. This condition happens on 2 of the respondents. This case described how important the livelihood that was provided by this area. Beside the decision to live apart as the consequence, one respondent informed that the absence of education facilities had a negative impact on their son education;

*“the middle son dropped out from his primary education because the school is quite far from home”*

This was a case of a farmer household that has low income. They had to choose an option to concern more in livelihood activity or make an extra effort for children education because those cannot be handled at the same time. Preference to one of them is a part of livelihood strategy.

- **The government important programs are still continuing**

Statements about government that had ignored people in Kalitengah Lor, Kalitengah Kidul and Srunen was not 100% true, since there were two programs that was still provided for all people in Kalitengah Kidul, Kalitengah Lor and Srunen. All respondents admitted that they still can buy cheap rice that was provided by *Bulog* (Logistic Agency) and *Jamkesmas* (Health Insurance) which are very helpful;

Respondent 15 said;

*“... meanwhile the rice can be bought from Bulog.”*

Meanwhile respondent 16 informed;

*“In 15 day, I gets Rp. 50.000,- from sweet potato’s yield that will be use for buying daily needs except rice which we can get it from Bulog at price Rp 24.500,- for 13 kgs.”*

The role of government in supporting food and health, had influenced the strategy in livelihood which make people do not have to put extra effort in gaining basic needs, therefore they can concentrate on secondary needs. Those two programs can still run since they related to personal identity, not location. Since the area was no longer for occupancy and social activity. According to PP Sleman No. 12 year 2012, Cangkringan district is for environment supporting and mining

activities only, not for dairy farming. It indicated that the government will relocate the area.

### 5.2.3 Economic Component

The role of economics in livelihood strategy in prone area was very important since it related to resources availability and the opportunities to explore it.

#### - **The economic value is higher than the risk**

The economic value was stated by some respondents as a reason in living in prone area. 100% respondents admitted that this area was their life and valuable livelihood resources. Respondent 1 and 24 represented the others who believed that economic reason is more important than the risk in hazard zone;

*“The value here is near from our main livelihood that cannot be afforded by relocation area. Such as an area for livestock, farming land or grass for cows.”*

*“We reoccupied our house and refused relocation because of economic reason; our livelihood is here.”*

#### - **People focused on the most beneficial livelihood resource**

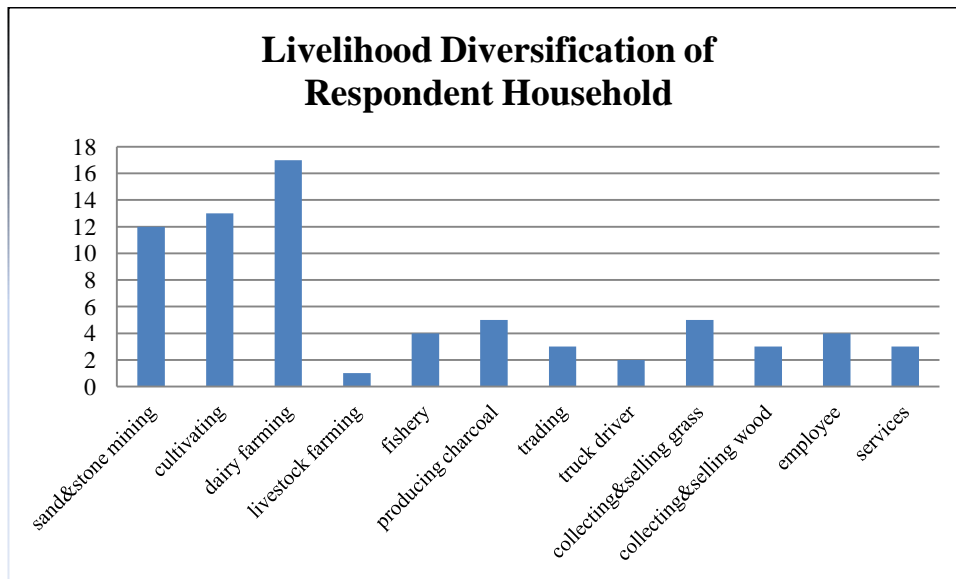
Each household had certain strategy in optimizing the revenue. In case of the access to resources was unlimited or accessible to anyone, respondents can decide what strategy is the best for them whether they focused on one or diversified their job.

An example of focusing on the highest income activity; there was a household that focused only on sand mining without considering other resources and obtained more income. They earned more or less Rp. 4,500,000.00 in a month from sand mining.

*“There are eight persons in this house, five of us work, and 4 persons, and who are strong enough, are still working on sand mining. We gain enough for living from that resource, from morning until 2 or 3 o’clock in the noon or start at 3 pm until evening,”*

#### - **People diversified their livelihood as optimal as they can**

Livelihood diversification of the respondents was described by the next figure.



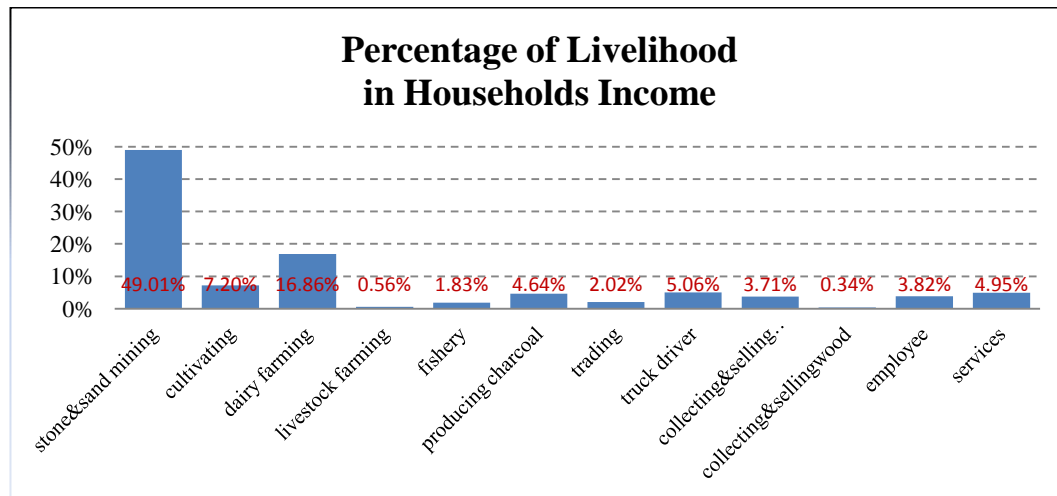
**Figure 5. 2 Livelihood Diversification of Households in Kalitengah Lor, Kalitengah Kidul and Srunen**

The amount of livelihood diversification was more than the number of labors of household member, which is only 68 persons, since one person could have more than one job. The favorable livelihoods were dairy farming, cultivating and sand and stone mining in Kali Gendol respectively, which all of them are primary sector. Only four of household members were employee; three of them work in *Koperasi* and one person as print-shop employee. Meanwhile three of respondents provided services as barber, dishes marker and housekeeper.

The information was about how people diversify their livelihood as the strategy for getting a better economic condition stated in the next statement. One respondent had diversified livelihood in many ways, for example collecting and selling grass and firewood, stone mining, *Koperasi*'s employee and farming. The stone mining activity was only done five until ten times in a month even though it gave a higher income, they still prefer to farming.

- **Sand mining, dairy farming and cultivating is the favorable livelihood**

The income of respondents based on livelihood is in figure 5.5.



**Figure 5. 3 Percentage of Livelihood in Household Income**

The percentage of income from existence livelihood in Kalitengah Lor, Kalitengah Kidul and Srunen was dominated by stone and sand mining. 49.01% of total respondents income came from this livelihood whereas the respondents who do this only 11 persons. It indicated the high value of it as stated in biophysics component that make certain people coped the area for mining, even there was a respondent household that has only this livelihood. This condition make people who do not involve in it diversify their livelihood as strategy in optimizing the income.

The second highest income percentage was provided by dairy farming since the suitable of the area for dairy and the availability of *Koperasi* (Cooperative Institution) which manage the trading and provide the concentrate for farmer's dairy cows. The income from dairy farming is regular since its milk is always bought by *Koperasi* as long as they take care of the dairy cows. Cultivating gave only 16.86% of entire income meanwhile there were 13 households had it as livelihood. This fact related to the statement of respondent 15;

*“We have limited knowledge of farming. That is why we only plant crops that can be consumed,”*

and respondent 3 said,

*“There is only grass in my land now. It is for about 0.5 Ha in large. Grass is more beneficial, since I have livestock.”*

Based on the statement above, the strategy of livelihood was based on economic value, the dairy farming as the most popular livelihood resource due to the daily regular income, even though that had made the farming land was allocated for grass.

The calculation showed that some households gained more income than the others who diversified their livelihood. It emphasized that the diversification as the livelihood strategy did not guarantee a higher income.

- **People do not do any adjustment related to Merapi condition**

Regarded to field observation that described the normal condition in farming and neighborhood, respondent 20 emphasize the existence of livelihood resources in providing family needs is more important than worrying about hazard potency, they keep working on their daily livelihood as usual.

*“I am not afraid of the danger of Merapi and keep focus on working to fulfill every day needs.”*

Respondents did not consider the eruption repose period by planting all kind of crops; seasonal and perennial. But the preference to seasonal crops is just because it gives short time revenue.

- **The increasing in needs**

In general, the life in Kalitengah Lor, Kalitengah Kidul and Srunen just re-started like before 2010 eruption. But people had to give an extra effort just for fulfilling the basic needs since they have to spend lot of money in re-building house. This situation impacted all the people as represented by respondent 25 and 26.

*“I had groceries shop before eruption, but it was gone. Everything was change due to eruption; income decreased significantly.”*

*“Merapi eruption affected people economically. For example, 99% of houses were permanent building before, but now there are a lot of semi-permanent houses. They also have to re-start in everything, including in earning for living. The money we got was allocated for housing, and the rest is for basic needs. It makes life harder.”*

- **The decreasing in assets and income**

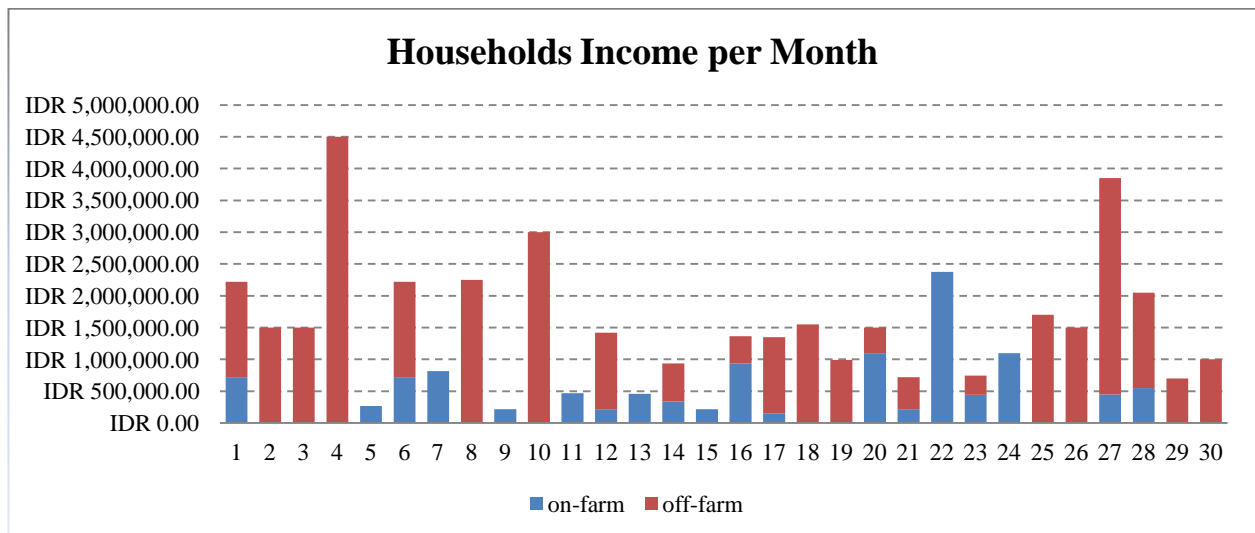
In the context of natural resources, the sand mining and farming land were the most affected livelihood resources that were associated with eruption. The sand mining took first place as the most beneficial resource. On the other hand farming land, as the largest part in research area, did not give equal income as its quantity. Since the cultivating activity depends on rain, the yield was not sufficient and available in a whole year. As the impact of it, people tend to grow grass on their land. Beside it is less maintenance, it is the input for dairy farming that gives daily and regular income.

*“My farming area now is less than 1000 m<sup>2</sup>, some had become sand mining.”*

The degraded land was one of the factors that forced people to work on sand mining. It was also the process for getting back the farming land by mining the sand on their land. Not only in farming area, the sand was also impacted on grass collecting activity of respondent 12.

*“It is more difficult to collect grass after 2010 eruption since the former location is covered by sand now, so we can only collect grass in our land/farm.”*

The less in both area and grass had affected the on-farm income because those related to capital and input for cultivating and dairy farming. But, as impact of decreasing in on-farm income, sand mining gave more and roles as the main resources of off-farm income. Figure 5.4 illustrates the role of on-farm and off-farm resource in respondent household income.



**Figure 5. 4 Households Income Based on On-Farm and Off- Farm Resource**

The off-farm dominated the household income. The highest revenue is respondent 4 which only have sand mining as livelihood resources. Comparing to others, it is the most beneficial livelihood resource now but not to the condition before 2010 eruption.

*“I have not gone to Kali Gendol since 2010 eruption, since the existence of bego (machine) makes me difficult finding site for mining. At the beginning, those machines just for dredging the sand in order to make a way for stream. But then they keep working until now and dominate the sand mining. So now, I only wait for request for my skill (handyman)”*

Respondent 24’s statement indicated the role of capitalist in sand mining that use machine in working on it that affected their opportunity. He also explain about the decreased income in sand mining after 2010 eruption which is only Rp. 50,000.00

more or less in a day, whereas it was easy to get Rp. 100,000.00 until Rp. 200,000.00 before 2010. So, indirectly, the great eruption impacted most on sand mining as profitable livelihood resource.

#### **5.2.4 Social Component**

Social asset was one of the values in Kalitengah Lor, Kalitengah Kidul and Srunen. The rural environment had certain conditions that make people know and care each other that make them have close relationship among community. Even a large and extended family still lives in one location that consists of several houses. It really influenced the decision making process of a family since the final decision used to be the agreement of all members and relatives.

##### **- A very good social network**

Based on the fieldwork, social value can be divided into community and personal value. Social aspect in community referred to social network that encourages and has an important role for people in living in the prone area. This value can influence people in making a decision, as stated by respondent 2;

*“I do want to be relocated since all of my relatives did not want to move, but actually I myself do not object to move to the house that was provided by government in relocation area. But now, I just follow the others.”*

The statement emphasized the impact of social value to people opinion and decision, even though it positioned them in a hard situation. The social network in Kalitengah Lor, Kalitengah Kidul and Srunen was constructed by the hazard experience they had, which is Merapi eruption.

The value can be in the form of helping each other in building houses after eruption or giving something to each other, as the experience of respondent 30;

*“The social network is very good, friends use to give vegetable or food for us.”*

*“My house was built by volunteer and neighbors.”*

These situations had encouraged respondent 30 to comeback for living in prone area after 2 years in evacuation shelter, even though their income sources was still the same with those in shelter before.

##### **- Most of the local community had primary education**

The social component also considered personal value, their capability and capacity that affected people in choosing their livelihood. As described in figure 5.2, the diversification of livelihood was in primary sector that did not need certain skill or knowledge.

Figure 5.6 revealed the respondents education level.



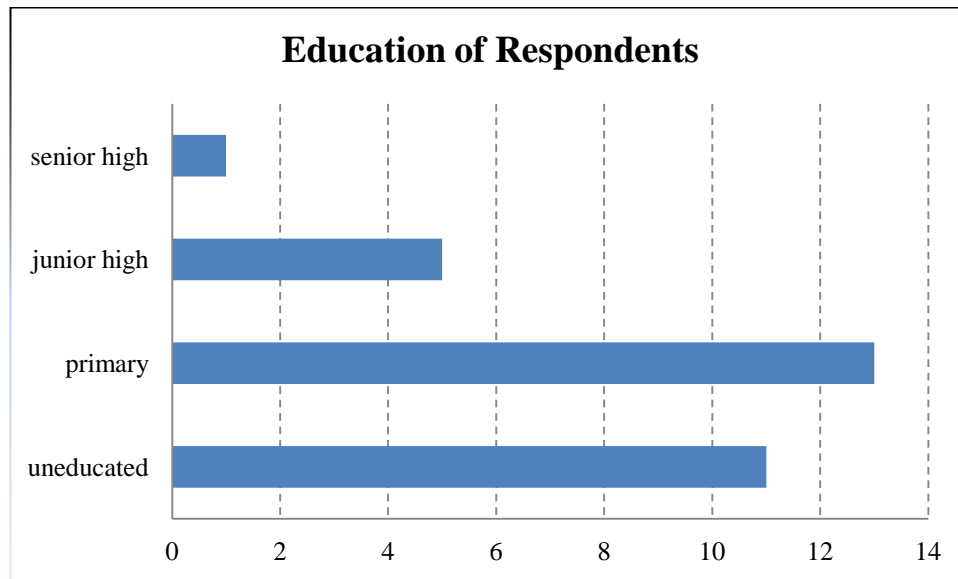


Figure 5. 5 The Education of Respondents

Most of the respondents were primary education as described meanwhile uneducated category was dominated by respondents above 50 years old. 80% of the respondents were uneducated and primary graduated.

- **Less of knowledge about repose period**

Based on interview, some of the respondent did not know about the repose period and potency of eruption. Even there was no respondent that exactly know what the repose period is. Even though after the explanation about it, they still did not think it as important issue that need to be considered at that time. It seems like the local people had the same knowledge and the way of thinking, just like respondent 6's respond about Merapi repose period question.

*"I am not afraid coming back here. Why should I? If we want to live here, just do it. ... My opinion about Merapi repose period, there must be some signs. And many modern gadgets right now, such as hand phone that can give information. I will follow the others."*

*"There will be no more within decades, even hundreds of years, because I had observed for long time. The last eruption is the greatest."*said respondent 7.

The confidence of respondent 7 was supported by his wife and a guest who was there at that time. But this was the only opinion that was sure that Merapi will not erupt again, meanwhile the other respondents were just not sure about the repose period.

### 5.2.5 Cultural Component

Cultural component is about the strength, importance and beliefs that affected the livelihood strategy of people in Kalitengga Lor, Kalitengga Kidul and Srunen.

#### - **Dependency on religious values and belief**

The facts in fieldwork showed that the choices and values were determined by the beliefs of local community in God, not by the hazard potency or risk perception.

The belief influences the decision for living, for examples respondent 8 said,

*“Merapi is not a threat anymore, it is over, and no more worry, I rely on Allah. I heard rumor about dangerous zone, but people here won't move because we have decided to live here. We were born here, die or alive is here. I think it is the only reason. If there is emergency/danger, just evacuate.”*

This statement emphasized about the beliefs that God rules everything and people just accept what had become their destiny. There were four other respondents relied everything on Allah SWT.

#### - **People assumed Merapi as living thing**

This statement related to the Java culture which believes in legends and folk tale.

*“Mount Merapi eruption and its repose period are reasonable. We can say that Merapi will be getting higher or in self improving condition.”*

The same opinion was also given by respondent 29,

*“Actually Merapi is friendly. We just have to go when it is angry, and when we come back, it had already nourished our farm. So, we do not need to fertilize our farm at all.”*

There were also some respondents called Merapi volcano as *Mbah* (nickname for old people). In real life, people had to respect to old people, that is why people surround Merapi keep living in harmony with it.

#### - **Cultivating and having a cow is a must**

The culture component influenced the way of people managed their livelihood resources as part of the strategy. In Kalitengga Lor, Kalitengga Kidul and Srunen, cultivating and having livestock, in this case is cows, is a must.

Respondent 1 said,

*“But we must have at least a cow as an asset. Related to land farming which only 0.25 Ha, we prefer to plant grass for cows and plant some crops for self consumption.”*

Respondent 14

*“However, nothing had changed in Kalitengga Lor after the eruptions of Merapi. Most people are still farming.”*

For people who lived surround Merapi, including Kalitengga Lor, Kalitengga Kidul and Srunen, cultivating had become the culture. Even though they had other livelihood resources, they keep cultivating and planting crops.

### 5.2.6 Psychological Component

Psychological aspect influenced the chosen and effort of people in earning for living. All the components before had affected the livelihood strategy in some other ways, but the psychological component is more important and could be a reason for ignoring the economic, social or other components.

#### - **People did not consider Merapi volcano as a threat**

People who live with Merapi for a long time did not consider it as a threat, on the other hand it provides them with arable land and sand. Most of people in Kalitengga Lor, Kalitengga Kidul and Srunen are familiar with Merapi since they were born there and never stayed in other place. They lived there in generations and had accumulated assets and rights. They live in peace with Merapi, and will never leave the area otherwise it is just a while in emergency case.

In general, local community cannot believe in outsider judgment about their fate since they know Merapi well. All respondents believed that Merapi would not harm their life and the greatest eruption had passed. Respondent no 7 said convincingly;

*“I am already 70 years old. Only in 2010, Mount Merapi had great eruption.”*

Respondent 29 admitted that Merapi is dangerous;

*“but it has to erupt sometimes, otherwise it will be more dangerous. The eruption like in 2010 is the greatest, even the oldest people in this village never experience it before. So it is better if Merapi erupt frequently. We just have to evacuate for a while.”*

Those statements above mention that Merapi never had a greater eruption that forced them leaved their area. Another fact is this area never been affected by the pyroclastics flow since year 1911 until 2006 (see chapter. 2 figure 2.3).

Similar responses were also given by others that believe Merapi is not a danger at all, even respondent 19 do not know about the risk they face;

*“I do not know about the danger of Merapi, but I am not afraid. I am originally from Kalitengga Lor. People were only afraid when it erupted, but now it is just calm.”*

- **Sand mining was not considered as a permanent livelihood**

The chosen for sand mining was based on the livelihood resource availability that gave the highest income, but people still considered about the effort and risks. Respondent 2, who just lost her cow, had only sand mining as livelihood due to the lack of farming area and no skill. But she had to have livelihood resource for living and plan to buy livestock and leave that activity since the economic component is not the only reason in deciding the livelihood,

*“The sand mining area is very hot, like boiled water; the sand itself can melt the shoe,”* (show her rubber shoes)

The fact that sand mining activity is a very hard work, made some people confessed that the most wanted thing is live in comfort. Even the respondent 7 had revealed the orientation of living was not only income, but the comfortable and safety had become the priority too.

*“Sand mining gives more profit, compare to farming. But cultivating is more peaceful.”*

- **People prefer to not consider about the loss**

The last respond before about the tendency to peaceful life was not only about the occupation, but also human sense. Even though all people around Merapi especially in study area were not afraid living with Merapi, but the eruption occurrences still giving effects on their way of thinking, as stated in following;

*“We do not desperate due to the losses in the last eruption. Many people were sick because of it, but we did not take it too serious and tried to relax.”*

People had realized that life was not only about prosperous but also the quality and convenience.

- **People become more religious and wary**

There was no change in people opinion about Merapi after 2010 eruption, but the greatest eruption had affected on people behavior that was noticed by respondent 25 and 26.

*“Merapi eruption in 2010 has change people behavior into better personality, for example; more people come to mosque for praying and held religious even once in a month now.”*

Regarding the psychological factor, there is a mosque in each hamlet which is a most visited place now. The survival in the last eruption was believed it was a gift and they thank God for it.

*“People had got trauma and become more careful due to the last eruption. Maybe in the next eruption, people will go flee immediately after the sign*

*of danger. Unlike the last eruption that people did not expect a great eruption.”*

All people in Merapi prone area relied on the Early Warning System (EWS) that exists in each hamlet. The only situation they considered as danger, which is only temporary, is when EWS turn on. They had planned to evacuate as soon as possible when danger is detected.

### **5.3 The Value of Area**

Value of area analysis considered biophysical and bio-psychological component of livelihood strategy. It is related to the value of this area compare to others or proposed area for relocation.

#### **- The availability of livelihood resources**

Regarding to responses, the value can be the reason for people keep living there, and those physical and psychological factor found in the field as respondent 1, 28 and 2 said respectively;

*“The value here is near from our main livelihood that cannot be afforded by relocation area. For example an area for livestock, farming land and grass for cows.”*

Each person had different perspective about the value of their land, but the livelihood resource availability was the mainly reason for them to stay. It was supported by a good environment and neighborhood.

Even though they have to live in the new places or relocation area, they will keep coming there for livelihood resources, but there would be cost them in transporting.

#### **- The fresh air and good environment**

*“I have land house, and livelihood here, for example sand mining, grass availability and others. I know that living here is at risk but I still want to live here because of the fresh air and kind neighborhood. I prefer to stay here than any other place.”*

This opinion by respondent 28 represented all respondent who agree with the fresh and clean air. It was supported by the experienced along the fieldwork that the air in this area is much better than others which had been contaminated by pollution from vehicles or/and sand mining activity.

#### **- Suitable area for dairy farming**

Base on field observation, almost all people in research area have livestock; most of them are dairy cow which is suitable in mountainous area due to low temperature. 17 households work on dairy farming, which was the highest number

in occupation. But as stated before, government did not have a plan in developing this area for dairy farming.

- **Arable land**

Refers to soil research by Suriadikata (2011) in literature review; Kalitengah Lor, Kalitengah Kidul and Srunen land after eruption was fit for grass. This statement was proved in the field as respondent 7 believes the increasing of soil fertility after eruptions;

*“... the soil in Kalitengah Kidul is more fertile because of ash from Merapi. It becomes four times fertile and productive.”*



**Figure 5. 6 Land for Grass and Cassava**

Soil fertility was proven by the condition of crops and plants that grow fast after 2010 eruption as shown in figure 5.6. Those make people comfort and optimist living there, even though it is prone area.

- **The existence of sand mining**

The existence of sand mining as the more profitable livelihood resource became one of the value of the area according to respondent 3 opinions. The location for mining is Kali Kendol (river) which is quite far from settlement; at the western part of area. But on the other hand, the distance itself is another value for Kalitengah Lor, Kalitengah Kidul and Srunen since they are away from lahar potency that used to flow through the river as stated by respondent 3 and 4 respectively;

*“Some values of this area are we can plant here and go to Kali for mining. It is very helpful and as main livelihood now.”*

*“I never think to move from here, since the river upstream is away from here. So, it is safer here from cold lahar.”*

The statement above was supported by 11 households that their main livelihood is sand mining. People realized that it gave more income than any other resources as described in figure 5.4.

Following statements from respondent 10 and 2 reveal about psychological factors, for example;

*“I am happy living here, and my livelihood resources are here. Even though I live in shelter, I will keep coming here for livelihood.”*

- **Family relationship and good neighborhood**

*“The other reasons for me to stay are; Srunen is my birth-place and gives like home feeling.”*

Relocation area and houses were provided by government just for people who want to move. Based on the interview, only two respondents considered the offers but still choose to stay. Those two persons were already old and not strong enough to work. The reason for them to stay is just their feeling; like at home.

- **Personal property and assets**

Besides the personal reasons that can be categorized into livelihood resources availability, sand mining profit, social empathy and comfortable feelings, the important fact is all the land had been certified. All the respondents stated the same about their occupied land; it was legal and valuable asset that cannot be ignored by government. Furthermore the certified land they have was quite large, for about 500 m<sup>2</sup> to 4 Ha of land per household. Compare to limited relocation area that was provided by government which is 100 m<sup>2</sup> of land and 36 m<sup>2</sup> of house, their asset in land is incomparable.

- **The opportunity to live there**

Without considering the risk, which is unknown in time, it is an opportunity for people who can live in certain area that can provide all the value above. There can be a possibility if they leave this area, other people will take place and get the opportunities.

## 6. The Livelihood Strategies After 2010 Eruption

According to Gottret (2002), it was important to classify the household based on its assets in analyzing the livelihood strategy. In case of Kalitengah Lor, Kalitengah Kidul and Srunen, the variables that were used for classifying the households was the value of asset which based on assets scoring by Bishop (2005). The livelihood assets involved education level, household size, household labor, social network, livelihood diversification, livestock ownership, income, quality of housing and land ownership.

### 6.1 The Welfare Condition

The value of assets indicated the welfare. Each household can be differed based on quality of five livelihood assets. Referred to table of valuing household asset in Agricultural and Food Engineering Technical Report by Bishop (2005), the assets were divided into low, middle and high score. Field survey and interview found that 80% of households sample were in the middle level of welfare, the high and low quality of households livelihood got 13% and 7% respectively just like in figure 6.1.

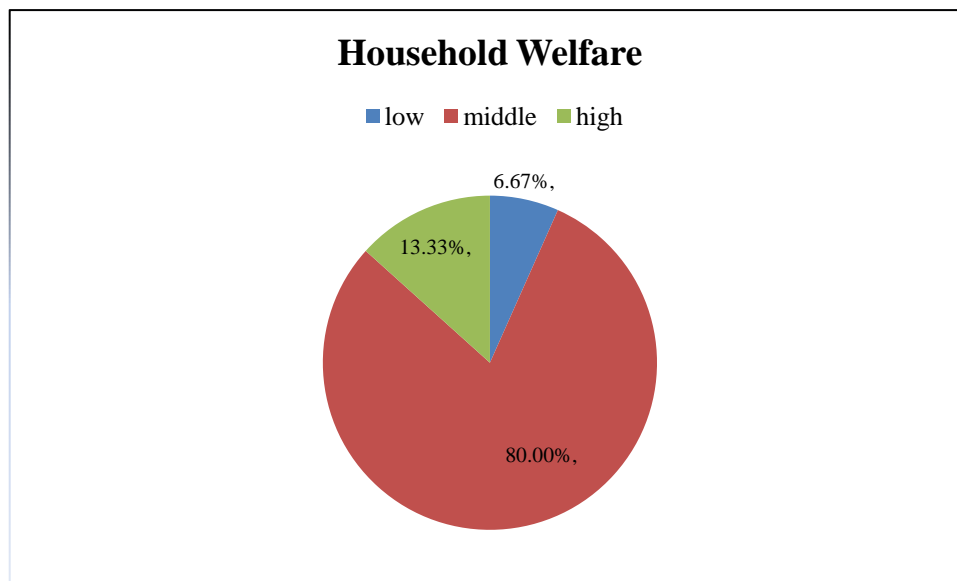
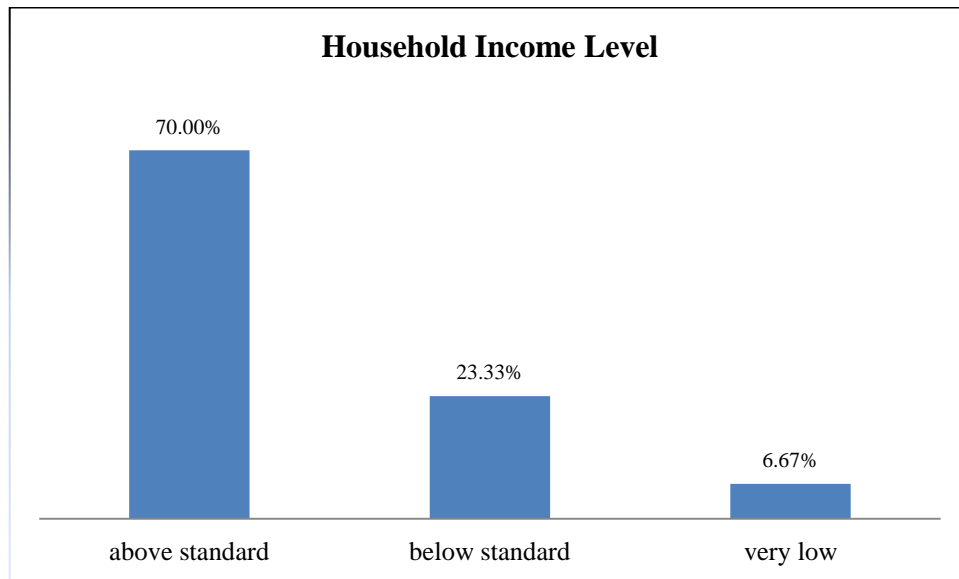


Figure 6. 1 Welfare Condition Based on Livelihood Asset

The livelihood condition was also indicated by the amount of income. The minimum wage of Yogyakarta province, which is Rp. 892,660.00, is the standard for living in appropriate. Whereas for those who can only fulfilled the basic needs for food, equal to Rp. 218,042.00 (Purwantini, 2007), was categorized as very low level.





**Figure 6. 2 Percentage of Income Level**

70% of household sample were in appropriate condition of income or more than regional minimum wage, but other 30% were below Rp. 892,660.00, even 6.67% of it were only got minimum required for daily basic need or for food. But income was one of some variables that affected the value of assets as welfare indicator. In general, the livelihood aspect was recovering after 2010 eruption.

Respondent 28 said,

*“I returned to Srunen 3 weeks after eruption to see my house. It was devastated and all my 12 cows died.”*

This statement indicated the prosperous life before 2010 eruption, as also stated by almost all respondents that were represented by respondent 25 and 26;

*“I had have groceries shop before eruption, but it was gone.”*

And,

*“99% of houses before were permanent, but now there are a lot of semi-permanent houses”*

They admitted the degradation in living condition now, but everything had been recovering and they are optimist to live there. That is way they choose to stay rather than leave the area now, the livelihood strategy. People consider more about the potential condition there, even though there is a threat of volcano hazard. Furthermore, the livelihood assets value and income as in figure 6.1 and 6.2 described that the majority of people live in appropriate life.

## 6.2 Human Capital

### 6.2.1 The Head of Household Capacity

In assessing the quality of human asset, we considered several important points, they were the age and sex of head of households, their education degree, the training they ever had, the personal skill for supporting main livelihood and the health condition. Beside those criteria, the number of household member and the labor in the family need to take into account in supporting the assets quality. Most of the head of households were male and 57% still in the range of 30 to 50 years old. 33% were more than 59 years old and the rest were 25 years old.

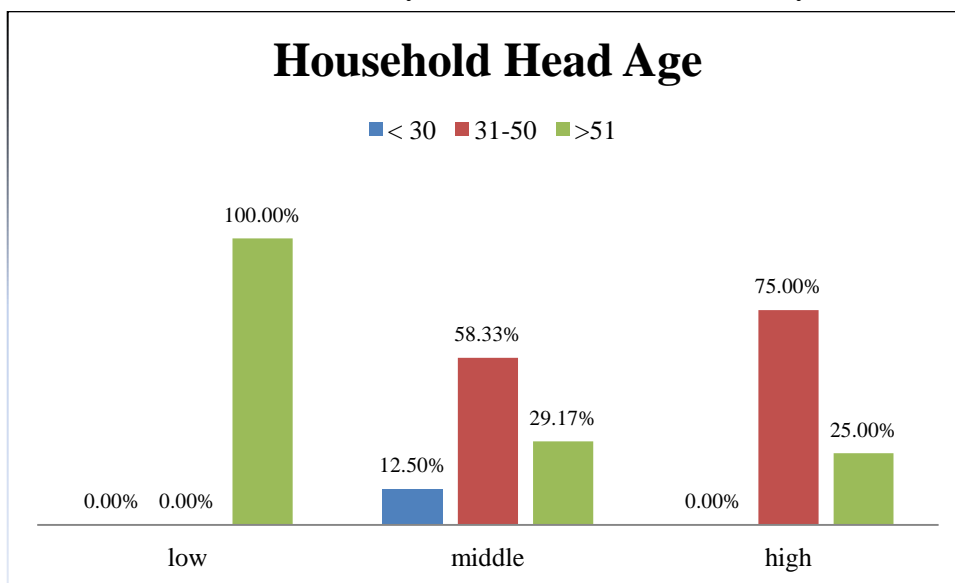


Figure 6. 3 Age of household head according to welfare status

The statistic described the percentage of households head age according to welfare status. The ability and capacity of head of household which was in the same age are more or less the same in earning for living. 100% of low welfare households head were more than 50 year, in this case was more than 59 years old. Based on field observation and interview, they cannot support their family optimally; one of them was sick and relied on his children to fulfill household needs. Their strategy for living was just for surviving, that was why this household was in a low progress of developing.

The productive age of household head dominated middle welfare status. The strategy found in this case was all the household member work optimally, but unfortunately they had more needs or limited assets. For example respondent 19;

*“My wife and I collect grass every day for selling and we do not work on sand mining. I earn Rp. 25.000,- a day from selling grass. Meanwhile*

*charcoal production is not continuous since I only get wood from my own land that makes me have to wait for a while for next harvest time. I can sell 2 sacks of it in one time production to a corporation which organizes charcoal trading.”*

Both of them can work optimal, but they did not have access to sand mining as the most beneficial livelihood resource, had limited assets in annual crop as the raw material for charcoal, and did not cultivating their farmland. But their livelihood strategy which was only optimizing used of their assets and did not invest on farming have minimized the risk. It positioned them at middle level of welfare. The middle and high welfare group was dominated by productive age of household head who also have at least primary education, access to beneficial livelihood resource and high value of natural and physical assets. There was a household which was at high welfare status whose unproductive household head. But the fact that there were two families who live together made it possible for them to live in appropriate.

The gender issue still affected the livelihood strategy. Only 13.33% of the head of household samples were women who are unmarried woman and widows. This condition influenced the selection for main livelihood which was farming and less diversification of livelihood. In case of farming, they tend to plant consumable crops only. One of them was in low welfare status, meanwhile the others who live at middle welfare status, got remittance from relatives or live with a family member who can support her life well.

The education showed in the next figure.

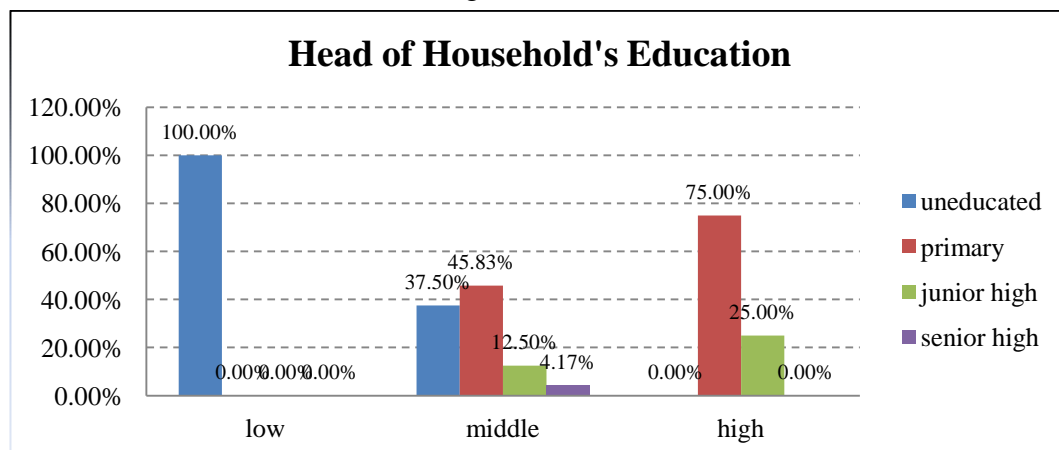


Figure 6. 4 The Education Level of Head of Households

The education degree was divided into uneducated for who was never got formal education, primary that for people who had been literate and gotten the first education in elementary school. Subsequent to basic education was junior and senior high school for six and nine years of formal education respectively. Education degree and literate condition had important roles in empowering other assets, strategy and decision making. Respondent 29, who was senior high school graduated, managed his time in order to make him live comfortably.

*“The main livelihood of mine is farming; cultivating and raising livestock. Then I sell chicken noodle at the afternoon, start from 4 or 5 pm until evening. The farming size is about 2 Ha and planted with grass for feeding my 2 cows.”*

His farm land was planted by only grass due to less maintenance and providing fodder. Then he used his skill as secondary livelihood. Even though this respondent was in middle welfare status, he did not have to give the effort as much as the others for achieving the welfare.

All the households at low assets value were uneducated which less in diversification of livelihood and time management. This indicated that the education level determined the planning and organizing of livelihood.

On the other hand this condition did not exist at the high category of households which all of the household heads had at least primary education for 75% and the rest was junior high graduated. Meanwhile the middle category was more heterogenic and dominated by primary educated for more than 45%. In both categories, the livelihood was more various and manageable, for example a statement by respondent 17.

*“I usually collect wood or mine stone in Kali Gendol. There is no main livelihood; meanwhile my wife has regular occupation in Koperasi that provide crust, 7 days a week from morning until noon. She earns Rp. 400.000,- and 20 kgs rice per month. I mine sand and stone for about 5 – 10 times a month. But I prefer to farming. I provides grass for people who ordered it, for Rp. 25.000,- per bunch. There are 3 times orders for 3 bunch in a week in average. I also collects timber for firewood once in 2 months that earns Rp. 10.000,-.”*

He can managed his activities, furthermore his wife is also educated that make her occupied by *Koperasi* (cooperative institution).

The fact about the availability of courses or counseling that involved citizen was only known by 63.3% of respondents who never enrolled any of it. This condition described the limited knowledge of respondents in research area. 26.67% of

respondents did not know about them and only 10% ever attended some of courses, training or counseling. It was important information in assessing the assets since informal educations also enriched and supported the formal. Some of the household's head had skills. 30% of them confessed that they only know about what they used to do without develop any skill. For about 46.7% admitted that they had special skill for example carpenter and handyman, but just for family needs and society. 20% of the respondents commercialized their skill by request, and only 3.3% of the respondent used the skill as main livelihood. All skilled respondents were in middle welfare status that indicated they can manage or diversify their livelihood.

Personal health condition influenced the household livelihood significantly. 6.67% of head of household had serious health problem that decreased the value of assets; one of them cannot involve in livelihood activity at all, and another had to spend large amount of income on medicine regularly. Most of the respondents are in well condition but 26.67% cannot work optimally due to certain health conditions.

### **6.2.2 Households Member and Labor**

The size of household related to potency and availability of labor. It determined the welfare since this has important role in applying and operating the livelihood strategy of a household. So, the amount of household member had a positive correlation with welfare level. Figure 6.5 shows that more households were small size family that only consisted of three persons. Subsequent to this, four or five members were found in nine households and four household had more than five members.

The households that have four or five members can manage the labor and diversify their livelihood. This condition supported most of the welfare status in research area is at the middle level.

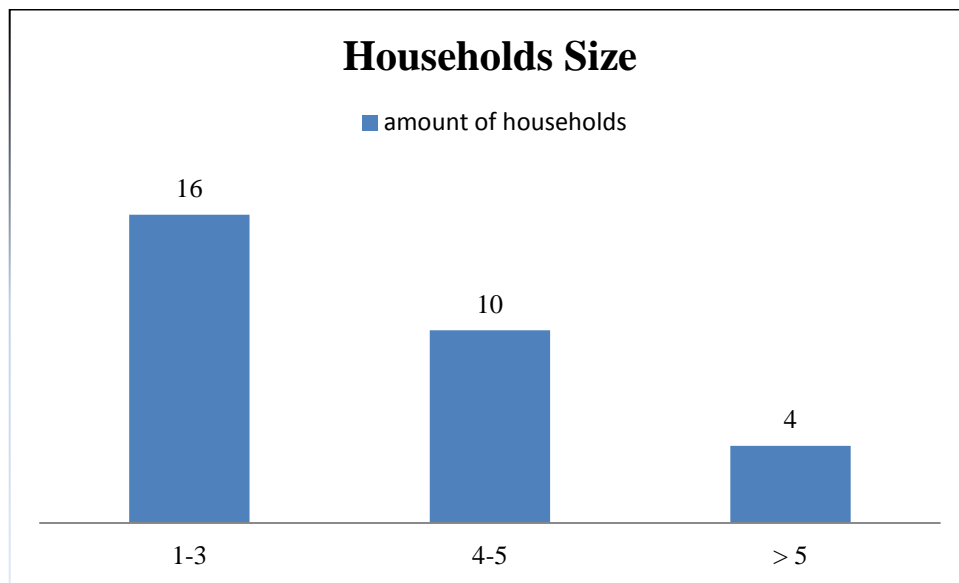


Figure 6. 5 The Households Size

The average of household member related to the livelihood assets level was shown in figure 6.6. The high level had 5.3 members in average meanwhile the middle and low got 3.4 and 2.5 respectively.

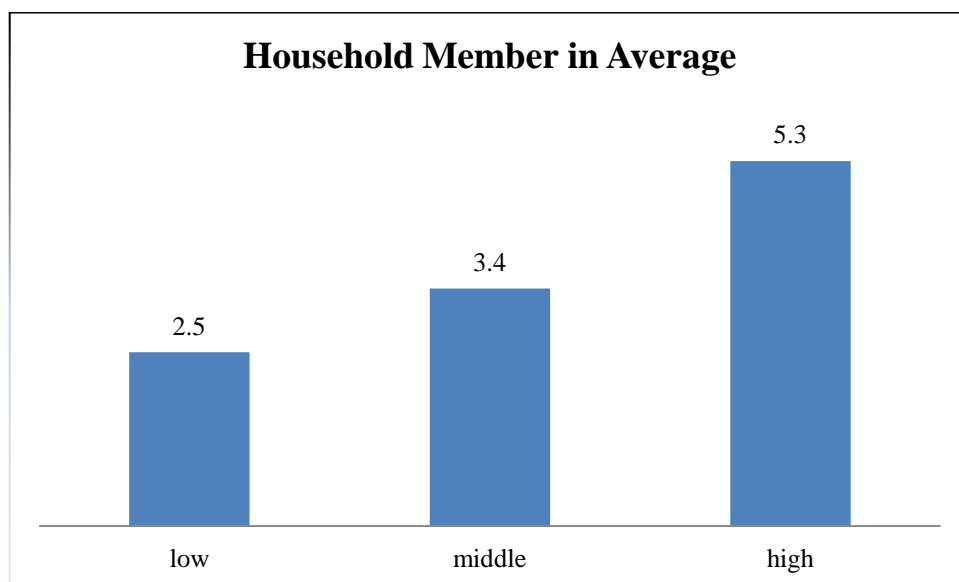
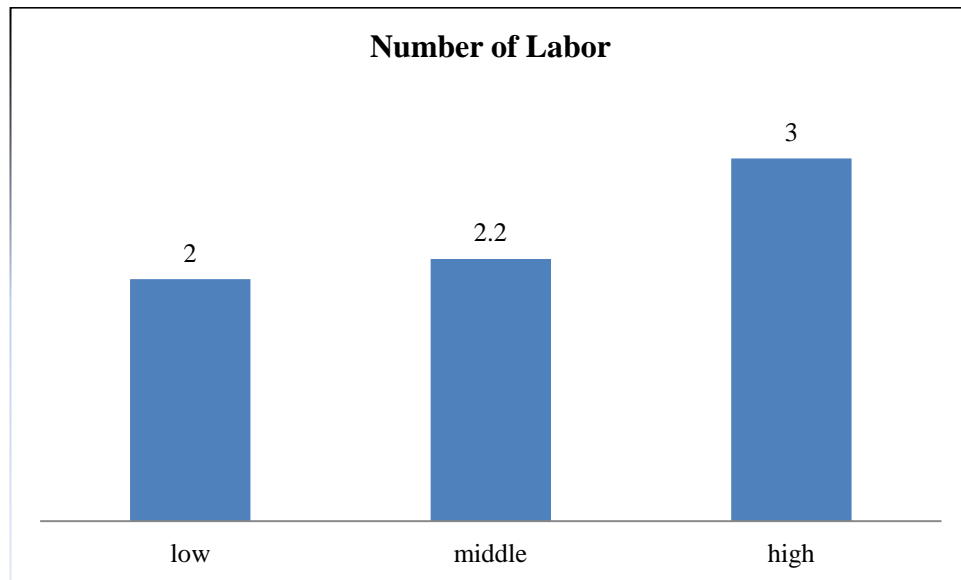


Figure 6. 6 The Average of Households Member Related to Assets Level

The range between the middle and the high was two persons meanwhile the different in low and middle was only 1 person. The household size determined the strategy for living since the larger the number, the higher the effort for gaining a better life. People always try to fulfill their needs in some other ways. In case of

low welfare status that only consisted of 2 or 3 persons, they were just satisfied with certain amount of income. But not for a larger family at high welfare status that must fulfill the needs of more than 5 people that have to find a strategy for a better income.



**Figure 6. 7 The Productive Age of Households**

Figure 6.7 described the labor availability of households. There was slightly difference in number of labor between low and middle level, and only one number that distinguished those to high level of assets. It means the number of labor was the determinant factor in assets valuing and welfare status since one can give a significant contribution to welfare condition.

The amount of labor allows a household to diversify their livelihood and make divisions of work, as stated by respondent 27.

*“My daughter works at Koperasi. We have dairy cows that are kept by my wife and my daughter in law. It is very helpful in reconstruction phase while sand mining is not ready yet. My son and I go to kali Gendol every day. We do everything for living, and as you can see, we survive.”*

From his statement, they had a division of labor which empowered all the human assets in household.

### **6.3 Social Capital**

All of people who lived in Merapi prone area counted on the neighborhood in alarming them and helping each others during and post eruption. The social

activities had been proven in easing the work and reducing cost, for example in building houses. Respondent 3 and 7 represented in informing it.

*“I built my house by myself with some help from friends. We help each others in building the house, after finishing one house, we move to another. It moves faster.”* And,

*“I sometimes do community service to build a house.”*

The next figure showed a helping house by government in a semi-permanent construction, and a private house which was built by community work. The last house is also barbershop which indicated that even in the most dangerous area related to Merapi eruption, the service who provide tertiary needs can be exist.



**Figure 6. 8 Houses in research area**

Regarding to those houses, it is important to have a good social network as a livelihood strategy for a better life. Respondent 27 even stop the interview since he had to go to social event;

*“...because it is important and if we not attendant it, community will do the same to us.”*

Reciprocity in social relationship affected the life in positive way. Respondents said that it eased the problem and work. In daily life there were many social activities that were still done, for example marriage ceremony, funeral, building pathway or bridges. 73.33% of the respondents prioritized the reciprocity. 13.33% of them cannot do this due to health problem. Woman household head, which was not as active as the man, involved 13.33% in reciprocity percentage.

Social group membership had an important role in livelihood that can be a strategy for gaining a better life. But 76.67% of the people in research area were not a member of any group, 6.67% involved in temporary group like money gathering group. The main activity is saving, but the members have to take turn in receiving the money.

16.67% of respondents were the member of formal group, for example farmer group. Some advantages of being a member of farmer group were getting



assistance about agriculture, having livestock from government, involving in positive programs, etc.

Respondent 1 admitted that his involvement had a tendency.

*“I am member of Kelompok Tani Peternak Sapi Perah ... My wife got loan Rp. 1.000.000,- from UPI, an organization that manage loan for micro business.... We involve in those organization as strategy for getting a better livelihood”*

About the relationship with the relatives outside, all the respondents confessed that they had a good relationship and their relatives were ready to accept them just in case of disaster occurrence.

## 6.4 Natural Capital

The natural capital was one of the reasons for people to come back to this area. Furthermore the ownership status of their land had been 100% certified. So, they only need to think about the strategy of livelihood. The main livelihood in this area was dominated by primary sources which are sand mining, dairy farming and farming. The respondent was hard to define about which the main occupation is since all family members did all they can and diversified the livelihood as the strategy. The following figure presents the percentage of livelihood availability in research area.

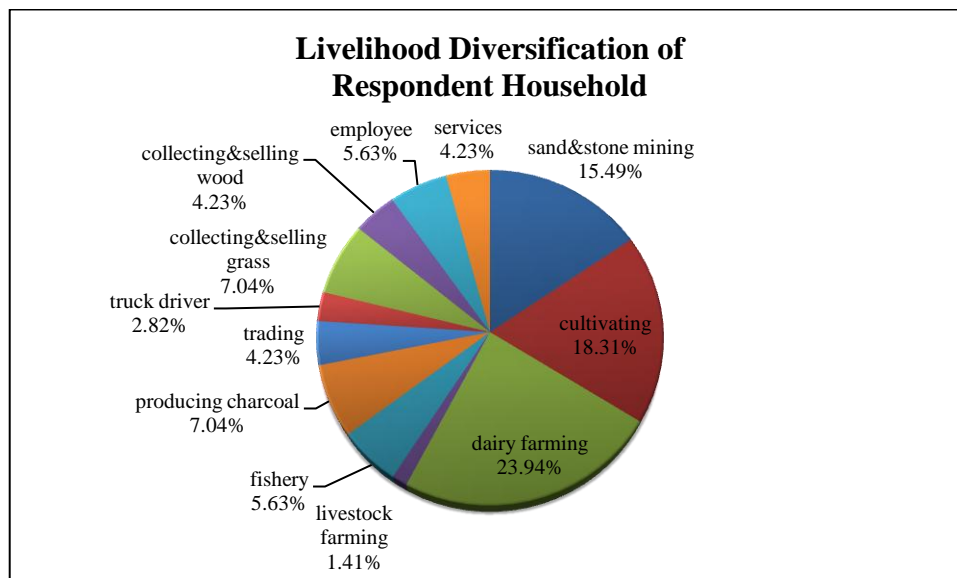
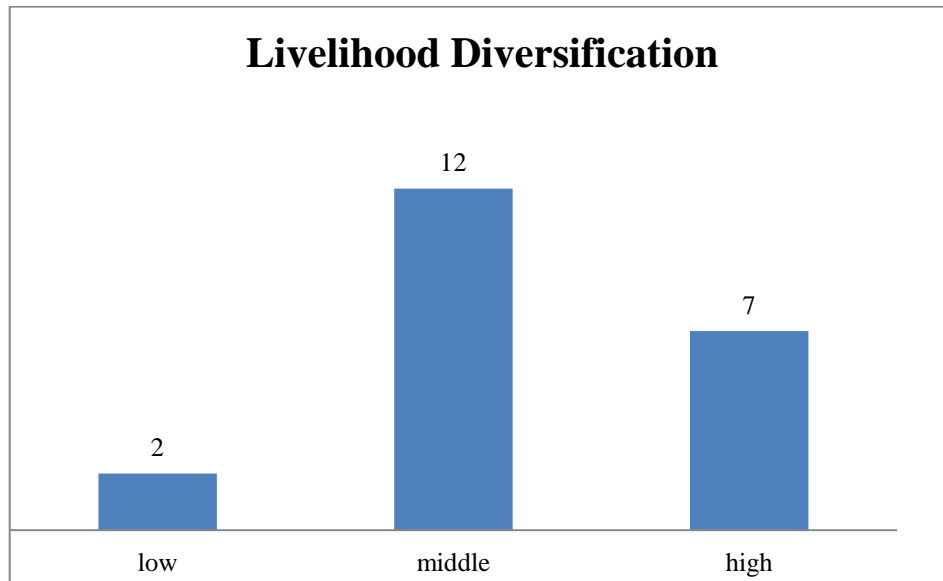


Figure 6. 9 Livelihood Diversification

The highest percentage in livelihood diversification was dairy farming, then cultivating and mining. Services was only got 4.23% which were represented the barbershop, housekeeping and small vendor.

Related to the assets value, there was no livelihood diversification in households which is at low level of assets. But there were more diversification at middle level than the high one which was 12 and 7 respectively.



**Figure 6. 10 Livelihood Diversification**

The middle level of welfare had the most varied livelihood that can be caused by the amount of samples in this group. The fact that all the samples in high welfare status had sand mining as the main livelihood resources proved the most beneficial resource as we discussed before.

Dairy farming as the dominant livelihood related to the number of livestock that respondents had. It had two functions; as the daily income source and savings or investment, as reported by Diwyanto (2001). Therefore there were more livestock in group of high welfare, as described in figure 6.11.

Most of people in research area prefer to save in livestock, represented by 8 respondents, than bank or other institution. It was more beneficial since livestock value is increasing (Diwyanto, 2001).

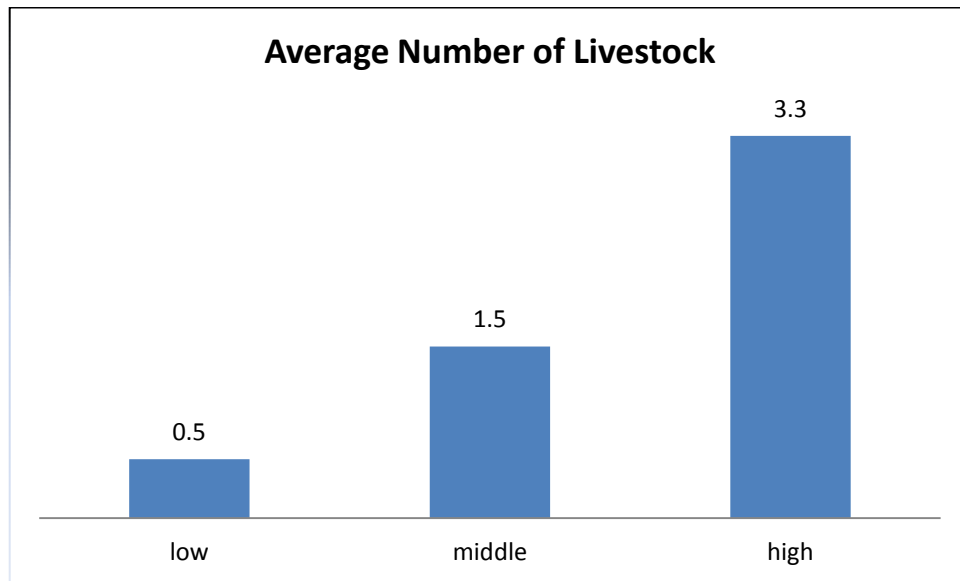


Figure 6. 11 The Ownership of Livestock

After 2010 eruption, government facilitated fishery farming by providing catfish and its ponds. But the respondents who still worked on it was only 16.67%, and mostly for self consumption. They said that this business was high cost since the fodder is expensive, therefore they only kept as many as they can feed.

The second position of livelihood activity was farming. Unlike livestock that have positive correlation with welfare status, the correlation between it and the ownership of land was not in linear way as in graph of 6.12.

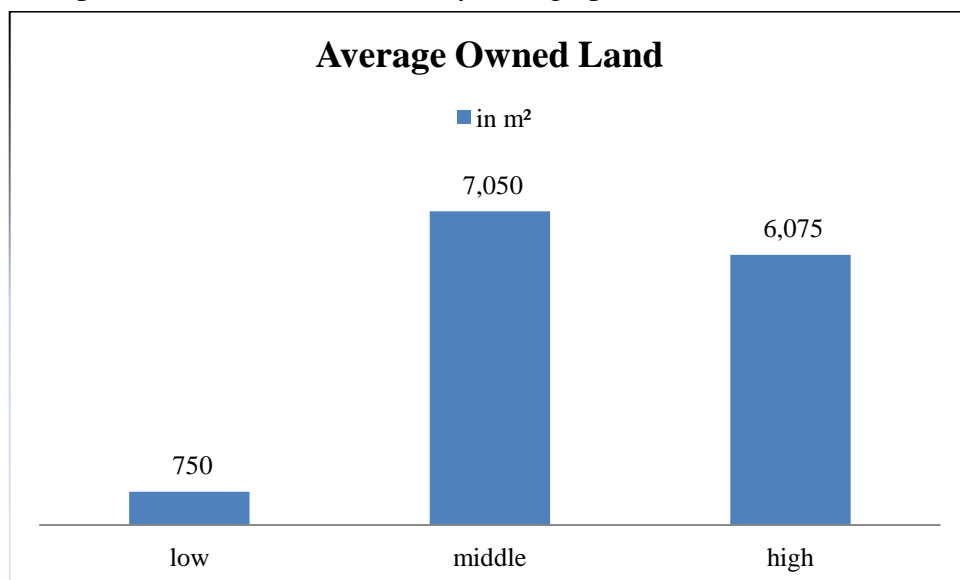


Figure 6. 12 The Ownership of Land in Average

The highest average of land ownership was in the middle level. It indicated the utilization of farmland was not optimal yet. This was supported by the information from interview; only 16.67% of respondent cultivated their land optimally, but only 13.33% sold the yield. Most of them, which was 53.33%, cultivated farmland based on the needs, for consumption. And the rest of them just fallowed the land and yield the grass for fodder. This was more beneficial choice due to some condition;

- Farming yield needs extra cost and effort in distribution, like respondent 15 said;

*“They do not know how to distribute/sell the farm yield, furthermore, going to market needs extra effort and cost.”*

- The farming product price is uncertain, meanwhile the grass has an obvious price for selling or self utilizing. Respondent 25 and 27 informed it.

*“I planted chili 2 times and yield 15 and 20 kgs each, but its price was low. For now I just grow grass for selling. It harvests once a month and gives Rp. 200,000.00.”*

*“We planted tobacco after eruption. But now we plant chili but the price is quite low, but the most important is working for living. The farming area size is for about 1 Ha, and now only produces grass for feeding cows.”*

- High cost in cultivating was the reason of respondent 28.

*“I plant vegetable like beans and chili which is loss, by considering the cost for cultivating land. But I have to do that in order to keep land friable and displace sand.”*

The choice for only plant grass was the strategy for avoiding the loss. Another strategy was diversifying the crops in the farming land that can be harvested daily, weekly, monthly and annually. It would give them the regular income from farming. The dairy farming activity as the highest number of livelihood made growing grass in farmland more valuable. One respondent was landless but his main livelihood was sand mining that positioned him at middle welfare status. Sand mining was the most beneficial livelihood resource in research area. But it was not accessible for everyone. There was only 36.67% of the respondent had access to daily activity on both sand or stone mining. On the other hand, 43.33% cannot involve in such activity, but for about 6.67% had access to this resource at night. Not only the household in high welfare status get access to this livelihood resource, but also one household at low welfare had. But its other livelihood assets such as land, education, livelihood diversification and social network were low had made this household in its situation now. So, the guarantee for a better

living not only based on access to the most beneficial resources, but it needs strategy in livelihood assets management.

Land is one of the reasons for people who did not agree with relocation idea since the lowest welfare status of sample have 750 m<sup>2</sup> in average meanwhile the relocation area provided only 100<sup>2</sup>. But based on the observation in the field and the idea in interview, people would never agree to move from this location since the existence of sand mining, as the first reason, and suitable and supported area for dairy farming which are cold temperature and grass availability.

The strategy that related to natural capital in Merapi prone area is optimizing the utilization of resources as much as they can now since nobody can predicts the next eruption, could be next year, in the next 10 year or even hundred years.

## **6.5 Physical Capital**

Physical capital referred to the visible assets that were considered as house, vehicle, utensil and tools. 50% of the houses in the research area were permanent and large buildings, meanwhile the other permanent house that only (for about) 36 m<sup>2</sup> were 16.67%. And the semi-permanent house was 33.33%. The ownership of permanent house described the safety feeling and long-term living plan in this area. People are not afraid to invest in building and do not consider the potential of destruction by the hazard. To have a comfortable and appropriate live is the priority for people who live in this area more than avoid the potency of danger which does not have the exact time.

The availability of resources and permanent house was supported by the existence of good public facilities, for example mosque, water resource, roads and electricity.



**Figure 6. 13 Public Facilities**

Some respondents said that the ownership of vehicle was one of the most important things in living in prone area. Beside for transporting to public services, that were no more exist in prone area, it was very helpful for shuttling when disaster occurred. Almost all the respondent had at least a motorbike. Based on field visited and interview, there was 30% of respondent had one motorbike, 43.33% had two and 3.33% had a car, the other 20% did not have any vehicle.

The ownership of vehicle has advantages as reported by respondents;

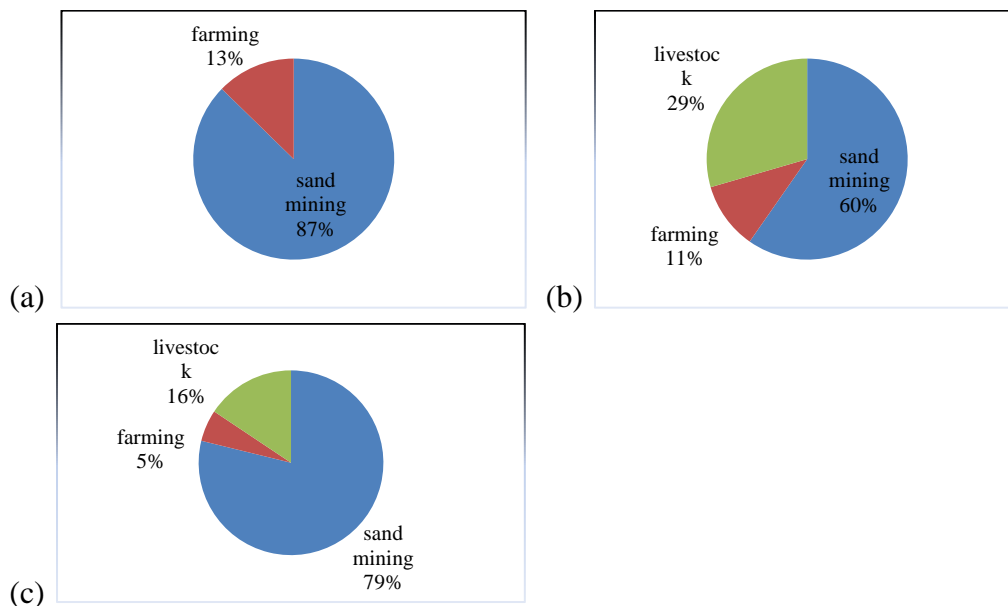
- Easing people to move from one location to another in doing their works.
- For reaching the public facilities outside the area; school, medical service, etc.
- As the transportation for distributing the farming product.

The condition that most of respondents have two motorcycles is one of the strategies in livelihood. It indicated that two persons in one household can mobile and do more than one activity in the same time.

## **6.6 Financial Capital**

For observing the financial capital in this research, it was important to observe the capacity of a household based on income, access to credit, saving and remittance. The analysis about income related to the three main income sources; livestock, sand mining and farming. The comparison of those in each level of household assets was shown by the next figures. At the low level welfare, there was no respondent who got income from livestock, as described by figure (a), the biggest

portion, 80%, came from sand mining. In middle level in figure (b), sand mining activity was still dominated, but there were 29% of the income was from livestock. Like the statement before, this gave the regular income. Meanwhile the portion for farming was smaller, 11%. And it was getting smaller at the high welfare group, 5%, (c). It indicated that farming did not give a good income, but sand mining activity did and it was supported by the ownership of livestock.



**Figure 6. 14** The comparison of three main livelihood resources; (a) low, (b) middle, (c) high

The common problem in extending livelihood activity by using certain skill, for example carpenter, was the capital for doing it and lack of access to credit. There was only 10% of them got loan from dairy *koperasi*, but none of them got access to bank. The other 90% did not get from any other. This condition forced people to explore other available resources and set a certain strategy to optimize the yield as had been discussed above.

People in Kalitengah Lor, Kalitengah Kidul and Srunen still think that they need to save for future preparation. All the respondents considered it but the realization was based on personal ability. There were 36.67% of them cannot save due to prioritizing the basic needs. More than a half of them, which was 53.33% admitted that they can set aside some of their income and prefer to invest it in livestock. And 10 % were keeping their money in certain institutions. The preference to invest in livestock because beside its price was never goes down, the daily revenue from milk can support the living.

Even though the hard living condition in prone area and all respondent confessed that they need a help, but most of them did not accept any help in the form of money from their relatives regularly. There were only 6.67% of the respondent who still got remittance from family and the rest of it did not. This condition forced people to live independently and work harder to gain a better life.

## 6.7 Evacuation Preparation

Even though people did not consider the risk of volcano hazard or Merapi repose period, but most of them still have plans for evacuation. The plans were divided into five categories as described in the next figure.

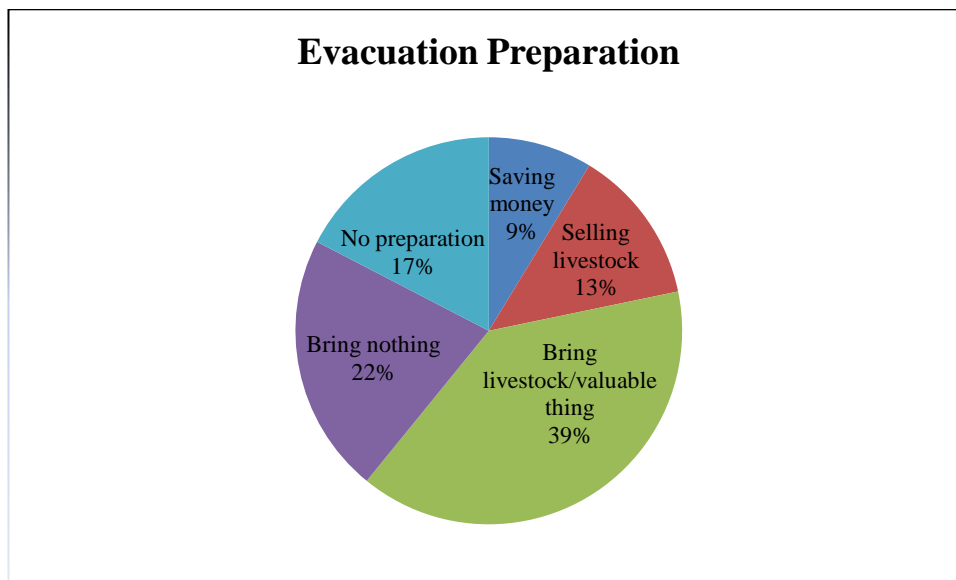


Figure 6. 15 Planning for the next eruption

The lowest percentage, 9%, represented respondents who are saving money in case of emergency. Respondent 26 informed that everybody in his hamlet was involved, but the other respondents, who were in this category, mentioned their chose as self initiative.

*“Each RT (neighborhood institution) manages monthly fee in preparing for groceries stocks while emergency. Its amount depend on each household’s ability; Rp. 5,000.00, Rp. 10,000.00 or Rp. 20,000.00, that was noted by head of RT and kept in bank.”*said respondent 26.

13% of respondent chose to sell the livestock as the first action if there is a sign of disaster occurrence. But still there were 17% of respondent who did not have any plan for the next eruption at all. And 22% of respondent, who considered the next eruption, planned not to bring anything. One of them just believed that they will



get the compensation for their next loss. It is one of the strategies in living in prone area; based on their experience, most people believed that they will get the compensation or help from government, non-Government Organizations or privates soon after the disaster occurred. This makes people keep living there and not too worrying about the life after disaster.

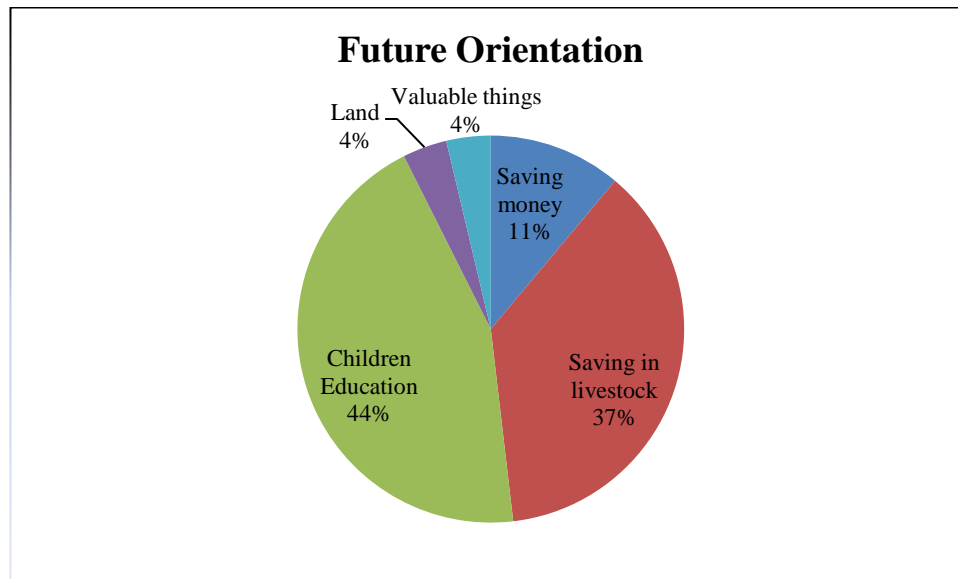
*“There is no specific preparation in facing Merapi next eruption. Just go for refuge without livestock. Base on previous events, they will be compensated by the government.”*

Most people, 39%, preferred to bring their valuable things and livestock, even though some of them did not know where to put their cows later. But respondent 3 believes that government will provide place for livestock in the next eruption since they have taken a lesson from the 2010 eruption.

There was difference in evacuation preparation related to livelihood welfare status. The low welfare category had no special preparation, just relied on neighbor informing them the situation. Furthermore, they had planned not to bring livestock. On the other hand, in the high welfare category, their plans included bringing livestock or saving money from now, and prepare all certificates. Meanwhile the middle welfare category had various plans.

## **6.8 Future Orientation**

Living in prone area did not make people in Kalitengah Lor, Kalitengah Kidul and Srunen had less future orientation. As described in figure 6.15, there was five groups of orientation that was considered as the most important investment for them.



**Figure 6. 16 Future Orientation**

Based on the result of interview, there was no difference in future orientation among those three welfare status. There was 4% of respondent considered to buy land outside this area, but not for living, just as asset. This was as much as respondents who decided to invest in valuable thing, for example gold or jewelry. The highest percentage was saving orientation; in livestock and money, which was 11% and 37% respectively. And almost a half of respondent, 44%, prioritized their children education as the most important investment. Respondent 6 and 25 represented the reason for this category of future orientation.

*“The most important is children’s education. Their parents are uneducated, so if the children really want to go to school, we intend to give it to them. It is more important than things/goods, because those can be gone. I would not invest in something like that.”* And,

*“I will prior education for my child so that would make her success, unlike her parents.”*

Those statements described a hope for their next generation. People still believe that education can give a better life achievement, more than money or valuable things.

## **7. Recommendations of improvement for an appropriate livelihood**

### **7.1 Introduction**

This chapter provided recommendations of improvement for an appropriate livelihood based on the analysis of resource used. The analysis was based on the real condition that was observed by field survey and interview which was covering;

- Phenomena were found in research area and the constraints related to resources utility and household assets.
- Recommendations for an appropriate livelihood

### **7.2 Livelihood description**

There were three main livelihoods available in Kalitengah Lor, Kalitengah Kidul and Srunen which are sand mining, farming and livestock farming. Every household did at least one of them as livelihood. Based on field observation, majority of land surround Merapi had turned into sand mining, like figure 7.1 showed, so did the livelihood.



**Figure 7. 1 The sand mining on farming land**

This condition influenced the farming productivity, but in the other hand, it had increased the off-farm income significantly for more than 15 years. In former discussion stated that sand mining activity now was explored by corporation that reduced a chance and opportunity for people to work on it. Figure 7.2 describe the condition in sand mining that was dominated by machines.



Figure 7. 2 Machine dominated sand mining activity

Even though there was a decreasing in sand mining opportunity, the income from this livelihood was still high, compare to others that were available in research area. Figure 7.3 and table 7.1 provided information about it at household level and assets.

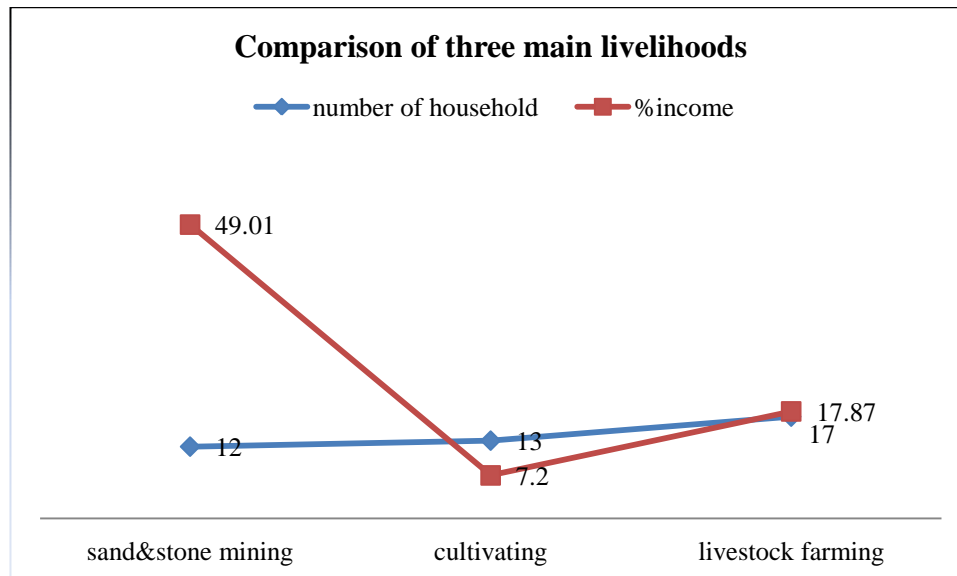


Figure 7. 3 Comparison between number of person doing the livelihood and its revenue in percentage to total income

Table 7. 1 Average income per asset used from three main livelihood

	Capital	Income (Rp.)	Income/capital (Rp)
Sand&stone mining	16 persons	21,800,000.00	1,362,500.00
Cultivating	20.21 Ha	3,204,546.00	158,562.39
Livestock Farming	49 livestock	8,200,000.00	167,349.94

These data presented the information about the amount of income from each livelihood both in percentage for household and in number per asset. The important information came from sand mining and cultivating category in figure

7.3, graphic showed that sand and stone mining was only done by 12 households but gave the highest percentage in income. From interview, the only problem in sand mining just limited access in sand mining that had been informed in the former discussion.

Meanwhile, cultivating had the lowest in percentage even though the number of households was more. Furthermore in table 7.1, the average amount of income from cultivating was the lowest among those livelihoods, whereas it had more than 20 Ha farming land and only produced Rp. 158,562.39 in average per hectare. Based on interview and survey, the potency and result from farming was not equal, indicated the needs for improvements. There were some constraints that were experienced by respondents, for example lack of labor that was informed by 10 respondents whose small number of household member. But for larger households who can cultivate their land optimally, the problems were; they did not know about what the beneficial and most suitable crops are and how to distribute the farming yield. Finally, they just did the conventional farming, as respondent 15 reported;

*“We have limited knowledge of farming, that is why we only plant crops that can be consumed because we do not know how to distribute it. And go to market needs extra effort and cost. People here need guidance in cultivation practices and distribution. It would be better if there is any of agricultural cooperative, like dairy cooperative institution, that manages the farming yield.”*

The extra effort and extra cost for distributing and selling the farming yield was informed by five more respondents.

Meanwhile the livestock farming was the most stable livelihood since it had cooperated with a cooperative institution. So, there was no need for improving since the system had been established. The dairy business in Indonesia was managed by GKSI (The United of Indonesian Dairy Cooperation) which established the term and condition in trading and also the price. So, it was not farmer profit oriented. But the demand for milk in local market was still high (Yusdja, 2001) that can guarantee the continuity of dairy farming income in Kalitengah Lor, Kalitengah Kidul and Srunen.

Even though the cooperative institution of dairy farming is not farmer oriented, but the guarantee in buying dairy yield had made the farmer prioritize and give extra effort to this livelihood. Meanwhile, sand mining needs a very hard work and high competition with both people and machine. Compare to

farming/cultivating that was admitted by most respondents as the most comfortable livelihood but unfortunately has no certainty in distribution.

### **7.3 Toward a strategy for household income improvement**

There were some strategies that had been applied for improving the farming system.

#### **7.3.1 Cooperative Farming System**

According to Soetrisno (2002), agricultural sector had provided 19% employment opportunities at national scale, together with agribusiness, the number became 49%. It was a very potential sector that was not utilized and managed optimally. It was described by farmer welfare and their low standard of living. Actually, there was a cooperative institution that had been established since 1960s that ruled the management of farming at the farmer level. But the former system was program driven or top down that need to be restructured into incentive driven which was bottom up system. This was the main idea of cooperative farming system.

The basic capital for founding a cooperative farming was the existence of farmer group. Kalitengah Lor, Kalitengah Kidul and Srunen already had more than one farmer groups. The system based on farmer empowering, which farmers was not only as members but also as administrator and management. It was not an easy work and need coordination with both vertical, with government, stakeholders and privates, and horizontal with local community. The entire local farmer must be active and consistent, and should support and have the sense of belonging to their organization.

There were procedural steps that had to be undertaken (Nuryanti, 2005);

(1) Identifying the potency of area

Based on field survey and interview, in general local people use to plant vegetable as regular crops on their farm land. It is suitable with government program in Bappeda (Regional Planning and Development Agency), Kalitengah Kidul and Srunen are for horticulture farming. But a comprehensive observation can be conducted in order to get more detail information about land potency.

(2) Organizing the farmer and farmer groups

The existing farmer groups can be integrated into a complex organization that has manager, administrator, divisions and sub-divisions according to tasks.

(3) Determining the technology that will be used

Discussion or consultation was important in deciding about what and how to run the organization. It involves government or extension officer, to give guidance or introduce a specific technology for farming.

(4) Coordination with agricultural input provider

This part needs collaboration with privates sector that would provide fertilizer, seeds and other farming input for farmers. It was facilitated by organization using joint capital of all members.

(5) Consolidation about on-farm activity

Members must have an agreement about time to start, the use of fertilizer, maintenance and management during the cultivating process.

(6) Consolidation about post-harvest activity

This step handles the post-harvest management, for example storage, distribution or product processing.

(7) Established the distribution network

This is the important part that involves government and privates. The cooperative farming organization has to get a link to privates who would distribute their product. In this step, the role of government is very important as the facilitator and communication supporter.

Beside the government, farmers can have coordination with non-Government Organization or university to guide and support in establishing the cooperative farming system.

### **7.3.2 Crop Livestock System**

Crop Livestock System was a system that had been applied for many years by farmers who had livestock and crops. In Indonesia, it was first introduced in South Sumatera in 1985 (Diwyanto, 2001), and now exist in upland Java that use livestock manure for fertilizing rice, maize and grain legume, taking advantages from forages in crops to feed cattle in Bali and using cattle for draught power in rice in Southern Sumatera (Devendra and Thomas 2002).

There were some advantages from crop livestock system as said by Devendra (1997), which were diverse and efficient resource use, reduced risk, labor efficiency, low external input, decreasing the dependency of biological and chemical energy, can improve soil fertility, sustainable production system, increasing output and improve the farmer household condition.

According to (Devendra 2002), the crop livestock system used to apply in irrigated area, and it was a challenge to be applied on rain-fed area like Kalitengah Lor, Kalitengah Kidul and Srunen. But its fertility supports this area to produce

amount of forage for fodder and manure for fertilizer. The use of manure had been done by farmers there.

As we know from the discussion before that the local farmer in research area produced cassava for self consumption. In fact, it can be alternative fodder as explained in table 7.2.

**Table 7. 2 Crop residue that was used by animals**

<b>Quality and sample of residue</b>	<b>Nutrient potential</b>	<b>Livestock/product</b>
Good - oilseed - cassava leaves	High protein, high energy supplement, mineral	Chickens, ducks, ruminants / milk, meat
Medium - coconut - Palm - Sweet potato vines	Medium protein	Chickens, ruminants / milk, meat
Low - cereal straws - palm press fiber - stover	Low protein, very fibrous	Ruminant / meat, draught

\*ruminant; buffalo, cattle, goat, sheep (source: Devendra, 1997)

The custom of people in Kalitengga Lor, Kalitengga Kidul and Srunen in drought season, when there was lack of grass, was feeding their dairy cows with straws as alternative fodder. In fact, that was not good for milk producing. Based on table 7.2, cassava leaves was more qualified as fodder. It was also stated by Lebdosukoyo (1983) in Diwyanto (2004) that leaves of sweet potatoes, peanuts, soya and cassava contain 11.3%, 11.1%, 10.6% and 20.4% of protein respectively. The CLS program that was ever applied in Yogyakarta was raising cows at coffee and melinjo (*Gnetum gnemon Linn*) farm (Masbulan *et al.*, 1995 in Diwyanto, 2004). According to Paris (2002), there was an integration of crop livestock farming system in upland farming in Indonesia between animals and rubber and food crop-based that can be also applied in Kalitengga Lor, Kalitengga Kidul and Srunen.



## **8. Conclusion**

### **8.1 Final Remark**

This research found that all respondents in research area realize the risk of living in prone area but most of people did not know about the repose period of Merapi eruption. The dependency on the livelihood resources that are available in this area have made them ignored the risk of volcano hazard and refused to be relocated. And the study also reveals that all households in research area had a harder and more difficult life since 2010 eruption because of the loss and degraded land. All land in Kalitengah Lor, Kalitengah Kidul and Srunen have been certified. This is not worth with the relocation area that was provided by government which is only 100m<sup>2</sup> in large. But it is not the only reason; the opportunity and livelihood availability that are offered by this area is incomparable.

Regarding to other livelihood assets, most people have only primary education without having any skill or training experience but they have a very good social network and relationship. In physical asset, most of people have permanent house now and at least one motorbike. Water, electricity, roads are in good condition, and each hamlet has Early Warning System for Merapi eruption. But people in this area have very limited access to credit institution whereas many of them need it. In general, based on the assets valuing, most of people live in middle level of welfare. Their strategies in facing the volcanic activity and livelihood depend on the capability of household head and amount of household member and labor.

The favorable livelihood resources are sand mining, dairy farming and farming/cultivating. Sand mining attracts people since it gives instant and regular revenue, but it needs extra effort in doing it and has high risk among other livelihood, and people did not consider it as permanent and long term livelihood. The preference to dairy farming because it is not only gives daily revenue but also as a saving. Meanwhile the largest area is available for farming, but this sector gives the lowest income for farmer since it has certain constraints which are mainly in post-harvest stage.

The opportunity, livelihood resources availability and certified land/legal assets have made people in Kalitengah Lor, Kalitengah Kidul and Srunen will never agree to be relocated. But they promised to obey the Early Warning System in case of emergency.

## **8.2 Recommendation**

Government and related institutions should have a very good planning in relocating people from Kalitengah Lor, Kalitengah Kidul and Srunen for short time and long term living. Otherwise they must reconsider about the program in relocating this area since it does not guarantee the people with a better life. So, even though they have been relocated, people will keep coming back for livelihood and can be reoccupied this area, again. The better way is just let the people live in their own land with certain term and conditions that are regulated by the government.

Base on land availability and fertility, farming has a good potency as main livelihood for people in Merapi area, but it is not used optimally. Problem that was revealed based on grounded information is the yield distribution process that was uncertainty and costly. It can be solved by creating a cooperative farming system which is from farmer, by farmer and for farmer. Furthermore, to get more advantage in farming activity, farmers have to do the Crop Livestock System to optimize the utilization of crops and nutrients of livestock. Both recommendation need support from government, non-government organization and university.

## References

- Bale, H. A. (2011). Analisis Pasir Lahar Dingin di Sungai Opak untuk Material Beton dengan Pengerjaan Konvensional. Seminar Nasional Pengembangan Kawasan Merapi; aspek Kebencanaan dan Pengembangan Masyarakat Pasca Bencana. DPPM & MTS UII. Yogyakarta
- Bappeda Kabupaten Sleman. 2011. Fasilitasi Pemetaan Kawasan Rawan Bencana Merapi
- Barrett, C. B., T. Reardon, et al. (2001). "Nonfarm income diversification and household livelihood strategies in rural Africa: concepts, dynamics, and policy implications." *Food Policy* **26**(4): 315-331.
- Bishop, C. 2005. Contribution of farm power to smallholder livelihoods in sub-Saharan Africa. AGRICULTURAL AND FOOD ENGINEERING TECHNICAL REPORT
- Creswell, J. W. (1994). Research design: qualitative & quantitative approaches. Sage Publications. London
- Creswell, J. W. (2010). Research Design. Pendekatan Kualitatif, Kuantitatif dan Mixed. Pustaka Pelajar. Yogyakarta
- Darmawan, H. 2011. Pemodelan Aliran Awan Panas Dengan Menggunakan TITAN2D Untuk Memprediksi Bahaya Awan Panas Gunungapi Merapi Pasca Erupsi 2010. UGM. Yogyakarta
- de Vaus, D. (2002). Surveys in Social Research. Fifth edition. Routledge, Taylor & Francis Group. London and New York.
- Devendra, C. 1997. Crop Residues for Feeding Animals in Asia: Technology Development and Adoption in Crop/Livestock Systems. *International Livestock Research Institute. Kenya*
- Devendra, C. (2002). "Crop-animal systems in Asia: implications for research." *Agricultural Systems* **71**(1-2): 169-177.
- Devendra, C. and D. Thomas (2002). "Crop-animal interactions in mixed farming systems in Asia." *Agricultural Systems* **71**(1-2): 27-40.
- Diwyanto, K., B. R. Prawiradiputra, D. Lubis. 2001. INTEGRASI TANAMAN-TERNAK DALAM PENGEMBANGAN AGRIBISNIS YANG BERDAYA SAING, BERKELANJUTAN DAN BERKERAKYATAN. *Seminar Nasional Teknologi Peternakan dan Veteriner 2001. Pusat Penelitian dan Pengembangan Peternakan, Bogor*
- Diwyanto, K., Handiwirawan, E. 2004. Peran Penelitian dan Pengembangan Pertanian dalam Mendukung Usaha Agribisnis Pola Integrasi Tanaman-Ternak. Prosiding Seminar Nasional Sistem Integrasi Tanaman & Ternak. Puslitbang Peternakan. (<http://digilib.litbang.deptan.go.id>)
- Esperanza, L. V., M. M. Luisa, et al. (2008). "Volcanic Risk Exposure, Feelings of Insecurity, Stress, and Coping Strategies in Mexico." *Journal of Applied Social Psychology* **38**(12).
- Gottret, M. V. and D. White (2002). Assessing the impact of integrated natural resource management: challenges and experiences.  
<http://www.tempco.read/news/2012/10/24/173437506/>

- Lavigne, F., B. De Coster, et al. (2008). "People's behaviour in the face of volcanic hazards: Perspectives from Javanese communities, Indonesia." Journal of Volcanology and Geothermal Research **172**(3-4): 273-287.
- Nurmanaf, A. R., Supadi. (2004). *Pendapatan dan Pengeluaran Rumah Tangga Pedesaan dan Kaitannya dengan Tingkat Kemiskinan*. Pusat Analisis Sosial Ekonomi dan Kebijakan Pertanian. Bogor
- Nuryanti, S. 2005. " Model *Cooperative Farming* " untuk Peningkatan Pendapatan petani. *Tabloid Sinar Tani*, 29 Juni – 5 juli 2005
- Pamungkas, B. (2011). *Economic Resillience of Agribusiness Household in Putih River Region Following the 2010 Merapi Vulcnism Event*. UGM. Yogyakarta
- Paris, T. R. (2002). "Crop-animal systems in Asia: socio-economic benefits and impacts on rural livelihoods." Agricultural Systems **71**(1-2): 147-168.
- Pemda Kabupaten Sleman. 2008. At <http://kecamatan.slemankab.go.id/cangkringan>. 14-05-2012: 23.42
- Perda Klaten Regency No. 11 Year 2011
- Perda Sleman Regency No. 12 Year 2012
- Peter, G. and A. Runge-Metzger (1994). "Monocropping, intercropping or crop rotation? An economic case study from the West African Guinea savannah with special reference to risk." Agricultural Systems **45**(2): 123-143.
- Purwantini, T. B., Ariani, M. (2008). *Pola Konsumsi Pangan Pada Rumah Tangga Petani Padi*. Pusat Analisis Sosial Ekonomi dan Kebijakan Pertanian. Banten
- Ritohardoyo, Su. 2000, *Strategi Peningkatan Pendapatan Penduduk Perdesaan: Kasus Penduduk Perdesaan Sekitar Hutan Negara di Daeah Istimewa Yogyakarta*. *Majalah Geografi Indonesia*. Volume 14 Nomor 2, September 2000, p 57-73
- Sagala, S., N. Okada, et al. (2009). Modeling the social resilience of mountain communities under volcanic risks. *Systems, Man and Cybernetics, 2009. SMC 2009. IEEE International Conference on*.
- Sagala, S., N. Okada, et al. (2009). "Predictors of Intention to Prepare for Volcanic Risks in Mt Merapi, Indonesia." Journal of Pacific Rim Psychology **3**(2): 47-54.
- Sleman Regent Regulation No. 20 Year 2011 about Merapi Volcano Disaster-Prone Area
- Soetrisno, N. 2002. *WAJAH KOPERASI TANI DAN NELAYAN DI INDONESIA : SEBUAH TINJAUAN KRITIS*. Workshop Pemberdayaan Ekonomi Rakyat, Tani dan Nelayan, Badan Pengembangan Tani, Nelayan dan Universitas, Koperasi Amanat Nasional. 30 Juli 2002. PKBI-Jakarta
- Thouret, J. C., F. Lavigne, et al. (2000). "Toward a revised hazard assessment at Merapi volcano, Central Java." Journal of Volcanology and Geothermal Research **100**(1-4): 479-502.
- Voight, B., E. K. Constantine, et al. (2000). "Historical eruptions of Merapi Volcano, Central Java, Indonesia, 1768-1998." Journal of Volcanology and Geothermal Research **100**(1-4): 69-138.
- [www.belantaraindonesia.org/2011/05/sejarah-gunung-merapi.html?m=1](http://www.belantaraindonesia.org/2011/05/sejarah-gunung-merapi.html?m=1)
- [www.kecamatan.slemankab.go.id/cangkringan](http://www.kecamatan.slemankab.go.id/cangkringan). 14-05-2012: 23.42

[www.nakertransjogjaprovo.go.id](http://www.nakertransjogjaprovo.go.id)

Walker, J., B. Mitchell, S. Wismer. (2001). Livelihood Strategy Approach to Community-Based Planning and Assessment: a case study of Molas, Indonesia. *Impact Assessment and Project Appraisal*. 19:4, 297-309

Wilson, T., G. Kaye, et al. (2007). Impacts of the 2006 eruption of Merapi volcano, Indonesia, on agriculture and infrastructure, University of Canterbury. *Geological Sciences*.

Young, K. D., B. Voight, et al. (2000). "Ground deformation at Merapi Volcano, Java, Indonesia: distance changes, June 1988–October 1995." *Journal of Volcanology and Geothermal Research* **100**(1–4): 233-259.



## Annex 2 - The scoring base on household livelihood assets

(modified from Bishop, 2005)

Characteristics	Scoring system		
	Low (up to 2 points)	Middle (3 points)	High (4-5 points)
<b>Human Asset</b>			
Household head;			
- Age	Elderly, more than 60 years	50 – 60 years/under 30 years	30 -5 50 years
- Sex	Female	Male/female	Male
- Education	Uneducated/ illiterate	Primary/literate	Secondary/above
- Skill	No/limited skill,	Some skill/not as regular job	Skill as main job
- Training	Never enroll any of it	Some, <5	Active
- Health	Poor health	Some health problems	Health
Household member	1 – 2	3 - 4	>4
Household labor	1	2 – 3	>3
<b>Natural Asset</b>			
Land	<5,000 m <sup>2</sup>	5,000 – 20.000 m <sup>2</sup>	>20,000 m <sup>2</sup>
Livelihood diversification	No	Limited	>3
Access to resource	No	Some	Good
Cultivated Land	No	Some	All cultivated
Farm yield	No	For self consumption	For sale
Farming crops	No	Limited	Seasonal & annual
Livestock	No	1–2	>2
<b>Physical Asset</b>			
House condition	Semi-permanent	Permanent, up to 36 m <sup>2</sup>	Permanent, > 36 m <sup>2</sup>
Utensil availability	Very limited	Limited/some	Complete furniture
Farm tool	Basic hand tools	Some machines	Machines tools
Farm input	Local seeds, no fertilizer	Hybrid/local seeds, fertilizer	Hybrid seeds, fertilizer, herbicides
Vehicle	No	1 motorcycle	>1 motorcycles/car
<b>Financial Asset</b>			
Access to credit	None	Limited	Access to credit institutions
Remittance	None	Limited	Significant
Saving	None	Limited	Various forms of saving
Regular income	<Rp. 218,042.00	Rp. 218,042.00 – Rp. 892,660.00	>Rp. 892,660.00
<b>Social asset</b>			
Social group membership	No	Yes	Active
Reciprocal opportunity	No	Limited participation	Active