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## **Local Wisdom in Responding to Disaster of Merapi Eruption: Case Study of Wonolelo Village**

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### **Abstract**

The people who live in the Merapi area have been going on for years. Merapi is the most active volcano in Central Java that can threaten the community, but the community still exists today, of course, having local wisdom in responding to the eruption of Merapi. This study aims to determine the local wisdom of Wonolelo Village before, during, and after the Merapi eruption. In addition, to find out the historical relationship of the Merapi eruption to local wisdom and the challenges faced by Wonolelo Village in maintaining the sustainability of local wisdom. This research was used as a descriptive qualitative method. The method of collecting data is done through observation, in-depth interviews, and documentation. Data sources of this study are community leaders, spiritual leaders, and people who are more than 70 years old. Analysis of the data used is sourced triangulation based on the Miles & Huberman model. The results showed that local wisdom in responding to the Merapi eruption in Wonolelo Village still exists today. Local wisdom is divided into three segments, namely before, during, and after the eruption of Merapi. Local wisdom before the Merapi eruption is a notification that Merapi eruption activity will occur. Local wisdom in Wonolelo Village has challenges in the form of modernization and not running the local wisdom relay to young people.

Keywords: Disaster, Local wisdom, Merapi volcano.

### **1. Introduction**

Merapi is unique from various points of view. Merapi is seen by experts as being the most active volcano in Indonesia. Merapi eruption is famous throughout Indonesia and even the world. The history of the biggest Merapi eruption is the Volcanic Explosivity Index (VEI)

4. The Volcanic Explosivity Index (VEI) 4 eruption occurred in 1872 with a recorded death toll of 200 and in 2010 recorded 367 fatalities. (Voight et al, 2000; BNPB, 2010; Gertisser et al, 2012). Merapi eruption is still ongoing, in 2018 several eruptions occurred, resulting in an increase in the status of Merapi from the Normal level to the Alert level (BPPTKG, 2018; PVMBG, 2018). Merapi's status level is still on alert in 2019. Merapi launched a hot cloud with a sliding distance of seven kilometers on 2 March 2019 (BPPTKG, 2019; PVMBG, 2019). Merapi activity will continue, as long as the supply of magma from the bowels of the earth is still there.

Merapi activities are still ongoing, and then it has the potential to pose a threat to the community. There are 435,331 people living in the Merapi area, from four districts (Kabupaten Boyolali dalam Angka tahun 2018; Kabupaten Klaten dalam Angka tahun 2018; Kabupaten Magelang dalam Angka tahun 2018; Kabupaten Sleman dalam Angka tahun 2018). The number of people in the Merapi area is classified as large, and potentially affected by eruptions and / or secondary hazards in the form of lava. People living in the Merapi area find it difficult to evacuate and relocate to a safe place. There are several factors that make it difficult for people to be relocated, among others, life and livelihood activities that go on for generations, inner bonds to deceased ancestors, resources such as fertile land, abundant water, and natural beauty. Widodo, Nugroho & Asteria, (2017: 135) explained that: 61.6 percent of the population remained in the Merapi area due to environmental, economic, and social factors. People who have lived a long time, of course, have experienced several periods of Merapi eruption with various Volcanic Explosivity Index (VEI) and ways to act before, during, and after the eruption so that local wisdom arises in responding to Merapi.

Merapi volcano activity had been going on since  $\pm$  42,000 years ago (Mulyaningsih et al., 2006: 103). Based on history , 11 major eruptions have occurred since 3000 years ago on Mount Merapi (Andreastuti et al., 2006: 201). Merapi eruptions in the form of a stream of hot clouds, stone flares , and ash rain (Bardintzeff, 1984: 432). The history of the eruption certainly affected the high population in Merapi. The general public refers to Merapi as "*Simbah Merapi*". The Merapi people assume that the center of the kingdom is at the top of a mountain (Fatkhan, 2006: 111). Haba, (2008: 29) argues that *simbah Merapi* is scary, but also full of love for the villagers. *Simbah Merapi* is far from the palace that is not approached by

humans, but mbah Merapi approached and gave fertility to humans. The community and Merapi have been very closely linked and harmonious. Community interaction and Merapi form local wisdom.

Local wisdom in dealing with Merapi is certainly growing over time, the renewal of science and technology such as people living in the Merapi-Merbabu valley. The community in the Merapi-Merbabu valley is now potentially affected by the Merapi eruption because Merbabu no longer shows its volcanic activity. The Merapi-Merbabu Valley is to the north of Mount Merapi. Although the current Merapi eruption is dominant towards the south and west, but in 1954-1956 it headed north (Andreastuti et al., 2006: 202). The community already has local wisdom in the form of an early warning system through natural signs when an eruption will occur. The community also has the point of view that Merapi's activities are related to three types of natural supernatural spirits: mountain spirits, *segoro kidul* spirits (south sea), and *cikal bakal* (hereditary family)(Rokib, 2013: 11). People in the Merapi-Merbabu valley who still believe in the existence of "*Simbah Merapi, Simbah Petruk*" are difficult to agree to evacuate or relocate to a safe place, so it is necessary to identify local wisdom in the Merapi-Merbabu valley as an effort to synchronize local wisdom with government policy.

Previous studies related to the current study are understanding the character of the community is very effective in implementing disaster risk reduction programs (Andreastuti et al, 2019). Disaster knowledge is very effective if it has been developed since elementary school (Atmojo et al, 2018). Module development in learning related to local wisdom is one of the efforts to increase community knowledge related to disasters (Setiawan et al, 2017). Conflict resolution in disaster-prone areas must be resolved so that disaster risk reduction programs can be implemented properly (Lestari et al, 2016). Community-based economic management is very suitable for handling after natural disasters (Permana et al, 2017). Previous studies have not analyzed the condition of the community in detail in the event of a disaster, so studies related to local wisdom before, during, and after a disaster become very important to do.

Wonolelo village is not far from Merapi volcano. The people of Wonolelo Village generally have jobs as farmers. The residents of Wonolelo Village, who live not far from

Merapi, have experienced several eruption periods. Residents who experience the Merapi eruption period, of course, have experience in reacting. Hereditary experience in responding to the Merapi eruption formed a local wisdom in Wonolelo Village. This study aims to determine the local wisdom of Wonolelo Village before, during, and after the Merapi eruption. In addition, to find out the historical relationship of the Merapi eruption to local wisdom and the challenges faced by Wonolelo Village in maintaining the sustainability of local wisdom.

## 2. Methods

This research is a survey research using a descriptive qualitative method. Data is collected through in-depth interviews. Data sources of this study are community leaders, spiritual leaders, and people who are more than 70 years old. Analysis of the data used is sourced triangulation based on the Miles & Huberman model. The research location was in Wonolelo Village, Sawangan Sub District, Magelang Regency.

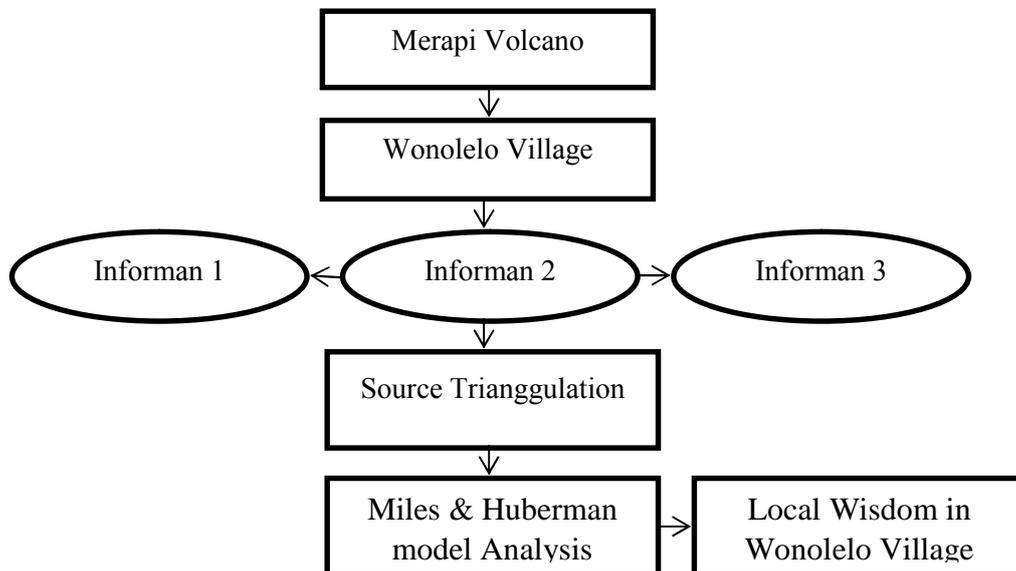


Figure 1. Research stages

Table 1. List of informants' names

Name	Status	Initial
Marpomo	Community leaders (Village Head)	M
Amirejo	Spiritual Figure (Dukun)	A
Tukimo	People over 70 years old (Farmers)	T

### 3. Results and Discussion

The research location was in Wonolelo Village, Sawangan District, Magelang District. Absolute location is at 431953 MT to 438158 MT and 9170087 MU to 9176080 MU. Wonolelo village has an area of 12.35 kilometer square. The population of Wonolelo Village is 6,361 with details of 3,274 men and 3,087 women. Population density of Wonolelo Village is 515 people / kilometer square (Kecamatan Sawangan dalam Angka, 2018). Wonolelo village has a buffer distance of about 8 kilometers from the peak of Merapi.

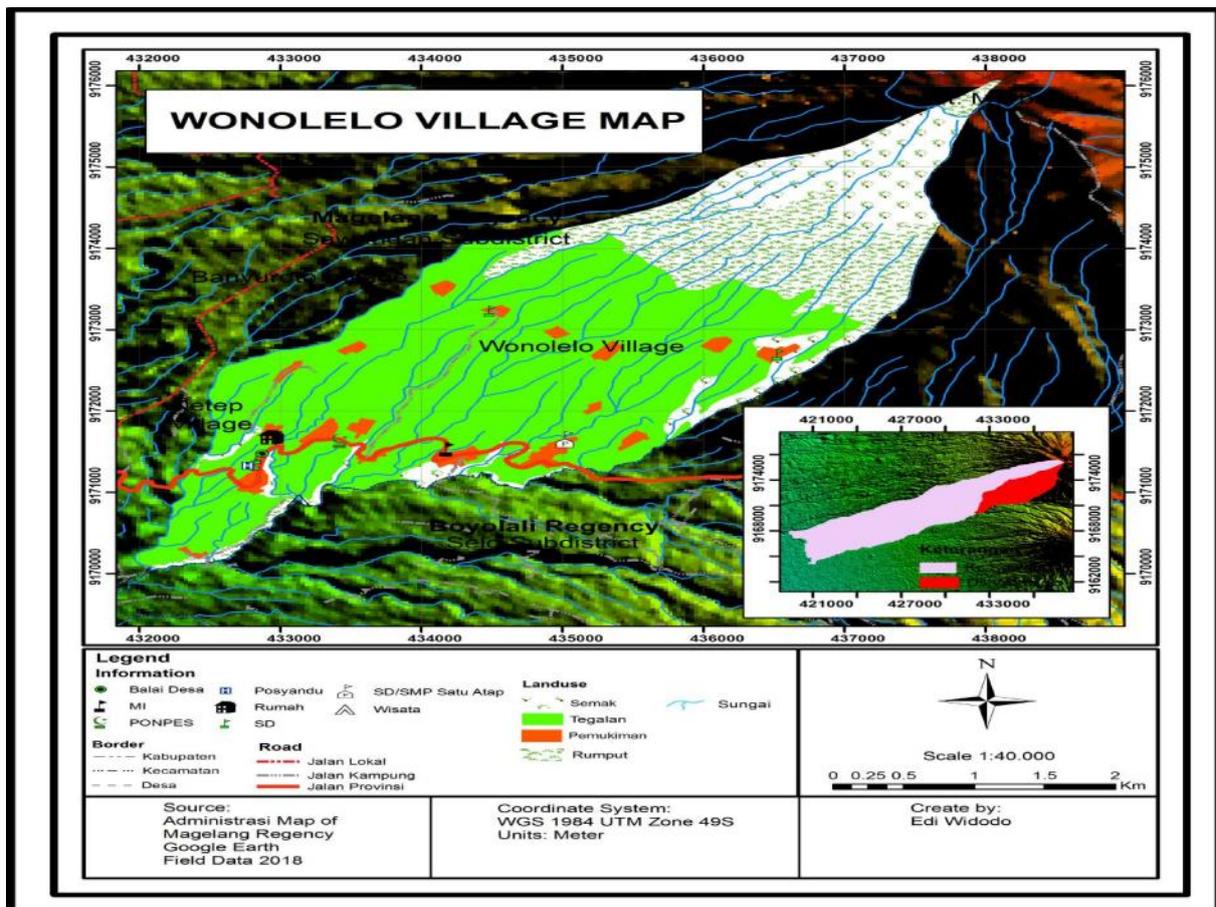


Figure 2. Location of study area

### 3.1 Local wisdom in Wonolelo Village

#### a. Before the Merapi eruption

Results of interviews with Mbah T (age 81 years): "*Mbiyen pas gluduk gunung Pencar, ono wong lagi mantu manten, terus ono bocah cilik ngandani nang gon wong manten kuwi, yen Simbah Merapi, arep mlaku utawa arep lewat, kon podo minggir, eh malah do ora minggir lan nyeneni bocah cilik mau, terus ujug-ujug gluduk gunung lah sing ora minggir ya podo mati, sing minggir podo slamet* (Friday, 6/21/2019)" a "When there was an eruption of Mount Merapi, which led to the scatter area, there were people who were carrying out a wedding celebration, then there were small children telling them that Simbah Merapi would go or pass (erupt) the community was expected to stay away from the area, but instead on heeded the information and even the public scolded the child, finally Merapi erupted, finally those who did not move away from the area died and those who stayed away from the area survived." Mbah A as a Dukun (86 years old): "*Ndisik pas arep ono gluduk gunung, ono cah cilik ngomongi wong lagi ndudah letong sapi, ngandani yen Simbah Merapi arep arak-arak, nanging wong sing lagi nimpal mau ora nggugu malah ngusir bocah cilik lanang mau, nah pas cah cilik kuwi mau lungo seko ndeso kono mau, teko langsung mabur njup ngilang, jebule bocah mau utusane Simbah Merapi. Banjur ora suwe Merapi mlaku* (Wednesday, 05/23/2018)" means "Before the eruption of Merapi, there was a small child who told the person who was cleaning the cowshed, the little boy told me that Merapi would erupt, but the person who was cleaning the cage (nimpal), instead chased the boy earlier, then the child flew and disappeared, apparently the child was a messenger from Simbah Merapi. Not long ago Merapi erupted.

Mbah A as a Dukun (spiritual figure) (age 86 years): "*Menowo Simbah Merapi, arep arak-arak aku dinei wisik lewat mimpi, dino opo arep arak-arak, bar kuwi kene slametan utawa gendurinan* (Wednesday, 05/23/2018)" it means "If an eruption will occur, then I will be given information through dreams, what day Merapi will erupt, after which here do slametan or genduri events". Based on this information, it can be understood if there is local wisdom that before the Merapi eruption certain people such as spiritual figures were given

magical information. The "*Slametan*" or "*Genduri*" procession is carried out by inviting neighboring neighbors so that community gatherings occur. When the people gather they are given information from the spiritual leader that, Merapi will erupt on a certain day (according to the information obtained by a spiritual figure) the community is expected to remain calm and alert. The results of an interview with M, that: "The people of Wonolelo Village still believe in magical matters related to events before the Merapi disaster (Friday, 09/20/2019)". Local wisdom in Wonolelo Village before facing the Merapi eruption still exists.



Figure 3. Informant A is burning incense in the "*Genduri*" procession (Source: Field data 2018 & 2019)

#### b. During the Merapi eruption

The results of the interviews of the three informants who are domiciled on the southern slopes of Merbabu that, the community should not point towards the mountain, because the community became focused on the eruption of the mountain and forgot to escape. The public must not ring a block, because it can cause panic. If people panic, it will disrupt the evacuation process. How to tell the public through codes without noise. For example, when you wake up a family member who is asleep by "*tangi, simbah arep mlaku*" while slowly awakened. "*tangi, simbah arep mlaku*" means that Merapi Mountain will experience an eruption and the awakened family members will understand. The informant as a whole gave the same explanation when the Merapi eruption occurred. A, add that explanation "*Nek pas Merapi mlaku, terus udan awu asline ora oleh nutup irung (masker) kanggo ngehormati Simbah Merapi, wong awune kuwi malah nyuburke tanduran*(Wednesday, 05/23/2018)". the public is actually not allowed to wear a nose covering (mask) when an eruption occurs because to honor the "*Simbah Merapi*".

c. After the Merapi Eruption

The results of the interview with T explained that, after the Merapi eruption to remind the family through the song *Kinanthi*, namely:

*“Kinanthi pinongko pimut, nuju dinten senin pahing, ing wulan jumadil awal, catur ngesti boyowati, pajujuk kulo, catur ngesti januari (Friday, 6/21/2019)”*.

The meaning of song is to warn the eruption of Merapi in the past. The song explained that the Merapi-Merbabu valley community already had efforts to reduce the impact of the Merapi eruption. Through song, the Merapi eruption that had occurred and led to the Merapi-Merbabu valley became easy to remember and used as information material for the next generation. Information material can be used as a disaster mitigation effort. The results of an interview with A, that: "*Mergo diparingi keslametan kabeh, syukuran nganggo gendurinan (Wednesday, 05/23/2018)*". The informant explained that although after experiencing the disaster in the form of the Merapi eruption, but still grateful because it was still given safety. The results of interviews with M, that: "*Rehabilitation efforts from the village government, in collaboration with the district government. Data collection is done immediately to help the community (Friday, 09/20/2019)*".

After the Merapi eruption, the community and the government worked together to rebuild the affected villages. The community has local wisdom to respond to the Merapi eruption, namely through the song "*Kinanthi*", and through "*Genduri*" to express the gratitude that God is still given salvation. The village government is rehabilitating, and carrying out relief efforts for affected communities is a form of support and does not conflict with existing local wisdom.

### 3.2 The history of the Merapi eruption relates to local wisdom

Mount Merapi has a history of eruptions with periods of repetition of different times, different intensities, and cause a number of fatalities. Merapi can cause major eruptions or small eruptions that do not care so that it can cause disasters that are unprecedented in the

history of Merapi (Voight et al., 2000: 69). Therefore, the government and the community need intensive coordination so that integrity can be established in responding to the Merapi eruption.

Table 2. History of events and victims affected by the Merapi eruption

No	Years	V.E.I	Number of Victims	Interval (years)
1	1550	3	-	-
2	1555	3	-	5
3	1560	3	-	5
4	1585	3	-	15
5	1588	3	-	3
6	1658	3	-	70
7	1663	3	-	5
8	1672	3	3,000	9
9	1677	3	-	5
10	1678	3	-	1
11	1745	2	-	67
12	1752	2	-	7
13	1755	2	-	3
14	1768	2	-	13
15	1786	1	-	18
16	1791	2	-	5
17	1797	1	-	6
18	1807	1	-	10
19	1810	1	-	3
20	1812	1	-	2
21	1820	1	-	8
22	1822	3	-	2
23	1828	2	-	6
24	1832	3	-	6
25	1836	3	-	4
26	1840	1	-	4

27	1846	3	-	6
28	1849	3	-	3
29	1861	2	-	3
30	1862	2	-	1
31	1865	2	-	3
32	1869	2		4
33	1872-1873	4	200	3
34	1878-1880	2	-	5
35	1883-1884	1	-	3
36	1885-1887	1	-	1
37	1888	2	-	1
38	1889	1	-	1
39	1891-1894	2	-	5
40	1897	2	-	3
41	1902-1904	2	-	5
42	1905-1906	2	-	1
43	1907-1908	1	-	1
44	1913	1	-	5
45	1915	1	-	2
46	1920	3	-	5
47	1923	2	-	3
48	1924	1	-	1
49	1929	3	-	5
50	1930-1931	3	1,369	1
51	1933-1934	2	-	2
52	1939	2	-	5
53	1942	3	-	3
54	1944	2	-	2
55	1948	2	-	4
56	1953	3	-	5
57	1953-1956	2	64	3
58	1957-1959	1	-	3

59	1961	3	6	2
60	1967	2	-	6
61	1967-1969	2	3	2
62	1971	1	-	2
63	1972	3	-	1
64	1976-1979	2	28	4
65	1984	3	-	5
66	1984-1991	2	-	7
67	1992-1993	2	-	1
68	1994	2	66	1
69	1996	2	-	2
70	1997	2	-	1
71	1998	2	-	1
72	2001	2	-	3
73	2006	1	2	5
74	2010	4	367	4
75	2018	0	-	8
total			5103	

Source: Voight et al,(2000); Wilson et al., (2006); BNPB,(2010); Gertisser et al, (2012); Preece et al, (2014), Dibyosaputro et al., (2016): 3; Analisis (2018).

A historical record of the largest eruption is in 1872-1873 and 2010. This eruption reached the volcanic Explosivity Index (VEI) 4 of the lowest liver 1. Merapi eruption in 2010 caused 367 people to die (BNPB, 2010 and Jousset, 2010). Vulnerable time of eruption , which reached Volcanic Explosivity Index (VEI) 4 is 138 years. The most frequent Merapi eruption interval is five years. The fastest interval of the Merapi eruption is one year. The longest occurrence of Merapi eruption is 70 years. The average interval of occurrence of Merapi eruptions is 5.8 years from 75 events. The number of victims during the Merapi eruption record was 5103 inhabitants. Mount Merapi again shows its activities. In 2018 several phreatic eruptions occurred. Chronology from June 1 to 2018. Rumbling accompanied by tremors was felt up to a distance of 8 km from the peak of Merapi, namely in Wonolelo Village. Mount Merapi eruption period is erratic, as evidenced in 2018 an eruption will occur and will be repeated as the history of the eruption of Merapi. The eruption of

Merapi which lasted a long time and repeated until now, forms local wisdom. Sibarani (2013) that local wisdom is the original knowledge of the community obtained from noble values to regulate the order of life so that peace and prosperity. Local wisdom also means wisdom (Ridwan, 2007). Local wisdom shaped the community to be wise in responding to the repeated eruptions of Merapi.

Modernization, reliance on gadgets, and social media are opportunities but they can also be challenges. Local wisdom has been known as a scientific instinct that is owned by the community from a hereditary experience. The Interrupted relay in an age group can cause the fading of local wisdom. Cahyadi (2013: 114) that, technological developments cause young people in Indonesia not to recognize local wisdom, which is generally not written. In fact, local wisdom in the form of the ability to face disasters is proven to maintain the existing civilization (Hardoyo et al., 2011; Marfai, 2011; Marfai & Hizbaron, 2011; Cahyadi, 2013). Wonolelo village has youth resources aged 15-24 years amounting to 1,136 people in 2017 (Kecamatan Sawangan dalam Angka, 2018), this is certainly increasing due to increasing population growth. The average number of young people who have a smartphone and social media makes them reluctant to learn about local wisdom to respond to disasters in Wonolelo Village.

Comparison with previous results of studies is local wisdom that begins to lose relay on children will easily become a vulnerability in responding to disasters. Magelang Regency has three aspects of vulnerability in addressing hazards, namely economic vulnerability, environmental vulnerability and structural vulnerability (Cho, Won, and Kim, 2016: 5). Adaptation to disasters must consider the condition of the community including local wisdom, it needs to be applied for various kinds of policymaking (Inaotombi and Mahanta, 2019). Disaster knowledge could be passed on to future generations, especially in disaster prone areas (Syahputra, 2019). Collaboration between the government and the community will increase community knowledge related to disaster reduction (Ikeda and Nagasaka, 2011). After a disaster occurs, the community must be the subject of development, while the government only supports the community's needs and activities back to normal (Kusumasari and Alam, 2012). Institutions are very important to increase community knowledge related to disasters (Daly, 2015).

The advantage of this research compared to previous studies is the depth of qualitative analysis that emphasizes at each stage in efforts to reduce volcanic eruption disaster. The results of this study contribute to each institution and community in collaboration to reduce disaster risk in depth to aspects of local wisdom at each stage of disaster. Wonolelo village also has the same vulnerability, because it is close to the peak of Merapi, the majority of farmers, structurally the settlements are not yet resistant to earthquakes and local wisdom has begun to disappear. Local wisdom can be integrated with government policies in tackling the disaster of the Merapi eruption so as to avoid casualties.

#### **4. Conclusion**

Local wisdom in responding to the Merapi eruption in Wonolelo Village still exists today. Local wisdom is divided into three segments, namely before, during and after the eruption of Merapi. Local wisdom before the Merapi eruption is a notification that Merapi eruption activity will occur. Local wisdom during the Merapi eruption in the form of a prohibition not to do activities that could cause panic and attention of the masses, so forget to save themselves immediately. Local wisdom after the Merapi eruption took the form of an invitation to the community to interpret it as a blessing, not a disaster and the community immediately started their activities as before. Local wisdom in Wonolelo Village has challenges in the form of modernization and not running the local wisdom relay to young people. The government should look at local wisdom as a barrier to policy, but it can be a good collaboration in an effort to respond to the catastrophic eruption of Merapi. Local wisdom, generally not written and not massively taught by parents to children or youth, can cause the loss of the relay of perpetrators of local wisdom, so local wisdom education needs to be held through formal and non-formal education.

#### **Conflict of Interest**

The authors declare that there is no conflict of interest with any financial organization regarding the material discussed in the article.

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