doi: 10.29244/jli.v17i2.62922

ISSN-P: 1907-3933
ISSN-E: 2087-9059

Community-based Landscape Planning in Kampong Batu Lonceng within Lembang Faults Mitigation Framework

Budi Faisal[1,*], Mohammad Zaini Dahlan[1], Widjaja Martokusumo[1], Medria Shekar Rani[1], Rr. Diah Asih Purwaningrum[1], Widyastri Atsary Rahmy[4], Izaza Binta[1], Astyka Pamumpuni[2], Irwan Meilano[2], Hirohide Kobayashi[3], Shozo Shibata[3]

[1]School of Architecture, Planning, and Policy Development, Institut Teknologi Bandung
[2]Faculty of Earth Sciences and Technology, Institut Teknologi Bandung
[3]Graduate School of Environmental Studies, Kyoto University
[4]Faculty of Engineering and Design, Institut Teknologi Sains Bandung
*Email: bfaisal@itb.ac.id

Article Info

Received: 28 February 2025
Revised: 19 May 2025
Accepted: 19 May 2025
Published: 01 October 2025

Keywords
community-based landscape planning
Lembang Fault
natural disaster
relocation
traditional belief

ABSTRACT

Lembang Fault is one of the active faults produced by the subducted Indo-Australian plate beneath the Eurasian plate along Java Island. It has a high potential for hazard due to its proximity to densely populated areas, including Kampong Batu Lonceng, located approximately 150 meters from the fault. This paper explores the interplay between philosophical beliefs, emotional attachment to the land, natural hazards, land availability for relocation, and applicable regulations in Kampong Batu Lonceng. A three-phase landscape planning regarding the Kampong settlement disaster mitigation was proposed based on data collected from the community stakeholders through field surveys, initial interviews, and discussion. The first phase proposed that the community stays in the existing area with minor preventive developments. The second phase proposed that the community moves across the river and move further to a new, safer location in the third phase. The first phase is the most reasonable since the community does not have to move to another location but needs to revitalize the forest. The second and third phases can only be pursued when the community understands the potential disaster of the fault. Moreover, the third phase requires that the government provide a safer zone for the community to relocate. Another discussion with the community stakeholders shows an agreement towards the first and the third phases and a reluctance over the second phase. However, although many regulations have already taken place formally, enforcing them towards implementation in a traditional community needs to be handled very carefully.

INTRODUCTION

Disaster Literacy and Mitigation in Indonesia

According to the Meteorological, Climatological, and Geophysical Agency (*Badan Meteorologi, Klimatologi, dan Geofisika*/BMKG) report in 2023, Indonesia experienced 10,789 earthquakes of varying magnitudes, primarily triggered by numerous active faults (CNN Indonesia 2023). The report mentioned that earthquakes of more than 5 magnitudes happened 219 times, and the two biggest quakes happened with tsunami potentials in Maluku (7.9 magnitude) on January 10th, and in Mentawai, West Sumatra (7.0 magnitude), on April 25th.

Although Indonesia is prone to earthquakes due to its active faults (Figure 1), its disaster mitigation system does not yet meet universal safety standards. Moreover, disaster public literacy is also still very minimal (Nugroho 2022). For example, unlike Japan and other earthquake-prone countries, the Indonesian government has not adequately conducted public education on the risks and impacts of disasters and what to do or not to do when such disasters occur (Nugroho 2022).

In his speech at the opening of the seventh session of the Global Platform for Disaster Risk Reduction (GPDRR) on May 25th, 2022, in Bali, Joko Widodo, the former president of Indonesia, stated that Indonesia was committed to Disaster Risk Reduction (DRR). Unfortunately, until now the government has not placed DRR and disaster mitigation efforts as a focus of the country development policy (Nugroho 2022). Between 2011 and 2022, Indonesia has already issued 23 disaster-ready National Standards, including the government-published National Standard (SNI) 1726 about building and non-building infrastructure for earthquake resistance. However, these standards are not reliably applied (Nugroho 2022).

Scientists published a report in Nature, reminding the possibility of a megathrust earthquake and potential tsunamis in south Java (Widiyantoro *et al*. 2020). This report attracted broad attention nationwide and called for reinforcement of the existing tsunami early warning system, especially in Java, Indonesia most densely populated island. Unfortunately, the government has not taken any appropriate measures to mitigate the potential hazards.

The two most recent earthquakes, triggered by the Cimandiri Fault in Cianjur Regency (November 2022) and an unmapped fault in Sumedang Regency (December 2023), finally prompted many disaster-related experts to speak out about how weak our disaster mitigation system is. They also served as a wake-up call for Indonesia to build up the capacity of the government and the community in natural disaster resilience.

doi: 10.29244/jli.v17i2.62922

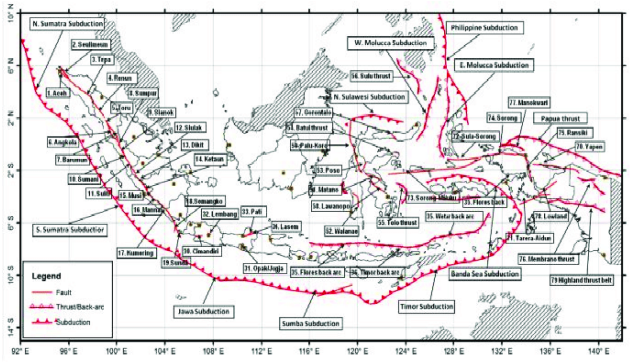

Figure 1. Tectonic Map of Indonesia
Source: Ministry of Public Works 2010 in Nugroho 2020

The Lembang Fault

West Java has a complex tectonic structure since the region is affected by the Java subduction zone and faults (Supendi *et al.* 2018). The subducted Indo-Australian plate beneath the Eurasian plate along Java Island has produced some active faults in West Java, including Baribis, Cimandiri, and Lembang (Figure 2). These faults pose high potential hazards because they are close to densely populated areas (Supendi *et al.* 2018).

On November 21st, 2022, a 5.6 magnitude earthquake originating from a previously unidentified fault line shook Cianjur, West Java. The quake had not only destroyed buildings, houses, and infrastructures, but also claimed at least 334 casualties, wounded 593 others, and made 114.683 people homeless overnight (Nugroho 2022). According to the BMKG, the quake was a shallow or surface quake, which did not need to be destructive. The level of destruction was mainly due to the building structure and infrastructure not being ready for disaster (Nugroho 2022).

On New Year Eve of December 31st, 2023, a 4.8 magnitude (5 km deep) earthquake in the Sumedang District area, West Java, caused at least 1,300 buildings to collapse (Marliyana 2024). Fortunately, there were no casualties, but only some people got hit and injured by building damages according to the report from the West Java Regional Disaster Mitigation Agency (*Badan Penanggulangan Bencana Daerah*/BPBD). BMKG said that this earthquake was triggered by the movement of an unmapped active fault that may be associated with the Cileunyi-Tanjungsari fault (Herlambang 2024). This fault is close to the Lembang Fault, around 3 kilometers, where Kampong Batu Lonceng, the study area of this research, is located.

Lembang Fault is a major fault in western Java that skirts around 10 kilometers on the northern edge of West Java capital, Bandung City, one of Indonesia largest cities, just south of the active Tangkuban Perahu volcano. Although it has no recorded or historical large earthquakes, the fault shows obvious geomorphic evidence of recent activity and has long been thought to be active (Daryono *et al.* 2019). This fault zone is visible as a prominent landmark of slope breaks between a series of east-west-trending linear ridges separating the north Bandung highland from a wide and flat Lembang basin farther to the north (Daryono *et al.* 2019).

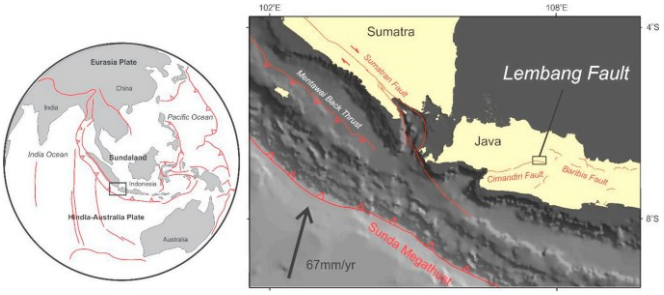

Figure 2. Three West Java Major Faults: Lembang Fault, Cimandiri Fault, and Baribis Fault
Source: Daryono *et al.* (2019)

Community Traditional Belief

"*Kabuyutan*" is a term that refers to a sacred area or structure and is often associated with spiritual beliefs and rituals within the Sundanese community in the West Java region, Indonesia. *Kabuyutan* can generally be understood as a specific location, such as a settlement area, forest, or certain natural site, with cultural, religious, archaeological, or traditional significance (Dahlan 2017; Dahlan *et al.* 2022; Perdana and Wahyudi 2020). It is also used to define the sacred place allocated for the center of knowledge, settlement of priests or religious leaders, or conservation areas. This term was occasionally used by philologists and archeologists concerned with Sundanese studies. The evidence of its existence can be found in the ancient Sundanese manuscript (Dahlan *et al.* 2022).

According to Dahlan *et al.* (2022), the physical features of *kabuyutan* landscape can be easily distinguished from their surrounding landscape because it is mainly covered by dense vegetation or marked by a particular sacred element that shaped their structure. The sacredness of *kabuyutan* has been understood over generations, and its existence has been protected by the customary rule in which it was perceived as taboo by its community. Sundanese people argued that accessibility restriction is the main rule in managing *kabuyutan*. Therefore, there are two types of status for *kabuyutan*, namely, restricted access and limited access. Common people might be allowed to enter the areas with limited access on permission from the custodian, whereas they are strictly prohibited from entering the restricted ones.

Based on the definition of *kabuyutan* as mentioned above, Kampong Batu Lonceng the study area of this paper, cannot be categorized as an authentic *kabuyutan* for several reasons. First, there is no customary rule that is agreed upon and followed by the whole community and continuously passed over from generation to generation. Second, there are no such rules as restricted access into a particular area within the kampong, while limited access is applied only when there is a visitor who wants to visit a sacred site.

Research Objective

This research aims to challenge the future landscape planning of Kampong Batu Lonceng within the Lembang Faults mitigation framework through a community-based approach. It develops landscape planning strategies based on inputs from community leaders and primary stakeholders, mainly leaders representing the Kampong Batu Lonceng community. Views on philosophical beliefs, emotional attachment to the land, and mitigation of natural hazards across different community groups in Kampong Batu Lonceng are inquired and identified. Those views become the foundation for developing three phases of future landscape plans of Kampong Batu Lonceng to accommodate various possibilities of future scenarios based on the community preference, the availability of a new place for relocation, and the currently applicable regulations. Finally, the same primary stakeholders are expected to provide feedback on the proposed plans to determine the best option for implementation.

METHODS

Study Area

Geographically, Kampong Batu Lonceng (ca. 1,290 m above sea level) is situated approximately 10 kilometers north of Bandung City in the Lembang District area of West Java

doi: 10.29244/jli.v17i2.62922

Province. The kampong is part of Suntenjaya Village, West Bandung Regency, which consists of two *rukun warga* (citizen association) with a population of fewer than 1,000 people (696 people; Loen 2023) and fewer than 300 households (282 households; Loen 2023). It is known as a tourist village, and its inhabitants are predominantly characterized as coffee farmers and cattle ranchers (Wulandari 2018).

Kampong Batu Lonceng is located around 150 meters from the Lembang Fault (Figure 3), a potential earthquake source in the middle of West Java province (Daryono *et al*. 2019). The village morphological structure has formed a linear development parallel to the Lembang Fault line (Figure 4). This fault zone is a notable feature of slope breaks between a range of east-west-aligned ridges separating the northern Bandung highlands from the expansive and flat Lembang basin located further north (Daryono *et al.* 2019). Among the potential disasters in Kampong Batu Lonceng due to its proximity to the fault are surface rupture, land shaking and cracking, seismic activity, landslides, and rock falls.

Data Collection

This research collected data through site visits and field surveys, including in-depth interviews and discussions with relevant stakeholders. Data collected from site visits includes the study area physical characteristics, such as topography, natural features (e.g. river, hill, fault, and plain area), landscape elements (e.g. vegetation stratifications for conservation and landslide protection), archaeological sacred sites, settlement area, geological features, and position of the remnant of rockfalls.

In-depth interviews and discussions were conducted with local respondents who are the primary stakeholders of Kampong Batu Lonceng. Four groups of respected leaders (Table 1) were selected as the respondents based on the kinship relationships among the Kampong Batu Lonceng community. The selection was made using a snowballing effect and included representations of the respected caretakers of archaeological sacred sites, religious leaders, traditional leaders, and youth leaders. An earthquake-related expert is also involved in the research team to validate collected data. The methods, in-depth interviews and discussions, were selected to collect authentic qualitative data of views on philosophical beliefs, emotional attachment to the existing land, and mitigation of natural hazards across different perspectives among the community of Kampong Batu Lonceng to understand the study area socio-cultural context better.

Figure 3. Location of Kampong Batu Lonceng Site
Source: Redrawn after Google Map by Authors 2023

Figure 4. Aerial View from the North of Kampong Batu Lonceng Site
Source: Authors 2023

Table 1. List of respondents (primary stakeholders of Kampong Batu Lonceng Community).

Leaders Group #	Community Group Representatives	Respondent Code
1	Leaders of the New Batu Lonceng *Kabuyutan* Foundation	R1
2	Caretaker of the Batu Lonceng Archaeological Sacred Site	R2
3	Youth organization leader (*Karang Taruna*)	R3
4	Religious leaders	R4

Site visits and surveys were conducted within approximately ten months, from November 2023 to August 2024. The first visit was on the 29th of October 2023 for site inventory and initial interviews and discussions. The second visit was on the 4th of February 2024 for the first in-depth interviews. An additional online discussion was held on the 13th of July 2024. The third and fourth visits were held on the 8th and 24th of August 2024 for follow-up in-depth interviews and discussions regarding the feedback from the primary stakeholders on the results of the proposed landscape plan for future Kampong Batu Lonceng.

Analysis

Two analyses were conducted, those are: (1) physical analyses of the site and (2) socio-cultural analyses of the community views on disaster mitigation based on the cultural context, philosophical beliefs, and emotional attachment to the land. The physical analyses were completed by mapping the Kampong Batu Lonceng site existing condition (Figure 5 and Figure 6), which mainly focused on the mapping of the existing settlement/housing area, agriculture and pastoral area (also known as *Leuweung Baladahan*), Perhutani conservation area, buffer zone, and scattered natural stones (remnants of rockfalls). The map also showed the site location toward the Cikapundung River and Lembang Fault. From the site existing conditions mapping, we analyzed the probability of big stones destroying the whole *kampong*/village area when a landslide happened and followed by rockfall through a simulation (Figure 7).

The Kampong Batu Lonceng community responses regarding philosophical beliefs, emotional attachment to the land, and natural disaster mitigation were sought through in-depth interviews and discussions with selected respondents of respected leaders as the community representation. The questions focused on identifying similarities and differences in perspectives across different community groups. Philosophical beliefs on nature protection and disaster, level of disaster awareness and readiness, and willingness to relocate are the key information that was concluded to develop a landscape plan for mitigation based on the community need while preserving the local wisdom.

doi: 10.29244/jli.v17i2.62922

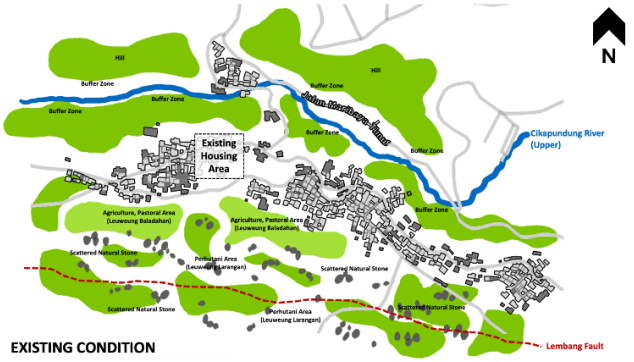

Figure 5. Existing condition of Kampong Batu Lonceng

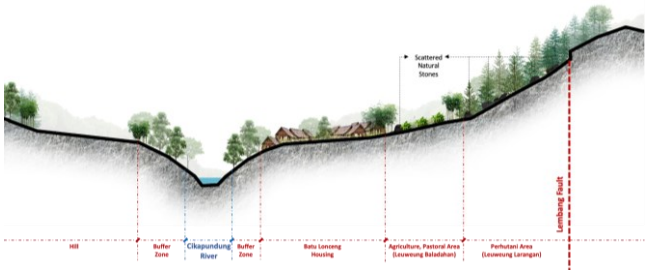

Figure 6. Section of existing Kampong Batu Lonceng

Figure 7. Remnants of stones near Kampong Batu Lonceng
Source: Authors 2023

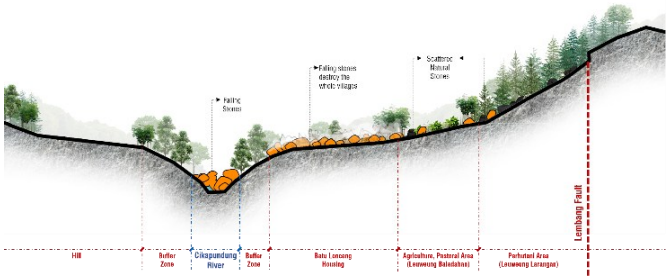

Figure 8. Simulation of falling stones when a landslide and rockfall happens

RESULTS AND DISCUSSIONS

Existing Situation of Kampong Batu Lonceng

In terms of the existing situation, Kampong Batu Lonceng is spatially located in the northern part of the Lembang fault, on its hillside (Figure 5). The kampong has been developed linearly parallel to the 29 km length fault line in response to the hilly, steep area along the fault (Figure 6). In the north of the west-east linear tiny settlement, there is the Cikapundung River as a boundary to the kampong. There are steep-sloped buffer zones on both northern and southern sides of the river, where the one on the south serves as a buffer for the residential area. These buffers consist of mixed plants, including bamboo, wood trees, and fruit trees. The distance to the active Lembang fault ranges from 100 to 200 m. The area between 50 to 100 m from the active fault is dedicated to plantation and farming activities.

Through site surveys, we identified and documented abundant remnants of stones near the Kampong Batu Lonceng area (Figure 7). The stones sizes range from small to quite big, some bigger than a normal Indonesian man size. The stones originated from the top of the Lembang fault that fell toward the kampong when a natural disaster, such as an earthquake followed by a landslide, happened. It is most likely that the big stones can destroy the whole kampong and cause harm to the inhabitants if no further disaster mitigation is applied (see the simulation in Figure 8).

Primary Stakeholders of Kampong Batu Lonceng

This study challenges the perspectives among different community groups in Kampong Batu Lonceng on how they view disaster and mitigation efforts within the Lembang fault disaster mitigation framework. Through interviews and discussions, we identified how different community groups view awareness and preparedness for disaster as they live next to the Lembang Fault, which is prone to natural disasters such as earthquakes, landslides, and rockfalls. Four clusters of respected leaders in Kampong Batu Lonceng were selected as respondents representing primary stakeholders of the community various groups: (1) leaders of the New Batu Lonceng Kabuyutan Foundation (Respondent Code R1); (2) the caretakers of the archaeological sacred sites (Respondent Code R2); (3) youth leaders from the *Karang Taruna* organization (Respondent Code R3); and (4) religious leaders (Respondent Code R4).

Leader of the New Batu Lonceng Kabuyutan Foundation

The New Batu Lonceng *Kabuyutan* Foundation was established in 2012. Based on interviews and discussions with different community groups, it is understood that unlike the Sundanese Kabuyutan, which has long established traditional and cultural evolutionary embedded system, this 'new' *Kabuyutan* foundation seems to be formally created in the interest of government-funded projects that deal with cultural value preservation. This might be why the foundation does not have a strong root in the Kampong Batu Lonceng community. There are many resistances from other community groups, including from the caretakers of the archaeological sacred sites, the religious leaders, and the youth organization.

According to the leader of the 'New' *Kabuyutan* Foundation (R1), Kampong Batu Lonceng has three philosophical beliefs as the foundation for the community daily activities, including dealing with disaster. The first is Forest Conservation (*Jaga Leuweung*), which means protecting the forest or environmental ecosystem. Secondly, Keep the Tradition (*Jaga Tradisi*) or preserve the adaptive evolution of cultural heritage. The community periodically holds special cultural and spiritual rituals as a form of gratitude for being given protection and safety. These events are also held to anticipate or prevent misfortunes and bad luck. Thirdly, Persistence in Praying (*Jaga Doa*) or continuously keep praying, which is strongly related to a particular spiritual belief of the local people. With this belief, they believe they are not in a state

of "disaster preparedness" but "ready to face disaster" or "disaster ready." Most of the elderly in the community, including the caretakers of the archeological sacred site (R2), agree with this belief. However, the young generation from the Youth Organization (*Karang Taruna*) (R3) and the Religious Leaders mostly disagree (R4).

Caretaker of the Archeological Sacred Site

Kampong Batu Lonceng is part of the historically developed settlement, which was already cultivated since the Neolithic period. Several objects categorized as archaeological features still exist in the area and its surroundings, including the protected Batu Lonceng sacred site (Perdana dan Wahyudi 2020).

The Batu Lonceng sacred site, named after the village, is located at a higher position in the eastern part of the kampong, managed by the same local family from generation to generation as a caretaker of the sacred site. This site has been designated as an archaeological site and serves as a spiritual place for the traditional community from the surrounding area to visit. The active Lembang fault passes exactly through the location of the Batu Lonceng site. In this site, there are two important stones, namely Batu Lonceng, a look-like bell (*lonceng*) andesite stone (*batu*), and Batu Kujang stone, a look-like cleaver (*kujang*) andesite stone (Figure 9).

According to the caretaker of the sacred site (R2), the Batu Lonceng stone possesses the power to help and protect someone by praying to God while carrying it. Furthermore, it is believed that this stone can also function as an early warning system by producing a bell sound, while the Batu Kujang stone will move down from its position when a natural hazard happens. This belief, however, is not completely believed by the whole community of Kampong Batu Lonceng. Some parts of the community, including the religious preachers and the young generation, believe more in scientific arguments regarding natural hazards than this superstitious traditional belief, as implied by the youth leaders (R3) and the religious leaders (R4).

Regarding the three philosophical beliefs in dealing with the disaster, the caretaker of the sacred site (R2) agrees with 'keep the tradition' (*Jaga Tradisi*) or preserving the adaptive evolution of cultural heritage. However, there are some differences in the traditional ritual practices compared to those implied by leaders of the New Batu Lonceng '*Kabuyutan*' Foundation (R1).

(a) (b)

Figure 9. (a) Batu Lonceng and (b) Batu Kujang
Source: Authors 2023

Youth Leader (Karang Taruna Organization)

The youth organization (*Karang Taruna*) is the most progressive community group in Kampong Batu Lonceng. They use a more logical and realistic thought and approach in response to the potential natural hazards of the Lembang Fault. The leader of *Karang Taruna* also disagrees with keeping the tradition (*Jaga Tradisi*) belief and the concept of *siap bencana* or disaster ready (being ready for disaster) because it is against scientific data that shows the possibility of earthquakes and rock falls.

According to the leader of *Karang Taruna* organization (R3), between 2015 and 2019, there were attempts at collaboration between the youth organization of Kampong Batu Lonceng (*Karang Taruna* Organization) with several external organizations, such as Lembaga Penanggulangan Bencana dan Perubahan Iklim (Disaster Management and Climate Change Agency)/LPBI-NU, Save the Children, Balai Besar Wilayah Sungai (River Basin Center)/BBWS, and Department of Public Works - Water Resources (Dinas PU-SDA), in order to relocate the kampong to a safer area. Finally, in 2019, most of the young generation of Kampong Batu Lonceng supported this idea, but this attempt was not continued when the COVID pandemic happened.

Based on an earlier interview, it was known that efforts to socialize the potential for disasters in Kampong Batu Loceng have been carried out by external parties, such as academics. BPBD also has participated and invited the community to create *Tagana* (*Desa Tangguh Bencana* or Disaster Resilient Village). However, these efforts were still ineffective in reaching the entire community considering that most of them are carried out in villages. In addition, the government, especially the Head of Village, has regulated which areas may and may not be built, also advised by the village elders. However, in Kampong Batu Loceng, these regulations are not currently applied. Anyone can build anywhere, including in areas that are vulnerable to disasters, due to land limitations along with the increasing population and its subsequent needs of space for settlements.

Religious Leaders

Religious Leaders (R4) strongly agree with the concept of forest conservation (*Jaga Leuweung*) and persistence in praying (*Jaga Doa*) but they still disagree with keeping the tradition (*Jaga Tradisi*). They argue that, majorly, the implementation of *Jaga Tradisi* is still against the most fundamental principle of Islam as a widely practiced religion in Kampong Batu Lonceng, namely *syirik* (an Islamic term that refers to the act of associating partners with the almighty Allah and it contradicts with the concept of *tauhid*, the oneness of God).

Furthermore, Religious Leaders do not agree with the concept of *siap bencana* or disaster ready (being ready for disaster) because it is against the Islamic value that prefers to anticipate or mitigate potential problems first rather than being resigned (*pasrah*) or surrender before making maximum efforts. They prefer improving awareness of disaster preparedness instead of being ready to face disaster.

Summary of Interviews and Discussions with the Primary Stakeholders

The Kampong Batu Lonceng community generally understands the consequences of living close to the Lembang fault, as it can trigger many natural disasters. Ironically, as implied through the interviews and discussions with all the community representatives, instead of having an awareness of disaster (*siaga bencana*), some of the villagers claimed that they were more of being 'ready for disaster' (*siap bencana*).

Siap bencana is a term often used by some parts of the Kampong Batu Lonceng community to refer to their 'readiness' to face disasters as they happen. Due to their customary law, traditional beliefs, and long experience, these parts of the community are unafraid of land shaking and seismic activities such as earthquakes. However, they are afraid of landslides and rockfalls, as some remnants of big stones from the previous

doi: 10.29244/jli.v17i2.62922

instances of rockfalls are located very close to the community village.

In terms of the three local philosophical beliefs, as introduced by the leader of the New 'Kabuyutan' Foundation, the first and third beliefs, Forest Conservation or *Jaga Leuweung* and Persistence in Praying or *Jaga Doa*, are widely acceptable by the primary stakeholders of the Kampong Batu Lonceng community. The reason is that they share the same values about these beliefs and have been practicing them for a long time. Forest Conservation (*Jaga Leuweung*) involves a regular reforestation program by the community to mitigate natural disasters triggered by the Lembang fault. They continuously plant various trees, such as bamboo, which has a very good root system, and many other big trees in the southern part of Kampong Batu Lonceng to protect the villagers from landslides and rockfalls. Persistence in Praying (*Jaga D*oa), on the other hand, entails regular prayer to seek protection from various hazards, particularly disasters caused by the Lembang fault.

The second belief, Keep the Tradition or *Jaga Tradisi* involves traditional rituals, such as *hajat buruan*, *hajat lembur*, and *ziarah* (pilgrimage) to Batu Lonceng and Batu Kujang sacred sites to pray. These practices are mostly refused, especially by the youth and religious leaders of the community. Furthermore, there are also different perceptions towards this belief from the caretakers of the Batu Lonceng sacred site, which has long been established and rooted among the community, and the leader of the New 'Kabuyutan' Foundation, which was relatively newly established. It seems that they have their own specific rituals and traditions.

Proposed Landscape Planning of Kampong Batu Lonceng

Based on the prediction of potential disasters, informed by the existing site situation as well as the different perceptions and preferences among the community leaders of Kampong Batu Lonceng regarding the Lembang fault disaster mitigation, we propose the following three-phase landscape planning of Kampong Batu Lonceng.

Phase 1: The Community Stays in the Same Location

In the first phase (Figure 10 and Figure 11), the community does not have to relocate to another place. However, they must be more cautious of natural disasters from the Lembang fault and consider implementing some in-situ mitigation programs. According to the caretaker of the archeological sacred site (R2) and the youth leader (R3), for the time being, this phase is the most realistic and preferable condition for the community since they do not have to move to another place. However, at the same time, this is also the most dangerous option in terms of when natural disasters triggered by the Lembang fault, especially landslides and rockfalls, happen.

Figure 10. Siteplan of Phase 1: The community stays in the same location, with retaining walls and reforestation

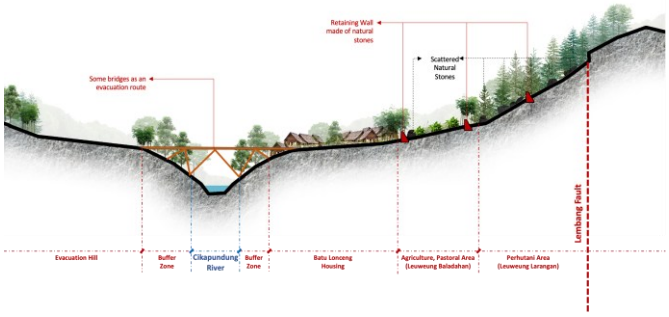

Figure 11. Section of Phase 1: The community stays in the same location, with retaining walls and reforestation

With the philosophical beliefs of *Jaga Leuweung*, *Jaga Doa*, and *Jaga Tradisi*, the kampong community, especially the elderly, are somehow confident of staying in the existing location by implementing some specific programs on a regular basis, such as:

a) Disaster-based Landscape Revitalization

The local community is willing to collaborate with stakeholders, such as the local government, private sectors, universities, civil societies, etc., to revitalize the landscape through tree planting to mitigate landslides and rock-falls caused by earthquakes triggered by the Lembang fault. Suitable vegetation includes those already grown in the surrounding area, such as bamboo, pines, and eucalyptus, and other trees, such as asam jawa, pulai, etc. (Figure 12). Since 2015, bamboo and pine trees planting specifically are part of the disaster mitigation efforts done by Perhutani in the area.

Figure 12. Existing trees planted by the community: Bamboo, Pines, Eucalyptus, Tamarind, and Pulai
Source: Authors 2023

b) Retaining Wall Construction

Retaining walls can be constructed using the abundant natural stones scattered within the Kampong Batu Lonceng area as remnants of the previous rockfall from the Lembang fault (Figure 13). The construction can be executed by professional contractors or community members under expert supervision. The retaining walls can help trap some stones when a landslide and rockfall happens (Figure 14). However, there is a probability that some stones could still destroy some houses within the kampong area.

Figure 13. Remnants of natural stones close to Kampong Batu Lonceng as a main source for retaining wall construction
Source: Authors 2023

doi: 10.29244/jli.v17i2.62922

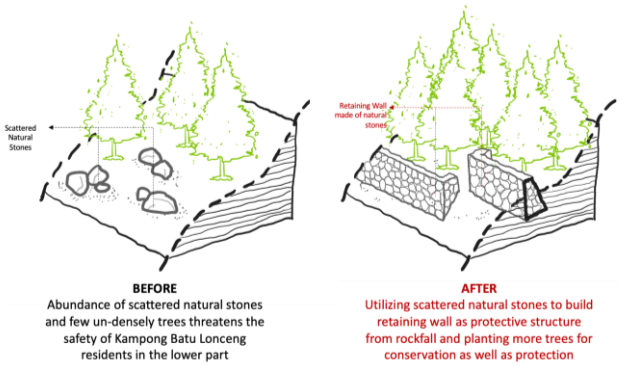

Figure 14. Utilization of existing scattered natural stones for retaining walls and more tree planting

c) Evacuation Route and Meeting Points

The purpose of the evacuation route is to allow the community to cross the river up to the main road in the North while meeting points are made to ensure a safe evacuation process.

d) Strengthening the Existing Buildings Structure

The strength of existing building structures needs improvement to become earthquake-resistant buildings, following the Indonesia National Standard (*Standar Nasional Indonesia*/SNI) 1726 about building and infrastructure earthquake resistance, published by the Government of Indonesia.

Phase 2: Move the Housing Area Across the River but Keep the Agricultural and Pastoral Land in the Existing Area

In phase 2 (Figure 15 and Figure 16), the settlements/housing area of the kampong will be moved across the river. However, the agricultural and farmland areas will be kept in the existing location for the community to cultivate as well as to maintain as part of the cultural heritage of Kampong Batu Lonceng. Agricultural landscape, especially the traditional ones perceived as a cultural heritage, is an important part of a community life in rural areas (Dahlan *et al.* 2020; Ilmi *et al.* 2022; Faisal *et al.* 2022). Additionally, it is also possible for them to farm on the new land (Hasibuan *et al.* 2017; Awalia *et al.* 2018). According to the youth leader (R3), the land across the river used to belong to Kampong Batu Lonceng. But now, only 10% of the area that is still owned by the residents as most of it has been sold to people outside of the community.

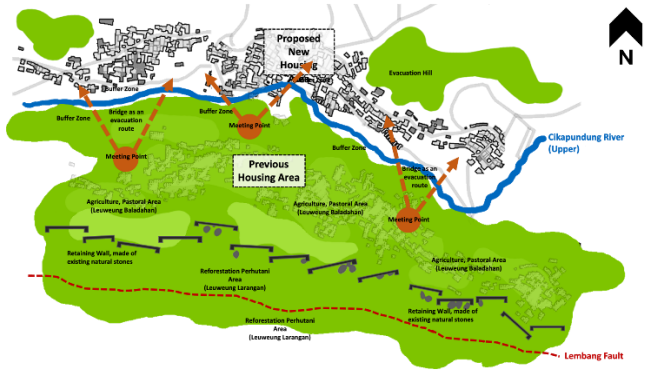

Figure 15. Siteplan of Phase 2: The community being relocated across the river

This phase is relatively safer than the first one because if a landslide or a rock fall happens, the falling stones and rocks will be trapped at the bottom of the river (Figure 17). It is important to note that the area is quite steep, so that the kampong infrastructure and buildings in the new location must be constructed following the SNI 1726 about building and infrastructure earthquake resistance. The buildings can be made either of wood/bamboo (traditional), bricks, or mixed materials, depending on the availability of materials and the community preference.

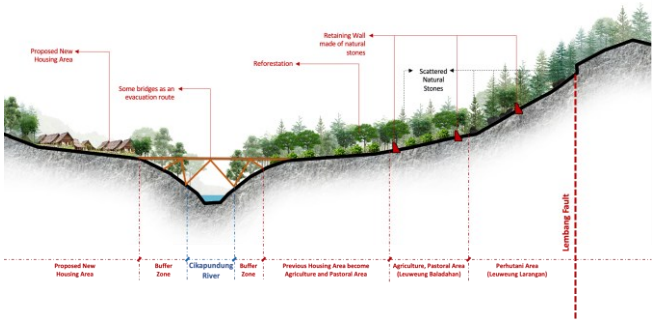

Figure 16. Section of Phase 2: The community being relocated across the river

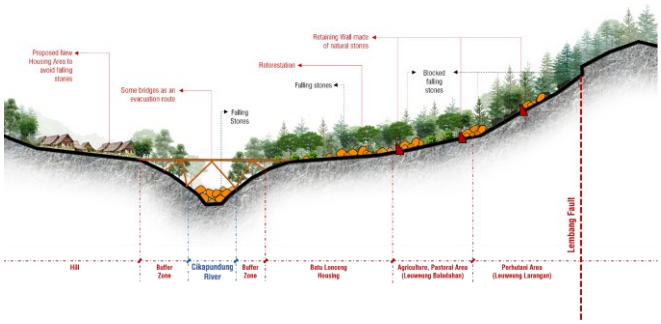

Figure 17. Simulation of a disaster with landslides and rockfalls: Some stones will be trapped in the retaining wall, and some others will be trapped at the bottom of the river; the kampong and the community are safe

Phase 3: Move the Community Further to the New Safe Location

In phase 3 (Figure 18 and Figure 19), the kampong will be relocated further to a new, safer location than the existing area. This phase will be the final but the most difficult to execute because of some considerations.

First, the surrounding area of Kampong Batu Lonceng is already densely populated. Therefore, it is not easy to find a sizeable and proper vacant land (at an affordable price) to accommodate the whole community of Kampong Batu Lonceng. Based on the information from the youth leader (R3), one possible alternative for relocation destination is a pine garden (*Kebun Pinus Kampung Asrama*) situated around 2,5 kilometers from Kampong Batu Lonceng (Figure 20) with area of approximately 1.000 hectares, which is currently dominated by cinchona trees (*Cinchona pubescens*).

Figure 18. Siteplan of Phase 3: The community relocates to the new, safer area

doi: 10.29244/jli.v17i2.62922

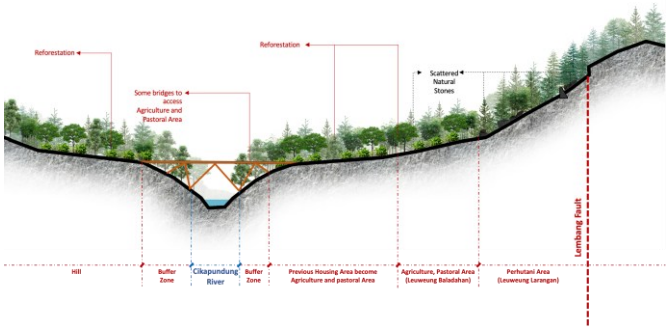

Figure 19. Section of Phase 3: The community relocates to the new, safer area

Figure 20. An alternative location for relocation: Pine Garden of Asrama Village (*Kebun Pinus Kampung Asrama*) Source: Google 2025

Second, the community has a very strong emotional attachment to the existing site. It will take some time to negotiate and convince the community to willingly move further away from the current location.

Third, the local government needs to guarantee the residents of Kampong Batu Lonceng that they will keep holding ownership of their existing land and farmland area and can partly cultivate their agricultural land on a regular basis.

Responses to the Proposed Plan of Kampong Batu Lonceng

The 'New' Kabuyutan Foundation (R1) leader agreed with the proposed Phase 1, where the community stays in the same location, with minor preventive measures such as retaining walls and reforestation. He also completely agreed with the proposed Phase 3, where the community will be relocated to the new, safer area, as long as the government can provide larger land for their houses and farmland. However, he was very reluctant and disagreed with the proposed Phase 2, where the community will be relocated across the river since the destined area is not wide enough to accommodate the villagers and the land is too steep for a settlement zone.

He expressed confidence that the Phase 1 plan could be easily agreed upon by the community and implemented soon. As for the Phase 3 plan, he implied that the phase was the ideal solution as the proposed new location is relatively safe from the fault and situated only 2 kilometers away from the existing kampong. Furthermore, he was willing to propose to the government that after the relocation, the existing Kampong Batu Lonceng could be transformed into a forbidden forest (*Leweung Larangan*) for conservation where people are prohibited from having activities in that area.

Similarly, the caretaker of the Batu Lonceng (R2) sacred site agreed on Phase 1 and Phase 3 plans but disagreed with the Phase 2 plan for the same reason as posited by the leader of the 'New' Kabuyutan Foundation. The leader of Kampong Batu Lonceng Youth Organization (*Karang Taruna*) (R3) agreed with the Phase 1 plan, disagreed with the Phase 2 plan, and completely agreed with the Phase 3 plan. Finally, the religious leaders of Kampong Batu Lonceng (R4) also expressed their preference for Phase 1 and Phase 3 plans, like the other three groups of stakeholders.

Interestingly, from the discussions about the three-phase landscape plan of Kampong Batu Lonceng, the primary stakeholders all agreed with the idea of relocation to a new, safer area (Figure 20) proposed at approximately 2,5 kilometers from the existing area. All four stakeholder groups of Kampong Batu Lonceng showed a similar preference for starting the plan with Phase 1 and then jumping to Phase 3. No consideration was given to Phase 2 as it was not viable due to the insufficient area of the land as well as its steep topography to function as a settlement area.

Among the three phases of the proposed landscape plan, Phase 1 is the most reasonable since the community doesn't have to move to other locations. However, they need to apply some preventive measures for disaster mitigation to protect the villagers from landslides and rockfalls. For example, reforestation or forest revitalization and construction of strong retaining walls by utilizing the abundant remnants of natural stones.

Depending on the community increasing awareness and understanding of the potential natural disaster, Phase 2 can be done after some time. This step requires the relocation of the residential area across to the northern part of the Cikapundung River. Meanwhile, the community still owns the existing land so they can keep working on their agricultural and farmland activities in the southern area.

Phase 3 is the hardest step since it is challenging for the government to find a sizeable area for relocation far enough from the hazardous zone of the existing area. It is also another challenge to convince the whole parts of the community to move and leave their ancestor land to start a new life in a new, safer area.

CONCLUSION AND RECOMMENDATION

Conclusion

Community involvement, as both planners and implementers, in the efforts of sustainable landscape planning that can improve welfare is deemed important (Pawa *et al*. 2014; Gege *et al*. 2023). Based on the research results discussed in the previous section, we can conclude that community-based landscape planning in Indonesia needs to be done gradually and very comprehensively. The existing village institutions and organizations of Kampong Batu Lonceng serve as a potential for community involvement (Violetta *et al*. 2024) in a community-based landscape planning.

Results of discussions with the Kampong Batu Lonceng community leaders provide insight into Indonesia generally low disaster literacy. A different perception of disaster awareness and readiness leads to a different understanding of disaster mitigation and how it should be worked on. It also reveals that what has been lacking in promoting disaster literacy is access to comprehensive information on the possibilities of what could be done as preventive measures.

The objective of this research is to challenge the future landscape planning of Kampong Batu Lonceng through a community-based approach addressing the Lembang Faults mitigation. Inputs from primary stakeholders, mainly leaders representing different groups of the Kampong Batu Lonceng community, serve as the foundation for developing three phases of future landscape plans of Kampong Batu Lonceng based on possible future scenarios. The plans are informed by, but not limited to, identified community views on philosophical beliefs, emotional attachment to the land, and mitigation of natural hazards across different community

groups. These scenarios also reflect community preference, availability of a relocation site, and applicable regulations.

The same community leaders provide their feedback on the proposed plans, which highlighted that:

1) Phase 1 plan (retaining wall construction) becomes the first preference as the community leaders agreed to the plan. Immediate follow-up and implementation should be done under a higher education institution supervision through a multi-stakeholder cooperation scheme, which involves government agencies, non-government organizations, and communities.
2) The Phase 2 plan (relocation to the other side of the river) is not preferred as the community leaders expressed reluctance, which was interpreted as a subtle rejection of the idea, over the area condition. The area is deemed too steep for a housing zone and insufficient to accommodate all inhabitants.
3) Phase 3 plan (relocation to another location) receives positive feedback as it brought awareness of the possibility of relocating. This awareness was fostered by the visualization of the plan and further explanation about the availability of potential land for relocation.

Among the proposed plans above, the government is expected to realize the advantages or positive impact of the Phase 3 plan for the environment and the community well-being by ensuring a safer and better living environment. Subsequently, the existing land could be transformed into a conservation zone (i.e., forbidden forest or *hutan larangan*). Conservation areas, including the forbidden forests, indirectly play a role in sustainable disaster mitigation efforts, while maintaining ecological functions, biological functions, and biodiversity (Akbar *et al*. 2020). If this plan demonstrates to be successful as a pilot project, it could be developed for future implementation in the other disaster-prone areas in Indonesia.

Successful implementation of the Phase 3 plan requires intensive community assistance to address the complexity of philosophical beliefs, emotional attachment to the existing place, and disaster mitigation among different community groups in Kampong Batu Lonceng. This process should occur under the supervision of related government agencies as well as the local government. It is imperative to have cross-sectoral cooperation in a disaster-related relocation to ensure the well-being of community groups involved, including preserving the cultural roots of their philosophical beliefs.

Recommendation

Recommendations for future action plans regarding the implementation of the proposed plans include:

1. Strengthening communication and cooperation among involved stakeholders, including government agencies and community groups, as the foundational step.
2. Prioritize Phase 1 plan implementation while assessing the possibility of Phase 3 plan implementation.
3. Prepare for Phase 3 plan implementation through action plans, such as:
   a) identify the availability of regulations supporting the legality of the community relocation process,
   b) identify the availability of a relocation site that is legal and suitable for a new settlement zone.

Recommendations for future research highlighting their importance in promoting community disaster literacy in Indonesia are outlined as follows:

1. Future research should focus more on promoting ecological restoration and conservation for disaster-prone areas with diverse local values and wisdom in Indonesia through policymaking and ratification of assigned conservation zones.
2. Researchers and academia are encouraged to expand their contribution to improving communities' well-being through projects that are socially more aligned with communities' local values and wisdom. The academic community is expected to utilize its social network strength to support the implementation of research works with positive impacts on the surrounding community.

REFERENCES

Akbar MAH, Kharis FA, Rahmawati OP. 2020. Perencanaan Lanskap Mitigasi Tsunami Berbasis Ekosistem Mangrove di Kota Palu. *Jurnal Lanskap Indonesia* 12(2):41–53. doi:10.29244/jli.v12i2.32383

Awalia RN, Nurhayati HSA, Kaswanto RL. 2018. Kajian Karakter Pembentuk Lanskap Budaya Masyarakat Adat Kajang di Sulawesi Selatan. *Jurnal Lanskap Indonesia* 9(2):91-100. https://doi.org/10.29244/jli.v9i2.17648

CNN Indonesia. 2023. BMKG: Indonesia Diguncang 10.789 Gempa Sepanjang 2023. *CNN Indonesia*. [accessed 2024 Des 23]. https://www.cnnindonesia.com/teknologi/20231231163116-199-1043779/bmkg-indonesia-diguncang-10789-gempa-sepanjang-2023

Dahlan MZ, Dewi MR, Putri VO. 2020. GIAHS Initiative untuk Pengelolaan Lanskap Pertanian Tradisional Berkelanjutan: Studi Kasus di Desa Sudaji, Kabupaten Buleleng, Provinsi Bali. *Jurnal Lanskap Indonesia* 12(1):13–22. doi:10.29244/jli.v12i1.32079

Dahlan MZ, Fukamachi K, Shibata S. 2022. The Potential of Kabuyutan Sacred Natural Site Towards a Sustainable Landscape Management in Indonesia. *IOP Conference Series: Earth and Environmental Science* 1027(1): 012025. **doi:**10.1088/1755-1315/1027/1/012025

Dahlan, MZ. 2017. Kabuyutan Sacred Sites in Sundanese Landscape of Indonesia: A Reevaluation from the Perspective of Sustainable Landscape Management [disertasi]. Kyoto: Kyoto University.

Daryono MR, Natawidjaja DH, Sapiie B, Cummins P. 2019. Earthquake Geology of the Lembang Fault, West Java, Indonesia. *Tectonophysics* 751:180–191. doi:10.1016/j.tecto.2018.12.014

Faisal B, Dahlan MZ, Arifin HS, Nurhayati, Kaswanto RL, Nadhiroh SR, Wahyuni TS, Irawan SNR. 2022. Landscape Character Assessment of Pekarangan towards Healthy and Productive Urban Village in Bandung City, Indonesia. *International Conference on Sustainable Environment, Agriculture and Tourism* (ICOSEAT 2022): 778-784. Atlantis Press. https://doi.org/10.2991/978-94-6463-086-2_102

Gege MJ, Setyabudi I, Budiyono D. 2023. Evaluasi Lanskap Agrowisata Desa Colol di Kabupaten Manggarai Timur. *Jurnal Lanskap Indonesia* 15(1):1–7. doi:10.29244/jli.v15i1.40744

Hasibuan MSR, Nurhayati HSA, Kaswanto RL. 2017. Karakter Lanskap Budaya Rumah Larik di Kota Sungai Penuh, Provinsi Jambi. *Jurnal Lanskap Indonesia* 6(2): 13-20. https://doi.org/10.29244/jli.v6i2.16558

Herlambang D. 2024. Tidak Terpetakan Sebelumnya, BMKG Berhasil Identifikasi Sesar Baru Penyebab Gempa Sumedang. *Badan Meteorologi, Klimatologi, dan Geofisika*. [accessed 2025 Jan 4]. https://www.bmkg.go.id/siaran-pers/tidak-terpetakan-sebelumnya-bmkg-berhasil-identifikasi-sesar-baru-penyebab-gempa-sumedang

Ilmi MR, Kaswanto RL, Nurhayati HSA. 2022. A Cultural-History Analysis on Malay-Islamic Heritage of Siak Sri Indrapura through the Historical Urban Landscape

Approach in Pekanbaru City. *JUSPI (Jurnal Sejarah Peradaban Islam)* 6(1): 78-90. http://doi.org/10.30829/juspi.v6i1.12160

Loen M. 2023. Pelatihan Microsoft Office untuk Meningkatkan Kinerja Aparatur Desa Suntenjaya. *SIKAMA: Jurnal Pengabdian Kepada Masyarakat* 1(1): 64-69.

Marliyana P. 2024 January 4. Sumedang 10 Kali Diguncang Gempa Terdata 1.325 Bangunan Rusak. *Pemerintah Kabupaten Sumedang*. [accessed 2025 Jan 4]. https://sumedangkab.go.id/berita/detail/sumedang-10-kali-diguncang-gempa-terdata-1-325-bangunan-rusak

Nugroho F. 2020. Seismic Capacity Evaluation of the Damaged Reinforced Concrete Building during Palu Earthquake 2018. *E3S Web of Conferences* 156: 05004. doi:10.1051/e3sconf/202015605004

Nugroho Y. 2022 December 19. The Cianjur Earthquake Reveals the Inadequacy of Disaster Resilience in Indonesia. *Fulcrum*. [accessed 2024 Jun 24]. https://fulcrum.sg/cianjur-earthquake-and-disaster-resilience-in-indonesia/

Pawa JP, Nurisjah S, Adiwibowo S. 2014. Rencana Penataan Lanskap Desa Wisata Secara Partisipatif di Ensaid Panjang Sintang Kalimantan Barat. *Jurnal Lanskap Indonesia* 6(1):17–23.

Perdana GC, Wahyudi WR. 2020. Rekonstruksi Lanskap Kabuyutan Bandung Utara. *PURBAWIDYA: Jurnal Penelitian dan Pengembangan Arkeologi*. 9(1):1–14. doi:10.24164/pw.v9i1.317

Supendi P, Nugraha AD, Puspito NT, Widiyantoro S, Daryono D. 2018. Identification of Active Faults in West Java, Indonesia, based on Earthquake Hypocenter Determination, Relocation, and Focal Mechanism Analysis. *Geoscience Letters*. 5, 31. doi:10.1186/s40562-018-0130-y

Violetta FR, Makalew ADN, Budiarti T. 2024. Kajian Potensi dan Kendala Desa Kamal Kecamatan Arjasa Kabupaten Jember Sebagai Desa Wisata Sejarah Berbasis Masyarakat. *Jurnal Lanskap Indonesia* 16(2):135–145. doi: 10.29244/jli.v161i2.48987

Widiyantoro S, Gunawan E, Muhari A, Rawlinson N, Mori J, Hanifa NR, Susilo S, Supendi P, Shiddiqi HA, Nugraha AD, Putra HE. 2020. Implications for Megathrust Earthquakes and Tsunamis from Seismic Gaps South of Java Indonesia. *Scientific Reports* 10: 15274. doi:10.1038/s41598-020-72142-z

Wulandari AW. 2018. Tergoda Pesona Kampung Wisata Batu Loceng yang Tersembunyi. *AyoBandung*. [accessed 2025 Jan 4]. https://www.ayobandung.com/wisata/pr-79635410/tergoda-pesona-kampung-wisata-batuloceng-yang-tersembunyi