

The Reconstruction of a Javanese Civilization Cultural Landscape in 8 AD based on Canggal Inscription in Gendol Hill Complex, Magelang, Central Java

Niken Wirasanti ¹⁾ and Helmi Murwanto ²⁾

¹⁾Faculty of Cultural Science, Universitas Gadjah Mada, Yogyakarta, Indonesia. ²⁾ Faculty of Mineral Technology, Universitas Pembangunan Nasional “Veteran”, Yogyakarta, Indonesia.

Received: 2019-05-18

Accepted: 2020-04-04

Key words:

Cultural Landscape;
Gendol Hill;
Gunung Wukir Temple;
Canggal Inscription

Correspondent email:

wirasanti@ugm.ac.id

Abstract The research took place in the Gendol Hill complex, Magelang, Central Java. One of the peaks in the hills complex is Mount Wukir, where a Canggal Inscription was found. The Canggal Inscription mentions an area named Java, rich in agricultural products with many sacred buildings. The term Javanese refers to an area of Gendol Hill complex, which is part of the Kedu–Central Java region. This paper aims to 1) interpret the cultural landscape of the Gendol Hill complex, 2) reconstruct the spatial structure (layout), and its utilization as a settlement area for Javanese society in the 8th century. This paper interprets the Canggal Inscription and collates information about the potential of both biotic and non-biotic resources. Data processing is conducted through inductive–explanatory analysis. The results suggest that the Cultural Landscape of Gunung Wukir Temple was in a place protecting it from disaster. The complex was protected by Gendol Hills, acting as a barrier against volcanic eruptions from Mount Merapi. Gendol Hill complex was located in an environment that flourished with both biotic and non-biotic resources. The community cultivated its alluvial plains and established settlements in this area. The denuded structural hills were also perceived as sacred spaces to erect temples with natural resources close by such as andesite rocks available from rivers around the hills.

© 2020 by the authors. Licensee Indonesian Journal of Geography, Indonesia.
This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY NC) license <https://creativecommons.org/licenses/by-nc/4.0/>.

1. Introduction

The Kedu region in Central Java in the 8th century became a part of the ancient Javanese civilization known as the Mataram Kingdom. An ancient Javanese civilization emerged and developed on the plains and slopes of some volcanoes, including Mount Sundoro, Mount Sumbing, Mount Merapi, and Mount Merbabu, as well as on the plains in the Gendol Hill complex.

The glory of the ancient Mataram Kingdom is exemplified by temples such as Borobudur and Prambanan Temples. The Canggal Inscription has become the signifier of the existence of the Mataram Kingdom. In its history, the Mataram Kingdom, which reached its height of glory from the 8th to early 10th century, was centered in Central Java. Based on the Canggal Inscription, the beginning of the Mataram Kingdom grew under the reign of King Sanjaya, who marked his victory over his enemies by erecting a *Lingga* on *Sthiranga* Hill in 732 AD, which is now known as Mount Wukir in the area of Gendol Hill complex. The parts of the Canggal Inscription were found in two places. The largest part was found in Canggal Village under Gunung Wukir Temple and the other parts were found on the

courtyard of Gunung Wukir Temple. Therefore, it can be concluded that the Canggal Inscription has a connection with the Gunung Wukir Temple (Boechari, 1979; Poesponegoro, 2009).

The physical environment of Gunung Wukir Temple in the Gendol Hill complex is a series of denudational structural hills, and some of them are separated by an alluvial plain. Between the hills of Gendol lies a wide and fertile alluvial plain marked by several sources of water (Figure 1h). The rivers that flow around the hills include the Blongkeng River, the Putih River, and its tributaries flowing from Mount Merapi (Figure 1j). The series of hills stretching from north to south acts as a barrier to eruptions from Mount Merapi. Disasters that often occurred are in the form of lava flowing through the Blongkeng Putih Rivers on the north side of the hills. Therefore, the temples on the top of the hill and the surrounding settlements were relatively safe from the lava.

Gendol Hill complex hosts archaeological resources, such as some temples on the peaks of the hills. Additionally, in this area, there is a natural resource in the form of igneous

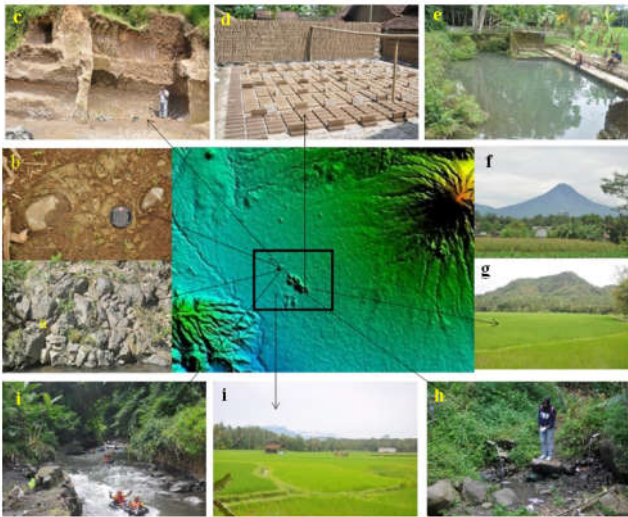


Figure 1. Physical resources of Gendol Hill complex, Magelang, Central Java, Indonesia (From Wirasanti and Murwanto, 2016)

rocks making up the Gendol Hill complex, which are chopped up by fault and fracture structures due to tectonic processes (Figure 1a). Because these rocks have experienced very strong physical and chemical weathering processes, the rock has transformed into soil material (Figure 1b) and very thick and broad clay (Figure 1c). Residents have long used the clay in the Gendol Hill complex as raw material for bricks (Figure 1d). In addition, there are several perennial springs (Figures 1e, h, and j), which have been used for the irrigation of agricultural land (Figure 1g, i, and j). The abundant deposits of andesite rock that are in the rivers were used for building temples, and the soil used to make bricks.

Potential natural resources, such as water in the area of Gunung Wukir Temple (Figures 1, h and i) played an important role in supporting agriculture, which was undoubtedly a part of the settlement. However, the existence of the settlement area around the temple has not been confirmed. The archaeological evidence in the form of a settlement is thought to have been made from wooden materials, a material that is easily damaged. However, domestic items such as stone mortars, which are assessed to have been used as water containers or for pounding rice, are found mostly scattered on the agricultural land, and in the courtyard of Gunung Wukir Temple.

This paper interprets the contents of the Canggal Inscription found in Gunung Wukir Temple and then reconstructs the spatial structure of the Gendol Hills area. The Canggal Inscription is important to research because the inscription contains information about the purpose of erecting the temples, states the year, the people who built the temple, toponym data, and outlines the potential environmental resources around the temple.

Reconstructing the environment of the Gendol Hill complex is done by using a paleogeomorphological approach. This means that, by analyzing landform units, namely

denudational structural hills and alluvial plains, the characteristics of each landform unit are discovered. These are marked by differences, such as rock structures, rock types, and availability of water sources (Figure 1). The analysis links the distribution of temples, toponyms, land resources, and water sources, therefore depicting the cultural landscape of the Gendol Hill complex. The results of the study will enable further research, such as investigating the dynamics of civilization in the research site. Besides, the results of the study provide an important reference in preparing a plan for the preservation of this cultural heritage area.

2. The Methods

Research techniques and data analyses consisted of 1) site data collection based on Dutch OV and ROD inventory records from 1923, 1925, and 1928; 2) observation of the temple sites in the area of Gendol Hill complex; 3) toponyms tracing based on inscriptions; 4) observation of plant types based on inscriptions and temple reliefs; 5) interpretation of the topographical map to delineate the research site; 6) observations of water sources; 7) observations of soil types; and 8) observations of land use.

Data processing and analysis include 1) registering the distribution of temple locations and toponym data; 2) analyzing the physical environment data based on the paleogeomorphological approach, and 3) reconstructing ancient spatial structure and its utilization (Figure 2).

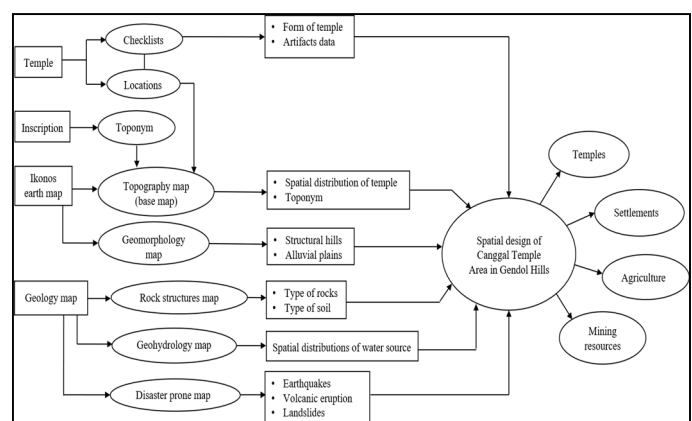


Figure 2. Research Design

3. Results and Discussion

Gendol Hill complex is located in the middle of South Kedu Plain, Central Java (110°05'E to 110°20'E and 7°30'S to 7°38'S). The South Kedu plain is very fertile land derived from the weathering of alluvial and volcanic deposit. In addition to the fertile soil there is an abundance of water, originating from the rivers flowing through the South Kedu plain. These rivers are the Progo River, the Blongkeng River, and the Putih River originating from the southwest slope of Mount Merapi (Murwanto, 2011) (Figure 3).

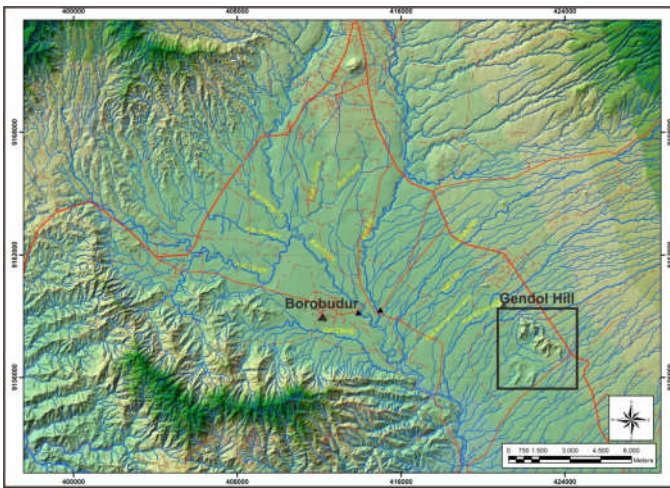


Figure 3. The study area. Gendol Hill complex and Borobudur Temple surrounded by the Progo River, the Blongkeng River, and the Putih River.
(Source: Murwanto, 2016)

Gendol Hill complex, from a geological review based on Van Bemmelen's hypothesis (1949), is the result of the volcano-tectonic activity of Mount Merapi in 1006 AD. At the time, a strong eruption resulted in the degeneration of the peak of Mount Merapi. The peak reaching 3300m above sea level experienced degeneration to the southwest of the volcano; the avalanche material was blocked by Menoreh Mountain Complex. As a result of the compression force, small fold structures were formed gradually and became Gendol Hill Range. Its rocks consist of the materials erupted by Mount Merapi (Nur Aini, 2018).

Geomorphologically, the landform of Gendol Hill complex is an isolated hills that appears in the landforms at the base of Mount Merapi. The existence of this hill complex influences river flows, and groundwater flows originating from the upper slopes of Mount Merapi. The water flowing to the southwest hits and is blocked by the walls of Gendol Hill complex. Therefore, the water flow is diverted towards the gaps between the hills or cut off by the river valley topography to form the springs around the hill complex. The existence of the rivers whose headstreams are located in Gendol Hill complex are springs which were utilized to cultivate agricultural land.

Thus the hill complex plays a role as a water catchment area for the west-southwest area resulting in many springs in several research sites. The water from the springs flows into the surrounding rivers, such as the Kuning River, the Pereng River, the Putih River, and the Blongkeng River (Figure 3). The rivers that flow on the north side of Gendol Hill complex are the Blongkeng River, the Putih River, and the Batang River. The headstreams of these rivers flow from Mount Merapi. These rivers carry lava from the volcano when it erupts. Andreastuti's (2006) observations showed that a violent volcanic eruption is usually characterized by material that bursts vertically and this material is dominated by pumices, as well as pyroclastic



Figure 4. Gunung Wukir Temple in Gendol Hill complex
(From: Wirasanti 2015)



Figure 5. Canggal Inscription found in Gunung Wukir Temple

Source: <https://fouronstate.com/isi-prasasticcanggal-serta-penjelassannya-lengkap/5103/>

deposition in the form of strongly consolidated andesite igneous rocks. Volcanic material has good porosity and permeability; therefore, this means the area of Gendol Hill complex has a fairly large water content. The potential of the water contained in the area is also influenced by the type of constituent material, the characteristics of rain, morphology, soil, and vegetation.

Field observations show that Gendol Hill complex is located on the lower slopes of the southwest of Mount Merapi's base. The hill complex becomes a fortress/protection for the environment of Gunung Wukir Temple from disasters, both primary eruption (pyroclastic flow and incandescent lava flow) and secondary disasters in the form of lava floods. The position of Gendol Hill complex is 70m – 150m higher than its surrounding plains, with its hill form extending ± 4.5 kilometers and with a distance of ± 18 kilometers from Mount Merapi; therefore, with this distance, the pyroclastic flow reaching the plain of the volcanic

mountain would begin to weaken. If it reaches a distance of more than 20 kilometers, it would be blocked by the slopes of Gendol Hill complex.

Evidence from field observations show traces of the ancient river valleys, originating from Mount Merapi flowing towards the southwest. The traces of the ancient river flow hit the slopes of the Gendol Hill complex, and its direction changes along the northern face of the hill complex, heading southeast and northwest. Subsequently, it flows towards the southwest and joins the Progo River flowing into the Indian Ocean. These ancient rivers, at the time or after an eruption of Mount Merapi, were the rivers that channel lava rain floods, evidenced by the discovery of lumps of andesite rocks of various sizes in the rivers around Gendol Hill complex (Murwanto, 2011).

Gendol Hill complex is referred to as a complex because it consists of several hills, and the one located at the center is known as Wukir (336 m). At the top of Wukir Hill (Mount Wukir) there is a temple called Gunung Wukir Temple (Figure 4), and the Canggal Inscription dated 732 AD is inside the temple (Figure 5).

Interpreting the contents of the Canggal Inscription starts from the name of the figures mentioned in the inscription, tracing the toponym, and interpreting the potential of biological and non-biological resources, supplemented with supporting data in the form of environmental images carved on the walls of Borobudur Temple.

The Canggal Inscription mentions that Sanjaya erected a *Lingga* (*linga*=skrt) on *Sthiranga* Hill in the Kunjarakunja area. The toponym *Sthirangga* means sturdy; as a whole, the toponym denotatively means a hill whose rocks are composed of old tertiary volcanic rocks, which are older than the Ancient Mount Merapi's sediment, which is quarterly old (Wirakusumah, 1989; Murwanto, 2015)—connotatively establishing that the *Lingga* (complete with the temple) on *Sthirangga* Hill symbolizes Sanjaya's victory over his enemies (Wirasanti 2015).

The Canggal Inscription also mentions the toponym *Kunjarakunja* which can be interpreted as an elephant (*Kunjara*) and a place full of creeper plants (*kunja*). Poerbatjaraka defines *Kunjarakunja* as an elephant forest or a forest where elephants live. However, this definition is now doubted. The word *kunjarakunja* can mean *ficus religios* forest that means a forest full of bodhi trees because the word *kunjara* does mean not only elephants but also the names of several types of trees, including bodhi trees (Zoetmulder, 1982; Poesponegoro, 2009; Wirasanti, 2015). It is interesting to note that today, near Gunung Wukir Temple, there is a hamlet whose name is a toponym, Gajahan (one of the toponym data) (Wirasanti, 2018).

In addition to the toponym Gajahan village, there is another toponym, Medangan Hamlet. It is said that Medang

palace was located in Poh pitu (*mdang i poh pitu* = Mantiyasih I Inscription dated 907 AD). The place is the royal palace of the Mataram Kingdom. In order to link the toponym of Medangan Hamlet and the word Medang (as the location of the Mataram's palace), archaeological data is needed. The word Medang (Phoebe) in the Indonesian dictionary is a tall and large tree. Its wood is used for buildings. In addition to Medang tree, there are a number of other perennials used to name some hamlets in the area of Gendol Hill complex, such as Canggal, Ngasem, Gambir, Losari, Bendosari, Mantingan, Duwet, and Waru. The utilization of perennials is not only for building materials but also for making *sampán* (a small boat) and wood fiber. Canggal is the name of a tree (*Neobaluncarpus heimi*) commonly used to make canoes (Figures 6 and 8). As for Waru (*Hibiscus tillaceus*), its wood is used as fiber for ropes and clothes. Kakawin Arjunawihaha mentions that *rsi* (monks) were dressed in the bark and lived in hermitages (*wanasrama*). The Ancient Javanese Ramayana script also mentions clothes made of bark (Santiko, 1986; Poerbatjaraka, 2010; Wirasanti, 2015).

Gunung Wukir Temple, which was erected in the middle of Gendol Hill complex, shows the ability of the community to choose a good location for the building. It also demonstrates their ability to manage the sacred space and utilize the andesite rocks that are found in rivers around the hills. The results of field observations in the layout and utilization of the space at the Gunung Wukir Temple site and its environment suggest that the residents did not behave randomly, especially in choosing a sacred space to build a temple. They might have also perceived that spaces have different values and that spaces vary in terms of quality. Space is not only understood physically, but a person or community will also attribute to spaces different values, such as the value of being sacred or profane (Rapoport, 1977; Mundarjito, 1995; Dillistone, 2006.). This illustrates that society gives meaning to space (Eliade, 2002; Ahimsa-Putra, 1995).

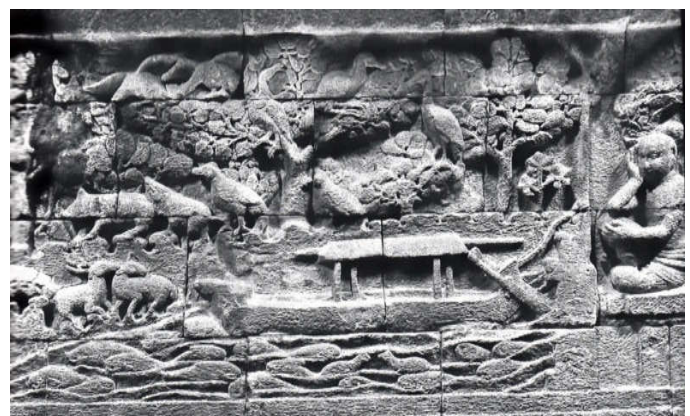


Figure 6. *Sampán* carving at Borobudur Temple made of wood from the Canggal tree that grows in the Gendol Hill complex
(Source: Titus Leber, 2011, Wirasanti, 2015)

Mount Wukir located near Canggal Hamlet is a hill located in the middle of Gendol Hill Complex, which is interpreted as a sacred space and seen from its physical essence. It is also the highest point in the area. At the top of the hill, Sanjaya built a temple with a *Lingga*. Establishing a *Lingga* means establishing a sacred milestone, and Sanjaya's *Lingga* is the *jayacihnalingga* or *jayastambha* that means "a pole as the sign of victories." Gunung Wukir Temple, as a sacred space, is the central point and the center of orientation. This means that from all directions, there is a central axis (center) that has an important value in the orientation cycle (Kramrisch, 1946; Mangunwijaya, 1995; Eliade, 2002; Idedhyana, 2009; Wirasanti, 2015). Based on Canggal Inscription, it is implied that the purpose of establishing the *Lingga* is for tranquility:

(:.....*ketika narapati sri sanjaya mendirikan di sthiranga, linga dengan tanda-tanda kesucian (untuk) ketenangan....*)

(:when His Highness Sri Sanjaya erected it in *Sthiranga*, a *Lingga* with signs of purity (for) tranquility ...)

Therefore, a *Lingga* as *jayacihna* means "a symbol of victory" because without victory, there will be no tranquility (Purbatjaraka, 1982; Santiko, 2010). The construction of Gunung Wukir Temple on a hilltop with a *Lingga* as its marker represents a picture of the cosmos, meaning that the surrounding area has become a habitable area (Wirasanti, 2015). This also means that around the temple, the plain between the hills of Gendol Hill complex can be a place of community activities at that time. A calm environment for activities can also be interpreted as a safe environment from volcanic disasters.

In addition to Mount Wukir, archaeological data shows other hilltops in Gendol Hill complex that have become locations for erecting temples, such as Mantingan Hill, Sari Hill, Bobosan Hill, and Pring Hill. Canggal Inscription mentions that *....an island full of holy shrines, especially worships of Lingga that was erected in the sacred area of Kunjarakunja* (Poerbatjaraka, 1982) (Figure 3). The existence of the temples on the tops of the hills strengthens the assumption that the reason the community chose a location to build a temple on the hilltop have a sacred meaning.

Canggal inscription mentions that *....is an island called Java that has unparalleled crops/produce, especially rice*. (Poerbatjaraka, 1982) (Figures 7 and 8). It can be interpreted that in addition to the Javanese community's ability in 8 AD to select a good location to erect the temple, it is also evidence that they had the ability to cultivate their land in the vicinity of Gunung Wukir Temple. The agricultural practices was supported by the availability of water resources and fertile land (paddy fields).

The environmental description in the Canggal Inscription of land resources for agriculture can be

complemented by observing the images carved on Borobudur Temple's walls. The environment of paddy fields, gardens, and community activities in farming crops and fish are engraved on the walls of Borobudur Temple (Boechari, 1977; Sokmono, 1974; Kartakusuma, 1996).

Some previous studies provide lists showing the diversity of flora/plants and fauna carved on the walls of Sojiwan Temple, Prambanan Temple, and Borobudur Temple



Figure 7. Paddy fields around Gunung Wukir Temple in Gendol Hill complex (Source: Yogi, 2016)



Figure 8, Wooden buildings, rice fields and dry rice fields are sculptured on Borobudur Temple's walls

<https://kebudayaan.kemdikbud.go.id/bkborobudur/pertanian-masyarakat-jawa-kuno-pada-masa-borobudur/>
<https://kebudayaan.kemdikbud.go.id/bkborobudur/juwawut/jewawut/>

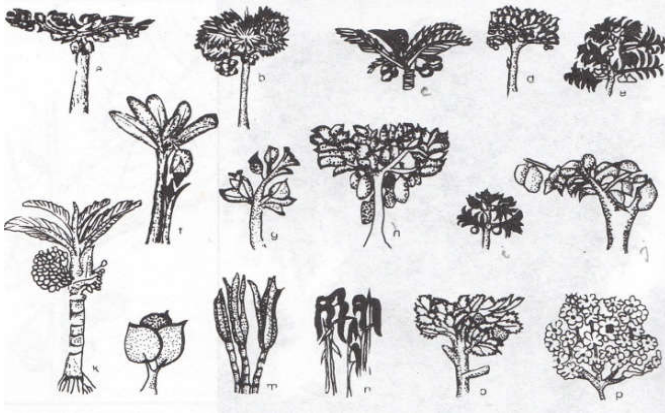


Figure 9. Plants carved on the walls of Borobudur Temple.
(Sources: Sarwono, 1988, Wirasanti, 2015)

(Siswanto, 2000; Setyawan, 2007) (Figure 9). The list of biodiversity sculpted on the walls of the temples are hibiscus tree (*Hibiscus tiliaceus* L), tamarind (*Tanarindus indica* L), bodhi tree (*Ficus religiosa*), durian (*Durio zibethinus* Murr), guava (*Psidium guajava*), darssana guava (*Eugenia malaccensis*), jatropa (*Jatropha curcas*), frangipani (*Plumeria* sp); fish poison tree (*Barringtonia asiatica*); coconut (*cocos nucifera*), artocarpus camansi (*Arthocarpus comunis*), banana (*Musa paradisiaca*), breadfruit (*Arthocarpus integra*); sugarcane (*Sacharum ffcinarum*), lotus (*Nymphaea* sp), sugar palm (*Arenga muricata*), corn (*Zea mays*), mangosteen (*Garcinia mangosiana*), rice (*Oriza sativa*), palm (*Palmae*), taro (*Colocasia* sp), country almond (*Terminalia catapa*), palmyra palm (*Borassus Flabellifera*), mango (*Mangifera* sp), jackfruit (*Arhocarpus heterophylus*), mast wood (*Calophyllum iniophyllum*), areca palm (*Areca catechu*); soka (*Asoka pinata*), rose apple (*Eugenia aqua*), cotton (*Gosipium* sp), and pandan (*Pandanus* sp).

Field observations show that the biodiversity carved on the temple's wall consists of the plants that grow in Gendol Hill complex area. The plants that are found on the hills and plains include poison nut (*Jatropha curcas*), banana (*Musa paradisiaca*), cotton (*Ceiba pentandra*), guava (*Psidium Guajava*), coconut (*Cocos nucifera*), jackfruit (*Arthocarpus heterophylus*), durian (*Durio zibethinus*), taro (*Colocasia* sp.), sugar palm (*Arenga muricata*), areca palm (*Areca catechu*), corn (*Zea mays*), frangipani (*Plumeria* sp.), country almond (*Terminalia catapa*), palm (*Palmae*), rice (*Oriza sativa*), rose apple (*Eugenia aqua*), hibiscus tree (*Hiibiscus tiliaceus*) (Figure 10), sugar cane (*Sacharum officinarum*), breadfruit (*Arthocarpus communis*), pandan (*Pandanus* sp.), mangosteen (*Garcinia mangosiana*), cempedak (*Arthocarpus integra*), and mango (*Mangifera* sp.). These plants are used not only for their fruit and leave but also for their stems and trunks to be used as a building material, to make *sampan* (Figure 6), and their bark is used for fabric fibers (Santiko, 1986; Poerbatjaraka, 2010; Wirasanti, 2015).

The findings of the cultural landscape of Gendol Hill complex, based on inscription sources, can be summarized



Figure 10. Hibiscus tree (*Hiibiscus tiliaceus*) growing around Gunung Wukir Temple in Gendol Hill complex
(Source: Yogi, 2016)

as follows. Gunung Wukir Temple's cultural landscape in the Gendol Hill complex is an area that is safe from enemies, marked by a pole (*Lingga*) as a symbol of victories (*jayacihnalingga* or *jayastambha*). With these victories, the Javanese at the time, we're able to live safely, not only safe from enemy attacks but also safe from the volcanic disasters of Mount Merapi. This was because the hill complex played an important role as a barrier.

In 8 AD, the area was declared a safe area, and there was human interaction with the environment, which was the ability to process biological and non-biological resources into food and building materials. The community's perception of the environment can be seen in the selection of the locations, which were the tops of hills, for the temple buildings. In addition, the plains were used as agricultural land, which is assessed to be located near the settlement areas.

4. Conclusion

The cultural landscape in the area of Gendol Hill complex is mentioned in the Canggal Inscription as fertile land with crops, and that the area had many holy places (temples). It also describes that Javanese community in the 8th century was able to meet the challenge of the physical

environment by managing spatial arrangement. They were able to determine or decide space as either sacred or non-sacred space. The description of the physical environment in Gendol Hill complex is marked by temples on the hilltops (Mantingan Hill, Bobosan Hill, Pring Hill, and Sari Hill). In addition, fertile alluvial plains were turned into agricultural land, an illustration of the community's adaptation in utilizing the environment. Utilization of space and spatial arrangement for sacred buildings, agricultural land, and settlement areas reinforces the theory that a temple is built close to its supporting community.

Acknowledgment

This research was supported by funding from the Faculty of Cultural Science, Universitas Gadjah Mada. We are grateful to our colleagues in the Department of Archeology, who provided valuable insights into the research.

References

- Andreastuti, Supriati Dewi., Chris Newhall., dan Joko Dwiyanto., (2006). "Menelusuri Kebenaran Letusan Gunung Merapi", *Jurnal Geologi Indonesia* Vol. 1 No 4 Desember, p. 201-207
- Bemmelen, R. W. V. 1952. *De Geologische Geschiedenis Van Indonesie*. NV Uitgeverij, W.P. Van Stockum Enzoon Den Haag, p. 67-68.
- Boechari. (1977). *Candi dan Lingkungannya*. Cibulan, PIA, p. 319-341.
- _____,(1979). "Some Considerations on the Problem of the Shift of Mataram's Centre of Government from Central to east jawa in the 10th Century", *Early South East Asia*, p. 473-491.
- Eliade, M. (2002). *Sakral dan Profan: Menyingkap Hakekat Agama* (translation). Yogyakarta: Fajar Pustaka Baru.
- Ghilandi, Matthiey., Shephare Desruelles, (2009). "Analysis : Geo-archaeology : Where Human, Social and Earth Sciences Meet with Technology", *Jurnal S.A.P.I.E.N.S Surveys and Prespectives Integrating Environment and Society*. Vol 2/ Special Issue, 2.2.
- Idedhyana, I. B. and Suryada, I. G. A. B., (2009). "Serpihan Teori Arsitektur India Purba". *Dinamika Kebudayaan* Vol XI (2): p. 73-82.
- Kartakusuma. (1996). "Obyek Upacara Sima pada Masyarakat Jawa Kuna Abad IX-X Masehi (Kajian Awal Tentang Lumpang Batu Berdasarkan Prasasti Panggumulan dan Prasasti Rukam)", *Jejak Jejak Budaya*, p. 393-435.
- Kramrisch, S. (1946). *Hindu Temple, Vol II*. New Delhi: Motilal Banasidas
- Mangunwijaya. (1988). *Wastu Citra*. Jakarta : PT Gramedia.
- Mundarjito. (1995). Kajian Kawasan: Pendekatan Startegis dalam penelitian Arkeologi di Indonesia Dewasa Ini. *Berkala Arkeologi Edisi Khusus*. p. 24-36.
- Murwanto,Helmi. (2011). "Mengenal Dataran Kedu Selatan Berdasarkan Tinjauan Geologi", *Menyelamatkan Candi Borobudur dan Erupsi Merapi*, Balai Konservasi Borobudur, p 73-84
- _____, (2015). *Penelusuran Jejak Lingkungan Danau Purba Di Sekitar Candi Borobudur Dengan Pendekatan Paleogeomorfologi, Dissertation*, Yogyakarta Pascasarjana UGM
- Newhall, C.G., Bronto, S., Alloway, B., Banks, N.G., Bahar, I., Marmor del, M.A., Hadisantono, R.D., Holcomb, R.T., McGehiin, J., Miksic, J.N., Rubin, M., Sayudi, S.D., Sukhyar, R., Andreastuti, S., Tilling, R.I., Torley, R., Trimble, D., Wirakusumah, A.D., (2000), *10,000 Years of explosive eruptions of Merapi Volcano, Central Java : archeological and modern implications*. Publisher?
- Nur Aini,Emilia; Arhananta, Anindya Wiguna Pitri, Helmi Murwanto, (2018). "Mengenal Kipas Alluvial Kuarter Utara Perbukitan Menoreh dan implikasinya terhadap masswasting", *Seminar Nasional Kebumihan ke 11*, Unpublished,Yogyakarta: Graha Sabha Pramana
- Poesponegoro, Djoened, M. and Notosusanto, Nugroho. (2009). *Sejarah Nasional Indonesia II*, Jakarta: Balai Pustaka.
- Poerbatjaraka. 1982. *Riwayat Indonesia I*. Jakarta Yayasan Pembangunan.
- _____, (2010). *Ramayana Jawa Kuna*. Perpustakaan Nasional RI.
- Rapoport, A. (1977). *Human Aspect of Urban Form*. Oxford, Toronto: Perganon Press.
- Santiko, H. (1986). Mandala Pada Masyarakat Majapahit. *PIA IV* Jakarta Puslit Arkenas p.149-169.
- _____. (2010). "Agama Hindu pada Masa Kerajaan Mataram (Abad VII-X Masehi)", *Pentas Ilmu di Ranah Budaya* p. 626-636.
- Siswanto. (2000). *Eksistensi dan Eksploitasi Sumberdaya Lingkungan Jawa Kuna: Kajian Relief Candi Borobudur, Mendut, dan Sojiwan*. Balai Arkeologi Yogyakarta.
- Titus, L. (2011). *Lalitavistara, Riwayat Hidup sang Buddha Seperti dikisahkan pada Relief Candi Borobudur*. Jakarta: Gramedia.
- Wirakusumah,A.D., Juwarna, Loebis. (1989). *Peta Geologi Gunungapi Merapi, Jawa Tengah (Geologic map of Merapi volcano, Central Java)*, Colcanologila survey of Indonesia
- Wirasanti, Niken.. (2015). *Lingkungan Candi di Poros Kedu-Prambanan. Disertation of Universitas Gadjah Mada*, Yogyakarta.
- _____, (2018). *Toponyms and Identity of Canggal Temple Area in Eco-linguistics Perspective*, Solo: The 4a Prasasti International Seminar Current Researrch in Linguistics.
- Zoetmulder,P,J. (1982). *Old Javanese English Dictionary*, Gravenhage, Martinus Nijhoff

Websites

- <https://fouronstate.com/isi-prasasti-canggal-serta-penjelarasannya-lengkap/5103/>
- <https://kebudayaan.kemdikbud.go.id/bkborobudur/pertanian-masyarakat-jawa-kuno-pada-masa-borobudur/>