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The Innovation Breakthrough in Digital and Disruptive Era
Identification Liangan Site: Archeological Predictive Modeling

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ABSTRACT

This research was conducted in Liangan Site, an archeological Hindu temple site situated on the eastern slope of Mt. Sundoro, Temanggung District. The discovery of Liangan Site was in the area of sand mining. This research’s interest is trying to disclose the spatial component of the site that are important to the history, science and culture. The objectives of this research: Mapping the width of Liangan Site that still has the potential to contain of archaelogical artifacts. The method that used for this research analyze the distribution of archaeological remains at the Liangan Site with the scoring method through field surveys. While cultural resource management is done by knowing the predictions of the length area of the site using Archaeological Predictive Modeling. Results from this research include the entire potential zone that contains archaeological remains at the site of 20.71 ha. The zone sensitivity archaeological remains are divided into zones of high sensitivity (3.007 ha), medium sensitivity zones (4.369 ha) and low sensitivity zones (13.34 ha).

Keywords: Site Liangan, Predictive Modeling, GIS

1. INTRODUCTION

Hindu and Buddhist influence took place in Indonesia from the 4th century until the 16th. In Kedu into Prambanan region, Hindu Mataram kingdom’s influence is quite broad in the archipelago. Remains in the form of the temple is considered cultural heritage, representing the influence of Hindu and Buddhist culture. In 2008 in Liangan Hamlet, Purbosari Village, Ngadirejo District, discovered the structure of stone and ancient artifacts allegedly part of an enshrinement.

The Discovery of Liangan Site contributes to the science of the history and culture of the nation. The remains on the Liangan Site are also able to provide an overview of public relations with the volcanic environment in the past. The existence of the Liangan Site can also benefit local economic development with the development of the tourism sector. With this development, it is expected that the welfare of communities around the site could be improved.

The research area is included in the Volcanic Foot morphology unit. The relief conditions are undulating with an average slope of 8-13% [1], [2]. The Liangan site is located in a strong undulating morphological unit and a hilly morphological unit. Strong wavy morphological units are characterized by steep slopes, rough relief and a slope percentage of between 8-16%, while hilly morphological units are characterized by prominent hill shapes, rough relief, steep slopes with narrow valley shapes and a slope percentage of > 16% [3].

The Liangan site is a potential cultural heritage that cannot be preserved renewable (non-renewable) and is an asset to the nation's wealth. The rule regarding cultural heritage has been regulated by the Republic of Indonesia Law Number. 11 of 2010 concerning Cultural Conservation Article 1. Conservation constraints Liangan Site that mining activities are ongoing at the site of intensive environments. As already noted Liangan Site was found for sand mining activities in Liangan, Purbosari village. The site area is predicted to continue to expand to 300 x 400 m² (12 ha), because most of the archaeological remains are found in sand mining area [4].
1. Building: The archaeological remains in the Liangan Site in the form of buildings classified into the Temple 1, Batur 1, Batur 2A, 2B Batur, Batur 2C, 2D Batur, Batur 3, Batur 4, Temple 2, water facility and charcoal were identified as the rest of the building.

2. Structure: Variable structure in the study area is represented by some of the stone structure longitudinally and has a straightness. Structures that have been discovered up to 2015 cover structural talud balok, stone paths, and stone walls.

3. Distribution of Artifacts: The remains of artifacts collected in the field totaled 50 pieces, distributed in villages around Liangan Site. These villages include Purbosari, Tegalrejo, Pringapus, Kentengsari and Dlimoyo village.

2. RESEARCH METHOD

This research found the Predictions Area of Archaeological Liangan Site with Archaeological Predictive Modeling. The analysis uses a quantitative approach by weighting and grading the research variables. The research questions posed in this study can be formulated as follows: How does the projection area of Liangan Site?

The selection of study sites is based on predictions of the extent of the coverage area grid of Liangan Site. Area boundary grids are made based on the initial assessment results related to the distribution of archaeological remains. The stages in the creation of a map grid survey are as follows:

1. Determine the limits of the virtual grid in the field by using the reference coordinates and map grid.

2. Each grid measuring 50 x 50 meters with 400 grids so that an unknown number of broad areas of research: 100 ha. The determination of the boundaries of each grid is integrated with the National Archaeological Mapping Systems (SPAN) [5].

3. The orientation of the grid leads to the northeast due to the structure of the remains of the ancient stone path from Liangan Site leading to Liangan Hamlet, located in the northeast of the site.

4. Determination of the southwest limit of the grid is determined based on the remains of interviews with community artifacts. In astronomy research area lies between point (A) 391350 mE 9199700 mN, point (B) 394950 mE 9199700 mN, point (C) 394950 mE 9197600 mN and point (D) 391350 mE 9197600 mN (according to the UTM coordinates Zone 49s) Administratively, the study site covers most of Ngadirejo District.

3. RESULTS AND DISCUSSION

3.1. Spatial Approach in the Context of Liyangan Site Mapping

Geography examines landscapes in the context of their relationship with humans, while the core of the study is landscape. Vink has defined a landscape as a stretch of the earth's surface with all phenomena, including landforms, vegetation and attributes that are influenced by human activities [6]. Muta'ali applies a regional landscape pyramid to explain the interaction and process of forming landscapes in Figure 2.1 [6].

The regional landscape pyramid consists of three landscape-forming components, both natural landscapes and cultural landscapes, namely the natural environment component, the social environment component (culture) and the superstructure which is more related to norms, beliefs, religion and social traditions.

Landscape components are divided into two, namely natural landscapes and cultural landscapes. Landscapes are a visible part of the natural environment, while cultural landscapes (cultural landscape) is a form of concrete appearance of the results of human adaptation to the environment.
Geography focuses on the study of the earth’s surface as a place of human life with human spatial organization and ecological relationships to the environment. The scope of geography is more focused on awareness of space on earth and the distinctive shape of that space [7].

Yunus states that geography has different characteristics in the analysis of the relationship between humans and the environment. Spatial analysis focuses on the existence of spatial elements, while ecological analysis focuses more on the ecosystem. While the region complex approach focuses more on the existence of a region in which there is a complexity of interrelated regional elements to form a complex system [8].

Spatial clusters of artifacts, ecofacts and features are referred to as sites, while regions are the larger form of sites. Regions are also defined as supporting areas where people develop the same ecological cultural system [9]. Schiffer in his book Behavioral Archaeology Principles and Practice states that in recording archaeological data there are four principles in describing the dimensions of data variability. The dimensions of the data variability include formal dimensions, spatial dimensions, frequency dimensions and relational dimensions [10].

The context of the research study proposed regarding the mapping of the Liangan Site places this research in a spatial analysis. In a spatial approach, this study attempts to understand the distribution of archaeological remains from the Liangan Site. Bintarto dan Hadisumarno states that in the study of geography there are three distinct approaches, namely: Spatial analysis studies the important characteristics of the distribution of spatial use from various interests. In this case, we learn about the variation and interpretation of the population distribution and learn about the factors that influence it [11].

3.2. Archaeological Predictive Modeling

Kohler and Parker define Archaeological Predictive Modeling as a simple technique used to predict the location of archaeological sites in an area, based on fundamental ideas about human behavior [12].

The predictive model will produce an estimate of the amount of archaeological data found [12]. Predictive models are generally used to estimate the location of archaeological sites in archaeological resource management. [13] used a predictive model to obtain an assessment of site density in an area that is likely to receive threats or disturbances in the planning zone so that it will determine the CRM (Cultural Resource Management) policy that needs to be implemented [13].

The predictive model produces a map of archaeological potential which is commonly referred to as an Archaeological Sensitivity Map/Sensitivity Map of Archaeological Findings. The map contains three sensitive zones for archaeological findings, covering areas that may contain high, medium, to low archaeological sites. The goal of predictive model analysis is to produce computer-generated archaeological predictive models that can illustrate zonations with high, medium and low archaeological potential [14].

Wansleeben states that GIS plays an important role in the modeling that is done. Basically, GIS provides convenience starting from the planning stage, testing to model applications [14]. GIS has a spatial component that enables the capture, efficient manipulation and storage of geographic information. GIS also has the ability to encode from various sources so as to produce new data. GIS technological innovation will certainly make it easier to apply predictive models that are more realistic and reasonable in managing cultural resources [15].

3.3. Predictions Area of Archaeological Liangan Site with Archaeological Predictive Modeling.

Sites predictive models are used to obtain estimates of the density of the site and are also used to determine the planning zone in CRM [13]. The data used in this analysis is a kind of archaeological remains that can be seen in the following table (3.1): Liangan archaeological remains at the site are divided into three categories.

1. Building : Structure built objects made of natural or man-made objects to meet the needs of space-walled and / or not walled and roofed.
2. Structure : The structure in the category of features that can not be moved without change, and has a straightness miners around the sit
3. Artifact : Goods moving artifacts that have been modified either in part or whole human beings.

Analysis of the data is the third calculation done by assigning appropriate weights and dignity to the study parameters. So far, there has never been in the field of archaeological research using weighting in the assessment of archaeological resources to predict the extent of an archaeological site. Then the percentage of the parameters used to use the level of the importance of archaeological data. In this case, the parameter value of each of the essential values of data will be given a score as follows:

a. Way data acquisition (Weight: 3)
b. Level data transformation (Weight: 2)
c. Artifacts category (Weight 2)
The way data acquisition/record ing archaeological data at Liangan Site is divided into Variations of Data Recording Techniques of Archaeological Data

1. Excavations: Archaeological data were found from the results of the archaeological excavations (weight: 3)

2. Interview: Archaeological data obtained from the public information about the archaeological remains they have (Weight: 2)

3. Survey: The archaeological data obtained from the field survey (Weight: 1)

In determining the extent of the site-level predictions transformation into a second parameter after the data recording techniques.

Table 1. The level of variation Data Transformation in Liangan Site

<table>
<thead>
<tr>
<th>No.</th>
<th>Transformation Specification</th>
<th>Description</th>
<th>Dignity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Small Transformation</td>
<td>building / structure is still intact with broken or missing parts is minimal so that the original shape is still easily recognizable, with the percentage of the integrity of components by 75%.</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>Medium Transformation</td>
<td>building / structures found in a state of only a few parts that are damaged or missing so that the shape can still be recognized by the percentage of the integrity of the 50%.</td>
<td>2</td>
</tr>
<tr>
<td>3.</td>
<td>Large Transformation</td>
<td>buildings / structures are damaged or lost nearly thoroughly so unrecognizable shape, with a percentage of 25% integrity</td>
<td>1</td>
</tr>
</tbody>
</table>

Assessment categories of artifacts based on elements of position, number and function. Therefore parameters artifact category given a weighted value (weight 2) is equal to the level of data transformation. The variations in the category of artifacts can be seen in the following table.

Table 2. Variations Category Artifacts in Liangan Site

<table>
<thead>
<tr>
<th>No.</th>
<th>Artifacts category</th>
<th>Description</th>
<th>Harkat</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Category A</td>
<td>finding that a building element that has an element of position and number / yoni / statues as included in the means of worship.</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>Category B</td>
<td>finding building elements that do not have element of position and number</td>
<td>2</td>
</tr>
</tbody>
</table>

The final result of the analysis is the sensitivity maps of archaeological remains. Acquisition of these maps is based on the assessment criteria of the type of archaeological remains in Liangan Site. Function Model of Map Sensitivity Archaeological remains formulated as the following:

\[ J : [(P1*B1)+ (P2*B2)+(P3*B3)...............+(Pn*Bn)] \]

J: The amount of the total value
P: Dignity variable
B: weighting factor

The total score is classified based on geometric intervals because the nature of the data is not normally distributed. Class division interval is done to divide the classification of the sensitivity of the remains including remains sensitivity valuable grid of high, medium and low:

Table 3. Sensitivity Classification Zone

<table>
<thead>
<tr>
<th>No</th>
<th>Class Interval</th>
<th>Sensitivity Classification</th>
<th>Zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>27-159</td>
<td>High Sensitivity</td>
<td>Zone 1</td>
</tr>
<tr>
<td>2.</td>
<td>9-26</td>
<td>Sensitivity Medium</td>
<td>Zone 2</td>
</tr>
<tr>
<td>3.</td>
<td>5-8</td>
<td>Low sensitivity</td>
<td>Zone 3</td>
</tr>
</tbody>
</table>

3.1 Mapping Projection Size of Liangan Site

Based on the results of the analysis through the Archaeological Predictive Modeling approach, then discovered the extent of the different classes of each zone of the sensitivity of archaeological remains. The extent of the entire study area containing archaeological remains along with the results of the analysis that has been done. Coverage of the entire region, which contained the archeological remains of 20,71 ha or 20.7% of the entire area of research. The villages are included in the scope, namely Purbosari, Tegalrejo, Dimoyo, Campursari, Kentengsari, and Gejagan village.

Table 4. Sensitivity Zone Area of Archaeological Remains

<table>
<thead>
<tr>
<th>No.</th>
<th>Zone Area of Sensitivity Remains</th>
<th>Width</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Zone High Sensitivity remains</td>
<td>3,007 ha</td>
<td>14.5 %</td>
</tr>
</tbody>
</table>
Zone of high sensitivity include locations around the Village site which is located in LianganPurbosari and Tegalrejo. Most of the remains are included in the remains of the high-sensitivity zone in Liangan Site Complex, Purbosari Village. Medium sensitivity zones covering villages around Liangan Site is Purbosari, Tegalrejo and Dlimoyo village. Low sensitivity zone is an area that has a low grid. Grid value are included in the remains of a low sensitivity zone covering Campursari, Purbosari, Dlimoyo, Tegalrejo, Kentengsari, Gejagan, and Pringapus Village.

### References


