

Potential Efforts for Conservation of Dayak Tomun Traditional House in Lamandau Regency, Indonesia

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Abstract: Damage to buildings can generally be seen after identifying the problems that occur in the building. Identification research is initial research on the condition of the building which includes: architecture, structure, utilities, historical and archaeological values of old traditional buildings. A multi-disciplinary approach is certainly needed and the uniqueness of heritage structures, with their historical value, requires regular research and analysis in the actions used in the investigation of a building. The stages that need to be carried out in this research are: data acquisition, historical investigation, structural survey, field research and testing, laboratory (if needed), and monitoring. The results showed that some of the building components of the Dayak Tomun Traditional House were categorized as lightly to heavily damaged. This condition is potential for conservation efforts. The approach to conservation activities at the Dayak Tomun Traditional House should follow the existing guidelines and hold consultations with experts who know about the materials used. To maintain the sustainability of this building, it is necessary to take appropriate conservation measures for this building, including the site. This traditional house conservation action must focus on sustainability from the previous era to the present era until to the next period.

Keywords: Dayak Tomun traditional house, conservation, sustainability.

I. INTRODUCTION

The Lamandau Regency area has several cultural heritage buildings that need to be preserved. Some of the buildings that can be said to be cultural heritage are in the form of the Dayak Tomun Traditional House [1]. The traditional house of the Dayak Tomun Tribe, one of which is a traditional house that has a unique characteristic, namely at the entrance there is a dragon carving, which is a building that has been built for a long time [2]. The building was immediately occupied in the year it was completed. Currently, the age of this traditional house building has reached more than 100 years. Until 2021, the Dayak Tomun Traditional House has not received any assistance contribution in its treatment or rehabilitation from the local government. This building has been repaired by the heirs of the owner of this building. Improvements made were to replace the bamboo floor with the same material. The condition of the building of the Dayak Tomun Traditional House is very worrying, because there has been weathering and heavy damage to many component parts of the building. This cultural heritage building needs to be given conservation measures so that its existence is maintained, besides that this building needs to be preserved considering its very high cultural value for Lamandau Regency [3] [4].

The traditional house of the Dayak Tomun tribe is in the form of a stilt house built with ironwood (*Eusideroxylon zwageri*) material. The stilt house is in the form of a long house or a betang house, and is built in mutual cooperation. The traditional house of the Dayak Tomun tribe is built in an east-west direction, where the front of the house faces east. The Dayak Tomun tribe is an acculturation with the Minang tribe, so that in some parts the traditional house also resembles a traditional gadang house, such as the curved roof. Some of these traditional houses are still maintained, as they were originally, even more than 50 years old. Generally, the traditional house of the Dayak Tomun tribe is also a place for storing musical instruments, which are used when carrying out their religious rituals [5].

Many of these traditional house buildings have been converted into jointly managed rice granaries. However, there are still many that are still used as their residence [3]. Generally, these traditional houses are built not far from the river, to make it easier to get clean water. After the electricity grid, they have used hand pump lights or electric pumps to get clean water. Traditional houses of the Dayak Tomun tribe generally have a height of 3 - 5 meters from ground level. The ladder used to reach the traditional house has an odd number of steps, and can be removed and stored. The ladder is kept to protect the family in the house from all things that are dangerous, both from nature, wild animals, and other things. The stairs are made of large ironwood rods and are notched in several parts to become steps, but nowadays there are many stairs made of ironwood boards.

Meanwhile, the UNESCO Convention held in Paris on November 16, 1972 explained that all countries participating in the meeting had the task of ensuring the identification, protection, and conservation of the existence of cultural heritage and the native environment in their country. In addition, the convention also explains the need for scientific and technical research so that the government of a country can prevent all things that endanger its cultural heritage or natural environment [6] [7] [8]. In this regard, UNESCO recommends the establishment of a national or regional body to train for treatment, conservation and preservation of cultural heritage and environmental heritage, as well as to develop scientific research in the field of cultural heritage [9] [10].

Regulation of the Minister of Public Works and Public Housing of the Republic of Indonesia Number 01/PRT/M/2015 concerning Preserved Cultural Heritage Buildings explains that efforts to protect cultural heritage buildings are efforts prevent and control cultural heritage buildings from damage, destruction, or vandalism by carrying out efforts to save, secure, maintain and restore the building. In addition, the second part of article 8 explains the provisions regarding the reliability of cultural heritage buildings, namely: health; convenience; convenience; and safety [11] [12]. Then it was also explained that the structural elements of cultural heritage buildings should be able to ensure the fulfillment of the building's strength to support the supported loads, hinder and overcome the dangers of fire, lightning, and natural disasters [13] [14]. The use of natural materials that can be flammable should be treated in a special way (fire-retardant treatment); and the use a new-materials, preferably non-combustible materials [15].

Studies on the identification of cultural heritage buildings have been included in various regulations in Indonesia. In these regulations, it is explained that in assessing damage is a prelude investigation of the physical condition in terms of architecture, structure, and utility; as well as the historical and archaeological value of cultural heritage. These investigative actions include [16] [17]:

- provisions regarding the appropriateness of action/ treatment of the form of buildings or buildings of cultural heritage that are maintained, either in whole form or in part only; and
- provisions of the appropriateness of action on the technical treatment of preservation.

Site and building conservation are the process of caring for and controlling changes in cultural heritage assets in a manner that supports and if necessary, enhances their importance. Most of our inherited assets can be matched or worked on to some degree without losing their purpose for existence. Indeed, transition or changing are often appropriate to facilitate optimal use of appropriate assets so that they can continue to receive assistance or support from various parties [16] [18] [19].

The purpose of conservation or preservation actions is to maintain the values of cultural heritage, which of course in the process of these actions need to be considered, namely [20] [21] [22]:

- Working in a cultural heritage site must be preceded by a study to understand the place and must also include physical, documentary, oral and other evidence analysis, which is described on the basis of appropriate knowledge, skills and other disciplines related to the cultural heritage.
- Real reports on cultural and policy interests for the cultural heritage must be provided, checked for correctness and accompanied by evidence. Significance and policy statements should be included in the cultural heritage management plan.
- Groups and individuals studying a cultural heritage should be given the opportunity to help and be involved in recognizing and realizing the meaning of the cultural heritage. In addition, they are also given the opportunity to assist or support conservation and management actions.
- Notice of cultural and policy interests for the heritage site should be examined at specified intervals, and the treatment and importance observed to ensure continued appropriateness and effectiveness.

The conservation process includes the method of maintenance and also includes the state of the preservation, restoration, reconstruction and adaptation processes, as well as the combination of conditions of these processes [23] [24]. Conservation is also one of the managements of cultural resources. Conservation activities are a process with the aim of preserving cultural heritage as long as possible. This can be done by maintaining and protecting its authenticity from damage. This action is needed so that the cultural heritage can be useful in the present, as well as in the future; either by retaining old functions or by introducing new functions as needed [25] [26].

Conservation efforts must also involve the community. The Burra Charter also explains that the maintenance, explanation and control of a cultural heritage must provide for the participation of people who have a special involvement and meaning in that cultural heritage, or who have social obligations or burdens, spiritual or cultural importance for the cultural heritage [27]. In this case, the participation of local communities in the process of preserving cultural heritage is very important, and it makes them feel responsible together with the local government [28]. The "affected" community (positive or negative) can be residents, whose daily lives are related to the heritage of the cultural heritage, can also be users (tourists, people who work, do business at the cultural heritage site), and owners or heirs of the cultural heritage. the cultural heritage [29] [30].

II. RESEARCH METHOD

The existing standard of conservation guidelines was originally from historic buildings and certain sites as cultural heritage located in European countries and their former colonies. This conservation standard is not in accordance with the object of traditional houses in the humid tropics, so an idea for a conservation adjustment method is needed by identifying technical damage and other scientific disciplines in an integrated manner. The use of the conservation adjustment method is caused by several factors, namely damage to traditional houses caused by a decrease in the function of material reliability, the level of ability of indigenous peoples to maintain them, changes in the function of the forest environment The area around traditional houses and the lack of attention from the local government

The old building structure in Lamandau Regency, based on its uniqueness and origin (materials and manufacture), poses many problems in restoration, investigation, inspection, supervision, and confirmation that restrict the implementation of official building regulations. Guidance is certainly expected and needed to determine appropriate investigative and research methods with cultural heritage coverage. These principles include: standard norms; research and investigation; and corrective and control actions. A multi-disciplinary approach is certainly needed and the uniqueness of heritage structures, with their historical value, requires regular research and analysis in the actions used in the investigation of a building [31] [32].

The research approach used is adapted to the nature of the research problem and research objectives [10]. The research will be conducted on the cultural heritage site of Pintu Banaga Traditional House, a house located in Lamandau Regency, Central Kalimantan. The research period was 4 (four) months, where the field survey was carried out in Lamandau Regency; and data processing and analysis as well as report preparation are carried out in Jakarta. The stages that need to be carried out in this research are:

1. Data acquisition: guide and inspection
2. Investigation of its origin, construction, and architecture.
3. Checking the structure of the Pintu Banaga Traditional House.
4. Inspection on site and building and if necessary, carry out laboratory testing
5. Observing

Inspection and assessment of structural safety are two successive and interrelated steps of the measure of determining effective requirements and the extent of maintenance action. If these steps are performed incorrectly, the resulting solution may become unfeasible: poor calculations may result in conservative maintenance measures and therefore an inappropriate level of reliability. Any security assessment is strongly influenced by the inherent ambiguity of the data (action, resistance, deformation, etc.), patterns, estimates, and others used in the investigation. Meanwhile, to obtain information and investigation data will be made in the filling form.

III. RESULTS AND DISCUSSION

A. General Condition of the Dayak Tomun Traditional House

The Dayak Tomun Traditional House is located in Kudangan Village, Batang Kawa District, Lamandau Regency. This house has a unique characteristic, namely the entrance is carved with a dragon image. The front roof has a unique decoration in the form of a bird, and this is indeed a characteristic of the Betang Traditional House which always has floral or animal motifs. This traditional house is in the form of a stage and is long, and is usually also a place for storing traditional musical instruments that are still used when cultural rituals are carried out. To reach the location of one of the Dayak Tomun Traditional Houses from Nanga Bulik City with a distance of about 120 km, it takes 4 (four) to 5 (five) hours when using a four-wheeled vehicle.

The traditional house of the Dayak Tomun tribe is more than 100 years old, although the year of construction of the house is not known. According to the owner of the traditional house, when viewed from the front; Traditional houses are built starting from the front on the left side, then to the left side of the back, then the right side of the back, and finally the right side of the front. This is done according to the belief held by them with the figurative word "the king ascends". The figurative meaning of this "king ascending" is that fortune or income rises from the left and then surrounds the house to the right of the house. The traditional house building uses ironwood material in all its components, except for the floor and roof truss. This old wooden building still looks sturdy and livable, although some of its components must be replaced, so that its existence as one of the traditional Dayak Tomun houses can be preserved.

The condition of the site which is still beautiful, with the presence of trees and other plants certainly greatly affects the condition of the traditional house building. The distance between this cultural heritage building and other traditional house buildings is also not too close. Meanwhile, there is no room division in this traditional house, but it can be seen that the front of the room functions as a living/dining room. The kitchen is separated from the other wooden building and is connected by an open stilt deck. The stage deck area also functions as a washing and bathing room, as well as for drying clothes. On the inside of this traditional house building, several large jars or jars are also found. Most of the jars are placed on the supporting wood for the roof structure and only a few are placed on the floor of this traditional house of the Dayak Tomun tribe. Most of the jars are plain patterned, but there are also jars that have a dragon pattern.

The environmental conditions of traditional houses consisting of natural forest wood trees are decreasing in population, the availability of natural wood raw materials is decreasing and replaced by:

- the rapid development of land clearing for oil palm tree plantations in the surrounding forest area,
- less or no maintenance program from the local government,
- lack of attention and concern for the community and the heirs of traditional houses.

In addition, in the area around traditional houses, it is necessary to control proportionally the ratio of the growth of oil palm plantations to natural wood trees. This causes flood water immersion which results in a decrease in the physical strength of the wooden columns of traditional houses which are technically embedded directly into the ground or without a foundation point. To overcome this requires regulations and maintenance budgets from the local government.

B. Architectural Condition

The architecture of the Dayak Tomun Traditional House is like traditional houses in Indonesia in the form of a house on stilts. This traditional house must be built facing east and the back facing west. This is believed by the Dayak Tomun tribe who have the Kaharingan belief as a symbol of their life journey, namely from birth (sunrise) until dusk or death (sunset) [8]. The traditional house built in the form of a house on stilts, of course, also aims to protect its inhabitants from attacks by wild animals and flash floods. In addition, the traditional house of Dayak Tomun was built close to the river, because apart from being close to a source of clean water, they also believe that the river is also a source of livelihood.

The roof or covering of the traditional house of Dayak Tomun resembles a gadang house, which is shaped like a buffalo horn (slightly curved). Meanwhile, at the end of the roof is decorated with wood shaped like a hornbill, while at the back it uses a bird's tail decoration. The architectural style of the Dayak Tomun Traditional House is influenced by the architecture of the Pagarryung Kingdom. This traditional house uses bamboo floors and is covered with mats. There are no windows

in this traditional house building, there are only vents. The stairs to reach the house from the front there are 2 (two) parts, namely the stairs from the ironwood board to the terrace with 7 (seven) steps, then from the terrace using a ladder made of ironwood rods that are notched as much as 5 (five) notches. There is an additional building to the left behind the main building, which functions as a kitchen. The connecting area of the main building and outbuildings is the exposed stilt deck. This traditional house is bordered by the road and residents' houses. There are 39 pillars supporting this traditional house, and all of them are made of ironwood.

C. Structural Condition

The structural condition of this Dayak Tomun Traditional House looks quite sturdy with its age which is more than 50 years, maybe even more than 100 years. The pillars supporting the building of this traditional house are made of ironwood, which the locals call ironwood. Likewise for all buildings that use ironwood as wall material, both on the columns and wall coverings. Meanwhile for the floor using bamboo slats covered with mats made of woven bamboo.

The roof construction of this traditional house uses bamboo as a support, and for the roof covering using ironwood shingles. The section under the Dayak Tomun Traditional House is used as a storage area for ironwood boards and beams. The distance between the floor of the building to the roof of the house is about 3-4 meters. Meanwhile the length of the building is + 12 meters and the width of the building is + 5.5 meters. The height of the terrace from the land surface is about 2 (two) meters, while the height of the main building of the Dayak Tomun Traditional House is about 3 (three) meters from the ground. In general, the construction of this building looks livable, although there are building components that must be repaired immediately.

D. Condition of Components of the Dayak Tomun Traditional House

This Dayak Tomun traditional house building in Kudangan Village deserves to be called a cultural heritage building, because it is more than 50 years old. Currently, the owner himself is more than 80 years old, and explains that his own parents built the traditional house. Based on this explanation, it can be estimated that the age of the building is more than 100 years. This traditional house building uses ironwood as the main material. Ironwood (*Eusideroxylon zwageri*) is wood tree that grows in Kalimantan. Ironwood which has a specific gravity of 1.04 is classified into Strong Class I and Durable Class I [33]. Of course, with the age of the building which is more than 100 years old, the condition of the building components is no longer good or not. The condition of building components is strongly influenced by maintenance conditions and environmental conditions.



Fig 1. The pillars of the damaged traditional house building supported by wooden supports.

The pillars of the building are made of ironwood which are planted directly into the ground without using stones. The condition of the pillars of the building generally still looks good, although there are some pillars that are already visible starting to break and are supported by other support wood (Fig 1), there are also some that have started to have cracks at the ends of the pillars that are in contact with the ground. This happened because the condition of the supporting poles used had begun to shift (tilt and not perpendicular) from its initial position, so it needed to be supported by other wood. The cause could be the ground shifting or also the floor load at the point of the support pole. In addition, the wood of the support poles has begun to be attacked by fungus, which causes a change in color. Ironwood is classified as a very durable wood, so the fungus attack does not really affect the strength of the wooden pillars supporting this building.

Almost all of the pillars supporting the Dayak Tomun traditional house have been attacked by termites. The occurrence of land subsidence can also cause the pillars of traditional houses to tilt, where the supporting poles do not use pedestal foundations. In addition, by not using a pedestal foundation, if it is hit by a flood, it will accelerate the weathering of the material supporting the traditional house. Similar to the pillars of the building, the floor supporting beams also use ironwood

as the material. The condition of the support beams is still in very good condition. The beams supporting the floor rest on the pillars supporting the building. Meanwhile, the supporting beams for the terrace floor of the traditional house of the Dayak Tomun tribe have many mold stains. This is because the terrace is not protected or does not have a roof, so it easily becomes damp, and is susceptible to fungus.

The floor rafters of the Dayak Tomun traditional house use large and long round bamboo materials. The diameter of the bamboo is about 15 cm, with an average length of 12 meters. The bamboo used as floor rafters still looks very good condition. Judging from the appearance of the bamboo, the type of bamboo used is stone bamboo or petung bamboo (*Dendrocalamus asper*). Petung bamboo is often used as a building material, it can even function as a building support pole [34]. The floor of this stilt house building is made of split bamboo material which is cut lengthwise. The bamboo halves are made of 4-5 cm in size and are not arranged tightly, but there is a distance of about 1 - 1.5 cm. Thus, there is a gap in the bamboo floor (Fig. 4). To overcome this, the occupants/owners of the Dayak Tomun traditional house use mats made of bamboo. These bamboo mats are used on the entire floor surface of the Dayak Tomun traditional house, so that the floor of the house made of split bamboo is covered by bamboo mats. Bamboo mats are comfortable to use when sitting or lying down.

The condition of the outer stairs that stand from the ground to the terrace area of the traditional house is still quite good, although there has been a change in color with stains (white spots). These stains indicate that there is already mildew on the ironwood stairs. This can happen because the stairs are located in an open area. There is even moss growing on the left and right sides of the stairs of this building as shown in Fig 2. If you look closely, you can find some very fine hair cracks on some of the steps. The stairs of this traditional house are made of ironwood material. The wood is known as Class I wood, which is of very good quality. Even though it is quite old, it is still strong, but it is often exposed to rain, causing the stairs to become damp, and this condition is very favored by wood-destroying fungi. Of course, this needs to be addressed, so that the condition of the stairs can function properly.



Fig 2. The stairs to the terrace (left) and into (right) the traditional house of Dayak Tomun

Stairs from the terrace to the house using ironwood that is notched. The condition of this ladder is still very good and looks well cared for. Likewise, the stairs to the drying/laundry room, use ironwood that is notched. According to the owner of the household, it can be stored in the house at night. This habit is carried out because of their belief in protecting the occupants of the house from all possible dangers.



Fig 3. The outer (left) and inner (right) wooden walls of the Dayak Tomun Traditional House.

The walls of this traditional house of Dayak Tomun use boards made of ironwood. On the outside of the walls of wooden boards, it looks drier and lighter in color. Just like the other components, the exterior of this building is more often affected by natural/weather factors, so the color of the wood has also changed, unlike the original color (Fig 3). However, these natural/weather factors do not or very little affect the quality of this wooden plank wall. Meanwhile, the inner wall looks darker in color, and matches the color of ironwood (Fig 5). The wooden walls of this traditional house look still in very

good condition, although in some parts of the walls there are already visible gaps in the wooden plank walls. This can happen because the wood is hygroscopic (can experience shrinkage), and also the age of the wood is quite long (more than 50 years).

In traditional philosophy, the door is a barrier or meeting point (point of tangent) between the outer world which is not limited to the inner world which is ordered and limited. The door is a transition from unsafe or uncertain outside to a safe and certain area. The traditional house of Dayak Tomun has a very unique entrance. The door is made of very good quality ironwood material, and is engraved with the image of a dragon, as shown in Fig 4. Besides the entrance, there is also a door leading to the laundry and drying room, but the door is just plain, without any carvings. The condition of the doors is very good, and still functions well, although it looks like the wood has started to change color. Like most other building components in the house, there is this Dayak Tomun, the wood is left without being painted, the maintenance is very simple, just clean it from dust. The doors in this building use iron hinges on the top and bottom of the door leaf.



Fig 4. The door engraved with a dragon image.

The roof frame of this building uses a ring beam of ironwood material at the bottom. The condition of the ring beams from the roof truss of this building is still quite good (Fig 5). The ironwood which is used as the ring beam becomes the support for the horses and the battens on the roof truss. The condition of the ironwood block ring is still quite good. Meanwhile, the horses and battens for the roof cover use bamboo material. The rafters of bamboo material are arranged tightly about 60 cm, as well as the battens that cover the roof with a distance of + 50 cm. The diameter of the bamboo for the roof truss is about 8-10 cm. The width of the bamboo battens is about 2 cm which is composed of 2 - 3 small bamboo sticks of small diameter (Fig 5).

The bamboo rods for the battens are tied with bamboo ropes. The condition of the horses and battens looks still quite good. Tree bark made of ironwood material is used to cover the roof of the Dayak Tomun traditional house. The bark of the ironwood tree is indeed a common material used in Dayak Tomun stilt houses. As a roof covering, of course, it is often exposed to rain. In some parts of the roof covering has been damaged, and must be replaced immediately, so that water does not enter the building or damage other components of this building.



Fig 5. The roof frame and roof covering of the Dayak Tomun Traditional House

E. Conservation of Site/Land and Traditional Houses of the Dayak Tomun

The Island of Borneo is indeed famous as a producer of ironwood. However, at this time the forest has begun to be preserved, considering that the wood has become rare in natural forests due to illegal logging that occurred several decades ago. When this traditional house was built, ironwood was still commonly found in natural forests in Kalimantan. Of course, it is very difficult to find a substitute for ironwood. Meanwhile, the condition of several components of the Dayak Tomun Traditional

House is categorized as lightly damaged to moderate damage. The building components of this traditional house are often cleaned every 2 – 3 months by the owner, especially for the prevention of fungal attacks, but maintenance measures still need to be improved. Considering that this traditional house building is more than 100 years old, it certainly needs to be preserved and proposed as a cultural heritage building. To maintain the existence of this traditional house, of course, it must also be considered to repair components that are starting to break. It is necessary to take appropriate conservation measures for this traditional house building, including the site.

Conservation activities are not the same as renovating a building. Actions for conservation of cultural heritage buildings that are starting to break down, should strive to restore their physical condition to their original state, so that the restoration of the Dayak Tomun Traditional House needs to be carried out:

1. The originality of the building elements, the condition, the place/situation of the building, the architectural form of the building and the method of manufacture.
2. Restoring the building to its authentic state, even though there are modifications, it needs to be as small as possible by not interfering with the architectural form of the building.
3. On conservation actions, should use the mechanism, technology, and non-destructive materials.
4. Involve competent officers and workers in the cultural heritage conservation sector.
5. Alignment can be done when needed, this is to heed the comfort of the community and the safety of cultural heritage.
6. If there are adverse impacts that arise on the natural environment/site and the community, an environmental impact analysis must be made by taking into account the provisions of the applicable regulations.
7. According to existing regulations, it was found that there were 3 (three) main principles of restoration, namely: knowledge, application and assessment [9]. In this case the notion of knowledge is knowing the physical condition of the building, its originality and the site of the building. Assessment consists of proper functioning, improvement of materials, habits and technology, sustainability and historical evidence. Evaluation consists of current application to new problems, continuity and interpretation. This confirms that the appropriate action for the Dayak Tomun Traditional House is a conservation activity that still refers to regulations of the Republic of Indonesia regarding cultural heritage. Meanwhile, the conservation actions that must be taken for the building elements of the Dayak Tomun Traditional House are as follows:
 8. Building support poles: clean, repair by pasting on damaged wooden poles with wood that is the same or not stronger than the original, give anti-fungal and termite treatment, give foundation/base on each building support pole
 9. Roof: adjust to the quality of the previous material, texture, arrangement and pattern as before.
 10. Doors: clean, give anti-mildew and termite-proof treatment, the color quality or paint of the wood should be the same as before.
 11. Floor: clean and repair materials that are still suitable for use, replace damaged materials and make sure to use the same material as the original.
 12. Outer wall and inner wall: clean and tidy up, repair by pasting on walls that are not suitable for use with the same quality wood material.
 13. Stairs: clean, give anti-mildew and anti-termite.
 14. Frame structure system: strengthen, do not make repairs using materials that are stronger than the existing materials, replace damaged materials, give anti-termite treatment.
 15. Ornament: clean; repair; ornaments from wood material adjust to the original, give anti-fungal and termite treatment

The approach to conservation activities at the Dayak Tomun Traditional House should follow the existing guidelines and hold consultations with experts who know about the materials used. This is intended so that the existence and sustainability of the Dayak Tomun Traditional House is maintained. sincerity and originality are also important actions to be applied to this traditional house conservation activity. In addition, this traditional house conservation action must focus on sustainability from the previous era to the present era to the next period.

IV. CONCLUSION

The architecture of the Dayak Tomun Traditional House is like traditional houses in Indonesia in the form of a house on stilts. This traditional house must be built facing east and the back facing west. This is a form of symbol of their life journey, which is from birth (sunrise) until dusk or death (sunset). The roof or covering of the traditional house of Dayak Tomun resembles a “gadang house” (West Sumatera traditional house), which is shaped like a buffalo horn (slightly curved). The structural condition of this Dayak Tomun traditional house looks quite sturdy with its age which is more than 50 years, maybe even more than 100 years.

The condition of several components of the Dayak Tomun Traditional House is categorized as lightly damaged to moderate damage. The building components of this traditional house are often cleaned every 2 – 3 months by the owner, especially for the prevention of fungal attacks, but maintenance measures still need to be improved. To maintain the existence of this traditional house, of course, it must also be considered to repair components that are starting to break. It is necessary to take appropriate conservation measures for this traditional house building, including the site.

Almost all of the pillars supporting the Dayak Tomun traditional house have been attacked by termites. The occurrence of land subsidence can also cause the pillars of traditional houses to tilt, where the supporting poles do not use pedestal foundations. In addition, by not using a pedestal foundation, if it is hit by a flood, it will accelerate the weathering of the material supporting the traditional house.

Conservation activity is a process that aims to extend the life of cultural heritage; by maintaining and protecting the authenticity of the interference damage. The approach to conservation activities at the Dayak Tomun Traditional House must follow the instructions and in consultation with an expert who understands the materials used (both in terms of quality and age of the material). This traditional house conservation action must focus on sustainability from the previous era to the present era to the next period.

REFERENCES

- [1] Central B. o. S. f. Lamandau Regency. 2021. Lamandau Regency in figures 2021. Nanga Bulik: Central Bureau of Statistics for Lamandau.
- [2] Anonymous. n.d. “Traditional House of Pintu Banaga.” Accessed 1 March 2022. <http://cagarbudaya.kemdikbud.go.id/cagarbudaya/detail/PO2014102400019/rumah-adat-pintu-banaga>.
- [3] Indrianto J. 29 June 2021. “Looking at the Lamandau Culture.” Accessed 31 January 2022. <https://www.djkn.kemenkeu.go.id/kpknl-pangkalanbun/baca-article/14007/Menilik-Budaya-Dayak-di-Lamandau.html>.
- [4] Attia, A.S. 2021. "Traditional Islamic House (Ottoman House) Architecture, in Old Fatimid Cairo and Rosetta Cities, Egypt - An Example of Sustainable Architecture." *International Journal of Sustainable Development and Planning* 16 (8): 1509-1517. doi: 10.18280/ijstdp.160812.
- [5] Nurfalalah, H. 2019. Borneo News. [Online]. Available: <https://www.borneonews.co.id/berita/116870-bupati-lamandau-sehkan-sk-tiga-bangun-cagar-culture>. [Accessed 20 February 2022].
- [6] Pola, A.P. 2019. "When heritage is rural: Environmental Conservation, Cultural Interpretation and Rural Renaissance in Chinese Listed Villages." *Built Heritage* 3(2): 64-80. doi: 0.1186/BF03545728.
- [7] Ribera, F., A. Nesticò, P. Cucco, and G. Maselli. 2020. "A Multicriteria Approach to Identify the Highest and Best Use for Historical Building." *Journal of Cultural Heritage* 41: 166-177. doi: 10.1016/j.culher.2019.06.004.
- [8] Rubeis T., I. Nardi, M. Muttillio, and D. Paoletti. 2020. "The Restoration of Severely Damaged Churches – Implications and Opportunities on Cultural Heritage Conservation, Thermal Comfort and Energy Efficiency." *Journal of Cultural Heritage* 43: 186-203. doi: 10.1016/j.culher.2019.11.008,
- [9] Jokilehto, J. 2017. *Conservation. A History of Architectural Conservation*, pp:209-254.
- [10] Bertolin, C. 2019. "Preservation of Cultural Heritage and Resources Threatened by Climate Change." *Geosciences* 9 (6): 1-11. doi: 10.3390/geosciences9060250.

- [11] Anonym. 2015. Regulation of the Minister of Public Works and Public Housing of the Republic of Indonesia Number 01/PRT/M/2015 concerning Preserved Cultural Heritage Buildings." Jakarta: Ministry of Public Works and Public Housing of the Republic of Indonesia.
- [12] Marzouk, M., M.E. Sharkawy, P. Elsayed, and A. Eissa. 2020. "Resolving Deterioration of Heritage Building Elements Using an Expert System." *International Journal of Building Pathology and Adaptation* 38(5): 721-735. doi: 10.1108/IJBPA-12-2019-0106.
- [13] FEMA. 2020. Preliminary damage assessment guide. FEMA Preliminary Damage Assessment Guid, New York: FEMA.
- [14] Gopinath, V.K. and R. Ramadoss. 2021 "Review on Structural Health Monitoring for Restoration of Heritage Buildings." In *International Conference on Advanced Materials Behavior and Characterization (ICAMBC 2020)*, Chennai, India: Science Direct. doi: 10.1016/j.matpr.2020.09.318.
- [15] Galanis, M., K. Rao, X. Yao, Y.L. Tsai, J. Ventura, and G. A. Fricker. 2021. "DamageMap: A Post-Wildfire Damaged Buildings Classifier." *International Journal of Disaster Risk Reduction* 65(102540): pp. 1-10. doi: 10.1016/j.ijdr.2021.102540.
- [16] Kiruthiga, K. and K. Thirumaran. 2019. "Effects of Urbanization on Historical Heritage Buildings in Kumbakonam, Tamilnadu, India," *Frontiers of Architectural Research* 8(1): 94-105. doi: 10.1016/j.foar.2018.09.002.
- [17] Cabrera, V., Á. Yustres, R.L. Vizcaíno, Ó. Merlo, M.A. Ruiz, E. Torrero, and V. Navarro. 2021. "Determination of the Hygric Properties of the Heritage Stone of the Cathedral of Cuenca Through the Water Absorption by Capillarity Test." *Journal of Cultural Heritage* 48: 186-195. doi: 10.1016/j.culher.2020.11.009.
- [18] Johnston, B., Ruffell, A., McKinley, J., Warke, P. 2018. "Detecting Voids within a Historical Building Facade: A Comparative Study of Three High Frequency GPR Antenna," *Journal of Cultural Heritage* 32:117–123. doi: 10.1016/j.culher.2018.02.003
- [19] Benchekroun, M., S. Chergui, F. Ruggiero, and S. Di Turi. 2019 "Improving the Indoor Climate of the Traditional Ottoman Houses in the Medina of Algiers." In *IOP Conference Series: Materials Science and Engineering*, vol. 609, issue 4, 2019. <https://iopscience.iop.org/article/10.1088/1757-899X/609/4/042073>.
- [20] Vandever, M.W., S.K. Carter, T.J. Assal, K. Elgersma, A. Wen, J.L. Welty, R.S. Arkle, and R. Iovanna. 2021. "Evaluating Establishment of Conservation Practices in the Conservation Reserve Program Across the Central and Western United States." *Environmental Research Letters* 16(7), 074011. doi: m10.1088/1748-9326/ac06f8.
- [21] Richards, J. and P. Brimblecombe. 2022. "The Transfer of Heritage Modelling." *Heritage Science* 10 (1): 1-10. doi: 10.1186/s40494-022-00650-4.
- [22] Orr, S.A., J. Richards, and S. Fatorić. 2021. "Climate Change and Cultural Heritage: A Systematic Literature Review (2016–2020)." *The Historic Environment: Policy & Practice* 12(3-4): 434-477. doi: 10.1080/17567505.2021.1957264.
- [23] Del, S.T.T., B.S. Sedghpour, and S.K. Tabrizi. 2020. "The Semantic Conservation of Architectural" *Heritage Science* 8(1): 1-13. doi: 10.1186/s40494-020-00416-w.
- [24] Woodward, A. and D. Heesom. 2021. "Implementing HBIM on Conservation Heritage Projects: Lessons from Renovation Case Studies." *International Journal of Building Pathology and Adaptation* 39(1): 96-114. doi: 10.1108/IJBPA-06-2019-0054.
- [25] Halifeoğlu, F.M. and M. Assénat. 2022. "Evaluation of the Excavations Carried Out between 2010 and 2017 in Diyarbakir Grand Mosque Complex for Restoration Work; Hanafis Section and Eastern Maksurah." *International Journal of Architectural Heritage* 14(2): 163-181. doi: 10.1080/15583058.2020.1765050.
- [26] Whitman, C. J., O. Prizeman, J. Gwilliam, P. Walker, and A. Shea. 2020. "Energy Retrofit of Historic Timber-Frame Buildings – Hygrothermal Monitoring of Building Fabric," *Preventive Conservation - From Climate and Damage Monitoring to a Systemic and Integrated Approach*, pp: 129-135. doi: 10.1201/9781003004042-20

- [27] Truscott, M.C. 2014. "The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance (1999)," Encyclopedia of Global Archaeology, pp; 1078-1082. doi: 10.1007/978-1-4419-0465-2_1046.
- [28] Wang, N., X. Zhao, P. Zhao, Y. Zhang, Z. Zou, and J. Ou. 2019. "Automatic Damage Detection of Historic Masonry Buildings Based on Mobile Deep Learning." Automation in Construction 103: 53-66. doi: 10.1016/j.autcon.2019.03.003.
- [29] Strauser, J., W.P. Stewart, N.M. Evans, L. Stamberger, Carena J. van Riper. 2018. "Heritage Narratives for Landscapes on the Rural–Urban Fringe in the Midwestern United States." Journal of Environmental Planning and Management 62(7): 1269-1286. doi: 10.1080/09640568.2018.1492908,
- [30] Cardoso, R. 2022. "Haussmannian Building Repair, Rehabilitation and Strengthening: Case Study from France." In Proceedings of the Institution of Civil Engineers - Engineering History and Heritage 175(1): 7-20. doi: 10.1680/jenhh.20.00006.
- [31] Mehr, S.Y., and S. Wilkinson. 2020. "The Importance of Place and Authenticity in Adaptive Reuse of Heritage Buildings." International Journal of Building Pathology and Adaptation 38(5): 689-701. doi: 10.1108/IJBPA-01-2020-0005.
- [32] Agapiou, A., V. Lysandroua, and B. Cuca. 2021. "Copernicus Earth Observation for Cultural Heritage." Proceedings ARQUEOLÓGICA 2.0 - 9th International Congress & 3rd GEORES - Geomatics and Preservation. doi: 10.4995/Arqueologica9.2021.12512.
- [33] Gibson, E. 2016. "Introduction of Shoot Buds Multiplication of *Eusideroxylon zwageri* Tesym & Binned (Borneo Ironwood) by using Nodal Explants," Advances in Plants & Agricultural Research 5(3): 551-555. doi: 10.15406/apar.2016.05.00184
- [34] Ardhyanta, H., E.I.Puspita, S.T. Wicaksono, F. Pakaya, A.T. Wibisono, and I. Hanafi. 2019. "Preparation and Characterization of Carbon from Petung Bamboo (*Dendrocalamus asper*) and Ori Bamboo (*Bambusa arundinacea*) by Carbonization Heat Treatment," Materials Science Forum 964: 26-32. doi: 10.4028/www.scientific.net/MSF.964.26.
- V. P. Gountis and A. G. Bakirtzis, "Bidding strategies for electricity producers in a competitive electricity marketplace," IEEE Trans. Power System, vol. 19, no. 1, pp. 356–365, Feb. 2004.