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The Mapping Out of Maros-Pangkep Karst Forest as a Cultural Heritage Conservation

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Abstract. Maros-Pangkep Karst Forest is a biological wealth that has an important role in maintaining the sustainability of the macro environment ecosystem in this region. The maintenance of the MarosPangkep Karst Forest has a positive impact on ecosystem sustainability, which guarantees the continuation of cultural heritage from the past in the form of prehistoric caves in the region. Therefore, arranging the Maros-Pangkep Karst Forest principally is either for preserving the environmental ecosystem or for maintaining the cultural ecosystem as well. Thus the Maros-Pangkep Karst Forest must always be well organized and managed. This is due to the utilization of mining potential in this area which has an impact on the destruction of karst forests. The method of comparison of previous research data conducted in this article shows that efforts to organize the Maros-Pangkep Karst Forest need to be done immediately, due to the efforts of the current government to propose this area as Unesco Global Geopark.

1. Introduction

One of the karst ecosystems in South Sulawesi Province is in Maros and Pangkep Regencies, known as the Maros Pangkep Karst Forest (MPKF) area. This karst has an area of 43,750 ha, and as much as $\pm 19,337$ ha are included in the Bantimurung Bulusaraung National Park area. This then made the MPKA being the second largest karst region in the world. The MPKA is unique in the form of lined high tower hills commonly referred to as karst towers, with extensive cliffs, which are not found in other regions in Indonesia. Karst Maros-Pangkep has tremendous potential for supporting human life, based on its physical characteristics; the karst region has a function As the main aquifer that meets raw water for hundreds of thousands of people living in it, the region serves as a guardian of the balance of the regional ecosystem. Karst itself is the name of a landscape that exists and develops specifically in carbonate and dolomite rocks. Carbonate rocks are often referred to as limestone with the chemical formula Calcium Carbonate/ CaCO_3 , a sedimentary rock formed on the ocean floor and arranged by various shells of marine animals in millions of years.

Samodr et al. [1] Limestone is lifted out through geological processes to form mountains or limestone plains. It is the *pelagian* water on limestone and dolomite called karst. Whereas dolomite ($\text{CaMg}(\text{CO}_3)_2$) is a carbonate rock whose magnesium content exceeds ordinary limestone. The karst on the surface is called eksokarst which consists of permanent springs, karst hills, dolina, uvala, polje, and telaga. Karst at the bottom of the surface of the soil is called endokarst, which consists of underground rivers and speleothems.



The MPKF area is astronomically located between S4° 42' 49" - 5° 06' 42" and E119° 34' 17" - 119° 55' 13". In the geological area, this area is included in the regional geological area of Maros, Pangkep, and Watampone which is generally divided into two rows of mountains that extend in the north-northwest direction which are separated by the Walanna River valley. On the western slope and some places on the eastern slope, there is a karst topography (karst topography), which indicates the presence of limestone. The type of hills in this area is karst topography characterized by steep hillsides, rounded hilltops, karst towers, stalactites, and stalagmites. This karst mountain region consists of steep hills with horizontal black holes which are slope side caves and Clift foot caves. Horizontal holes which are caves are formed by natural processes commonly found in the limestone region. Karst base rock is the Eocene complex limestone, thickly coated, rather flat and relatively pure layer, located above the crystalline schist and ofiolite cretaceous volcanic types [2].

Karst morphology interpreted as a form of karst landscape (karst landscape) that develops in an area/formation of carbonate rocks (limestone and dolomite) that have undergone a process of karstification or dissolution to a certain extent. Its peculiarities can be distinguished between the above-surface phenomena (exokarst) and the subsurface phenomena (endokarst). Exokarst, among others, is indicated by the existence of conical towers or domes (karst towers), valleys (locus), and dolina (polje) while the endokarst is indicated by the existence of caves (rock/rock shelters) with all forms of curvature, bench, aisle, an underground river and stalactite and stalagmite or called speleothem.

The economic value of the karst region has been identified with mining products, while many do not know that the karst area has a much higher economic value compared to relying on non-mining products. Non-mining economic values of the karst region such as aesthetic value or beauty possessed, natural form or geomorphology, unique karst areas found in several places and the presence of beautiful caves contained below the surface of the land. All these non-mining economic values will eventually run out because development continues to exist and will leave a lot of damage if there is less public awareness always to preserve it [3].

In some clusters in this karst region, there are prehistoric caves which are generally located at the bottom of the steep cliffs of karst hills which have hilltops like tower shapes with a height of 200-500 meters above sea level. The karst hills stretch from Pangkep to the south in Maros for + 45 km and have a distance from the hill to the coastline of 8–12 km in Pangkep, and 14–25 km in Maros. These prehistoric caves are evidence of human existence in the past. Based on data from the Bantimurung Bulusaraung National Park Management Agency, the Maros Pangkep karst area has considerable forest potential, consisting of national parks, protected forests, and total production forests reaching 17,041.79 ha. The existence of this forest which is in a karst cluster makes it a jungle of karts. The Maros-Pangkep Karts Forest stores biological wealth because it is home to endemic and rare animals. One of them is the Sulawesi Black Kera or the endangered *Macaca Maura*. Also, there are 125 types of butterflies living in this karst region.

2. Status and Problems of Maros Pangkep Karst Forest (MPKF)

MPKF forest has a characteristic karst land cover, so the potential of flora and fauna is also very large with some of them being endemic species. Efforts to protect the potential of flora and fauna have been carried out by the government through the Ministry of Forestry which stipulates that the MPKA is included in the working area of the Bantimurung-Bulusaraung National Park. Based on the decree of the Governor of South Sulawesi, the Minister of Forestry and Plantation issued Decree Number: 890/Kpts-II/1999 dated October 14, 1999 concerning the Reappointment of Forest Areas in South Sulawesi Province with an area of ± 3,879,771 Ha, known that the MPKA and other areas around it remain forest areas with functions of protection, production, and conservation.

On October 18, 2004, the Minister of Forestry issued Decree Number SK.398/ Menhut-II/2004 concerning Changes in the Function of Forest Areas in the ± 43,750 Ha Bantimurung-Bulusaraung Forest Group consisting of ± 10,282.65 Ha of Nature Reserve ± 1,624.25 Ha, Protected Forest covering ± 21,343.10 Ha, Limited Production Forest with ± 145 Ha, and Permanent Production Forest with ±

10,335 Ha located in Maros and Pangkep Regencies, South Sulawesi Province to Bantimurung Bulusaraung National Park.

Apart from the shared awareness of the importance of preserving natural and cultural resources in the MPKF area, it cannot be denied that there are also other resource potentials in the form of mine potential. This is what drives the emergence of mining businesses in this region. The rise of mining land clearing since the 1960s, started by *PT. Semen Tonasa* which conducts clay and limestone mining for cement production raw materials in the Minasate'ne region of Pangkep Regency (Tonasa I).

Mining activities by *PT. Semen Tonasa* is considered as the forerunner to the beginning of the Maros-Pangkep karst area being exploited as a mining area. *PT. Semen Tonasa* then continued to aggressively expand its concession area, plant construction and supporting infrastructure for its mining business, to be able to produce cement production per year of 5,980,000 tons through its four factories in the year 2014. In addition to cement raw materials, the potential of limestone mines in the Maros-Pangkep karst area is also in the form of marble, granite and landfill, which are also considered to have high economic value [4].

The economic potential of the mine then makes more mining businesses, especially the types of marble and granite, because in mining and processing it does not require large business capital. Since then the Maros-Pangkep karst region has become increasingly famous for its economic potential from the mining sector. Until 2014 there were 119 Mining Business Permits (IUPs) that had been issued in Maros and Pangkep regency. The issued IUP is for the type of marble excavation business, limestone, mountain stone, clay (soil urug), sirtu, sea sand, and coughapur.

Based on the explanation above, the MPKF ecosystem is rich in a variety of potentials, both potential non-biological resources such as caves and minerals for cement and marble raw materials and potential cultural resources such as prehistoric caves and other archeological sites. This is what makes this area high with pressure and threats to the biodiversity of the Maros-Pangkep karst ecosystem which is due to the impact of using biodiversity values and habitat values from the karst ecosystem itself. The threat can be carried out by individuals, as well as by a community group or company, and can be done directly or indirectly. The direct threat is the process of damaging the karst ecosystem, both activities that only damage the biogas resources as well as the destruction of the physical habitat and biological resources while the indirect threat is the impact of an activity or exploitation of biodiversity or its habitat which then influences the status and population of species which constitute the individual constituent of biodiversity itself [5].

Environmental degradation due to mining activities in the MPKF area is believed to have an effect on the quality and of course the quantity, environmental sustainability and archaeological remains of the prehistoric cave sites in the vicinity. One example is the research conducted referring to the results of air quality measurements at the mining site and factory area in Biringer in February, March, May and June 2000 at 12 Sampling Units (UPS), known to contain chemical compounds in the form of carbon monoxide (4-17 Ppm), sulfur oxides (0,010-0,075 Ppm), nitrogen oxides (0,000-0,004 Ppm) and hydrogen sulfide (0,000 Ppm) [6]. Asmunandar later concluded that the resulting smoke pollution endangers the preservation of cave wall paintings in the area. Damage is triggered due to the reaction process between pollutants and frescoes where ionization takes place between nonmetallic elements (pollutants) and metal elements (Ferrum), which then dissolve hematite, which makes the material crack. This condition also triggers a change in color which makes the painting of the wall detach from its media [6].

Based on the Study of the Existence of Marble Mining in *Bulusaraung* Protected Forest Karst, Maros Regency, South Sulawesi Province conducted by Moehd Subchan in 2008, it was concluded that mining activities carried out by *PT. Bosowa* Mining has violated several rules such as licensing, mining and waste management. Also, the existence of *PT. Bosowa* Mining in HL *Bulusaraung* will have an impact on changes in the water system of the karst area by reducing the capacity of water and reducing the quality of water (physics, chemistry, and biology) coming out of the area. Based on measurements of physical-chemical parameters it is known that there is an increase in parameter values in point II compared to point I, which shows that there has been a decrease in water quality at point II due to the

entry of marble waste. Whereas in biological parameters, the diversity value of Shannon-wiener species is known to be the first point 1.64 belonging to the medium polluted condition and the second point 0.60 belonging to the heavily polluted condition. The decline in HL Bulusaraung water quality will affect the condition of the community because most people are very dependent on HL Bulusaraung in meeting water needs [7].

Referring to the explanation above, it is increasingly clear that the Maros Pangkep karst forest area is essential to be protected, protected and preserved. In this protection effort, there needs to be clear rules and guidelines in managing the MPKF. This is where the government must take a role, including the executives, in this case, it is necessary to immediately make regional regulations governing the governance of the integrated MPKF in one area.

3. Ancient Trail in the MPKF as a national cultural heritage

The economic value of the karst region, including in Maros-Pangkep, has always been identified with mining products, while many do not know that the karst area has a much higher economic value compared to relying on non-mining products. Non-mining economic values of the karst region such as aesthetic value or beauty possessed, natural form or geomorphology, unique karst areas found in several places and the presence of beautiful caves contained below the surface of the land. All of these non-mining economic values will eventually run out because development continues to exist and will leave a lot of damage if there is a lack of public awareness always to preserve it.

The diversity of biological potential in the MPKA refers to what Ahmad mention. The results of his research on vegetation degradation and the impact of mining on the Maros-Pangkep karst ecosystem were presented at the Indonesian Karst Institution Workshop on October 19, 2011. In his research, it was explained that the diversity of plant species in the Maros-Pangkep Karst region was in the form of plants that made up 40 samples. Plots in rocky habitats (without land), totaling 199 species consisting of 107 genera and 48 families. When compared with 81 species that grow in habitats that have soil content, namely at topogafi sloping slopes and valley bases/fault areas, the same number only reaches 5%. The karst plant community in Maros-Pangkep can be grouped into four parts, namely the plant community above the facies of massive, porous, layered and metagaming carbonate rocks [5].

Referring to the data on zonation and delineation of cultural heritage areas in the Maros Pangkep karst region in 2011 [7], there were 127 prehistoric sites in this region, precisely 126 in the form of prehistoric caves and 1 open site in the court of Gua Sakapao, Pangkep Regency. These prehistoric caves are scattered in karst hills stretching over two administrative regions, Maros and Pangkep Regencies, of the 127 prehistoric sites 78 of them are sites with cave paintings on the walls or ceilings of caves. Hand drawing is the most dominant painting found in 71 prehistoric caves, meaning that only 6 prehistoric caves in the Maros Pangkep area that did not have paintings in the form of hand drawings and one cave did not have paintings. The paintings in the 6 prehistoric caves are in the form of human images in *Leang Batu Tianang*, *Leang Karama*, *Leang Ulu Tedong*, *Leang Pamelakkang Tedong*; pictures of kangkang humans in *Leang Tagari* and *Leang Kassi*. The latest data, based on the results of the 2016 BPCB Makassar survey and the Puslitarken Survey and the Archaeological Department of Unhas in September 2017, are prehistoric caves in the MPKF of more than 200 caves.

Archaeological studies that have been carried out in this region further strengthen the importance of these prehistoric caves, even the latest research places prehistoric cave paintings in one of the caves in Maros as the world's oldest prehistoric cave, with a minimum age of 39,600 years based on uranium dating series. The results of this study were published in the 2014 Nature Journal. This then attracted researchers from abroad to conduct research in the region. This potential should be used optimally for improving people's welfare, as mandated in Law No. 11 of 2010 concerning Cultural Heritage. one effort that can be taken, namely involving the community in the utilization of the prehistoric cave cultural heritage area of Maros Pangkep [8].

Besides the potential of tangible culture in the form of archaeological remains and biological potential, this Maros Pangkep karst forest area also has a diversity of intangible cultures. This is inseparable from the socio-cultural conditions of the people around the prehistoric caves in Maros and

Pangkep Regencies. The culture of Maros-Pangkep is a culture of the Bugis-Makassar tribal community. The life of community groups tells the language of Bugis and Makassar, related to the culture of the community usually gather to talk about things that are considered important, commonly called "Tudang Sipulung", when going down the rice field there will be an "Appalili" event, when the harvest is held a traditional ceremony *Ma'raga*, *Mappadendang*, *Ma'kampiri*, while welcoming of the Islamic New Year, a traditional ceremony of "Muharram Days and Mawlid of Rasulullah" was held, a ceremony to reject "*Salonreng and Kalubampa*". Remain intangible culture in the two districts, and has its charm.

The explanation above further confirms that the MPKF has tremendous potential for supporting human life, based on its physical nature, the karst region has the main function as an aquifer that meets raw water for hundreds of thousands of people living in it, the region also functions as guard the balance of regional ecosystems. There is a diversity of potential in this region which then encourages the government to make it a National Geopark, and thanks to the collaboration of all parties on November 20, 2017, officially the Maros Paengkep Karst Area has been designated as a National Geopark. The status was given by the National Geopark Indonesia Committee at the Belitung National Geopark Seminar through the submission of certificates. The certificate is also the main requirement so that the Maros-Pangkep Geopark can be submitted to become a UNESCO Global Geopark.

4. The integrated Maros Pangkep Karst Forest

At present the management in the MPKF area has not yet been integrated [9], each stakeholder seems to have their way of managing the potential in this region. This is what makes the Pangkep Maro karst area very vulnerable to change. Human activity is the biggest threat to the sustainability of the ecological functions of karst. The loss of the function of the karst ecology is a disaster for human life that is impossible to avoid [10].

The protection and management of the karst region environment are indeed one of the environmental problems in Indonesia, especially in the current Maros Pangkep area. As an area rich in natural resources, limestone in the karst region has the potential as a mining material for an industry which is beneficial for development. But on the other hand, in addition to its benefits as a mining designation area, the karst landscape is also part of a protected geological area that has other benefits as described above. The two functions that the region has become a problem in the community, namely between the economic needs of the people who use the mine with environmental sustainability for people who view karst as an area that needs to be preserved.

Furthermore, in his research, [10] showed that the protection of karstic landscapes in Indonesia and especially in the Maros-Pangkep area did not yet have the adequate legal instruments and protection forces, various ways have indeed been sought by the government including by improving legal instruments especially those related to the environment life. One legal product that has been ratified by the government is Law Number 32 of 2009 concerning Protection and Management of the Environment. Laws which came into force since October 2009 and are listed in the State Gazette of the Republic of Indonesia in 2009 Number 140 replaces the role of the Law. Law Number 23 the Year 1997 concerning Environmental Management Law No. 32 of 2009 is believed to have a level of completeness and a more comprehensive discussion when compared with Law No. 23 of 1997, In fact, there are still many legal gaps left by Law No. 23 of 1997. One of them is in the context of resolving the problem of environmental pollution and destruction, about how it will be resolved up to various criminal threats against violators.

The Karts area in Maros-Pangkep Regency (Bantimurung-Bulusaraung National Park) has been designated as an Essential Ecosystem Area through the South Sulawesi Governor Decree, No.1489/V/2011 dated May 4, 2011. One of the follow-up plans for the decree is the establishment of Consortium; Mapping of MPKA; Alignment of action plans for the management of the Maros-Pangkep Karst ecosystem, Bantimurung Bulusaraung National Park, Zonation of Bantimurung Bulusaraung National Park, Prehistoric Site Zoning, and District RTRW. Maros and Pangkep; Monitoring and evaluating the implementation of action plans for essential ecosystem management and national/international cooperation.

In its authority mechanism, the location of the essential ecosystem area is under the responsibility of the regional government (province/district/city), because it is outside the Nature Conservation Area and Nature Reserve Area. Therefore, the local government, in this case, the South Sulawesi Provincial Government needs to issue regulations relating to the management guidelines for the Maros-Pangkep karst essential area. Related to the effort to manage the Maros-Pangkep karst forest area as an essential ecosystem area, there are several points of problems that have been identified as follows, the location of the Essential Ecosystem Area is generally close to settlement and high regional dynamics; the integration and involvement of many parties, both government agencies, and regional users have not been integrated; and essential ecosystem areas always get high pressure.

Therefore, this area management model must be carried out in an integrated and collaborative manner so as to provide space to involve and accommodate all interests of the parties concerned. Thus it can reduce the potential for conflict with the community. In this case, the management of the Maros-Pangkep Karst Forest area must be well planned and integrated by the parties. Thus, it can enlarge the opportunity to improve the welfare of the community through conservation of ecosystem areas that are in the form of conservation-based uses. This integrated governance will directly have an impact on the increasing role of local governments and other stakeholders in supporting efforts to preserve the Maros-Pangkep karst forest which has a positive impact on the preservation of cultural heritage in the region.

5. Conclusion

Cultural ecosystems cannot be separated from the context of the environment in which the culture is located. Every form of culture including cultural heritage or cultural heritage from the past occupies space related to the character of its environment. Cultural heritage has important values related to science, education, history, economic and also culture. Therefore it needs to be protected and preserved. In this case, the cultural inheritance in the form of prehistoric cave distribution in the Maros-Pangkep forest karst forest area must of course also get conservation and protection efforts.

The interconnection of the natural and cultural environment is the thing that underlies the importance of designing a model of preservation of cultural heritage that rests on the preservation of nature. In the context of preserving the prehistoric cave cultural heritage in Maros-Pangkep, one of the areas that can be taken is to arrangement of the MPKF to ensure its sustainability so that the environmental ecosystem is maintained and it will have a direct impact on the preservation of prehistoric caves in this region

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