

Potential Study of Sibiuk Cave as a directive for special interest tourism in Ciampea District, Bogor

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Abstract. *The cave has many benefits and economic value, including the potential of the cave as a tourist attraction of special interest. The purpose of this study was to determine the potential of Cave and special interest tourism directives in Sibiuk Cave, in Ciampea District. This research method is a description of the data collection using the Forward method and the Top to Bottom survey system. The results of the study are the presence of stalactites, stalagmites, columns, cave fauna such as Purba shrimp (Stenasellus sp), Cave crickets (Rhaphidophora sp), Kala Cemeti (Stygophrynus dammermani), Scorpion Whip (Geralinuridae Thelyphonidae), Thousand Feet (Rhaphidophora sp.), Keong Darat (Leptopoma celebesianum), Centipede Syabur (Scutigeria sp), Bats (Rousettus amplexicaudatus) and Swallow (Collocalia vestita) and Guano. The Sibiuk cave area has been designated as the Pongkor geopark on November 29, 2018 with a special interest tourism direction on the introduction of cave speleology, cave biospeleology, cave expedition and rock climbing.*

Keywords: *Sibiuk Cave, forward method, Purba shrimp (Stenasellus sp), special interest tourism, Geopark*

1. INTRODUCTION

Cave is one of the examples of endokarst morphology. It formed as a natural chamber of karst that is created on limestone underground, both separated or interconnected with other chambers as a result of the dissolving process by water and geological activities that occur in an area (Uca & Angriani, 2018). The same thing was mentioned by (Aidin A, 2017) that explains alleys inside the caves were also formed through the process of limestone dissolution, in which this process is acidic. These caves are the part that remains after the dissolved limestone is transported by air. The remaining part formed as cavities. The cavities then fused to form a very large hole. The very large cavity is called cave mouth. According to (Rahmadi C, 2007) the cave mouth is an area that connects inner and outer areas. The sunray is still able to reach the outer area and its condition is strongly influenced by changes in the environment outside the cave. This condition is called the bright zone. While inside the cave there are three parts that include transition zones, dark zones, and total dark zones.

Cave has a lot of advantages and economic values, including the potential of the cave as a tourist attraction of special interest, as a habitat for fauna, as a source of water, and as an absorber of carbon dioxide (Mijiarto, 2014). The cave can also be a special interest tour regarding its wall decoration – this becomes a special attraction for tourists. The location of the cave sometimes is not all accessible by vehicle, so walking is an alternate way to reach the cave. Therefore, due to its extreme track, it requires excellent physical condition and adequate tracking equipment that is high cost, so that this tour might be intended for adventure enthusiasts. Based on this fact, besides giving the value of natural beauty, uniqueness, and science of speleology, it also has a high selling value. The attraction has given creates its own sensation for tourists, however, it does not rule out the possibility of getting damaged if it is not managed properly. In order to preserve the decent condition of the cave, it takes not only good maintenance but also the development of tourism in the cave itself.

Special interest tour according to Hadiwijoyo S S (2012) is a tour that has a private motive and has to do with adventure stuff. Special interest tourism is a tour that is only in demand by certain market segments and its tourism activities contain even dangerous risks (KO R.K.T,

2001). Special interest tourism is associated with efforts to create tourist experiences in unspoiled areas. This tour produces an incentive for tourists to learn about nature and culture (Fandeli C, 2002).

According to (Rahmadi C, 2007) the potential of the cave is superabundant that the cave highly needs proper protection and well conservation efforts. Considerations on the need to protect the cave are such as but not limited to: the vulnerability of environmental changes, the abundant natural wealth, the extinction of flora and fauna that live in, which usually caused by a very small population and the level of tolerance to environmental changes is small, the natural laboratory to study biology and evolution of living things as well as past climate history, the home to several faunae that is important for ecological balance (bats) and also fauna of high economic value (swallow), the reservoir of underground water sources, the opportunity to create an economically valuable tourist attraction, if managed properly.

One of the caves in the Bukit Roti karst region is the Sibiuk Cave. Sibiuk Cave has three cave mouth holes that produce a cold impression as if there is AC (Air Conditioning). It also has a tunnel that extends downwards so it requires special equipment to enter the cave. Tools used in vertical caves using the Single Rope Technique (SRT). SRT is a set of methods used to descend and ascend on the same single rope (Wikipedia, 2019). Furthermore, besides the need of adequate tools, vertical cave tracing also requires a self strong physique and high-cost equipment that supports high safety.

The potential of the cave Sibiuk as an adventure exploring cave site is tremendous, nevertheless, still many of the caves are not yet identified. Further research is needed to determine the potential of these caves, and one of which is the Sibiuk Cave or AC Cave, which is located in the Bukit Roti Karst region. No one has ever researched this cave, so it is important to know what potential exists in the Sibiuk cave that can be used as a special interest tour. In addition, the Bukit Roti karst area has been made into a Geopark which is included in the Pongkor Geopark on November 29, 2018, so the pupose of this study was to determine the potential of caves and special interest tourism directives in Sibiuk Cave, Ciampea District.

2. LITERATURE REVIEW

2.1 Cave

Karst landforms have great potential in the form of caves. Cave is a natural underground cavity including the entrance (entrance), hallway (passage) and space (room / chamber) that can be traced by explorers (Rahmadi C, 2007). Underground cavity that cannot be traced by humans is not a cave. Based on the shape of the tunnel there are two types of caves namely: horizontal cave and vertical cave. Cave can be used as a tourist attraction, research object, and object used for special interest sports. Exploring the potential of karst areas in the form of caves can provide great benefits for the lives of the surrounding community. Besides being used for tourism and research, the cave also has the potential in the form of underground rivers or water reserves that have not been widely used. Cave is a place that has its own charm because it provides an element of adventure. Cave is located in the karst region. Cave is underground passageways formed by cracks due to limestone dissolution. The caves in the karst region are formed by the process of dissolving water that is acidic to limestone. These caves are the remaining part after the dissolved limestone is transported by water. The part left by the dissolved limestone is in the form of cavities. The cavities are fused to form a very large hole (Aidin A, 2017).

Cave can be classified based on the process of forming into three (Mylroie JE & Carew JL, 2003):

- a. pit caves, caves formed by the development of shafts continuously until a protocave system is formed with vertical flow.
- b. phreatic caves (flank margin caves and "banana holes"), are caves that develop in underground water level. Flank margin caves are formed by the dissolution process at the edge of the ground water surface bordering the sea level, the dissolution process that occurs is influenced by two forces, namely groundwater power and sea water power. Banana holes are formed as a result of dissolution forces that work horizontally due to the flow of water in the ground water zone.
- c. fracture caves, caves that form in fault zones and develop vertically well or horizontally

2.2 *Potential Caves*

Tourism potential is everything that is owned by the tourist destination, and is an attraction for people to come to visit the place (Yoeti, 1996). Tourism potential according to Sukardi N, (1998) is everything that is owned by an area for tourist attraction and is useful for developing the tourism industry, the same thing was stated by Pendi, (1999).

Economic value apart from the mining aspect of the karst area is the value of environmental services such as water resources, landscape uniqueness, nature tourism objects of general interest and special interest, archeological sites and worship areas (Mijiarto, 2014). The ecological value of karst areas is the biodiversity stored in them. The various types of flora and fauna that live here are balancing the ecosystem in this region. Ecosystem diversity gives rise to species diversity. Biodiversity in the karst region is a paradise for a variety of fauna such as the bird nation like swallow. The presence of bird species is a counter weight to various other biotic factors. Birds that live freely in nature have a function as pollinators (seed dispersers), predators and environmental indicators. Besides birds there are several types of bats in the cave. Some types of bats that can live in caves are seed spreaders and insect eaters.

According to KO R.K.T, (2001) the potential that exists in the cave can be developed into special interest tourism requires more stringent requirements compared to general tourism such as: 1) Conducting degrees of difficulty in tracking and hazards arise at any time, especially in the rainy season 2) Researching skills cave searchers and equipment used, including self-rescue 3) Provide cave maps, if there are no trackers yet asked to map them 4) Remind the searchers to always be responsible and fulfill the applicable code of conduct 5) Clarity of the licensing and SAR system by relevant agencies 6) Conduct periodic studies on the level of cave damage and pollution

2.3 *Special interest tours*

KO R.K.T, (2001) said, special interest tourism is tourism which is a form of travel where tourists visit a place because they have special interests or destinations or activities that can be carried out at that location. Meanwhile, according to Anindita, (2010) that special interest tourism adventure can be defined as a form of travel tour carried out in a location that has physical attributes that emphasize the elements of challenge, recreation, and achievement of a tourist's desires through involvement / interaction with natural elements. Tourists involved in special interest tours are divided into 2, among others: 1. Light Groups (Soft Adventure) Groups that see their involvement more as a desire to try new activities, so the level of challenges undertaken tends to be at a mild to average level. 2. Hard Group The group that views its participation in tourism activities as special interests of adventure is more of a goal or primary motivation, so it tends to be more active and serious involved in the activities that are followed. This group tends to look for products that offer above-average challenges. Special interest tourism criteria as follows KO R.K.T, (2001): 1. A small number of enthusiasts; 2. High-risk travel; 3. Tourism that has a high level of difficulty; 4. The state of the object that is still original; 5. Has special equipment and high skills.

Special interest tourism has several principles Fandeli C dan Nurdin M, (2005) 1) Tourists motivation to look for something new, authentic, and have a quality travel experience. 2) Motivations and decisions for travel are determined by specific interests and/or special interests of tourists and not from other parties. 3) Tourists take a tour in general looking for new experiences that can be obtained from sports objects, natural knowledge, and culture.

Special interest tourism has become a tourism trend at this time where special interest tourism is carried out to avoid mass tourism in other words special interest tourism is one alternative tourism. Special interest tourism which is a new phenomenon in the world of tourism is one of the demands for tourism service providers. Tourist motivation in finding something new and having a quality tourism experience causes an increase in demand for special interest tourists (Wiwin IW, 2017). Special interest tourism object is a type of tourism that has just been developed in Indonesia. This tour is prioritized for tourists who have special motivation (Hadiwijoyo S. S., 2012).

3. METHODS

3.1. *Location and Time*

This research conducted in Sibiuk cave in February - May 2020, Ciampea sub-district,

Bogor district, West Java. The research location is vertical cave Sibiuk, it is located in between of karst hill, therefore the access to its location is difficult, and it requires experience, expertise, strong will, and adequate equipment for climbing.

3.2. Research tools and materials

There is various type of tools and materials used in this research. Each of it has a different function to support the conducted research. Tools used in vertical caves using the Single Rope Technique (SRT). SRT is a set of methods used to descend and ascend on the same single rope such as Rope Webbing, Harnesses, Croll, Headlamp, Carabiner (petzl oxan 25 pcs), Descender, Ascender, Helm, Warepack, Boots, GPS, compass and Compass software.

The types of data taken will be categorized in two categories, including general condition, physical condition, and special interest tourism directives (Table 1).

Table 1. Types of data and methods used

No	Parameter	Variable	Source	Methode
1	Sibiuk Cave Profile	geographical location of the cave's mouth, altitude The length, width, height of the aisle, the type and location of cave ornaments, the cross section of the aisle and the shape of the mouth of the cave, the presence of water	Field Observation	Mapping the cave with the Forward method and the survey system used in data collection is Top to Bottom
2	Potential of Sibiuk Cave	1. Cave ornament, cave fauna 2. Special interest tourism directives	<ul style="list-style-type: none"> • Field Observation • Study of Literature • local society 	<ul style="list-style-type: none"> • direct collection • interview

3.3. Data Collection Technique

The method used in this research is descriptive. The descriptive research method that is describing data obtained from field surveys about the potential of Sibiuk Cave. The survey results include observations, measurements, and recording data in the field. The process of taking data from the cave is done by determining the survey points. This survey point is then known as the station. The survey conducted is a survey forward, and the survey system used in data collection is Top to Bottom. All data obtained from the field are recorded and identified.

3.3.1 Survey Forward Method

The survey forward method is a method used by the user with the tool reader and note taker at station 1 (first) and the pointer (target) at station 2 (second), after the tool reader works completely, the pointer moves forward to the next station that has been determined and the tool reader moves right at the position of the pointer without changing the point of the station where the previous pointer stands, and so on (Figure 1).



Figure 1. Metode teknik *survey forward*

Source: Mapala GMS <http://mapala-gms-artikel.blogspot.com/2012/03/cave-mapping-pemetaan-gua.html>

3.3.2 Survey System Top to Bottom

Top to bottom survey system method is measurement and data collection that starts from

the mouth of the cave and ends at the end of the cave passage

Data to be retrieved include: Record and measure information about the profile of the cave, such as the geographical location of the cave's mouth, Determine the mapping station which is a point in the cave alley. For the next mapping station, it is determined based on how important the conditions are, which represent changes in the width of the hall, changes in roof height, changes in the direction of the hall, changes in the slope of the floor, and are at a point of connection for the branching alleys, Take measurements at each station, namely the distance between stations, width, slope height of the station, type of water fall, Take note of the findings in the cave such as an ornament, fauna of the cave, and others, Make referral plans for special interest tours.

3.4. Data Analysis

The data in the form of a flat distance, ordinate, height of the roof of the cave, and the slope is processed using the Compass software application to create a profile map of Sibiuk cave. From the potential results of the Sibiuk cave, a special interest tourism package program can be made in the Sibiuk Cave, Ciampea District.

4. RESULT AND DISCUSSION

4.1 Sibiuk Cave Profile

The cave which is used for this research is Sibiuk vertical cave, which is located in Cibadak Cibadak Village, Ciampea sub-district, Bogor district, West Java. The coordinates of the cave is $06^{\circ} 33' 09.08''$ LS - $106^{\circ} 41' 14.54''$ E (Figure 2). The following map of research locations is presented in figure two below. According to (Badan Pusat Statistik Kabupaten Boogr, 2018) The area of Ciampea District is 30.62 km^2 with an altitude of 354 meters above sea level. The total population of this area is 160,487 people, consisting of 82,409 men and 78,078 women. Administrative boundaries of Ciampea Subdistrict are: North Side of Rancabungur District, West Side of Cibungbulang District, South Side of Tenjolaya District, Kec. Pamijahan and the East Side of Dramaga District.

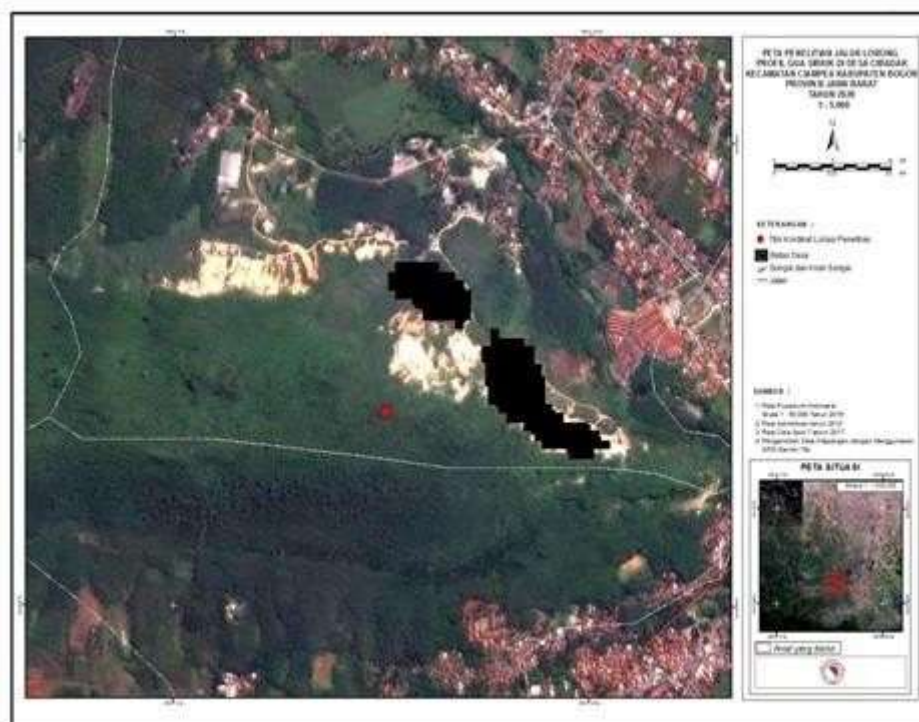


figure 2. Location Map of Sibiuk Cave

One aspect that supports tourist attraction development is accessibility because it is impossible for tourists to visit attractions if the access is difficult to reach (Abdulhaji, 2016). The same thing was mentioned by (Nawangarsi et al, 2018) which states that with good accessibility, visitors will easily reach tourist sites. Accessibility from Bogor to Bukit Roti Sibiuk cave is located can be taken in about 2 hours by using public transportation "Angkot 05" towards

Ciampea. Access to the Bukit Roti location can be passed by using a four-wheeled vehicle, but it cannot be passed by a bus. All types of transportation facilities that support the commute of tourists are important. Means transportation track including road conditions and distance from cities to tourist sites needs to be concerned.

However, considering that the road is still rocky, a large size bus is not recommended. To reach the location of the post manager, visitors can use two-wheeled vehicles and small four-wheeled vehicles or by just walking. Whereas the circulation lane only has 1 (one) lane used for vehicle and pedestrian. Another important component in a tourist trip undertaken by tourists is the amenities available in a tourist area. To support these activities, the management has provided the facilities although it is still very limited and simple. There are only entrance tickets and stalls, with one bathroom, and the construction of facilities and infrastructure needs to be improved.

Sibiuk Cave or also known as AC Cave. This cave can be called so because it has three cave mouths (entrance) so that a lot of wind blows into the cave. Sibiuk Cave has three entrances namely the top, middle and bottom doors. Each door has a different depth. The top door has a depth of approximately 15 meters, the middle door of approximately 40 meters, and the bottom door of approximately 50 meters. This research traced from the middle door with a depth of about 40 m due to the easy access to reach the research location.

The height and coordinate points of the Sibiuk Cave, which were taken directly using Garmin 76s GPS, obtained figures of 327 meters above sea level (meters above sea level). Compass is used for assisting the process of creating a map of the aisle path, that is bound from the tie point (Mouth of the Cave). The importance of taking the coordinates of the location of Sibiuk Cave as a connecting point in the mapping of cave passageways based on the compass azimuth used in the cave passageways, so that after processing it produces a map of the tunnel pathways presented as in Figure 4 is a map of the tunnel paths in the Sibiuk Cave.

Cave map is one of the final products of cartography and is part of a geographical information system. The making of a cave map is to document the cave (Uca & Angriani, 2018).

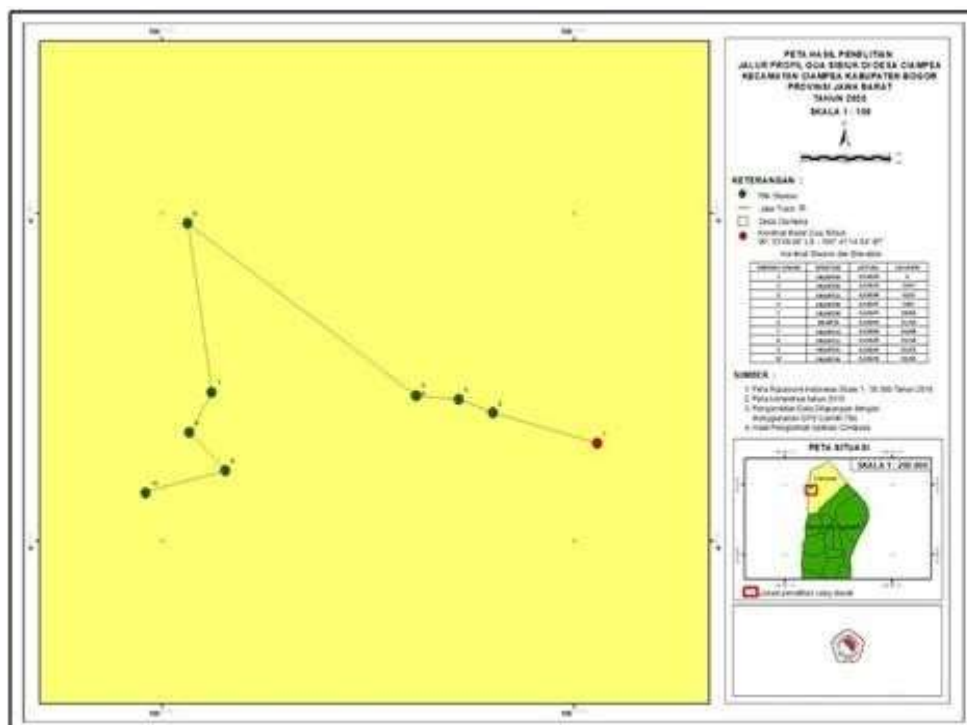


Figure 4. Map of the station alley inside the Sibiuk Cave

The use of maps can be functioned as a tool that helps in making certain policies related to mapped objects. The results showed that there were 10 stations ranging from the mouth of the cave which the sunray still reachable (bright zone) to the eternal dark zone. According to (Rahmadi C, 2007)The cave environment is commonly divided into 4 zones including the mouth of the cave, the transition zone (dim zone), the dark zone and the eternal dark zone. The results of the study show that Sibiuk Cave is a vertical type cave with its mouth type is pit cave type,

which is the mouth of the cave that extends vertically into the cave passage. (Myroie JE & Carew JL, 2003) stated that pit caves, are caves formed by continuous shaft development until a protocave system is formed vertically. Sibiuk Cave has a length of all stations and substations 117.63 meters, with the roof of the mouth of the cave as high as 4.10 meters, and width of 3.27 meters.

The longest station from the research results (figure 4) is station five to station six with a flat distance of 13.12 meters, the second longest is station three to station four with a flat distance of 12.3 meters. The biggest change in the slope of the cave floor is at stations 4-5 with a slope of -90° (perpendicularly) and at stations 6-7 with a slope of -31° entering the needle hole that leads to the second passageway. Changes in the slope of the cave floor with a negative sign (-) indicate the floor has decreased, otherwise if not using a negative sign (-) indicates an increase in the cave floor (uphill) (Table 2). Based on observations and processing of measurement data in Sibiuk Cave, an overview of the morphometry of the cave can be obtained. Sibiuk Cave has one chamber (hall) and 2 alleys connecting each chamber (hall) which are the result of direct observation and measurement in the field. There was none of the fauna found in the mouth of the cave and the dim zone (stations one and two), but there was only several branches seemed fell from the trees in the cave passage. This zone looks dry, no seepage or water droplets seen. This zone is still influenced by sunray. In table 2 it can be seen that there are types of falling water, some seeping into the cave walls and some dripping. This proves that in the Cave of Sibiuk is still moist with humidity ranging from 81% - 82% and in some stations still found puddles.

Table 2. Physical condition of Sibiuk Cave alley

Hall/ the hall way	Station	flat distance (m)	Average		Slope ($^\circ$)	Method of Measure ment	Ornament/ Zona	Type of water fall
			wide	high				
the hall way1	St 0 – St 01	4,80	2.90	4.10	23	Su	Twigs/ light	-
the hall way1	St 01 – St 02	5.51	1.09	4.42	-32	Su	Twigs / dimly lit	-
the hall way1	St 02 – St 03	2.14	1.10	5.80	-42	Su	Stalakmit, cave fauna / dimly lit	droplet
the hall way 1	St 03 – St 04	2.42	1.50	3.11	-40	Su	Stalakmit, cave fauna/ dimly lit	droplet
the hall way 1	St 04 – St 05	21.0	2.14	4.10	-90	Su	-/dark	seepage
the hall way 1	St 05 – St 06	11.76	12,56	27.00	-12	Su	Guano/ dark	-
Hall	St 06 - a	8.35	-	-	11	Su	Guano, CaveFauna / dark	droplet
Hall	St 06 – b	5.73	-	-	6	Su	Guano/dark	-
Hall	St 06 – c	5.00	-	-	4	Su	Guano/dark	-
Hall	St 06 – d	7.81	-	-	11	Su	Cave Fauna/ dark	droplet
Hall	St 06 – e	7.10	-	-	7	Su	Guano, Cave Fauna/ dark	-
Hall	St 06 – f	5.32	-	-	8	Su	Guano, Cave Fauna/ dark	-
Hall	St 06 – g	7.74	-	-	14	Su	Cave Fauna/ dark	droplet
Hall	St 06 – h	5.43	-	-	10	Su	Cave Fauna/ dark	seepage

Hall	St 06 – i	5.81	-	-	-12	Su	Cave Fauna/ dark	seepage
Hall	St 06 – j	7.70	-	-	-8	Su	Guano/dark	-
Hall	St 06 – k	9.76	-	-	11	Su	Guano/dark	-
the hall way 2	St 06 – St 07	6.50	0.70	0.70	-26	Su	Cave Fauna/ dark	seepage
the hall way 2	St 07 – St 08	2.28	3.50	0.35	-35	Sd	Cave Fauna/ dark	droplet
the hall way 2	St 08 – St 09	2.62	2.70	2.27	-33	Sd	Cave Fauna / eternal darkness	droplet
the hall way 2	St 09 – St 10	3.86	1.80	2.60	25	Sd	Cave Fauna / eternal darkness abadi	seepage

Information: Su: Stand up, Sd: Squat down

4.2 Potentials of Sibiuk Cave

Dark cave conditions and limited organic material resources create unique and interesting habitats to be concerned (Setyaningsih M, 2011). The cave in the Ciampea limestone is formed from the process of shallow sea sedimentation, in the scattered caves there are many found marine biota fossils such as shellfish (Nurwani Citra, 2010). This karst area formation process can occur because of the process of dissolving limestone due to rain. This condition occurs in a prolonged period of time which in geological terms is called karstification. Figure 5 is a profile map of Sibiuk Cave and the found ornaments. Sibiuk Cave or AC cave is a vertical cave located on Mount Cibodas, Ciampea. This cave is a karst cave (limestone) and has a depth of about 40 meters with a spacious hall that has several large ornaments. The substrate on the rocky cave floor and the ground where most of the stations are mixed with guano. Guano is an organic material derived from pile of bat droppings. Guano consists of sea bird guano and bat guano. Guano contains a lot of nitrogen and phosphate and based on the deposit are classified into two: cave and island deposits. The main components of guano are: elements N, P, and Ca and the additional components are: K, Mg, and S. Guano nitrogen and guano phosphate are important organic fertilizers because the levels of N in guano nitrogen and P levels in guano phosphate are much higher than contained in manure, agricultural waste, and municipal waste (Suwarno and Komaruddin, 2007).

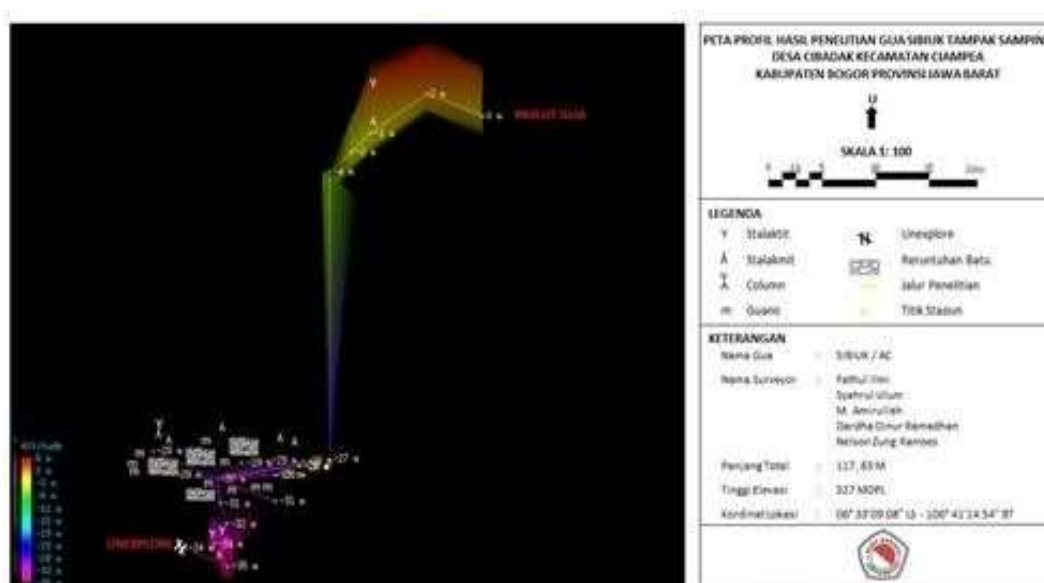


Figure 5. Profile map and distribution of Sibiuk cave ornaments

Endokarst Sibiuk Cave has several cave mouths (entrance). Ornaments contained in the cave are stalactites, stalagmites and columns (Figure 5). Satrio, *et al* (2012) said Stalagmites are ornaments that grow from the cave floor due to droplets from stalactites that continue to

accumulate at one point on the cave floor. Columns formed when stalactites and stalagmites meet. While stalactites are formed from the deposition of calcium carbonate and other minerals deposited in a solution of mineral water. Limestone is calcium carbonate rock dissolved by water containing carbon dioxide to form a calcium bicarbonate solution. This solution flows through the rocks until it reaches an edge and if the edge is on the roof of the cave, it will drip down. When the solution comes in contact with air, a reverse chemical reaction occurs and the calcium carbonate particles are deposited as a precipitate. Theoretically, seepage of water into the slope will increase pore water pressure resulting in increased shear stress and reduced shear strength. This situation will cause the slopes in unstable conditions or collapse (Muntohar AS, 2006), this can be seen in Figure 6d, there is stone debris (boulder) in the hall and cave passages, so it is advisable to be careful when doing the Sibiuk Cave expedition.



Figure 6. Potentials in Sibiuk Cave

On the floor and wall of the cave in the eternal dark and dark zones, animals were found for example crickets, centipedes, spiders and millipede (Setyaningsih M, 2011). The same thing is also found in Sibiuk Cave where there are water droplets and seepage on the walls and floors of the cave (Figure 7). There are Ancient Shrimp (*Stenasellus sp*), pink shrimp found in puddles on the floor of the cave, including the type of Isopoda. Based on research by Rahmadi C dan Yayuk RS, (2004) that this animal is a newly discovered that can enrich the diversity of cave fauna. In addition, in Sibiuk Cave there are also Cricket Cave (*Rhaphidophora sp*), Kala Cemeti (*Stygophrynus dammermani*), Scorpion Whip (*Geralinuridae Thelyphonidae*), Thousand Feet (*Orthomorpha coarctata*), Land Snail (*Leptopoma celebesianurutus*), Lip Scorpion , Bat (*Rousettus amplexicaudatus*) and Swallow (*Collocalia vestita*).



Figure 7. Fauna In Sibiuk Cave

The most common fauna found are swallow and bats. Swallow is a nest-producing bird that is very expensive. The nest is formed from the swallow's saliva. To get high-priced swallow nests, it is necessary to know the type of swallow that can produce good quality nests. Swallow is insect-eating birds that is aerial and likes to glide. This bird is dark in color, flies fast with a medium / small body size, and has narrow and sharp crescent-shaped wings, its legs are very small as well as its beak. The nest is efficacious as a medicine for health which is usually consumed by mixing the nest within medicine or food. Swallow nest is nutritious to strengthen the work of body organs, especially the lungs, improve nerve work power, improve digestion, treat vomiting of blood, cough, cancer, maintain vitality, increase endurance and renew damaged body cells (Arifin Moch Samsul, *et al* 2012).

Bats are also the fauna of Sibiuk cave which is most often found during research. Bats are nocturnal animals, they hunt for food at night and during the day they tend to sleep by hanging on trees, covering their bodies with wings when cold and wagging their wings when hot. There are two reasons bats prefer to be active at night. First, during the day there can be adverse radiation effects on the wings. Wings that are exposed to the sun will absorb more heat than is released. This is because bat wings are only thin skin membranes and are very susceptible to sunlight. Second, bats have undergone a special process of adaptation that they more likely to have a good sensitive sense at night, so those could eliminate competition with diurnal animals, such as birds. Bats are often seen eating on trees and dropping their leftovers to the ground. For mothers who have children, the parents feed their children before the parents eat (Barat, *et al* 2015), (Nurfitrianto, *et al* 2013). Bats have a very important role in human life (Prakarsa & Ahmadin, 2013). Guano-producing bats produce organic material derived from piles of bat droppings. The main components of guano are: elements N, P, and Ca and the additional components are: K, Mg, and S. Guano nitrogen and guano phosphate are important organic fertilizers because the levels of N in guano nitrogen and P levels in guano phosphate are much higher than contained in manure, agricultural waste, and municipal waste (Suwarno dan Komaruddin, 2007) Besides, bats are frugivores and nectar eater who play a role ecologically important role as seed dispersers and pollinators. At present, many farmers use pesticides to reduce the number of insects and fruit that leads to decrease number of bats after consuming the fruit, and also global warming cause drastical drop of bats population. Bats are hosts to various viruses. The virus is comfortable living in the body of a bat because this animal has a large autoimmune system, so that bats can survive even though their bodies have a lot of viruses.

Additionally, bats tend to live in a moist area and do not like being exposed to sunlight. This supports viruses to grow in the bats knowing viruses can only live in below 38^o C. But because of the heat of the earth due to global warming, many bats die. If the number of bats decreases, the viruses will lose their host. Bats are mammals, so bats will look for new hosts like humans (Forest Digest, 2020). Therefore, cave conservation is very necessary for the survival of bats. In the eternal dark and dark zones animals such as crickets, centipedes, spiders and millipedes are found on the floor and walls of the cave (Setyaningsih M, 2011).

Endokarst fauna must be able to adapt to the existing environmental conditions in order to survive. Endokarst habitat characteristics can be assessed from the temperature, humidity, and pH of the water. The temperature in Sibiuk Cave ranges from 22 ° - 23 ° Celsius with humidity ranging from 81% - 82%. Cave ecosystems are alien ecosystems, as the environment is dark, moist and not easy to achieve. Many caves have been threatened and neglected, especially vertical caves, because they require large costs to conduct research or observation. Besides, when conducting the research, physical strength and expertise in climbing or descending a vertical cave is needed, so guides from instructors or interpreters are needed, especially those who have a level 1 certificate based on the Ministry of Manpower.

4.3 Sibiuk Cave Directives as special interest tours

The direction of the development of cave tourism in Ciampea Subdistrict is inseparable from the condition of society surrounding, namely the socioeconomic conditions. People who live around the tourism object have an important role in planning the development of a tourism object at any time. Community involvement both directly and indirectly will have an impact on the smooth development of these attractions. Community involvement in special interest tours of cave research can be the involvement that is included in the community development system or often referred to as community development. The people around Bukit Roti where Sibiuk Cave was found, in Ciampea, still do not know much about the karst area and caves scattered there. That is because the caves are still inherent and the people who visit them are mostly only from nature lovers. The karst area was known around 2010 by some people. The following are the models for developing special interest tours in the Ciampea District:

1. For the object (cave). Cave conservation where the karst cave environment is a semi-enclosed environment that only gets very little exposure of sunlight so it is very vulnerable to damage. The formation process also requires a very long time so that visitors to the cave with various activities carried out can threaten the existence of the cave. The caves in the Ciampea District of Bogor are included in the Pongkor Geopark. Pongkor Geopark has been designated a National Geopark established by the Indonesian National Geopark Committee on 29 November 2018. Geopark is an area that has geological elements in which local people are invited to play a role in protecting and enhancing the function of natural heritage, including archeological, ecological and ecological values and the culture that is in it.
2. For society surrounding: a. Providing education and training to residents to become qualified personnel, ranging from a basic understanding of tourism and tourism of special interest, understanding of the base of the cave (both from the formation process, the dangers of tracing, to the technique of tracing the cave and SAR special cave) and conservation of the cave environment itself; b. Creating jobs so that later people not only gain knowledge, but they can even improve the economy of the society surrounding
3. For manager; a. Preparing experts / professionals to begin with in introducing the world of tourism special interest in cave search both to tourists and to residents; b. Improving the quality of infrastructure and facilities; c. Establishing collaboration between residents, government, and private parties (investors, travel agents); d. Promoting the potential of existing caves to various groups in the form of media, such as print media (brochures, pamphlets, newspapers), the internet (social media, making web about special interest tours of cave search).

From the potential results, special interest tour packages can be arranged. Arranging tour packages for tourists can be an innovative package that stimulates tourist visits for special interest tourism.

Make and offer several tour packages including: 1. Cave speleology introduction package (ornamentation, hydrology, geomorphology, cave formation process, etc.) for tourists who are

interested / interested in speleology; 2. Biospeleology introduction packages, especially tourists who are interested in learning the habitat of fauna that lives in the cave; 3. Historical discovery packages for tourists who want to get to know the historical value that exists in caves or want to explore the history that occurs in a cave in Ciampea District because according to ticketing guards, tourists often come to existing caves to do meditation; 4. Discovery cave package (adventure tour). this package is different from the historical discovery package. The difference is that discovery cave package emphasizing more on the challenges of exploring the cave passages such as hiking in the cave, the use of the SRT technique; 5. Educational packages, aimed at tourists who work as students, students, or scientists

CONCLUSION

The potentials of Sibiuk Cave are the presence of stalactites, stalagmites, columns, cave fauna such as Purba shrimp (*Stenasellus sp*), Cave crickets (*Rhaphidophora sp*), Kala Cemeti (*Stygophrynus dammermani*), Scorpion Whip (*Geralinuridae Thelyphonidae*), Thousand Feet (*Rhaphidophora sp.*), Keong Darat (*Leptopoma celebesianum*), Centipede Syabur (*Scutigera sp*), Bats (*Rousettus amplexicaudatus*) and Swallow (*Collocalia vestita*) and Guano

One way to develop Sibiuk cave to become a special interest tourism is to conserve the cave area, through the establishment of Sibiuk cave as Pongkor geopark on 29 November 2018. Furthermore, conducting education training of the cave railing to the community surrounding could also develop the tourism, it possibly creates jobs. For the manager, providing decent management to the area, improving adequate infrastructure, collaborating with various stakeholders, creating tour packages, and marketing the tourism would enable a good tourism of Sibiuk Cave.

REFERENCES

Journal article, one author

- Abdulhaji. (2016). Pengaruh Atraksi, Aksesibilitas, dan Fasilitas Terhadap Citra Objek Wisata Danau Tolire Besar di Kota Ternate. *Jurnal Penelitian Humano*, 7(2), 134–148.
- Aidin A. (2017). *Identifikasi dan arahan pemanfaatan kawasan eko karst di kecamatan balocci kabupaten pangkep*. [Skripsi]. Makasar (ID): UIN Alaudin Makasar.
- Fandeli C. (2002). *Perencanaan Kepariwisata Alam*. Yogyakarta: Fakultas Kehutanan UGM.
- Fandeli C dan Nurdin M. (2005). *Pengembangan Ekowisata berbasis Konservasi di Taman Nasional*. Yogyakarta: Fakultas Kehutanan UGM.
- Hadiwijoyo S. S. (2012). *Perencanaan Pariwisata Perdesaan Berbasis Masyarakat (Sebuah Pendekatan Konsep)*. Yogyakarta : Graha Ilmu.
- Muntohar AS. (2006). Pengaruh Rembesan Dan Kemiringan Lereng Terhadap Keruntuhan Lereng. *Journal Teknik Sipil*, 1(2), 19–28. <https://doi.org/10.1017/CBO9781107415324.004>

Journal article, two authors

- Rahmadi C dan Yayuk RS. (2004). *Gua-gua di Tumbang Topus , Hulu Sungai Barito , Kalimantan Tengah : tinjauan speleologi dan biologi Cahyo Rahmadi Yayuk R . Suhardjono Pusat Penelitian Biologi - LIPI Cibinong Karungut*.

Journal article, three or more authors, accessed online

- Arifin Moch Samsul, Rahayuningsih, M., & Ngabekti, S. (2012). Distribusi Walet (*Collocalia sp*) di Kabupaten Grobogan. *UnnesJournal of Life Science*, 1(1), 28–34.
- Nawangari et al. (2018). Pengembangan Wisata Pantai Desa Watu Karung Dan Desa Sendang Kabupaten Pacitan Tahun 2017. *Jurnal GeoEco*, 4(1), 31–40.
- Satrio, Sidauruk, P., & Pratikno, B. (2012). Studi Iklim dan Vegetasi Menggunakan Pengukuran Isotop Alam Stalaktit Goa Seropan, Gunung Kidul-Yogyakarta. *Jurnal Ilmiah Aplikasi Isotop Dan Radiasi*, 8(1), 43–52.

Journal article from a subscription database (no DOI)

- Badan Pusat Statistik Kabupaten Boogr. (2018). *Kecamatan Ciampea Dalam Angka 2018*. Kabupaten Bogor. Retrieved from <https://bogorkab.bps.go.id/publication/2018/09/26/9dec20cd0b54179b65207a4e/kecamatan-ciampea-dalam-angka-2018.html>
- Forest Digest. (2020, April). Mengapa Kelelawar Jadi Sumber Virus Mematikan? Retrieved from <https://www.forestdigest.com/detail/569/mengapa-kelelawar-jadi-sumber-virus-mematikan>

- Ikranagara R D F , Fauzan Rizky Pamungkas, Uswatun Hasanah, R. Bg. Irawanto Wisnu Broto, Agustin Erviana, M. F. F. R. S. S. Y. (2015). Inventarisasi keanekaragaman jenis kelelawar (chiroptera) penghuni gua di kawasan karst ciampea, jawa barat, indonesia 1. In *Prosiding Seminar Nasional Pendidikan Biologi dan Biologi* (pp. 97–106). Retrieved from https://www.academia.edu/35139736/_JOURNAL_keanekaragaman_kelelawar_Ciampea
- KO R.K.T. (2001). *Objek Wisata Alam*. Bogor: Yayasan Buena Vista.
- Mijiarto, J. (2014). Potensi Dan Pemanfaatan Jasa Lingkungan Kawasan Karst Gua Gundawang. *Media Konservasi*, 19(1), 57–66.
- Myloie JE, & Carew JL. (2003). Karst development on carbonate islands. *Speleogenesis and Evolution of Karst Aquifers*, 1(2), 1–21.
- Nurfitrianto, H., Budijastuti, W., & Faizah, U. (2013). Kekayaan Jenis Kelelawar (Chiroptera) di Kawasan Gua Lawa Karst Dander Kabupaten Bojonegoro. *Lentera Bio*, 2(2), 143–148. Retrieved from <https://jurnalmahasiswa.unesa.ac.id/index.php/lenterabio/article/view/2586>
- Nurwani Citra. (2010). Geologi Daerah Ciampea-Leuwiliang, Kabupaten Bogor, Jawa Barat Tugas Akhir a - Pdf. Retrieved from <https://docplayer.info/45772232-Geologi-daerah-ciampea-leuwiliang-kabupaten-bogor-jawa-barat-tugas-akhir-a.html>
- Prakarsa, T. B. P., & Ahmadin, K. (2013). Peranan Kelelawar Subordo Microchiroptera Penghuni Gua Sebagai Pengendali Populasi Serangga Hama: Studi Gua Lawa Temandang Di Kawasan Karst Tuban Jawa Timur. *Prosiding Seminar Nasional Biologi*, 10(1), 1–4. <https://doi.org/10.1017/CBO9781107415324.004>
- Rahmadi C. (2007). Ekosistem Karst Dan Gua. Retrieved April 20, 2020, from <https://cavernicoles.files.wordpress.com/2008/02/kh-karst-gunung-kidul.pdf>.
- Setyaningsih M. (2011). Keanekaragaman Fauna Gua Karst Di Pangandaran Jawa Barat. In *Prosiding Penelitian Bidang Ilmu Eksakta 2011* (pp. 35–44). Retrieved from <http://lemlit.uhamka.ac.id/index.php/berita/artikel-penelitian/207-01062012062708/keanekaragaman-fauna-gua-karst>
- Sukardi N. (1998). *Pengantar Pariwisata*. Bali: STP Nusa Dua Bali.
- Suwarno dan Komaruddin. (2007). Potential and Possibility of Direct Use of Guano as Fertilizer in Indonesia. *Jurnal Ilmu Tanah Dan Lingkungan*, 9(1), 37–43. Retrieved from <https://journal.ipb.ac.id/index.php/jtanah/article/view/2387>
- Uca, U., & Angriani, R. (2018). Pemetaan Gua Kalibong Aloa Kawasan Karst Pangkep. *Sainsmat : Jurnal Ilmiah Ilmu Pengetahuan Alam*, 7(2), 92. <https://doi.org/10.35580/sainsmat7273622018>
- Wikipedia. (2019). Single-rope technique. Retrieved April 5, 2020, from https://en.wikipedia.org/wiki/Single-rope_technique
- Wiwin IW. (2017). Wisata Minat Khusus sebagai Alternatif Pengembangan Pariwisata di Kabupaten Bangli. *Jurnal Ilmiah Pariwisata Agama Dan Budaya*, 2(2), 42–52. Retrieved from <https://ejournal.ihdn.ac.id/index.php/PB/article/view/840/696>

Books, in print

- Anindita. (2010). *Potensi Pengembangan Wisata Minat Khusus*. Jakarta :PT. Pradnya Paramita.
- Pendit, N. . (1999). *Ilmu Pariwisata: Sebuah Pengantar Perdana*. Jakarta: Pradnya Paramita.
- Yoeti. (1996). *Pengantar Ilmu Pariwisata*. Bandung :Angkasa.