

Potential of Karst Environmental Services Ngalau Anak Aia Ilang Sakayan Village Nagari Pasie Laweh Lubuk Alung District Padang Pariaman Regency

Helfia Edial¹, Ratna Wilis², Jhon Afnil³, Melfi Andini⁴
{helfia.edial@fis.unp.ac.id}

^{1,2,4}Geografi FIS Universitas Negeri Padang, Padang, Indonesia

³Teknik Sipil Universitas Muhammadiyah Bukittinggi, Bukittinggi, Indonesia

Abstract. This study aims to (1) determine the potential for environmental services in the Ngalau Anak Aia Ilang karst area. (2) to determine the utilization rate of potential environmental services in the Ngalau Anak Aia Ilang karst area by the community. This type of research is quantitative. The research subject is the people of Sakayan Village. The technique used is a survey, while the utilization rate can be identified using a questionnaire. The potential in the Ngalau Anak Aia Ilang karst area includes hydrological potential, land, landscape beauty and limestone cave ornaments. The hydrological potential in this karst area can be utilized to fulfill daily water needs, the land potential is used for agriculture and plantations, the landscape potential can be used as a natural tourist attraction, the environment can be used as a means of education as well as the potential for people's livelihoods. Utilization of the karst ngalau environmental services is still low both in terms of utilization of its natural resources as well as utilization in terms of science, environmental tourism and as a habitat for fauna and flora which are not very utilized.

Keywords: potential, utilization, environmental services, karst caves

1 Introduction

The Ngalau Anak Aia Ilang Karst area is an area that has exokarst and endokarst morphological types as evidenced by the presence of caves. This area is also an ecotourism area with cave tourism objects and natural features. There are 10 caves or canyons located in the karst area of Anak Aia Ilang Ngalau, namely: Anak Ilang Ngalau 1, Anak Aia Ilang Ngalau 2, Carocok Ngalau 1, Carocok Ngalau 2, Carocok Ngalau 3, Sumua Ngalau, Baringin Ngalau Pesona, Enchanted Ngalau Indonesia and the Kito Ngalau. The Karst area of Ngalau Anak Aia Ilang has potentials that can be utilized by the community and related agencies. However, this potential has not been recorded which makes the area underutilized both in the form of ecotourism potential, forest area management, hydrology and ecology. This is due to the lack of data on potential natural resources in Ngalau Anak Aia Ilang, the lack of knowledge of the surrounding community about the existence of this cave, management in the field of unstructured ecotourism, the lack of application of tourism supporting components and

¹ Dosen Geografi FIS UNP

the absence of data on the level of utilization of potential environmental services as a key point in order to help maintain and improve environmental quality in realizing sustainable ecosystem management. In this case it is very important to identify the natural potential of the Ngalau Anak Aia Ilang karst area and to identify the level of potential utilization of environmental services obtained from data on the natural potential of the Ngalau Anak Aia Ilang karst area, because this will have an impact on the availability of service data. environment that can be a reference for the community and related agencies regarding optimizing the utilization of potential environmental services in the Ngalau Anak Aia Ilang area.

2 Research Objectives

- a. To find out the potential for Environmental Services in the Ngalau Anak Aia Ilang Karst Area
- b. To determine the utilization rate of potential environmental services in the Ngalau Anak Aia Ilang Karst Area by the community

3 Research Methods

This type of research is quantitative research with a survey and questionnaire approach to obtain data. This research was conducted to describe the level of utilization of the potential of the Ngalau Anak Aia Ilang karst area. Administratively, this research is located in Korong Sakayan Kenagarian Pasia Laweh, Lubuk Alung District, Padang Pariaman Regency. The population of this study was the heads of families of the Korong Sakayan community, totaling 351 heads of families. In this case the sampling for research subjects used the Slovin method.

$$n = \frac{N}{1+N(e)^2} \quad (1)$$

Where :

n = size of the number of samples

N = population

e = allowable margin of error 0.12 = 10%

From the results of the calculation above, the number of respondents is set at 78 heads of families. Primary data was obtained from survey results in the Ngalau Anak Aia Ilang Karst area. Furthermore, secondary data was obtained from related agencies such as Wali Nagari Pasie Laweh, Google Maps, Ina Geoportal, Schools, and the Central Bureau of Statistics for Padang Pariaman Regency, as well as other sources that support this research.

3.1 Data Analysis Techniques

The analysis technique used refers to two research objectives, including:

$$DP = \frac{n}{N} \times 100\% \quad (2)$$

Where:

DP = Descriptive Percentage (%)

n = Empirical score (Score obtained)

N = Maximum score of question items

To find out the level of these criteria, then the scores obtained (in %) with descriptive analysis of percentages were consulted with the criteria table. The criteria used are Very High, High, Medium, and Low.

Table 1. Percent Descriptive Criteria

No	Interval %	Criteria
1	75 - 100	Very High
2	50 - < 75	High
3	25 - < 50	Medium
4	< 25	Low

3.2 Findings

The Ngalau Anak Aia Ilang karst area has an area of ± 340 Ha (representing 37% of the administrative area of Korong Sakayan). This area is located at coordinates 0° 39' 0" South Latitude and 100° 20' 30" East Longitude. Geomorphologically, the Ngalau Anak Aia Ilang area is located in the hills with an altitude of 130 meters above sea level. Geologically, this karst area is an area consisting of endokarst formations.

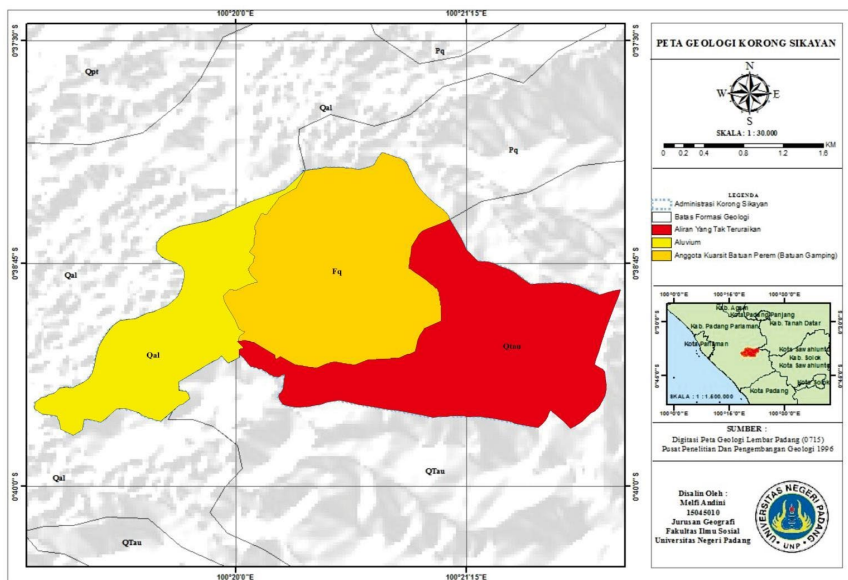


Fig. 1. Geological map of Korong Sikayan

3.2.1 Potential Hydrological Services

The water resources of this area are used as a supply of drinking water and fulfillment of daily water needs such as for bathing, washing as evidenced by the presence of a PAMSIMAS water reservoir (Community Based Drinking Water and Sanitation Provider). Judging from the water quality based on the temperature parameter of 25.5o-26o Celsius which shows that the water has a normal temperature. Physically, the quality of the water has met the needs of the community.

3.2.2 Land Cover Potential Services

The land cover of the Ngalau Anak Aia Ilang Karst area is dominated by shrubs, this is caused by the type of soil that contains lime so that the vegetation that grows is very limited by the suitability of the land.

Table 2. Land Cover In The Karst Area of Ngalau Anak Aia Ilang

No	Land Cover	Area (Ha)
1.	Forest	30.61
2.	Shrubs	308.95
3.	Plantation	0.34
4.	Rice fields	0.1
Total		340

Sumber : Citra Spot 6 perekaman 2021

Forests have various potentials. One potential that can be exploited is wood products and non-timber products. The wood obtained in the forest is used as building materials, materials for making furniture, etc [1]. However, the use of this wood must consider the environmental conditions of the karst hills which can be damaged. While non-timber products that can be utilized by the community are plantation products in the form of areca nut, rubber latex, durian fruit, mangosteen fruit, and petai.

3.2.3 Landscape Beauty Services

The potential services it has, among others, as a natural tourist attraction, fauna habitat, carbon dioxide (CO₂) absorber[2]. From the results of observations made in the research area there are 10 caves (Ngalau) which are explained as follows;

3.2.4 Baringin Ngalau

This canyon is named Ngalau Baringin because this canyon is located near a large banyan tree. This canyon is located at coordinates 0° 38' 45.688" South Latitude - 100° 20' 23.169" East Longitude. The ornaments contained therein are stalactites and pillars. The fauna in Ngalau Baringin are bats and diplopods (segmented and multi-legged animals).



Fig. 2. Baringin Ngalau
Source: Research Documentation 22

3.2.5 Ngalau Jantuang

Ngalau Jantuang is a dry cave because it is not drained by underground water flow. This canyon is located at coordinates $0^{\circ} 38' 45.859''$ South Latitude- $100^{\circ} 20' 25.225''$ East Longitude. Mouth Ngalau Jantung is big. The ornaments owned by Ngalau Jantung include stalactites, stalagmites, and large pillars that make the canyon attractive and beautiful.

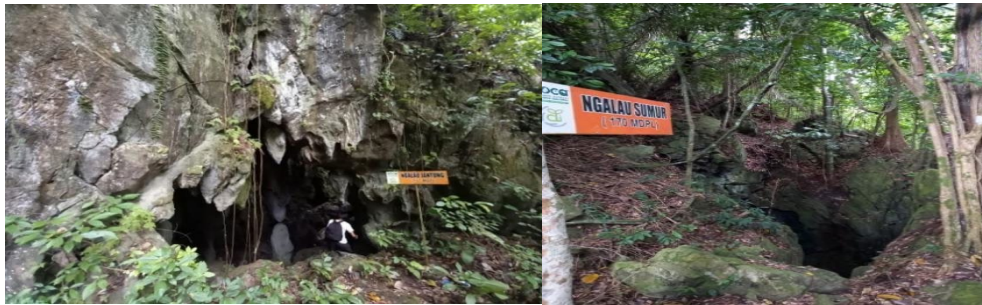


Fig. 3. Jantuang and Sumua Ngalau
Source: Research Documentation 2022

3.2.6 Ngalau Sumua

It is said that Ngalau Sumua is due to its shape which is like a well. Ngalau is a vertical type. The height of this canyon is approximately 20 meters and has a diameter of approximately 15 meters. Located at coordinates $0^{\circ} 38' 50.119''$ South Latitude- $100^{\circ} 20' 29.723''$ East Longitude. To be able to enjoy the uniqueness of this canyon requires special techniques and equipment. The ornaments found in Sumua Ngalau include very large stalactites, stalagmites and pillars.

3.2.7 Ngalau Carocok I, II, III

This canyon is called Ngalau carocok because of its shape which is like an oil funnel. Ngalau Carocok I is located at the coordinates $0^{\circ} 38' 49.646''$ South Latitude- $100^{\circ} 20' 24.471''$ East Longitude. Furthermore, Carocok II is located at the coordinates $0^{\circ} 38' 50.479''$ South Latitude- $100^{\circ} 20' 26.099''$ East Longitude and Ngalau Carocok III is located at coordinates $0^{\circ} 38' 51.558''$ South Latitude- $100^{\circ} 20' 28.078''$ East Longitude. These three canyons are connected to each other. Carocok I canyon is 22.9 meters long and Carocok II canyon is 10.31 meters long. Meanwhile, the Carocok canyon is 22.9 meters long. Carocok III is not known because the road is interrupted by piles of collapsed rock. Carocok I, II canyons have stalactites, stalagmites, pillars. In Carocok I, II canyons there is a small stream of water flowing in it. Fauna in Carocok I, II canyons These are bats, crickets and crabs. The reason why crabs were found in the cave is due to an underground river system. It is highly probable that this cave was formed from the development of dolinas that formed on rock apur all this time, but because it has been overgrown by shrubs and trees, the dolina trail is starting to break down.



Fig. 4. Ngalau Carocok I and II
Source: Research Documentation 2022



Fig. 5. Ngalau Carocok III and Anak Aia Ilang I
Source: Research Documentation 2022

3.2.8 Ngalau Anak Aia Ilang I

Ngalau Anak Aia Ilang I is an icon of this karst area. It was given such a name because the water flow outside Ngalau was lost and the flow appeared in Ngalau Anak Aia Ilang I. Ngalau is located at coordinates $0^{\circ} 38' 51.353''$ South Latitude- $100^{\circ} 20' 32.832''$ East

Longitude.. The mouth of Ngalau Anak Aia Ilang I has a width of 1 meter and a length of 13 meters. The fauna in it is kalelawar, crabs and swallows. The ornaments on Ngalau Anak Aia Ilang I are stalactites, stalactites, pillars and flowstones. The presence of this water flow shows that this aia ilang child is included in the active cave and has the ability to absorb carbon dioxide (CO₂). On the walls of the ngalau is also found the nest of swallows.



Fig. 6. (a) Pilar, (b) flowstone in Ngalau Anak Aia Ilang I
Source: Research Documentation 2022

3.2.9 Ngalau Anak Aia Ilang II

Ngalau Anak Aia Ilang II is located at coordinates 0° 38' 53.511" South Latitude-100° 20' 33.141" East Longitude. The mouth of Ngalau Anak Aia Ilang II has a width of 0.80 meters. Ngalau Aia Ilang II has ornaments in the form of stalactites, stalagmites and pillars. The fauna contained in it is dominated by kalalawar.

3.2.10 Ngalau Kito

Ngalau Kito is located at coordinates 0° 38' 46.142" South Latitude-100° 20' 36.203" East Longitude. This ngalau kito has the same ornaments as other ngalau-ngalau such as the presence of stalactites and stalagmites. Ngalau Kito has a large cave mouth and the length of the cave he has is short of approximately 50 meters.

3.2.11 Ngalau Pesona dan Ngalau Indonesia

There is nothing fundamental about giving names to Ngalau Pesona and Ngalau Indonesia. This idea came to mind because of the slogan of Indonesian charm so that the surrounding community thought of giving such a name. Ngalau Pesona is located at coordinates 0° 38' 51.625" South Latitude- 100° 20' 37.188" East Longitude. While Ngalau Indonesia is located at coordinates 0° 38' 45.378" South Latitude-100° 20' 31.442" East Longitude. In this country there are ornaments in the form of stalactites and stalagmites. The mouth of this ngalau is quite large.

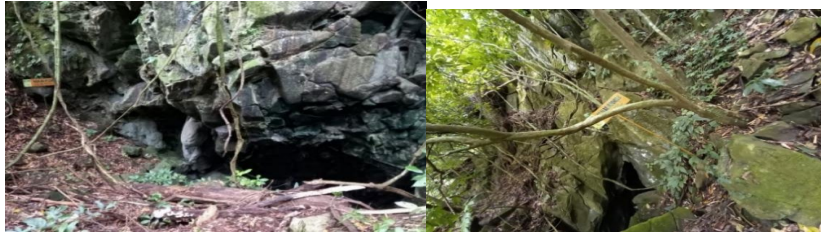


Fig. 7. Ngalau Pesona and Ngalau Indonesia
Source: Research Documentation 2022

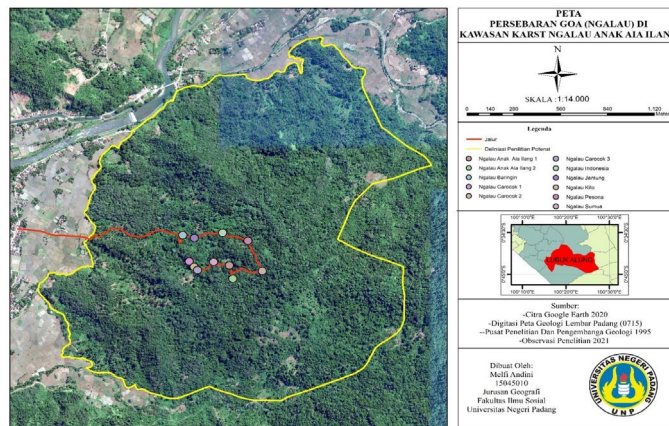


Fig. 8. Map of the Distribution of Goa in the Anak Aia Ilang Ngalau Area

3.3 Science Services. Potential Educational Facilities

Educational tourism or educational tourism is a program in which tourists visit a tourist location with the main aim of gaining direct learning experience at the tourist object[3]. In addition to attracting tourists, educational tourism objects can also be used as an alternative to become a means of learning for the community and students. Regarding the implementation of learning that utilizes natural, social and cultural conditions as well as regional wealth for the success of education with optimal content of all study materials, this is also in line with environment-based learning.[4]

Based on the research area, there is potential as an educational tool where the technique used is observation technique. In this case the results of the research are as follows: (1) The ornaments in the cave can be used as material for learning about karst areas, (2) With different cave ecosystem conditions we can learn about the beauty and biodiversity in it

3.4 Environmental Services

It is said to be an environmental object when there is human interaction with the environment. In this case the Ngalau Anak Aia Karst area has an influence on the life of the people there. One of the influences is that it is used as a place for livelihood fields. The

economic potential in the area that is possible and feasible to develop so that it will continue to develop into a source of livelihood for the local people can even encourage the regional economy as a whole to develop independently and sustainably. Forms of environmental services that can be created are the establishment of food stalls, local transportation, even if the potential for this area is growing, lodging and tour guide services can also be established for visitors (Suratman Worosuprojo in Eko Haryano, 2004)[1].

The non-physical potential in the Ngalau Anak Aia Ilang area is quite good in its utilization, judging from the potential of the cave (ngalau) which is used as a tourist attraction. It's just that it needs good management and development so that it can become a good tourist spot too. Furthermore, seen from the potential of caves as educational facilities, they are also not utilized properly because people do not know about caves, the contents of caves and the ecosystem of these caves can be used as learning facilities.

Furthermore, seen from the potential of the Ngalau Anak Aia Ilang Karst area as one of the supporting livelihoods for the community, it does not have a significant influence because the existing tourist objects are rarely visited so that people are reluctant to open businesses, both rice stalls, lodging, etc.

Table 3. Percentage of the Level of Utilization of the Ngalau Anak Aia Ilang Karst Area

No	Score	Category	Frequency	Percentage
1	75 - 100	Very high	0	0
2	50 - < 75	high	24	31
3	25 - < 50	Currently	38	49
4	< 25	Low	16	21
Total			78	100

Source: Primary Data 2022

Judging from the percentage level of utilization in the Ngalau Anak Karst Area, it is in the very high category of 0% because the utilization is still not very good. Furthermore, in the high category 31% due to utilization carried out with good management, it can be seen in the utilization of the water potential in the area. Furthermore, in the medium category, it is 49% because not all the physical and non-physical potentials owned by the karst area of Ngalau Anak Aia are utilized and managed properly. Furthermore, in the low category 21% because there is no utilization by the community.

4 Conclusion

- a. Potential natural resources found include; hydrological potential can be used as a source of clean water and irrigation for rice fields, most of the land cover is shrubs and a small part of the forest land cover is used for mixed plantations and wood products for fuel, building materials, furniture materials etc. In terms of the beauty of the landscape, there are 11 caves that have been used as tourist attractions. Then in terms of knowledge, it can be used as a means of learning about karst areas, and in terms of environmental objects, its connection with caves as a tourist attraction makes the people there take advantage of it by opening rice stalls and the habitat of flora and fauna in the karst area can also be used as a means of learning about the environment.
- b. Utilization of the potential environmental services in the Ngalau Anak Aia Ilang karst area by the community is still at a moderate level because the utilization carried out by

the community is quite good. In terms of natural resources in the form of hydrological potential and land cover potential, they have been utilized properly, but in terms of science, environmental objects and flora and fauna habitats have not been utilized properly.

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