# Habitat Utilization by Long-Tailed Monkeys (*Macaca fascicularis*) in Gunung Palung National Park as a Biology Learning Resource

Yoga Febriyanda[1], Ari Sunandar[1*], Anandita Eka Setiadi[1]

[1]Biology Education Programe, Faculty of Teacher Training and Education, University Muhammadiyah Pontianak, West Borneo, Indonesia

**Abstract:** One of the most distributed primate species in Gunung Palung National Park is the long-tailed monkey (*Macaca fascicularis*). This study aims to determine habitat characteristics, daily activities, use of habitat as a source of food by long-tailed monkeys, and potential use of habitat by long-tailed monkeys in Gunung Palung National Park as a source of learning biology. The study was conducted using the observation method with *focal animal sampling* data collection techniques in two transects. The results show that the habitat characteristics have a position that is not far from the watershed (watershed) and belongs to the alluvial forest area. The vegetation condition is dominated by trees from the *Angiospermae* sub-division which is divided into 12 families. The result of the frequency of resting activity is the highest daily activity among the 4 types of activity observed, which is 48 times. While the plant species that became the highest source of diet trees was *Blumeodendron tokbrai*, with a percentage of 55.56%. Judging from the results of 7 respondents who came from high school teachers in North Kayong Regency, Gunung Palung National Park was suitable as a learning resource. The requirements of learning resources, namely clarity of potential, conformity with learning objectives, the accuracy of targets, clarity of exploration guidelines, and clarity of expected gains, the results of the study on Habitat Utilization by Long-Tailed Monkeys in Gunung Palung National Park in achieving basic competencies in the spatial material scope of biology, various levels of biodiversity, plants, and materials ecology can be used as a learning resource for high school biology class X.

**Keywords:** *Macaca fascicularis*; Habitat utilization; Daily activities; Gunung palung; Learning resources

## Introduction

Gunung Palung National Park (1,080 km², 1°3′ – 1°22′ S, 109°54′ – 110°28′ E) is a conservation area in West Kalimantan with an Insitu conservation. Gunung Palung National Park was first protected in 1937 and now become one of the largest remaining primary lowland mixed dipterocarp forests on Borneo. To help inform conservation efforts, we measured forest cover change in the protected area using 11 multi-temporal Landsat series images with path/row 121/61. Annual deforestation rates have declined since measurement began in 1989, to around 68 hectares per year in 2011 and 112 hectares per year in 2017 (Fawzi et al., 2018). This National Park is also one of the habitats for the distribution of primates in Indonesia. Among the primates found in Gunung Palung National Park is the Long-tailed monkey (*Macaca fascicularis*). Regarding the Status of Primate Animal Populations in Gunung Palung National Park and Buffer Area, West Kalimantan, it is known that the location of the distribution of long-tailed monkeys in Gunung Palung National Park can be found in two locations, namely Lubuk Kuali which recorded 18 tails, and the Semanai River which recorded 4 tails (Prasetyo et al., 2010). Long-tailed monkeys are known as opportunistic omnivores, which are animals that eat all kinds of food (Kamilah et al., 2012). Besides being known as an arboreal primate species, this species can also be found in forest canopy areas, river forests, coastal

areas, mangroves, swamps, and tourist forests (Syah, 2020).

Each organism must make a selection and take advantage of the surrounding environment. habitats. Habitat is the main component in animal conservation, to meet the needs of life and breeding, suitable and supportive environmental conditions are needed, especially in terms of providing shelter, playing, nesting and breeding. The Panti branch is a research station located in the Gunung Palung National Park area of the North Kayong Regency. Branch Panti is a tropical forest area that has eight habitat types with an area of 2,100 ha. The eight habitat types are peat swamp, freshwater swamp, shrubland, alluvial, lowland sandstone, lowland granite, highland granite, and mountains (Setiawan, 2015). The types of habitats in this national park are inhabited by various types of animals including mammals, reptiles, and aves. With the conditions of various habitat types, researchers are interested in conducting research on habitat utilization by long-tailed macaques at the Panti Branch Research Station of Gunung Palung National Park.

Long-tailed monkeys have a distribution area that includes mainland South Asia, Indonesia, the Philippines, and more recently Mauritus, where a small number of founder animals was imported on a trading ship during the 15th century (Ebeling et al., 2011). These primates, have very important ecological functions for forests, namely playing a role in the regeneration of tropical forests (Rizaldy et al., 2016). This is in line with the important role of Long-tailed monkeys, namely as seed dispersers, pollination mediators, and insect population controllers. By knowing the habitat utilization by the long-tailed monkey, it is also known the condition of the habitat. It is hoped that this can be a reference that provides information for national park habitat managers to be able to maintain the habitat of the long-tailed monkey following the pattern of habitat utilization so as not to disturb the natural balance in Gunung Palung National Park.

Learning resources are experiences that are basically very broad, namely as wide as a life which includes everything that can be experienced and can lead to learning events. This means that there is a change in behavior towards a more perfect. Learning resources can also be interpreted as anything that can provide convenience to students in obtaining some information, knowledge, and skills in the learning process. According to (Purnomo et al., 2013), learning resources are materials that are used and needed in the learning process, which can be in the form of textbooks, print media, electronic media, resource persons, the surrounding environment, and so on that are available around the learning environment that function to help optimize results. study. Learning resources can be in the form of writing (handwritten or printed), pictures,

photos, resource persons, natural objects, and cultural products. Based on their shape, learning resources can be grouped into; 1) a place or natural environments, such as a library, or the surrounding environment; 2) objects, such as sites, temples, and the like; 3) people, for example, teachers, lecturers, policy makers, scientists, and experts in certain fields; 4) books, textbooks, dictionaries, encyclopedias, and the like; and 5) events and facts that are happening, for example, natural disasters, conflicts or wars, etc. (Susilo, 2018).

One of the main functions of learning resources is to increase students' knowledge, which according to Kratwohl (2002) in (Lau et al., 2018), The Knowledge dimension consists of four general types of knowledge that learners are expected to acquire or construct Factual, Conceptual, Procedural, and Metacognitive. In the cognitive domain, the taxonomy provides definitions for each of the six major cognitive categories. They include Knowledge (recall of learned information), Comprehension (understanding of a concept), Application (use of learned knowledge in a new situation), Analysis (classification of concepts into component parts for inference), Synthesis (integration of ideas into new concept), and Evaluation (assessment of situation based on certain criteria) (Wang et al., 2012).

Students feel the need to be close to the objective reality of life and one way is by having learning resources that can bring students to recognize many things are directly related to everyday phenomena whose sources can use and utilize the surrounding environment. The requirements for learning resources include clarity of potential, conformity with learning objectives, clarity of goals, clarity of exploration guidelines, clarity of information disclosed, and clarity of expected gains (Suhardi, 2007). The learning environment can be interpreted as conditions, influences, and external stimuli, which include physical, social, and intellectual influences that affect students (Harjali et al., 2016). Learning resources are also essentially a component of an instructional system that includes messages, people, materials, techniques, and the environment that can affect student learning outcomes. Thus, learning resources can be defined as resources that exist outside of the person (students) and can help to accelerate the learning process (Nur, 2012).

## Method

The research was conducted at the Cabang Panti Research Station of Gunung Palung National Park in western Borneo, an ideal site at which to investigate variation in primate communities over space and time because it contains seven distinct forest types (Marshall et al., 2014). This National Park located in Ketapang Regency and North Kayong Regency, West Kalimantan (Figure 1), which is geographically located at

coordinates 10°00'-01°20' latitude and 109°00'-110°25' east longitude, is in the downstream area and includes into three watersheds (DAS), in the north and east including the Simpang watershed, in the south including the watershed, and the east including the Pawan watershed. The location determination was carried out on two transects in the Panti Branch Research Station area, namely the CH and SP transects. The selection of transects as the location for observing activities was based on secondary data obtained from interviews with Panti Branch Research Station officers.
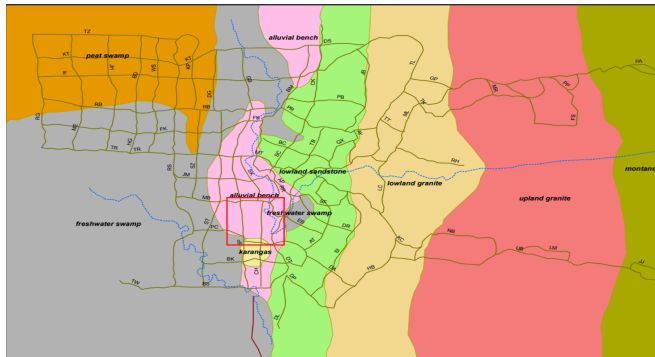


**Figure 1.** Location plan (source: Stasiun Riset Cabang Panti)

This study uses an observation method with *Focal Animal Sampling data collection techniques,* this method was chosen because of its high level of accuracy. This method requires a high sample record, inflating the required sampling effort in studies of large groups of individuals. In addition, during observations of free wild animals, the individual being observed might disappear. In these cases, the observer has two options: find again the focal individual or observe another individual (if the observer chooses the second option, observation data of the lost individual need not be discarded) (Bosholn et al., 2018). Duration of interval observation depends on multiple factors (Altmann 1974), including characteristics intrinsic of the focal species such as mobility and habit. For species that are very active or highly mobile, a short observation interval can be efficient to quantify the behavior of the focal individual using either recording rule (Anciães et al., 2008; Durães, 2009; Bosholn et al., 2016).

Observations of activity patterns are carried out in two time periods every day, namely 2 hours in the morning and 2 hours in the afternoon for 6 days, the observation period is carried out every 5 minutes. And to determine environmental characteristics based on vegetation conditions, 2 plots of vegetation analysis were made in two observation lines, 1 plot in each transect. Plot size for seedling level is 2 m x 2 m, sapling level is 5 m x 5 m, pole level is 10 m x 10 m, and tree level 20 m x 20 m. Then proceed with the stages of verification of research data and verification as a learning resource. Data analysis was carried out in 4 parts, namely:

1. Long-tailed monkey activity

$$Activities\ percetage = \frac{Frequency\ of\ activities}{Total\ frequency\ activities} x100\% \quad (1)$$

2. Habitat utilization as feed

$$Percetage\ of\ diet\ tree = \frac{Frequency\ of\ diet\ tree}{Total\ frequency\ of\ diet\ tress} x100 \quad (2)$$

3. Vegetation Analysis

$$K = \frac{Total\ individuals\ of\ species}{Sample\ plot\ area} \quad (3)$$

$$Kr = \frac{Density\ of\ a\ species}{Density\ all\ of\ species} x100\%$$

$$F = \frac{Total\ of\ Sample\ plot}{Total\ of\ observation\ plots}$$

$$Fr = \frac{Frequensi\ of\ species}{Frequency\ all\ of\ species} x100\%$$

4. Eligibility of learning resources

$$P = \frac{f}{N} x100\% \quad (4)$$

P = Precentage
$f$ = Total score obtained
$N$ = Maximum score

**Table 1.** Rubric for Eligibility Category as a Learning Resource ( et al., 2016)

| Percentage (%) | Interpretation |
|---|---|
| 81 ≤ score ≤ 100 | Very feasible |
| 61 ≤ score ≤ 80 | Feasible |
| 41 ≤ score ≤ 60 | Fairly feasible |
| 21 ≤ score ≤ 40 | Not enough feasible |
| 0 ≤ score ≤ 20 | infeasible |

## Result and Discussion

*Habitat characteristics*

Characteristics of long-tailed monkeys seen from the location not far from the watershed (watershed), with physical and chemical conditions of the environment 34-40 meters above sea level, light intensity from 304-675 LUX, air temperature around 27.4 degrees Celsius with air humidity around 93%, for soil pH around 4-5. Vegetation conditions are dominated by trees with many branches, this allows the monkeys to rest more.

**Table 2.** Vegetation Analysis

| Species | Growth rate | K | Kr | F | Fr |
|---|---|---|---|---|---|
| *Species c* | Seedling | 0.25 | 4.76 | 0.50 | 16.67 |
| *Garcinia Sp* | Seedling | 1.75 | 33.33 | 0.50 | 16.67 |
| *Spesies d* | Seedling | 1.25 | 23.81 | 1.00 | 33.33 |
| *Spesies b* | Seedling | 1.00 | 19.05 | 0.50 | 16.67 |
| *Syzygium sp* | Seedling | 1.00 | 19.05 | 0.50 | 16.67 |
| *Knema sp* | Stake | 0.04 | 7.70 | 0.50 | 25.00 |
| *Canarium sp* | Stake | 0.04 | 7.70 | 0.50 | 25.00 |
| *Ardisia sp* | Stake | 0.32 | 61.54 | 0.50 | 25.00 |
| *Maasia sumatrana* | Stake | 0.12 | 23.07 | 0.50 | 25.00 |
| *Strombosia sp* | Pole | 0.01 | 25.00 | 0.50 | 50.00 |
| *Popowia sp* | Pole | 0.03 | 75.00 | 0.50 | 50.00 |
| *Species a* | Tree | 0.005 | 18.18 | 0.50 | 16.67 |
| *Dracontomelon sp* | Tree | 0.002 | 9.09 | 0.50 | 16.67 |
| *Shorea sp* | Tree | 0.012 | 45.45 | 1.00 | 33.33 |
| *Diospyros sp* | Tree | 0.002 | 9.09 | 0.50 | 16.67 |
| *Blumrodendron sp* | Tree | 0.005 | 18.18 | 0.50 | 16.67 |

Vegetation analysis conducted at the habitat location found 16 plant species divided into 12 families and all families belong to the flowering plant class (*Magnoliopsida*) (Table 2).

*Daily activities Long-tailed monkeys*

Observed 4 types of activities, namely resting, moving, eating, and social activities that included activities in the form of grooming, mating and speaking. The number of different frequencies was found, 48 times for resting, 43 for moving activities, 39 for social activities, then the least number of eating activities, which was only 9 times (Table 3).

**Table 3.** Daily Activities Frequency of Long-Tailed Monkey

| Activities | Frequency |
|---|---|
| Resting | 48 |
| Moving | 43 |
| Eating | 9 |
| Social activities | 39 |
| Pause | 11 |

The highest daily activity occurred in the morning period, namely 72 times. In the morning the long-tailed monkeys move more often and perform social activities such as dressing up, and making noises. While in the afternoon, long-tailed macaques prefer to rest, as well as eating activities which are more comfortable to do in the morning than in the afternoon (Figure 3).
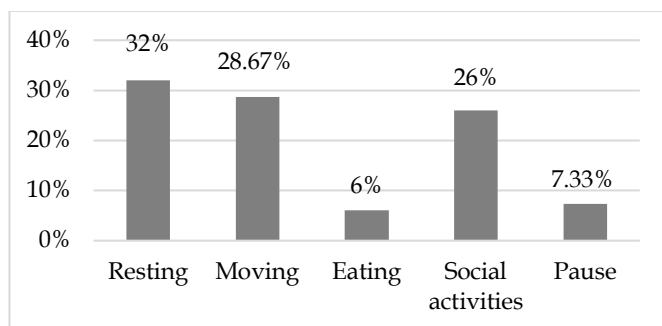


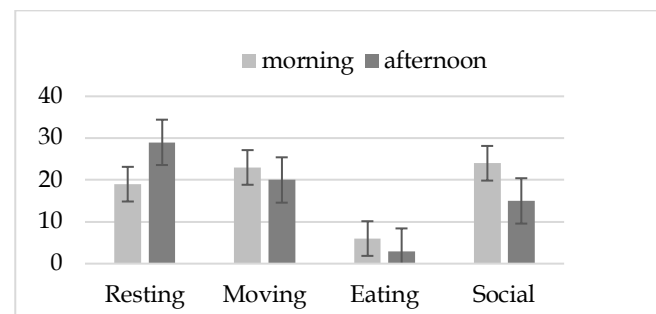**Figure 2.** Long-tailed Monkey Daily Activity Percentage Diagram



**Figure 3.** Long-tailed monkey daily activity frequency in two periods observations

*Diet trees for long-tailed monkeys*

There are 3 types of plants that are the source of food for long-tailed monkeys.



**Figure 4.** Diet trees of long-tailed monkeys. A) *Mezzetia parviflora*, B) *Monocarpia marginalis*, C) *Blumeodendron tokbrai*.

Feeding activity in long-tailed monkeys has a very low frequency compared to other activity frequencies, from 150 total activity frequencies there are only 9 frequencies. There are 3 sources of fruit plants that are used as food sources based on identification in the field assisted by research assistants at the research station branch of the orphanage, three types of fruit plants that are used as food sources, namely *Mezzetia parviflora*, *Monocarpia marginalis*, and *Blumeodendron tokbrai* (Figure 4).
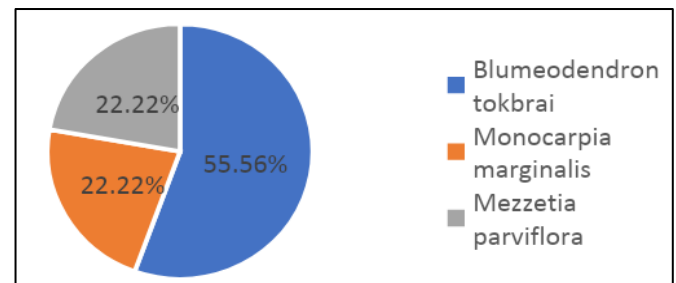


**Figure 5.** Percentage of Diet Trees

The total frequency of feeding activity, long-tailed monkeys ate *Monocarpia marginalis* (22.22%), *Mezzetia parviflora* (22.22%) and *Blumedendron tokbrai* (55.56%) (Figure 5).

*Feasibility of Gunung Palung National Park as a learning resource*

The nature around which is used as a learning resource can develop students' potential to carry out activities outside the classroom to find the causes of an event in their environment and to find out the relationship between the facts that exist in their physical environment (Ikhsan et al., 2017).

**Table 4.** Percentage Result of the Eligibility Questionaire for Learning Resources

| Aspect | Percentage (%) | Interpretation |
|---|---|---|
| Ease of access | 85.70 | Very feasible |
| Security | 85.70 | Very feasible |
| Time efficiency | 42.85 | Fairly feasible |
| Cost | 85.70 | Very feasible |
| Average | 74.98 | |

The questionnaire that was filled in by 7 respondents who came from junior high and high school schools in North Kayong Regency, it was found that the percentage of obtaining a questionnaire score of 74.98%, which means that Gunung Palung National Park is worthy of being used as a learning resource.

*Eligibility of utilizing long-tailed monkey habitat as a learning resource*

Something, both in the form of data, people and certain forms that can be used by students in learning is a source of learning (Susettyarini, 2019). In this study, there are several potentials in the form of research data used as a source of biology learning. Both in the form of data on the activity of long-tailed monkeys and data in the form of plant species found in the habitat of long-tailed monkeys.

*a. Clarity of potential*

Habitat utilization by long-tailed monkeys (*Macaca fascicularis*) in Gunung Palung National Park describes the daily activities of long-tailed monkeys, and describes the habitat characteristics of long-tailed monkeys both chemically, physically and in terms of vegetation structure which contains various types of information related to species. plant.

Learning resources must be able to facilitate students in obtaining a number of information, knowledge, experience, and skills in the teaching and learning process (Virgiawan, 2016). students will gain experience, information, skills, and knowledge about activity patterns and habitat characteristics of long-tailed monkeys in Gunung Palung National Park, on the other hand students have direct experience or knowledge of plant morphology.

*b. Conformity with learning objectives*

Based on the verification results of biology teachers in 3 different schools, it was found that the four potential research results were in accordance with learning objectives, especially for class X SMA. The results of the verification can be seen in Table 5.

**Table 5**. Verifier Results

| Potential Match with Learning Objectives | Verifikator 1 | | Verifikator 2 | | Verifikator 3 | |
|---|---|---|---|---|---|---|
| | Yes | No | Yes | No | Yes | No |
| Can determine the level of organization based on the types of plants found in Gunung Palung National Park | √ | - | √ | - | √ | - |
| Can group various types of plants based on the level of order, family, and genus | √ | - | √ | - | √ | - |
| Can classify species-level biodiversity | √ | - | √ | - | √ | - |
| Can understand the interactions that occur between living things in an ecosystem | √ | - | √ | - | √ | - |

*c. Accuracy*

The accuracy of the target is seen from the target of observation (object) and target designation (subject) research. The target of this research is the use of habitat by long-tailed monkeys (*Macaca fascicularis*), while the purpose of this research is the students of class X SMA biology subject.

*d. Clarity of information disclosed*

Based on the results of data analysis that has been carried out, the information contained in this study is the frequency of activity of long-tailed monkeys, where the highest frequency occurs in the morning, and the highest activity that is most often done is rest. The characteristics of the long-tailed monkey habitat are good from the physical chemistry of the environment, namely habitat contours of 28-34 meters above sea level, light intensity 304-675 LUX, air temperature around 27.4 degrees Celsius with air humidity around 93%, for soil pH around 4-5. Vegetation conditions are dominated by tall trees with many branches, 16 plant species from the *Spermatophyta division,* and divided into 7 orders. 6 species from the order *Magnoliales,* 4 species from the order *Malpighiales*, 3 species from the order *Sapindales*, and 1 species each from the orders *Myrtales, Ericales, Santales, and Malvales.* There are 12 families in total.

*e. Clarity of exploration*

In the exploration guidelines, clear work procedures are needed, including determining research samples, determining the time and location of activities, research variables, tools and materials, work methods, data processing, and concluding (Agus et al., 2014). In this study, Gunung Palung National Park has not been fully utilized as a direct learning source in Biology learning, this requires clear and structured work procedures. because in terms of location, not all schools can and can reach the location of Gunung Palung National Park.

*f. Clarity of expected gains*

According to Kurniawan (2014) that the clarity of the expected benefits is clarity based on the identification of the research process as a source of learning as well as a study of the results of selection and

modification, the eye acquisition in question includes 3 aspects, namely cognitive, affective, and psychomotor.

From the results of this study, the existence of learning resources by raising material from the results of the study is expected to help students better understand the material and can obtain the development of the following skills in the form of observation, accuracy in collecting data, suitability of data, and conclusions from the results obtained; develop a conscientious, disciplined, honest, diligent, curious, cooperative, creative and critical thinking attitude in the process of introducing plant species and observing the daily activities of long-tailed macaques; and the development of the concept links habitat use by long-tailed macaques with ecological principles.

## Conclusion

Based on the results of the study, it was found that the habitat characteristics of long-tailed monkeys with habitat contours 34-40 meters above sea level, light intensity 304-675 LUX, air temperature around 27.4° Celsius with air humidity around 93%, for soil pH around 4-5. Vegetation conditions are dominated by tall trees with many branches, 16 plant species from the *Spermatophyta* division, and divided into 12 families. The highest daily activity of long-tailed monkeys occurred in the morning, and the most frequent type of activity was rest. Resting 32%, moving 28.67%, eating 6%, and social activities 26% of the total activity. There are 3 types of plants that are used as food sources, namely *Monocarpia marginalis* (22.22%), *Mezzetia parviflora* (22.22%) and *Blumedendron tokbrai* (55.56%). Gunung Palung National Park was suitable as a learning resource**.** And The results of research on the use of long-tailed monkey habitats in Gunung Palung National Park can be used as a learning resource with targets in achieving basic competencies in the spatial material scope of biology, various levels of biodiversity, plants and ecological materials, all of which are included in the class X Biology material.

## Acknowledgements

## References

Agus, K., & Listiatie, B. U. (2014). Pengaruh Dosis Kompos Berbahan Dasar Campuran Feses dan Cangkang Telur Ayam Terhadap PertumbuhanTanaman Bayam Cabut (Amaranthus tricolor L.) SebagaiSumber Belajar Biologi SMA Kelas XII. *Jupemasi-PBIO*, *1*(1), 66–75. http://jupemasipbio.uad.ac.id/wp-content/uploads/2014/11/14.-NP_10008127_AGUS-KURNIAWAN.pdf

Anciães, M., & Prum, R. O. (2008). Manakin display and visiting behaviour: a comparative test of sensory drive. *Animal Behaviour*, *75*(3), 783–790. https://doi.org/10.1016/j.anbehav.2007.06.013

Bosholn, M., & Anciães, M. (2018). Focal Animal Sampling. *Encyclopedia of Animal Cognition and Behavior*, 1–3. https://doi.org/10.1007/978-3-319-47829-6_262-1

Bosholn, M., Fecchio, A., Silveira, P., Braga, É. M., & Anciães, M. (2016). Effects of avian malaria on male behaviour and female visitation in lekking blue-crowned manakins. *Journal of Avian Biology*, *47*(4), 457–465. https://doi.org/10.1111/jav.00864

Durães, R. (2009). Lek structure and male display repertoire of blue-crowned manakins in eastern Ecuador. *Condor*, *111*(3), 453–461. https://doi.org/10.1525/cond.2009.080100

Ebeling, M., Küng, E., See, A., Broger, C., Steiner, G., Berrera, M., Heckel, T., Iniguez, L., Albert, T., Schmucki, R., Biller, H., Singer, T., & Certa, U. (2011). Genome-based analysis of the nonhuman primate Macaca fascicularis as a model for drug safety assessment. *Genome Research*, *21*(10), 1746–1756. https://doi.org/10.1101/gr.123117.111

Fawzi, N. I., Husna, V. N., & Helms, J. A. (2018). Measuring deforestation using remote sensing and its implication for conservation in Gunung Palung National Park, West Kalimantan, Indonesia. *IOP Conference Series: Earth and Environmental Science*, *149*(1), 12038. https://doi.org/10.1088/1755-1315/149/1/012038

Harjali, Degeng, I. N. S., Setyosari, P., & Dwiyogo, W. D. (2016). Strategi Guru dalam Membangun Lingkungan Belajar yang Kondusif: Studi Fenomenologi pada Kelas-kelas Sekolah Menengah Pertama di Ponorogo. *Jurnal Pendidikan Dan Pembelajaran*, *23*(1), 10–19. http://journal.um.ac.id/index.php/pendidikan-dan-pembelajaran/article/view/10147

Ikhsan, A., Sulaiman, & Ruslan. (2017). Pemanfaatan Lingkungan Sekolah Sebagai Sumber Belajar Di SD Negeri 2 Teunom Aceh Jaya. *Jurnal Ilmiah Pendidikan Guru Sekolah Dasar FKIP Unsyiah*, *2*(1), 1–11. https://jim.unsyiah.ac.id/pgsd/article/view/4374

Kamilah, S. N., Fitria, R. S., Jarulis, & Syarifuddin. (2012). Jenis- Jenis Tumbuhan yang Dimanfaatkan sebagai Makanan oleh Macaca Fascicularis(Raffles, 1821) di Taman Hutan Raya Rajolelo Bengkulu. *Jurnal Ilmiah Konservasi Hayati*, *08*(02), 1–6. https://core.ac.uk/download/pdf/35337144.pdf

Lau, K. H., Lam, T., Kam, B. H., Nkhoma, M., Richardson, J., & Thomas, S. (2018). The role of textbook learning resources in e-learning: A taxonomic study. *Computers and Education*, *118*, 10–24. https://doi.org/10.1016/j.compedu.2017.11.005

Marshall, A. J., Beaudrot, L., & Wittmer, H. U. (2014). Responses of Primates and Other Frugivorous Vertebrates to Plant Resource Variability over Space and Time at Gunung Palung National Park. *International Journal of Primatology*, *35*(6), 1178–1201. https://doi.org/10.1007/s10764-014-9774-4

Nur, M, F. (2012). Pemanfaatan sumber belajar dalam pembelajaran sains kelas v sd pada pokok bahasan makhluk hidup dan proses kehidupan. *Jurnal Penelitian Pendidikan*, *13*(1), 68–78. http://jurnal.upi.edu/file/9-Paizah.pdf

Prasetyo, D., & Sugardjito, J. (2010). Status Populasi Satwa Primata di Taman Nasional Gunung Gede. *Jurnal Primatologi Indonesia*, *7*(2), 68. http://repository.unas.ac.id/164/

Purnomo, D., Indrowati, M., & Karyanto, P. (2013). Pengaruh Penggunaan Modul Hasil Penelitian Pencemaran Di Sungai Pepe Surakarta Sebagai Sumber Belajar Biologi Pokok Bahasan Pencemaran Lingkungan Terhadap Hasil Belajar Siswa. *Pendidikan Biologi UNS*, *5*(1), 59–69. https://jurnal.uns.ac.id/bio/article/view/5622

Rahman, Z. (2016). Pengantar Statistika. In *Pengantar Statistika* (6th ed.). alabeta. https://doi.org/10.14724/2002

Rizaldy, M. R., Haryono, T., & Faizah, U. (2016). Aktivitas Makan Monyet Ekor Panjang (Macaca fascicularis) di Hutan Nepa Kabupaten Sampang Madura. *LenteraBio*, *5*(1), 66–73. https://ejournal.unesa.ac.id/index.php/lenterabio/article/view/14566

Setiawan, E. (2015). *Stasiun Penelitian Cabang Panti The Heaven of Science*. Balai Taman Nasiona Gunung Palung.

Suhardi. (2007). *Pengembangan Sumber Belajar Biologi. Diktat kuliah*. UNY Press.

Susettyarini, E. (2019). Keanekaragaman Serangga Permukaan Tanah di Arboretum Sumber Brantas Batu-Malang. *Jurnal Pendidikan Biologi Indonesia*, *2*(2), 188–197. shorturl.at/jruAM

Susilo, M. J. (2018). Analisis Potensi Lingkungan Sekitar Sebagai Sumber Belajar Biologi Yang Berdayaguna. *Procending Biology Education Conference*, *15*(1), 541–546. https://jurnal.uns.ac.id/prosbi/article/view/32606

Syah, M. J. (2020). Long-Tailed Macaques (Macaca fascicularis) and Humans Interactions in Grojogan Sewu Natural Park (TWA GS), Karanganyar Regency, Central Java Province. *Al-Hayat: Journal of Biology and Applied Biology*, *3*(1), 31. https://doi.org/10.21580/ah.v3i1.6069

Virgiawan, C. (2016). Studi Keanekaragaman Capung (Odonata) Sebagai Bioindikator Kualitas Air Sungai Brantas Batu-Malang dan Sumber Belajar Biologi. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, *1*(2), 188–189. https://doi.org/10.22219/jpbi.v1i2.3330

Wang, S. L., & Hwang, G. J. (2012). The role of collective efficacy, cognitive quality, and task cohesion in computer-supported collaborative learning (CSCL). *Computers and Education*, *58*(2), 679–687. https://doi.org/10.1016/j.compedu.2011.09.003