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Mapping the Potential of Field Laboratories on Mount Galunggung for Learning the Concept of Plantae Biology

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ABSTRAK
Pembelajaran Biologi menekankan pentingnya fasilitasi oleh guru di dalam dan di luar kelas. Pengalaman di laboratorium lapangan sangat penting untuk memperdalam pemahaman konsep dan melengkapi pembelajaran di kelas. Penelitian ini bertujuan untuk mendeskripsikan jenis-jenis lumut dan paku di Kawasan Gunung Galunggung serta memetakan potensi laboratorium lapangan di sana. Metode penelitian yang digunakan adalah survei eksploratif dengan observasi langsung, wawancara, studi literatur, observasi lapangan, dan studi dokumentasi. Analisis data dilakukan secara deskriptif kualitatif dengan pendekatan Milles dan Hubberman, mengklasifikasikan Gunung Galunggung menjadi 3 stasiun dengan 9 zona. Hasil penelitian menunjukkan bahwa Gunung Galunggung memiliki 10 genus lumut dari 8 famili dan 16 genus paku dari 13 famili, menunjukkan potensi besar sebagai laboratorium lapangan. Penelitian ini diharapkan menjadi acuan bagi tenaga pendidik dan mahasiswa biologi dalam melakukan praktikum mandiri di Kawasan Gunung Galunggung.
Kata kunci: Laboratorium Lapangan, Gunung Galunggung, Konsep Plantae

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ABSTRACT
Biology education emphasizes the importance of teacher facilitation both inside and outside the classroom. Field laboratory experiences are crucial for deepening conceptual understanding and complementing classroom learning. This research aims to describe the types of mosses and ferns in the Gunung Galunggung area and to map its potential as a field laboratory. The research method used is an exploratory survey through direct observation, interviews, literature studies, field observations, and documentation studies. Data analysis was conducted qualitatively and descriptively using the Milles and Hubberman approach, classifying Gunung Galunggung into 3 stations with 9 zones. The research results show that Gunung Galunggung has 10 genera of mosses from 8 families and 16 genera of ferns from 13 families, indicating significant potential as a field laboratory. This study is expected to serve as a reference for educators and biology students for independent practicum activities in the Gunung Galunggung area.
Keywords: *Field Laboratory, Gunung Galunggung, Plantae Concept*

INTRODUCTION

Biology education plays a crucial role in shaping students' understanding and skills related to biological concepts, including plantae concepts such as mosses and ferns. Effective learning requires direct experience with learning objects, so that students can explore deep understanding through observation and exploration. In this context, field laboratories are a very important tool to support the learning process (Emda, 2017).

So far, out-of-class learning has become an integral part of biology education, especially in the Cryptogamae Botany course. Observation and exploration activities are carried out not only around the campus, but also involve external locations that represent the natural habitat of moss and fern plants. One of the destinations that is often chosen is Mount Galunggung.

Although previous studies have been conducted on the diversity and morphological characteristics of moss and fern plants on Mount Galunggung which have been conducted by Putra et al. (2019), Siahaan, (2022), Sarah, (2023), Kurnia, (2023) there has been no specific location mapping regarding the potential of these plants. The importance of this mapping is further strengthened by practical constraints, such as the uncertainty of points and location limitations of plants that can make it difficult for students to conduct independent observations. Based on previous research, it also indicates that Mount Galunggung has high potential to become a biology field laboratory.

A field laboratory is a natural environment that exists both naturally and man-made and can be used as a source of learning (Puspitasari et al., 2017). Natural field laboratory objects such as rivers, hills, lakes and so on. While artificial field laboratory objects are traditional houses, markets, arts, city parks, and so on (Syafiuddin, 2022). An area can be said to be suitable as a field laboratory if it meets the requirements of accessibility, availability of learning materials, ease of implementing activities, and avoiding the risk of threatening physical health and safety (Sugiharyanto, 2007).

In this case, this article aims to detail the efforts to map the potential of moss and fern plants on Mount Galunggung. This mapping is expected to provide a significant contribution to the development of more comprehensive data on the existence and location of plantae plants in the area. The results of this mapping are expected to facilitate learning activities outside the classroom, so that students can more easily and effectively carry out field observation activities, explore knowledge, and apply theories that have been learned in class.

METHODS

This research was conducted in the Mount Galunggung Tasikmalaya area in June-July 2023. The tools and materials used in this study were: stationery and observation tables, cameras/cellphones, Lensbong, GPS, Hygrothermometers and the objects in this study were moss and fern plants in the area. Data collection used the exploration method or direct exploration method and recorded tracking coordinates. Exploration was carried out to obtain the types of moss and ferns at the

research location. Each type of moss and fern whose scientific name is known can be directly recorded, while those that are unknown or still in doubt are taken and identified according to their type. Then the tracking results were analyzed using satellite imagery and a map was made using ArchGis software. The results of this study were analyzed descriptively and displayed in the form of tables and photos. The data processing technique went through three stages, namely, the first stage the inventory results were processed descriptively, the second stage the tracking results were processed into maps then the third stage, the inventory and mapping results would be a source of biology learning media in the form of student worksheets (LKM).

RESULT AND DISCUSSION

The results of the study showed that the potential for moss plants as many as 10 genera from 8 families were recorded as being found on Mount Galunggung. The largest number of genera was found in the area of station 2. Meanwhile, the potential for ferns was recorded as being found at 16 genera from 13 families. The largest number of families was found at station 3, namely 12 families. The types of moss and ferns found in the Mount Galunggung area are presented in full in table 1 and table 2.

Field observations provide an in-depth understanding of the biological potential in the Mount Galunggung area. Identification of plants and environmental conditions is the basis for determining the potential of a Biology field laboratory. Mount Galunggung also has easy accessibility and ease of implementing field activities and avoids the risk of work accidents. Mapping the area is an important step in identifying the structure and geographical distribution of the potential for a field laboratory. The division into three stations and nine zones provides a clear path for learning and research activities in the field, allowing exploration of aspects of morphology, ecology, and plant reproductive systems. Zone mapping can also be a basis for further research on the diversity of flora and ecosystems in the area.

From the results of the inventory and analysis of satellite imagery, it then becomes a learning media in the form of LKM with a design as in Figure 4. Implementation of the use of learning resources in this case is a field laboratory for independent practicum using student worksheets based on a free inquiry model. The free inquiry learning model is a learning approach that emphasizes the creativity and independence of students. In this model, students are encouraged to carry out learning activities through research or discovery independently, with minimal educator roles (Sadia, 2014). This approach follows the principles of critical-dialogic learning, collaborative direct experience, and cooperative learning, and pays attention to other basic principles such as active and participatory student learning (Andrini, 2017; Yewang, 2017)

Table 1. Potential of moss plants in the Mount Galunggung area.

No	Famili	Genus
1.	Lejuneaceae	*Lejeunea*
2.	Leucobryacae	*Leucobryum*

3.	Marchantiaceae	*Marchantia*
4.	Dumortieraceae	*Dumortiera*
5.	Meteoriaceae	*Floribundaria*
6.	Thuidiaceae	*Thuidium*
7.	Polytrichaceae	*Pogonatum* *Polytrichum* *Atrichum*
8.	Fissidentaceae	*Fissidens*

Table 2. Potential of ferns in the Galunggung mountain area

No	Famili	Genus
1.	Lycopodiaceae	*Lycopodium*
2.	Selaginellaceae	*Selaginella*
3.	Cyatheaceae	*Sphaeropteris* *Alshopila*
4.	Gleicheniaceae	*Dicranopteris* *Sticherus*
5.	Aspleniaceae	*Asplenium*
6.	Thelypteridaceae	*Christella*
8.	Pteridaceae	*Pytirogramma* *Pteris*
9.	Lindsaeaceae	*Odontosoria*
10.	Polypodiaceae	*Microsorum* *Aglaomorpha*
11.	Davalliaceae	*Davallia*
12.	Nephrolepidaceae	*Nephrolepis*
13.	Blechnaceae	*Blechnum*
14.	Thelypteridaceae	*Chingia*

Figure 1. Map of Mount Galunggung Field Laboratory Station 1

Station 1 has ideal conditions for the growth of mosses and ferns. The temperature reaches 26℃ with a humidity of 70-80%. The sunlight entering through the gaps in the canopy is sufficient to support photosynthesis while maintaining humidity around the plants. This habitat is divided into three zones based on altitude up to 800 meters above sea level. Zone 1, near the entrance, has two genera of mosses, Atrichum and Fissidens, and five genera of ferns: Sphaeropteris, Asplenium, Pteris, Microsorum, and Nephrolepis. Sphaeropteris and Microsorum are planted for aesthetic purposes. Zone 2, along the bike path, shows increased diversity with four genera of mosses (Athrichum, Leucobryum, Floribunda, Fissidens) and six genera of ferns, the same as zone 1, plus Christella and Pityrogramma. This zone is a transition to a more natural area. Zone 3, an area with lots of decaying wood, has the

highest diversity. Five genera of mosses (Athrichum, Leucobryum, Floribunda, Fissidens, Thuidium) and six genera of ferns were found. Decaying wood provides an ideal substrate for moss growth, influencing species composition and diversity.

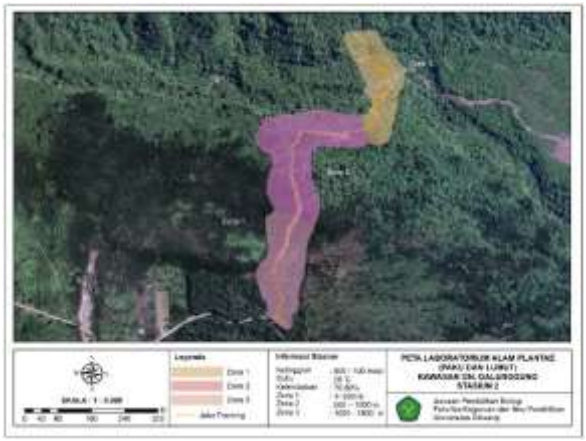

Figure 1. Map of Mount Galunggung Field Laboratory Station 2

Stasiun 2 menjadi destinasi populer dengan air terjun, sungai, dan formasi batuan yang indah. Kelembapan tinggi (70-80%) dan suhu 26℃ menciptakan lingkungan yang mendukung bagi lumut dan paku. Zona 1, area jalur sepeda, memiliki banyak pohon pinus dan kondisi panas. Lumut dominan adalah *Leucobryum*, sedangkan paku yang banyak ditemukan adalah *Nephrolepis*. Genus lain yang ditemukan meliputi lumut *Leucobryum*, *Marchantia*, dan paku *Sphaeropteris*, *Asplenium*, *Christella*, *Odontosoria*, *Nephrolepis*, dan *Blechnum*. Zona 2, dengan bebatuan, dinding, dan tangga, menunjukkan variasi vegetasi lebih tinggi. Lumut yang ditemukan adalah *Marchantia* dan *Pogonatum*. Paku yang ada mencakup *Lycopodium*, *Sphaeropteris*, *Asplenium*, *Alsophila*, *Christella*, *Pityrogramma*, *Pteris*, *Microsorum*, *Nephrolepis*, dan *Chingia*. Zona 3, area paling lembab dengan dinding batu, menjadi habitat bagi lumut *Lejeunea*, *Marchantia*, *Dumortiera*, *Thuidium*, *Fissidens*, dan paku *Lycopodium*, *Selaginella*, *Alsophila*, *Asplenium*, *Microsorum*, *Nephrolepis*. Kondisi lembab mendukung spesies langka seperti *Dumortiera* dan *Selaginella*.

Figure 1. Map of Mount Galunggung Field Laboratory Station 3

Station 3 has high humidity (80-90%) and temperature of 25℃, exposed to intense sunlight with few trees. Observation divides this area into three zones. Zone 1, the hiking trail to the crater, found the moss genera Marchantia, Floribundaria, Pogonatum, Polytrichum, and ferns Sphaeropteris, Alsophila, Dicranopteris, Sticherus, Asplenium, Christella, Pityrogramma, Pteris, Odontosoria, Microsorum, Davallia, Nephrolepis, Blechnum, Chingia. Plants in this zone show adaptation to strong sunlight exposure. Zone 2, the sandy path around the crater to the Canyon, only Marchantia moss is found. Ferns such as Lycopodium and Dicranopteris are more adaptive to sandy conditions. Zone 3, the Canyon area, the valley between the walls with hot sunlight. Mosses that grow include Pogonatum, Polytrichum, Campylopus, while ferns are Lycopodium, Sphaeropteris, Dicranopteris, Asplenium, Pityrogramma, Pteris, Odontosoria, Davallia, Nephrolepis, Blechnum, Chingia. Campylopus and Lycopodium are dominant, showing adaptation to extreme conditions.

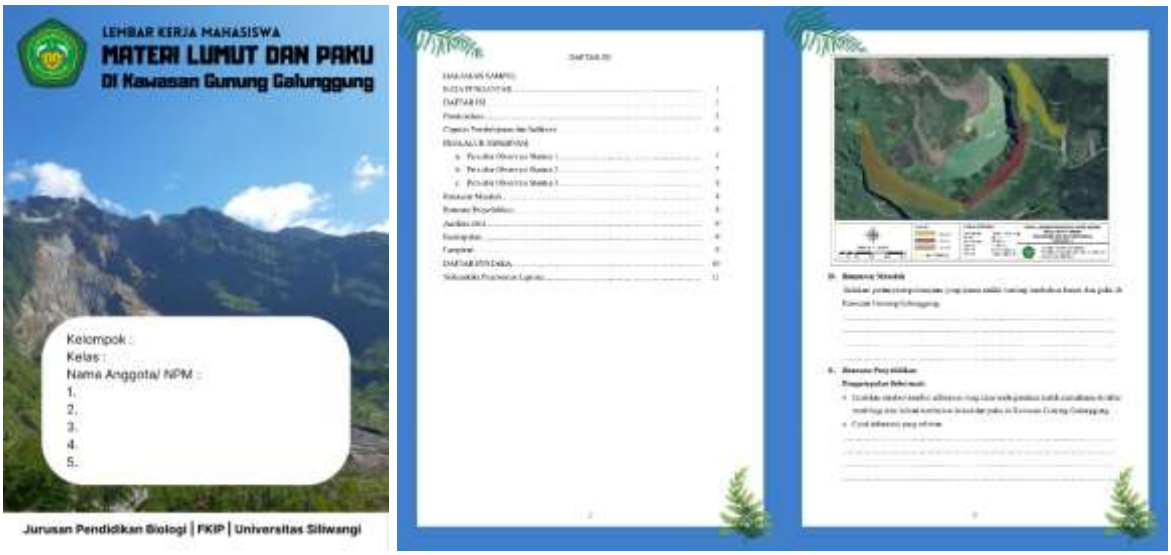

Figure 4. Overview of Student Worksheet

Based on the background of the problem where students experience difficulties when doing independent practicums, the creation of this LKM is designed using the inquiry learning model, namely a learning approach that emphasizes active exploration, independent discovery, and problem solving by students. The inquiry learning model involves a series of steps that stimulate critical thinking, questioning skills, and mastery of concepts. This LKM consists of a Cover, introduction to the material, objectives, observation flow maps and steps including problem formulation, hypothesis, investigation plan, data analysis, conclusions, reflections and attachments. It is hoped that this LKM can arouse students' curiosity in doing independent practicums on moss and fern plants on Mount Galunggung.

SUMMARY

Mount Galunggung has the potential for abundant plantae plants in the moss and fern categories, namely 10 genera from 8 families of moss plants and 16 genera from 13 families of ferns that have been recorded as having been found. Mount

Galunggung can be used as a field laboratory in biology learning based on the results of observations and mapping that are in accordance with field laboratory indicators. The Mount Galunggung area is a fairly large area where there are still many other locations that hold the potential for other plantae plants, so thorough exploration is needed for field laboratory mapping. The results of this study can be used as a learning medium for independent practical work for students to facilitate the process of independent field learningi.

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