The formation of mini illustrated dictionary of rare plants in the village forest of Penglipuran, Bangli, Bali

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Abstract. The objective of this study is to formulate a mini illustrated dictionary of rare plants in the village forest of Penglipuran, Bangli, Bali. The population of this research was the entire plant species in the village forest of Penglipuran, Bangli, Bali. The samples in this study were the entire plants covered by 100 quadratics of size 20 x 20 m. From those plant species covered by the quadratics, then conducted document studies, interview and comparative observations to determine the category of rare plant species. The sampling technique used was systematic sampling technique. ADDIE design was used in this dictionary formation. The research results showed that (1) There were 17 rare plant species out of 34 species found in the village forest of Penglipuran, Bangli, Bali; (2) Those 17 rare plant species were furthermore used as the content of the Mini Illustrated Dictionary of Rare Plants; (3) The Mini Illustrated Dictionary of Rare Plants which was developed based on ADDIE design is a dictionary with plants local name, scientific name, picture and the organ, classification, and the description.

1. Introduction
There have been many studies about plant ecology done by Wijana and the Biology FMIPA Undiksha student and other studies done outside Bali by the other researchers. From those studies result, in general they presented the data of plant species composition which constructed the ecosystem in which the study has been conducted. Those studies were conducted on land or terrestrial or in water ecosystem or aquatic. For examples, the studies done by Wijana [1],[2] in the village forests of Tigawasa, Buleleng. In 2008 and 2009 had been done a research in the Penglipuran, Karangasem tradisional forest Wijana & Sumardika [3] & Wijana [4]. The results of the study which was done in Batur Lake area by Wijana & Sumardika [5]. Another study result of terrestrial vegetation analysis in the village of Tenganan Pegingsingan, Sub-district of Manggis, Regency of Karangasem in 2005 Wijana & Sumardika [6]. As well as the study that had been done by Wijana [7] at Tourism Area of Lovina.

The studies of terrestrial vegetation outside Bali had been done also by Arrijani [8], Irwanto [9], Junaedi [10], Sri Hartini [11], Onrizal, et al. [12], Onrizal [13], Purwaningsih [14], and Purwaningsih & Yusuf [15] that examined the species composition, species diversity, and protected forests and National Parks management. Those studies were done in various regions such as Arrijani did the research in Cianjur, Irwanto in Malaku, Junaedi in West Java, Sri Hartini in East Borneo, Sunarti, et al in North Sulawesi, Onrizal in West Borneo, and Purwaningsih did the research in Southeast Sulawesi. The context of these studies were more oriented to the study of vegetation parameters or vegetation analysis.

From those research results showed that the plant species constructing the field research ecosystem were only listed in a form of floristic list. Floristic list is a form of plant species name list both in their scientific and local names. It is not completed yet with the plant pictures or photos, and the plant
species description based on the species list composed. If this continues and the students use this as a learning material, then there will be a proverb saying weruh ring aran tan weruh ring rupa, or vice versa weruh ring rupa tan weruh ring aran, which means the students will only be familiar with the plant species names without knowing the image of them, and vice versa they will know the object without being familiar with the name. Therefore, biology is considered as a rote science.

In general Biology science, and especially in Plant Ecology, the students will be exposed to the field realities. In Plant Ecology, they will be exposed to various plants in an ecosystem. The students will get confused, overwhelmed, and psychologically depressed when they are facing the situation to know the scientific names of those various plant species. There are a lot of unknown plant species, unknown the classification identity, and unknown taxon hierarch. This is one of the problems faced by the students on their field study, even on their thesis preparation.

In order the research results related to Plant Ecology have practical value to be used by junior and senior high school students, and then one alternative that can be done is to compile a Mini Illustrated Dictionary of Rare Plants in The Village Forest of Penglipuran, Bangli Bali. This mini dictionary contains the floristic lists, images and photos of the plant species, their classifications and descriptions. The species description includes the morphological, ecological, and taxonomic descriptions.

The formation of this illustrated dictionary about tree habits means that the dictionary is limited to plant species of tree habits, while plant species of bush and herbaceous habits are not yet explored. The location of this study is limited to the village forest of Penglipuran only, so that the illustrated dictionary is limited only by that ecosystem study area. Thus, this dictionary will be in mini, limited and local form. Although this dictionary is in mini and local form, but in terms of meaning, it can be used globally.

The establishment of this mini dictionary is not only based on some collection of book references, but it is also based on the field exploration results, the field realities on certain ecosystem. Therefore, it is important to do exploration on an ecosystem to acknowledge the plant species that construct the ecosystem. In this study, the exploration is done to the village ecosystem in one of tourism object of Penglipuran Village. From the explanation above then can be presented the objective of this study is to establish a mini illustrated dictionary of rare plants in the village forest of Penglipuran.

2. Methods
This was an explorative research. The location of this study was in the village forest of Penglipuran, Bangli, Bali. The population of this study was the entire plant species in the village forest of Penglipuran. The samples of this study were the entire species plants covered by 100 quadratics of size 20 x 20 m with interval 10 m (Cox [16], Barbour et al. [17], Mueller-Dombois & Ellenberg [18], Wijana [19]). From those plant species covered by the quadratics, then conducted a document study, interview, and comparative observation to determine the rare plant species category. The sampling technique used in this study was systematic sampling technique (Figure 1).

![Figure 1. Layout of Quadratic Positioning](image-url)
ADDIE design was used in the formation of this rare plant mini illustrated dictionary. ADDIE design consists of 5 steps, they are: (1) Analyze, (2) Design, (3) Development, (4) Implementation, (5) Evaluation (Tegeh, et al. [20]) (Figure 2). The data were analyzed descriptively.

**Figure 2.** ADDIE Design was used in the Formation of This Rare Plant Mini Illustrated Dictionary

### 3. Results and Discussion

The research results related to rare plants show that there are 17 rare plant species out of 34 plant species found in the village forest of Penglipuran. The data of rare plants in the village forest of Penglipuran are presented in Table 1.

**Table 1.** The List of Rare Plant Species in the Village Forest of Penglipuran

| No. | Family | Local/Indonesian Name | Scientific Name |
|-----|--------|-----------------------|-----------------|
| 1   | Magnoliaceae | Base-base | Elmerillia ovalis |
| 2   | Magnoliaceae | Cempaka | Michelia alba |
| 3   | Anacardiaceae | Bejaran | Lannea coromandelica |
| 4   | Rutaceae | Bila | Aegle marmelos |
| 5   | Euphorbiaceae | Boni | Antidesma bonius |
| 6   | Elaeocarpaceae | Genitri | Elaeocarpus ganitrus |
| 7   | Myrtaceae | Juwet batu | Syzygium cumini |
| 8   | Myristicaceae | Kayu jelema | Lamnea laurina |
| 9   | Myristicaceae | Pala jiwa | Myristica sp |
| 10  | Moraceae | Kepundung | Baccarea racemosa |
| 11  | Moraceae | Mabi | Ficus rasemosa |
| 12  | Phyllanthaceae | Nangka-nangka | Artocarpus sp |
| 13  | Clusiaceae | Peredah | Ficus benjamina |
| 14  | Clusiaceae | Majega | Dysoxylum densiflorum |
| 15  | Clusiaceae | Mundeh | Garcinia dulcis |
| 16  | Clusiaceae | Peredah | Garcinia cerlebica |
| 17  | Clusiaceae | Nyaman | Manilkara sp |

From Table 1 above it is found that there were 12 families with 17 species which were categorized as rare plant in the village forest of Penglipuran. Based on the results of the document study, the interview and the comparative observation, it was stated that the above plant rarity level could be explained that the plants with national rarity level were the family of Euphorbiaceae (*Antidesma bonius*) and the family of Meliaceae (*Dysoxylum densiflorum*). The plants with province rarity level were the family of Magnoliaceae (*Michelia alba*), the family of Elaeocarpaceae (*Elaeocarpus*).
ganitrus), the family of Myrtaceae (*Syzygium cumini*), the family of Myristicaceae (*Knema laurina*), the family of Phyllanthaceae (*Baccaurea racemosa*), the family of Moraceae (*Ficus benjamina*), and the family of Clusiaceae (*Garcinia dulcis* and *Garcinia cerlebica*). The plants with regency rarity level were the family of Magnoliaceae (*Elmerillia ovalis*), the family of Anacardiaceae (*Lannea coromandelica*), the family of Rutaceae (*Aegle marmelos*), the family of Myristicaceae (*Myristica sp*), Moraceae (*Ficus rasenoma* and *Artocarpus sp*), and Sapotaceae (*Manilkara sp*). So, there were 2 (11.76%) plant species categorized as rare plants at national level, 8 (47.05%) plant species as rare plants at provincial level, and 7 (41.17%) plant species as rare plants at regency level.

From the rare plant exploration in the village forest of Penglipuran, it could be developed into a dictionary. This dictionary had been formatted in 3 types of dictionary, they were type A dictionary, which contained scientific and local names only; type B dictionary which contained scientific name, local name and description; and Type C dictionary which contained images/photos of the plants completed with the organs, scientific name, local name, classification and description. The dictionary content displays of each type are presented in Figure 3, Figure 4 and Figure 5.

![Type A, Type B, Type C Dictionaries](image)

**Figure 3.** The Content Display of Dictionary Type A, B and C

Type A, type B, type C dictionaries were created to analyze a better dictionary type to be developed. Therefore, a survey was conducted to 5 students of 8th semester majoring at Biology Education, Faculty of Mathematics and Natural Sciences, Universitas Pendidikan Ganesha as the samples. The results of the survey showed that the students chose the dictionary type C because the dictionary type C was improved with the plant species images of trunk, leaf, flower and fruit that are the essential content of this dictionary. Therefore this mini illustrated dictionary was developed. The dictionary development result can be seen in the figure below (Figure 4, 5, 6, 7).

![Front and Back Covers of Rare Plants Mini Illustrated Dictionary](image)

**Figure 4.** The Front and Back Covers of Rare Plants Mini Illustrated Dictionary
The development of this Rare Plants Mini Illustrated Dictionary in this study used ADDI development design. ADDIE design consists of five steps which are Analysis, Design, Development & Production, Implementation, Evaluation (Tegeh, et al. [20]). On the early stage, there are 3 dictionary types composed, they are dictionary type A, type B and type C. The survey results explained the weakness and the strength of each dictionary type. Type A dictionary is good enough and easy to understand, but its weaknesses are that type A dictionary is only suitable to be developed if the species number used is huge, alphabetically completed, and it only has the species scientific and local names. Thus, it is difficult to identify the plants in the field. Type B dictionary is more interesting and more complete than type A one because it contains the species description and easier to use as a learning material. While type C dictionary has the advantages with the images of the species included the images of stems, leaves, flowers and fruits. Therefore this type C dictionary is developed.
Penglipuran, Bangli. This can be seen from this dictionary implementation in the field on the evaluation step to see the plant identification results by the students with this Mini Illustrated Dictionary of Rare Plants. The results of evaluation done in the field showed that from 17 rare plant species, there was 1 plant species could not be clearly identified, that was Nyaman plant species (Manilkara sp). It could be concluded that 99% this Mini Illustrated Dictionary of Rare Plants can be utilized to identify the rare plants in the village forest of Penglipuran.

![Aegle marmelos (Bila)](image)

**Figure 7.** The examples of the dictionary content from alphabetical A and S

### 4. Conclusions

From the results of this study can be concluded that (1) There were 17 rare plant species out of 34 plant species found in the village forest of Penglipuran; (2) Those 17 rare plant species were furthermore used as the content of the Mini Illustrated Dictionary of Rare Plants (3) The Mini Illustrated Dictionary of Rare Plants was developed by using ADDIE design, contains the local name, scientific name, images/photos and organs, classification and description. From the conclusions, here are some recommendations (1) The educator may use this dictionary as a learning material, both in the classroom or outside the classroom, especially when inviting the students to the field (Village Forest of Penglipuran, Bangli, Bali); and (2) The management of Penglipuran village forest may use this dictionary as an additional information for the visitors.
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