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Exploration of Rare Plant Species in the Sudaji Village of Sawan District, Regency of Buleleng, Bali and Implementation in Learning Model

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Abstract: The purpose of this research is to know the species of rare plants in Sudaji village, Sawan district, Buleleng regency, Bali. This research belongs to an explorative research type. The population of this research is all species of plants in Sudaji village. The research sample is plant species spread in public road location, Tri Mandala (housing) and in moor/community garden. The sampling method is a quadratic method with systematic sampling technique. To find out the rare types of plants conducted interviews and document studies. The results of this study indicate that there are 87 species of plants in the village of Sudaji, 14 of which fall into the category of rare plants.

INTRODUCTION

Indonesia's location in the tropics is very supportive of the survival of an organism. Thus many organisms are very suitable to live in it. Based on this, Indonesia is known as mega diversity. The amount of diversity present in Indonesia, according to Soerianegara and Indrawan, states that Indonesia has a bio diversity 300 times greater than forests in temperate climates.

The land area of Bali is 563,286 ha. Of the area, the forest area reaches only 127,721.01 ha (22.59%) of the total land area. This means that there has been a lot of forest damage. Deforestation can be caused by natural disasters, droughts, floods and landslides. With the destruction of this forest impact on the extinction of the types of plants that live in it. Including local species that have unique and endemic values or have a uniqueness or very rarely found elsewhere.

Associated with the issue of forest vegetation has been done a lot of research by some experts. Some studies may be mentioned such as the research that has been done by Wijana (2013, 2014) in customary forests in Tigawasa village and Cempaga village, Buleleng. Research related problems of species composition and others have been done also in Lovina tourism area. Another study that has been done also by Wijana (2012) is in the forest of Penglipuran village, Bangli. In by Wijana (2008) research in the Tenganan forest and Wijana *et al*. (2010) research has been conducted in the buffer zone of Lake Buyan, Sukasada Buleleng. The other results of research conducted in Lake Batur by Wijana and Sumardika (2004, 2005) and Wijana *et al*. (2006).

The result of Wijana and Sumardika (2004, 2005) research in Tenganan Pegringsingan village, Karangasem, shows that in Bukit Kangin and Bukit Kauh there are around 43 plant species that can be categorized as useful plants because they are widely used by people in the area for various purposes such as for household appliances (69.77%), food (51.16%), medicines (44.19%), religious ceremonies (44.19%), boards (27.91%) and clothing (16.18%). The parts of plants that are often used for these needs include stems (69.77%), fruits (46.51%), leaves (39.53%), flowers (9.30%) and roots (9.30%).

The results of Wijana and Setiawan study on rare plant species in the Monkey forest are also found from 63 species of recorded plants, of which 37 species fall into the category of rare plants. While the results of research Wijana and Setiawan (2018) and Wijana *et al*. (2018) in forest tourism traditional village Penglipuran, Bangli obtained 17 species of rare plants from 34 species plants recorded in the forest. From the two data above shows that in monkey forest forest there are 59% which includes rare plants, while for Penglipuran forest there are 50% rare plant category. This means that today's rare plants are largely present or conserved in natural ecosystems. While for the middle of society is not a few plants are also classified as rare plants but not yet known the percentage.

The results of research related to terrestrial vegetation outside of Bali have been done by Arrijani *et al*. (2006), Junaedi and Mutaqien (2010), Hartini (2007), Onrizal *et al*. (2006), Purwaningsih (2006) and Purwaningsih and Yusuf (2008) reviewing species composition, species diversity and management of protected forests and national parks. These studies were conducted in various areas such as Arrijani in Cianjur, Irwanto in Maluku, Junaedi in West Java, Sri Hartini in East Kalimantan, Sunarti, etc. in North Sulawesi, Onrizal in West Kalimantan and PurWhite Mangongsih in Southeast Sulawesi. The context of this study is more oriented to the study of vegetation parameters or vegetation analysis.

All of the above research results, in which plant species that compose the ecosystem of the study, are composed solely in the form of a floristic list. A floristic list is a list of names of plant species both concerning the scientific name or the local name. Not yet reflecting the rare plant species present in nature and yet not yet showing the usefulness of the studied plants.

Furthermore, the existing rare plants, as well as various benefits such as for clothing, food, medicine, household, religious and others. As a follow-up research that is considered important to be implemented is the study of rare plants in the yard (Tri Mandala), in the garden and on the highway of Sudaji village (Appendix 1).

This study was conducted in Sudaji village, Sawan sub-district, Buleleng-Bali district. With the reason that Sudaji village is a growing religious tourism village today. This village is an agricultural village that still maintains local rice as its agricultural icon. In addition, various types of fruit plants have been widely cultivated and have become a source of nursery for other villages in Bali. In the field/community garden is still preserved as befits the legacy received from the ancestors. Many local wisdom applied in agriculture in the broad sense. Various types of natural plants and plants are intentionally planted in the village, whether it has economic value, ecological, aesthetic, religious and plant species that have not known the meaning of the existing plant species, many found in the moor/garden community. Therefore, it can be considered important to conduct an exploratory research to determine the composition of plant species in general and various rare plant species in the village.

MATERIALS AND METHODS

The type of this research is explorative research type, that is exploring various rare plants in Sawan sub district, Buleleng, Bali. The location of this research is in the community garden, the home page (Tri Mandala) and on the public streets. The population in this study can be divided into two parts namely the plant population and the social population of the community. Plant populations in this study were plant species present in community gardens, Housing (Tri Mandala) and on public roads. While the social population is the entire community that exist in the village Sudaji, district Sawan Buleleng-Bali. The samples of this research are plant species in community gardens, housing (Tri Mandala) and on public roads in Sudaji village.

The sampling method of plant species is by using the quadratic method (Cox, 1976; Barbour *et al*., 1987; Ellenberg and Mueller-Dombois, 1974; Wijana, 2014), observation methods, questionnaires and interviews. While for the method of sampling society is by using purposive sampling method. Samples of plant species are all plant species covered by a 20×20 m^2 of squares in a community garden. For in Tri Mandala and on public roads, it is widely used in accordance with the conditions of the sampling location. For the social sample taken as many as 25 people.

The sampling technique of plant species using systematic sampling. Each square is recorded for its constituent plant species. Plant species that have been collected then determined the species of plants that fall into the rare category. The determination of this rare plant species, carried out by studying existing documents, conducting interviews and seeking information from various sources. Furthermore, with in-depth interviews with sources of informants from the community, from the government and document studies (Heyne, 1987; Wijana, 2016), to obtain information related to rare plants in the village. The collected data is further analyzed in ecological and descriptive statistics (Moore and Chapman, 1986; Ludwig and Reynolds, 1988).

RESULTS AND DISCUSSION

The floristic list of rare plant species present in each study site in each village is presented in Table 1-3. Based on Table 1 the number of plant species on the public road of Sudaji village as many as 50 plant species. Of the total

Table 1: List of floristic species of rare plants on public road section of Sudaji village, Sawan sub-district, Buleleng

Species name (Local and scientific name)	Rare categories	Not rare categories
Ti plant (*Cordyline fruticosa*)	-	√
Orchid (*Dendrobium* sp.)	-	√
Tamarind (*Tamarindus indica*)	√	-
Bamboo (*Bambusa* sp.)	-	√
Yellow Bamboo (*Bambusa vulgaris)*	√	-
Spinach (*Amaranthus* sp.)	-	√
Star Fruit (*Averrhoa carambola*)	-	√
Banyan Tree (*Ficus benjamina*)	√	-
Biduri (*Calotropis gigantea*)	-	√
Dragon Fruit (*Hylocereus cistericensi*)	-	√
Chili (*Capsicum annuum*)	-	√
Pine (*Casuarina equisetifolia*)	-	√
Yellow Champaca (*Michelia champaca*)	√	-
White Champaca (*Magnolia alba*)	-	√
Cocoa tree (*Theobroma cacao*)	-	√
Tiger's Claw (*Erythrina variegata*)	-	√
Pomegranate (*Punica granatum*)	-	√
Durian (*Durio zibethinus*)	-	√
Quickstick (*Gliricidia sepium*)	-	√
Marigold (*Tagetes erecta*)	-	√
Cashew (*Anacardium occidentale*)	√	-
Teak (*Tectona grandis*)	-	√
White Frangipani (*Plumeria alba*)	-	√
Cinnamon (*Cinnamomun verum*)	-	√
Coconut (*Cocos nucifera*)	-	√
Bougenville (*Bougenvillea spinosa*)	-	√
Marvel-of-peru (*Mirabilis jalapa*)	-	√
Poinsettia (*Euphorbia pulcherrima*)	-	√
Hibiscus (*Hibiscus rosasinensis*)	-	√
Lantana (*Lantana camara*)	-	√
Calabur (*Muntingia calabura*)	√	-
Indian-Almond-Tree (*Terminalia cattapa*)	-	√
Sweet potato (*Ipomoea batatas*)	-	√
Coffee (*Coffea* sp.)	-	√
River Tamarind (*Leucaena glauca*)	-	√
Mango (*Mangifera indica*)	-	√
Pineapple (*APineapple comosus*)	-	√
Jackfruit (*Artocarpus heterophyllus*)	-	√
Dhobi tree (*Mussaenda frondosa*)	-	√
Queen Sago palm (*Cycas rhumpii*)	-	√
Palem (*Hyophorbe lagenicaulis*)	-	√
Pandanus (*Pandanusus amaryllifolius*)	-	√
Bitter melon (*Momordica charantia*)	-	√
Papaya (*Carica papaya*)	-	√
Banana (*Musa paradisiaca*)	-	√
Garden Croton (*Codiaeum variegatum*)	-	√
Cassava (*Manihot utilissima*)	-	√
Betel (*Piper betle*)	-	√
Jungle Geranium (*Ixora coccinea*)	-	√
Eggplant (*Solanum melongena*)	-	√
Total	6	44

Table 2: List of floristic species of rare plants in the housing section of Sudaji village community, Sawan sub-district, Buleleng

Species name (Local and scientific name)	Rare categories	Not rare categories
Golden Trumpet (*Allamanda cathartica*)	-	√
Moth Orchid (*Phalaenopsis amabilis*)	-	√
Tamarind (*Tamarindus indica*)	√	-
Yellow Bamboo (*Bambusa vulgaris)*	√	-
Spinach (*Amaranthus* sp.)	-	√
Chili (*Capsicum annuum*)	-	√
Pine (*Casuarina equisetifolia*)	-	√
White Champaca (*Magnolia alba*)	-	√
Tiger's Claw (*Erythrina variegata*)	-	√

Table 2: Continue

Species name (local and scientific name)	Rare categories	Not rare categories
Pomegranate (*Punica granatum*)	-	√
Lanzones (*Lansium domesticum*)	√	-
Durian (*Durio zibethinus*)	-	√
Anthurium (*Anthurium plowmanii*)	-	√
Marigold (*Tagetes erecta*)	-	√
Jamaican Apple (*Syzygium malaccense*)	√	-
Castor (*Jatropha curcas*)	-	√
Gardenia (*Gardenia augusta*)	√	-
Japanese Frangipani (*Adenium obesium*)	-	√
White Frangipani (*Plumeria alba*)	-	√
Lime (*Citrus hystrix*)	-	√
Cactus (*Mammillaria xantina*)	-	√
Cinnamon (*Cinnamomun verum*)	-	√
Coconut (*Cocos nucifera*)	-	√
Basil (*Ocimum citriodorum*)	-	√
Peacock flower (*Caesalpinia pulcherrima*)	-	√
Bougenville (*Bougenvillea spinosa*)	-	√
Poinsettia (*Euphorbia pulcherrima*)	-	√
Hibiscus (*Hibiscus rosasinensis*)	-	√
Cananga (*Cananga odorata*)	-	√
Sweet potato (*Ipomoea batatas*)	-	√
Coffee (*Coffea* sp.)	-	√
Aloe (*Aloe vera*)	-	√
Snakeplant (*Sansevieria terifasciata*)	-	√
Mango (*Mangifera indica*)	-	√
Mangosteen (*Garcinia mangostana*)	√	-
Rose (*Rosa* sp.)	-	√
Dhobi tree (*Mussaenda frondosa*)	-	√
Pandanus (*Pandanusus amaryllifolius*)	-	√
Thatch Screwpine (*Pandanusus tectorius*)	-	√
Papaya (*Carica papaya*)	-	√
Banana (*Musa paradisiaca*)	-	√
Garden Croton (*Codiaeum variegatum*)	-	√
Rambutan (*Nephelium lappaceum*)	-	√
Sapodilla (*Manilkara zapota*)	-	√
Celery (*Apium graveolens*)	-	√
Cassava (*Manihot utilissima*)	-	√
Betel (*Piper betle*)	-	√
Jungle Geranium (*Ixora coccinea*)	-	√
Strawberry (*Fragraria x aPineapplesa*)	-	√
Taro (*Colocasia esculenta*)	-	√
Lotus (*Nymphaca pubercens*)	-	√
Eggplant (*Solanum melongena*)	-	√
Dutchman's Pipe Cactus (*Epiphyllum oxypetalum*)	-	√
Total	6	47

Table 3: List of floristic species of rare plants in section gardens community of Sudaji village, Sawan sub-district, Buleleng

Species name (Local and scientific name)	Rare categories	Not rare categories
Golden trumpet (*Allamanda cathartica*)	-	√
Sugar Palm (*Arenga pinnata*)	√	-
Tamarind (*Tamarindus indica*)	√	-
Spinach (*Amaranthus* sp.)	-	√
Star fruit (*Averrhoa carambola*)	-	√
Chili (*Capsicum annuum*)	-	√
White Champaca (*Magnolia alba*)	-	√
Clove (*Syzygium aromaticum*)	-	√
Lanzones (*Lansium domesticum*)	√	-
Durian (*Durio zibethinus*)	-	√
Quickstick (*Gliricidia sepium*)	-	√
Guava (*Psidium guajava*)	-	√
Jamaican apple (*Syzygium malaccense*)	√	-
Bay cedar (Guazuma ulmifolia)	-	√
White Frangipani (*Plumeria alba*)	-	√

Table 3: Continue

Species name (Local and scientific name)	Rare categories	Not rare categories
Grapefruit (*Citrus sinensis*)	-	√
Java plum (*Eugenia cumini*)	√	-
Cinnamon (*Cinnamomun verum*)	-	√
Coconut (*Cocos nucifera*)	-	√
Hibiscus (*Hibiscus rosasinensis*)	-	√
Cananga (*Cananga odorata)*	-	√
Kepundung (*Baccaurea racemosa*)	√	-
Turmeric (*Curcuma longa*)	-	√
Isen (*Alpinia galangal*)	-	√
Mango (*Mangifera indica*)		√
Melinjo (*Gnetum gnemon*)	√	-
Pineapple (*APineapple comosus*)	-	√
Jackfruit (*Artocarpus heterophyllus*)	-	√
Pandanus (*Pandanusus amaryllifolius*)	-	√
Papaya (*Carica papaya*)	-	√
Banana (*Musa paradisiaca*)	-	√
Garden Croton (*Codiaeum variegatum*)	-	√
Salak (*Salacca zalacca*)	-	√
Cassava (*Manihot utilissima*)	-	√
Betel (*Piper betle*)	-	√
Pleomele (*Pleomela angustifolia*)	-	√
Taro (*Colocasia esculenta*)	-	√
White mango (*Mangifera caecia*)	√	-
Total	8	30

number of plant species are 6 species of rare plants namely Tamarind (*Tamarindus indica*), Yellow Bamboo (*Bambusa vulgaris*), Banyan Tree (*Ficus benjamina*), Yellow Champaca (*Michelia champaca*), Cashew (*Anacardium occidentale*) and Calabur (*Muntingia calabura*).

Based on Table 2 the number of plant species in Sudaji community housing is 53 species of plants. Of the total number of plant species are 6 species of rare plants, namely Tamarind (*Tamarindus indica*), Yellow Bamboo (*Bambusa vulgaris),* Lanzones (*Lansium domesticum*), Jamaican Apple (*Syzygium malaccense*), Gardenia (*Gardenia augusta*) and Mangosteen (*Garcinia mangostana*).

From the data Table 3 the number of plant species in community gardens Sudaji village as many as 38 species of plants. Of the total number of plant species are 8 species of rare plants namely Sugar Palm (*Arenga pinnata*), Tamarind (*Tamarindus indica*), Lanzones (*Lansium domesticum*), Jamaican Apple (*Syzygium malaccense*), Java Plum (*Eugenia cumini*), Kepundung (*Baccaurea racemosa*), Melinjo (*Gnetum gnemon*) and White Mango (*Mangifera caecia*).

From the data of Table 1-3 then the data is recapitulated into Table 4. In this table is intended to know the species of plants belonging to the category of rare plants in the village of Sudaji as a whole.

The information from Table 4 shows that the total number of plant species present in Sudaji village is 87 species of plants. The total number of plant species

Table 4: Floristic list of rare plant species existing in Sudaji village, Sawan sub-district, Buleleng

Species name (Local and scientific name)	Rare categories	Not rare categories
Golden Trumpet (*Allamanda cathartica*)	-	√
Ti Plant (*Cordyline fruticosa*)	-	√
Orchid (*Dendrobium* sp.)	-	√
Orchid Bulan (*Phalaenopsis amabilis*)	-	√
Sugar Palm (*Arenga pinnata*)	√	-
Tamarind (*Tamarindus indica*)	√	-
Bambu (*Bambusa* sp.)		√
Yellow Bamboo (*Bambusa vulgaris)*	√	-
Spinach (*Amaranthus* sp.)	-	√
Star fruit (*Averrhoa carambola*)	-	√
Banyan Tree (*Ficus benjamina*)	√	-
Biduri (*Calotropis gigantea*)	-	√
Dragon Fruit (*Hylocereus cistericensi*)	-	√
Chili (*Capsicum annuum*)	-	√
Pine (*Casuarina equisetifolia*)	-	√
Yellow Champaca (*Michelia champaca*)	√	-
White Champaca (*Magnolia alba*)	-	√
Clove (*Syzygium aromaticum*)	-	√
Cocoa tree (*Theobroma cacao*)	-	√
Tiger's Claw (*Erythrina variegata*)	-	√
Pomegranate (*Punica granatum*)	-	√
Lanzones (*Lansium domesticum*)	√	-
Durian (*Durio zibethinus*)	-	√
Quickstick (*Gliricidia sepium*)	-	√
Anthurium (*Anthurium plowmanii*)	-	√
Marigold (*Tagetes erecta*)	-	√
Guava (*Psidium guajava*)	-	√
Jamaican Apple (*Syzygium malaccense*)	-	√
Cashew (*Anacardium occidentale*)	√	-
Castor (*Jatropha curcas*)	-	√
Teak (*Tectona grandis*)	-	√
Bay Cedar (*Guazuma ulmifolia*)	-	√
Gardenia (*Gardenia augusta*)	-	√
Japanese Frangipani (*Adenium obesium*)	-	√
White Frangipani (*Plumeria alba*)	-	√
Grapefruit (*Citrus maxima*)	√	√
Lime (*Citrus hystrix*)	-	√
Java Plum (*Eugenia cumini*)	√	-
Cactus (*Mammillaria xantina*)	-	√
Cinnamon (*Cinnamomun verum*)	-	√
Coconut (*Cocos nucifera*)	-	√
Basil (*Ocimum citriodorum*)	-	√
Bougenville (*Bougenvillea spinosa*)	-	√
Peacock Flower (*Caesalpinia pulcherrima*)	-	√
Marvel-of-Peru (*Mirabilis jalapa*)	-	√
Poinsettia (*Euphorbia pulcherrima*)	-	√
Hibiscus (*Hibiscus rosasinensis*)	-	√
Cananga (*Cananga odorata*)	-	√
Kepundung (*Baccaurea racemosa*)	√	-
Lantana (*Lantana camara*)	-	√
Calabur (*Muntingia calabura*)	√	-
Indian-Almond-Tree (*Terminalia cattapa*)	-	√
Sweet Potato (*Ipomoea batatas*)	-	√
Coffee (*Coffea* sp.)	-	√
Turmeric (*Curcuma longa*)	-	√
River Tamarind (*Leucaena glauca*)	-	√
Isen (*Alpinia galangal*)	-	√
Aloe (*Aloe vera*)	-	√
Snakeplant (*Sansevieria terifasciata*)	-	√
Mango (*Mangifera indica*)	-	√
Mangosteen (*Garcinia mangostana*)	√	
Rose (*Rosa* sp.)		√
Melinjo (*Gnetum gnemon*)	√	-
Pineapple (*APineapple comosus*)	-	√
Jackfruit (*Artocarpus heterophyllus*)	-	√

Table 4: Continue

Species name (Local and scientific name)	Rare categories	Not rare categories
Dhobi tree (*Mussaenda frondosa*)	-	√
Queen Sago Palm (*Cycas rhumpii*)	-	√
Palem (*Hyophorbe lagenicaulis*)	-	√
Pandanus (*Pandanusus amaryllifolius*)	-	√
Thatch Screwpine (*Pandanusus tectorius*)	-	√
Bitter Melon (*Momordica charantia*)	-	√
Papaya (*Carica papaya*)	-	√
Garden Croton (*Codiaeum variegatum*)	-	√
Rambutan (*Nephelium lappaceum*)	-	√
Salak (*Salacca zalacca*)	-	√
Sapodilla (*Manilkara zapota*)	-	√
Celery (*Apium graveolens*)	-	√
Cassava (*Manihot utilissima*)	-	√
Betel (*Piper betle*)	-	√
Jungle Geranium (*Ixora coccinea*)	-	√
\Strawberry (*Fragraria x aPineapplesa*)	-	√
Pleomele (*Pleomela angustifolia*)	-	√
Taro (*Colocasia esculenta*)	-	√
Lotus (*Nymphaca pubercens*)	-	√
Eggplant (*Solanum melongena*)	-	√
White mango (*Mangifera caecia*)	√	-
Dutchman's Pipe Cactus (*Epiphyllum oxypetalum*)	-	√
Total	14	73

are 14 species of rare plants namely Sugar Palm (*Arenga pinnata*), Tamarind (*Tamarindus indica*), Yellow Bamboo (*Bambusa vulgaris)*, Banyan Tree (*Ficus benjamina*), Yellow Champaca (*Michelia champaca*), Lanzones (*Lansium domesticum*), Cashew (*Anacardium occidentale*), Bay Cedar (*Guazuma ulmifolia*), Java Plum (*Eugenia cumini*), Kepundung (*Baccaurea racemosa*), Calabur (*Muntingia calabura*), Mangosteen (*Garcinia mangostana*), Melinjo (*Gnetum gnemon*) and White Mango (*Mangifera caecia*).

Table 1-3 are made in Table 5 to make it easier to know the number of plant species present in each of the locations in Sudaji village, Sawan district, Buleleng regency and which belong to rare plants are presented in Table 5.

Based on Table 5.the total number of plant species in Sudaji village is 87 species (Table 4). The number 141 of these plant species (Table 5) shows that in different locations the same plant species are found, so that, the number exceeds that of 87 plant species. Similarly, to rare plant species that amount to 20 species from three existing locations. This indicates that in different locations there are the same plant species that live in that location. Thus the significance of Table 5 is that there is a difference in the percentage of plant species in general as well as the rare plant species grown in each location. There are 6 species (12%) of rare plants grown in public road, in the residential location there are 6 species (11,32%) and most of them are in the community garden which is 8 species (21.05%). To clarify the rare plant species present in Sudaji village as a whole is presented in Table 6.

The occurrence of rare plants can not be separated from environmental factors and the activities of living things in it. Kimmins (1997) explained that the world community of plants have dynamics or changes, both caused by the activity of nature and humans. Sugita (2015) explains that changes in the natural environment or the composition of plants in a region can be caused by adaptation to soil environmental conditions, topography, geology and climate through changes in body and function while the environment also undergoes changes through physical or biogeochemical processes to maintain quality life support and balance of community systems.

On the other hand, Sarna *et al*. (1993), Wijana states that rare plants naturally occur as a result of abiotic factors (fire, drought) or biotic (pest or disease). This process of natural scarcity is especially, easy to occur in endemic plant species whose populations are grouped in certain areas. While Soemarwoto (1991) argues that the occurrence of rare plants due to human actions directly or indirectly such as exploration in excess without followed by adequate rehabilitation efforts. Below are given examples of rare plants that exist in the village Sudaji, district Sawan, Buleleng district.

Wijana *et al*. (2018) states that rare plants in the villages that have been studied show that there are several factors that cause the rare plants are: the growth of the plant is very slow, so, rare plants that have economic and non-economic value rarely planted by society; the community has not understood the way to do reproduction, to find and do the nursery; seeds or fruit or other seed candidates from such plants are hard to find because their reproductive prepagules are hard to find; and rare plants generally have no economic value, so that, people are not interested in planting them.

Implementation in learning: In plant ecology lectures, especially, vegetation analysis, the overall lecture model takes place in the field. Analysis of vegetation is directed at terrestrial vegetation. Thus the object of study used as a field study is forest vegetation, moor vegetation, housing vegetation and weed vegetation in rice fields. In the analysis of vegetation that is generally carried out is a spectrum of life forms, distribution patterns of plant species, association of plant species, stand structure, method of vegetation analysis without plot (method), analysis of plant diversity and ordination. By referring to the results of research that has been carried out and/or more broadly elaborated, the implementation of this research is modeled on the analysis of rare plant diversity at the location of this research site or in another

Table 5: Recapitulation of the number of rare plant species in each location in Sudaji village, Sawan sub-district, Buleleng regency

Location	Percentage of rare plants	Percentage of not rare plants	Species total
Public road	6 (12%)	44 (88%)	50
Housing (Tri Mandala)	6 (11,32%)	47 (88,67%)	53
Gardens	8 (21,05%)	30 (78,94%)	38
Total	20 (14,18 %)	121 (85,81 %)	141

Table 6: List of rare plant species in Sudaji village, Sawan sub-district, Buleleng regency

No.	Species name (Local and scientific name)
1	Sugar Palm (*Arenga pinnata*)
2	Tamarind (*Tamarindus indica*)
3	Banyan tree (*Ficus benjamina*)
4	Yellow Bamboo (*Bambusa vulgaris)*
5	Yellow Champaca (*Michelia champaca*)
6	Lanzones (*Lansium domesticum*)
7	Cashew (*Anacardium occidentale*)
8	Java Plum (*Eugenia cumini*)
9	Kepundung (*Baccaurea racemosa*)
10	Calabur (*Muntingia calabura*)
11	Mangosteen (*Garcinia mangostana*)
12	White mango (*Mangifera caecia*)
13	Grapefruit (*Citrus maxima*)
14	Melinjo (*Gnetum gnemon*)

place/location (Wijana, 2014b). By referring to the research method and data from the results of the research that has been conducted, the implementation of the learning can be presented as follows:

Title: Analysis of rare plant diversity.

Objective: Students are able to analyze rare plant diversity.

Tools and materials: A set of ecological tools and soil test kits.

How it works: Look back at the method of work or the method used in this study.

Field observations: Enter data from field observations about vegetation parameters as in the work table below:

Name of rare plant species	Number of individuals	Abundance
…….	……	……
……	……	……
…….	……	……
…….	……	…….
Total individual	……	……
∑(δ) abundance		……
Simpson index (d)		……

To find the Abundance index using the equation:

$$\delta = \frac{\sum ni\ (ni-1)}{N\ (N-1)}$$

δ = Dominance/abundance index
ni = Number of species individuals I
N = number of individuals

To find diversity based on Indedks Simpson used the equation:

$$Ds = 1-\delta$$

or:

$$Ds = 1- \frac{\sum ni\ (ni-1)}{N\ (N-1)}$$

Ds = Diversity index (Simpson)

Data interpretation: Students interpret the results of data analysis as done above.

Discussion: Students discuss the results of data analysis and data interpretation based on the study of theory and research results.

Conclusion: Students draw conclusions from the results of data analysis, data interpretation and the results of the discussion.

CONCLUSION

The conclusions that can be submitted from the results of this study are: there are as many as 87 species of plants in Sudaji village, Sawan sub-district, Buleleg district, 14 of which fall into the category of rare plant species. The fourteen species of rare plants are: Sugar Palm (*Arenga pinnata*), Tamarind (*Tamarindus indica*), Banyan Tree (*Ficus benjamina*), Yellow Bamboo (*Bambusa vulgaris)*, Yellow Champaca (*Michelia champaca*), Lanzones (*Lansium domesticum*), Cashew (*Anacardium occidentale*), Java Plum (*Eugenia cumini*), Kepundung (*Baccaurea racemosa*), Calabur (*Muntingia calabura*), Mangosteen (*Garcinia mangostana*), White Mango (*Mangifera caecia*), Grapefruit (*Citrus maxima*) and Melinjo (*Gnetum gnemon*). From these conclusions it is suggested that these rare plants can be preserved through in-situ conservation and to the government to participate in conserving and training the community for breeding. The results of this study can be implemented in lectures on plant ecology.

APPENDIX

Appendix 1: Here, is given a rare plant example which is in the Village Sudaji, District Sawan, Buleleng Regency, Bali

Kepundung (*Baccaurea racemosa*)	Kingdom: Plantae Division: Magnoliophyta Class: Magnoliopsida Order: Malpighiales Family: Phyllanthaceae Genus: Baccaurea Species: *Baccaurea racemosa* This plant has a height of 10-25 m with a diameter of 91 cm. The stems are erect with woody shapes round, the stems are slightly hairy and coarse, the branching in this plant is simpodial. Strong branching with twisted and very slender twigs. It has a single leaf, scattered leaf shape, oblong leaf shape, jagged leaf edge, pointed leaf tip, leaf base round with pinnate pertulangan. Flower multiplicity compound, shaped buliran-buliran integrated on twigs, fragrant flowers, flowers berpundung berpendamin one.
Java Plum (*Eugenia cumini*)	Kingdom: Plantae Division: Magnoliophyta Class: Magnoliopsida Order: Myrtales Family: Myrtaceae Genus: Eugenia Species: *Eugenia cumini* Java Plum or often referred to as Jamblang in the Java language generally grows in the lowlands to a height of 500 m above sea level. The height of the tree can reach 10-20 m, thick trunk has many branches and the growth of crooked. Has a single dauan, thick, the leaves bebbentuk rounded round or rounded round, wedge-shaped, flat edges, pinnate, glossy top surface, and green. Flower type compound panicles, petals bell-shaped, oval-shaped crown, stamens are many and white. Java Plum or jamblang fruit has many benefits for health, including preventing excess bad cholesterol in the body, healing the wounds of diabetes, treating chronic cough, asthma, diarrhea and canker sores.
Tamarind (*Tamarindus indica*)	Kingdom: Plantae Division: Magnoliophyta Class: Magnoliopsida Order: Fabales Family: Fabaceae Genus: Tamarindus Species: *Tamarindus indica* This plant height ±30 m Diameter of stem ± 2m, brown skin, grayish, rough and break down. The leaves are compound pinnate evenly with 8-18 pairs of leaflets. The fruit is brown pod-shaped, and has reddish-brown seeds
Lanzones (*Lansium domesticum*)	Kingdom: Plantae Division: Magnoliophyta Class: Magnoliopsida Order: Sapindales Family: Meliaceae Genus: Lansium Species: *Lansium domesticum* The leaves are compound leaves, that is if the plants are seen branching stems, and new on the branch of this stalk is a leaf strand. The leaves of this plant is a sitting leaf. The bone of the leaves is pinnate, on the top surface of the shiny leaves, the tip of the leaf is short, the edges are flat and the leaves are incomplete because they only have leaf strands (lamina), petiolus, Lanzones plants are dikotil plants that are two pieces

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