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Diversity and Utilization of Wild Plants and Macrofungi: Its Contribution to Rural Livelihood in Cabagan, Isabela, Philippines

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ABSTRACT

Wild plants and macrofungi play important roles in the lives of people in the world especially in upland and rural areas. The presence of wild plants in the community can significantly improve food security and the standard of living of the farmers in the upland agroforestry area in Masipi East, Cabagan. The main objectives of this research study were to determine the diversity, species richness, abundance, and distribution of wild plants; determine the conservation status, endemism, and utilization of wild plants; and determine the actual contribution of wild plants to the livelihood of rural communities. Floristic inventory was employed following the data gathering procedures of FMB technical Bulletin 16-A or the Biodiversity Assessment and Monitoring System (BAMS) for terrestrial ecosystem. Dataset was analyzed using the Paleontological Statistical software version 4 (PAST 4) for the different diversity indices. Results revealed a total of 31 wild plants that were found in the study area at Masipi East, Cabagan, Isabela. It was found that species belonging to families of Malvaceae, Araeceae, and Brassicaceae are the most abundant wild plants in the area. It was noteworthy to mention that 10% of the identified wild plants are categorized as endangered based on the IUCN 2022 Red List of Threatened Species. Percent endemism showed that 42% of the identified wild plants were found to be endemic to the country, while spatial distribution of species in the area revealed that Marakamote (*I. triloba* L) was found to be the most common species in the area where it was evenly

distributed in most of the area being sampled. The utilization of wild plants mainly focused on three aspects such as food, medicinal use, roofing, and basketry making.

Keywords: *wild plants, diversity, land uses, macrofungi, conservation, endemism*

Introduction

The term "wild edible plants" (WEPs) describes plant species that are not domesticated or grown but can be found in a variety of natural habitats and are used for food. Wild edible plants (WEPs) have an important role for rural communities in safeguarding food security, nutritive variation, and continued earnings (Kejela et al., 2021).

In recent decades, wild food plants have become a focus of research for many ethnobotanists, driven by a global interest in documenting ethnobotanical information on neglected wild edible food sources. Since traditional knowledge on WEPs is being eroded through the acculturation of Indigenous peoples and their cultural background and through the loss of plant biodiversity, promoting research on wild food plants is crucial in order to safeguard this information for future societies. However, due to anthropogenic activities that greatly affect the diversity of these wild plant species, the rapid decline of these natural resources will lead to the extinction of the many wild plants and other organisms that play a significant role in the lives of so many people. Wild edible plants and some other organisms such as macrofungi at present times become one of the resources that people all over the world as alternative food because of the abundance in the wild.

Furthermore, a floristic inventory of these resources is necessary and aims to taxonomically characterize wild edible plants and macrofungi in support of the attainment of Sustainable Development Goals (SDGs) in poverty eradication, food security, and nutrition, health, sustainable consumption and production, and the mitigation of climate change. Wild edible plants are not only considered for family consumption but also become a way to earn money because of their high marketable value and are being sold in the market and even on the roadside to augment household income due to the increasing population.

Nevertheless, WEPs are threatened due to various human activities and natural causes such as land use change (expansion of agricultural lands, developmental activities), habitat destruction (timber harvest, fuelwood collection, forest fire), over-harvesting, over-grazing, and invasive species. Although the potential impacts of climate change were also discussed, the respondents were reluctant to mention it as a major issue. It might be due to the fact that until recently the respondents did not experience and witness direct impacts of climate change on biodiversity.

Despite being one of the megadiverse countries, the alarming situation is caused by the rampant anthropogenic activities that continuously threaten the diversity of these wild foods and may eventually cause massive habitat destruction associated with the loss and high mortality rate of many organisms that greatly depend on these resources. If these forests are facing threats, then wild edible plants from these forests face the same set of environmental challenges (Rosales et al., 2019). The completion of floristic inquiry would make significant contributions to the body of knowledge on WEPs and increase knowledge about how WEPs can be used as alternative food sources,

particularly in distant communities. By identifying which WEPs served as backup food supplies during food emergencies, this study opened up a new area of research for reducing hunger in rural and even urban areas.

Hence, this study focused on the diversity, utilization, and contribution of wild plants. It aided not only in addressing food security issues but also in maintaining and reinforcing links between communities and the environment by promoting a sustained acceptance of wild edible plants as important dietary components and their propagation.

Methods

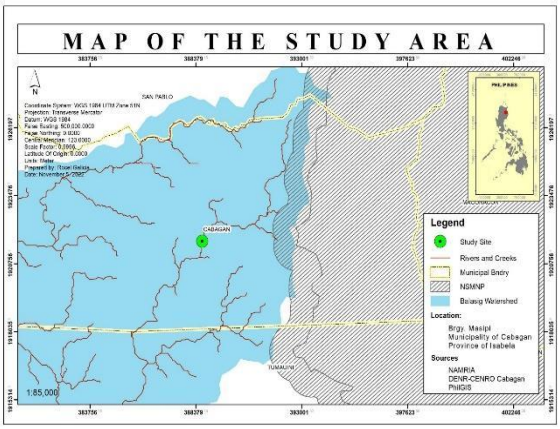

Figure 1. *Location Map of the Study Area*

The study was conducted at Masipi East, Cabagan, Isabela from November 2022 to January 2023. Barangay Masipi East is one of the 26 barangays in the municipality of Cagaban, Isabela. According to Philatlas (2022), barangay Masipi East, Cabagan, Isabela is situated at 17.3847^0 N, 121.8804^0 E. Elevation at this coordinate is estimated at 79.5 meters or about 260.8 feet above mean sea level. Adjacent municipalities include the municipality of San Pablo, Isabela on the northern part of the barangay, on the southern part is the municipality of Tumauini, Isabela, on the western part the municipality of Santo Tomas, and on the eastern part is the Northern Sierra Madre Mountain range. Despite part of Barangay Masipi East, Cabagan, Isabela being included in the total land area of the Northern Sierra Madre, there is a critical need to protect and conserve the remaining natural forest resources due to ongoing anthropogenic illegal activities that have caused significant decline and threaten the lives of many wildlife species living in the forest areas within Masipi East, Cabagan, Isabela. To address issues concerning the protection of the forest's resources including mitigation measures for the consequences brought about by the illegal activities caused by humans in the area, the need to support SDGs must be considered to eradicate poverty (SDG 1), for food security and nutrition (SDG 2), health (SDG 3), sustainable consumption and production (SDG 12), and climate change mitigation (SDG 13) for the conservation and protection of the wildlife species such as edible wild forest plants in the forest within Masipi East, Cabagan, Isabela and its adjacent forest areas specifically the Northern Sierra Madre.

Plot Establishment

The plots of the study area were established as follows:

Establishment of Sampling Plots: Nine (9) sampling plots (20m x 20m) were randomly selected in an alternating direction using the modified belt transect method within the study area in the Masipi East, Cabagan Isabela *(Figure 2).* A Global Positioning System (GPS) device was used to locate the coordinates of the plots. A string was also used to establish the area of each plot measuring (20m x 20m) within the sampling area at Masipi East, Cabagan, Isabela.

Floristic Inventory. Inventory of edible plants and macrofungi species was done in all nine (9) sampling plots. All edible plants and macro-fungi encountered in the plots were identified and counted.

Data Collection Process

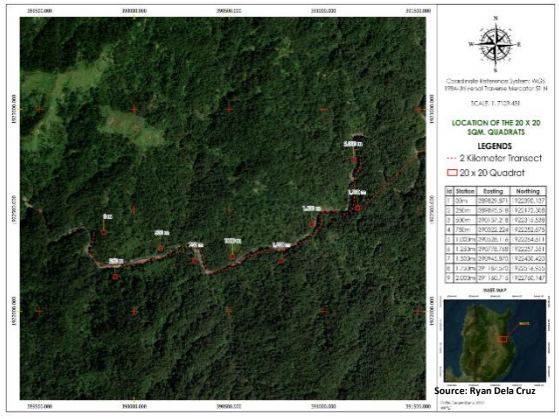

Figure 2. *Spatial Location of Nested Sampling Quadrats in the 2-km Transects Line*

Using Biodiversity Assessment and Monitoring System

Biodiversity Assessment and Monitoring System (BAMS) for terrestrial ecosystems (Cruz et al., 2017) used a modified belt transect method as described in the FMB Technical Bulletin No. 16-A (2019) on standard floral inventory techniques for terrestrial ecosystems, specifically forestlands. Nine (9) sampling plots with dimensions of 20m x 20m were randomly established in alternating directions at 250 m intervals along the transect using the nested quadrat technique (Figure 3). This quadrat was used for species-level assessment (Figure 4) within the study area located at Masipi East, Cabagan, Isabela.

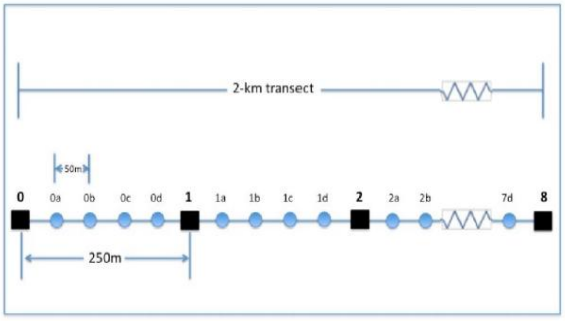

Figure 3. *Quadrat Sampling in the 2-km Transect Line*

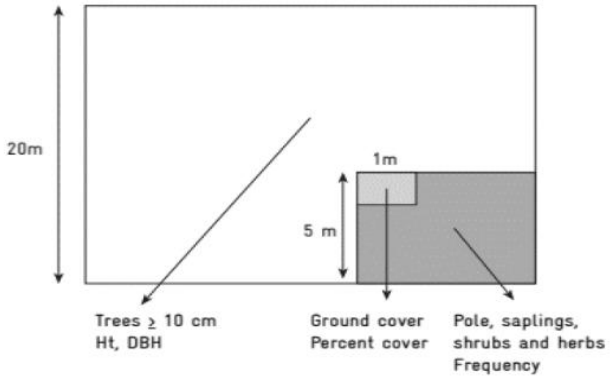

Figure 4. *Nested Quadrats for Species-Level Assessment*

(Source: FMB Technical Bulletin 16-A)

The species-level assessment (SLA) was determined through a nested quadrat sampling technique to assess and characterize the structure and species composition of the different plant communities. A Global Positioning System (GPS) device was used to locate the coordinates of the plots. Moreover, a string was used to establish the area of each plot measuring (20m x 20m) within the study area located at Masipi East, Cabagan, Isabela. Measurements for Species-Level Assessment Measurements for species diversity assessment were made at every 250-m interval along the transect using the nested quadrat technique. The quadrats were established in alternating directions on the transect line to eliminate bias in the selection of sampling quadrats. All trees (edible wild plants) were counted within the 20m x 20m quadrat. For shrubs, poles, and saplings inside the 5 m by 5 m quadrat, a number of individuals were counted to account for the abundance of intermediate species, while for understory species (grasses and other plants with below one meter of height) were counted within the 1 m by 1m quadrat.

Key Informant Interview (KII)

Other method was employed in the data collection which included the use of KII or Key Informant Interview. For the key informant survey, all the residents within a 1 km radius were interviewed. The residents within one kilometer radius are considered part of the upland community of barangay Masipi East, Cabagan, Isabela. These residents primarily rely on forest resources for their livelihood. The majority of the

residents of the upland community of the said barangay are migrants from mountain provinces. A list of questions were prepared to assist in drawing necessary data from the participants.

Moreover, informants were purposively selected, and they must have a thorough knowledge of the wild plants and macrofungi found in the study area and the inhabitants of the area. The interview was conducted with one person at a time to allow respondents to express their personal views freely without contradiction from others.

Data Analysis

The dataset was tabulated for the analysis of the number of species, genera, and families as well as the relative abundance of each species. For the diversity indices, the data was subjected to the Paleontological Statistical software package for education (PAST ver. 4.03). PAST is a software package for executing a range of standard numerical analysis and operations (Vavrek, 2011). Diversity indices were interpreted using the Biodiversity Scale developed by Fernando et al., (1998). Published books and articles, and repositories of online databases were used to acquire the needed information on species identification. Relevant literature about flora malesiana, flora of Manila, enumeration of Philippine flowering plants, and lexicon of Philippine plants was considered for the initial identification of the edible wild plants. Subsequently, photos of unknown plants were compared using digital images available online (JSTOR Plant and PhytoImages). Conservation status for all species was determined using the IUCN Red List for Globally Threatened Species and the DENR DAO 2017-11 for locally threatened species.

Additionally, collected soil samples were subjected to the macronutrient analysis to determine the soil requirements of the identified edible plants and macro-fungi species in the area as well as the plant species associated with the edible plants and macro-fungi species.

Table 1: Biodiversity Scale (Fernando et al., 1998)

Relative Values	Shannon Index	Evenness Index
Very High	3.5 and above	0.75-1.00
High	3.0 -3.49	0.5-0.74
Moderate	2.5-3.39	0.25-0.49
Low	2.0-2.49	0.15-0.24
Very Low	1.9 and below	0.05-0.14

This study is qualitative in nature. Hence, a descriptive method of research was used.

Ethical Considerations

The study is both qualitative and quantitative in nature; therefore, a non-destructive method was employed to protect the species from any potential harm. A photo-documentation and counting were employed to identify all possible wild plants and macrofungi in the study. Proper communication was made for the smooth process of the study from the establishment of sampling plots and data gathering.

Results and Discussion

The result of the study showed that there are 31 species of wild plants found in the study area in Masipi East Cabagan, Isabela (Figure 5). There were 454 individuals of wild plants with economic importance found in the area. The most abundant wild plants belong to families of Malvaceae, Araceae, and Brassicaceae with 48, 45, and 41 species, respectively.

Additionally, marakamote (*Ipomoea triloba* L) of the family convulvolaceae can be found commonly thriving in the three land uses of agricultural, grassland and kaingin area with 15, 10, and 18 species (Table 2), respectively. Furthermore, wild plant species specifically anahaw (*Saribus rotondifolius (Lam) Blume)* and pukinggan (*Centrosema pubescens* Benth.) had the lowest number of individuals found in the grassland and forestland area.

Moreover, *C. olitorius* had the highest number of individuals when it comes to abundance, followed by *A. macrorrhizos* (L.) G. Don, and *N. officinale.* The species distribution also shows that anahaw and pukinggan had the lowest number of individuals in the said land uses.

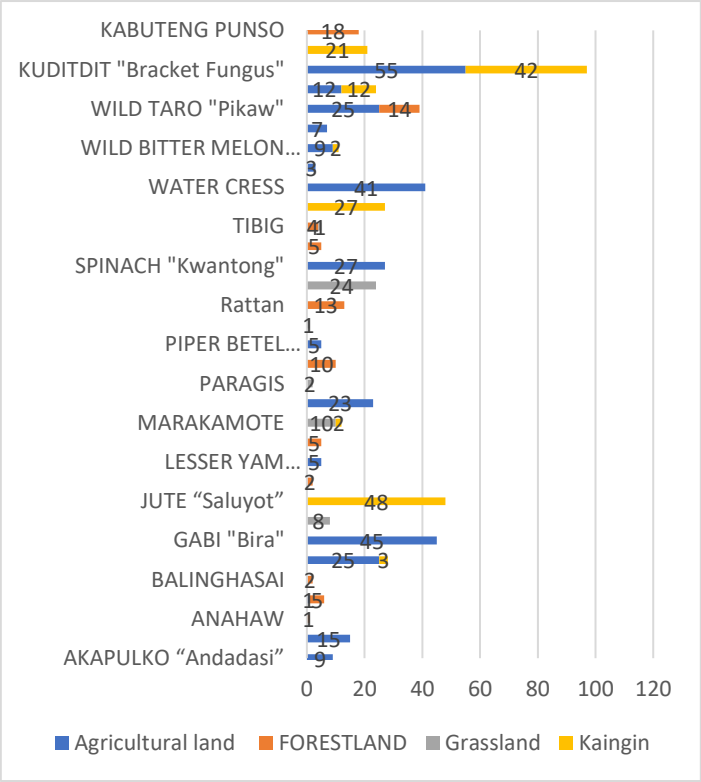

Figure 5. *Species of Wild Plants in the Study Area*

Diversity of Wild Plants and Macrofungi

The Shannon H Indeces of wild edible plants and macrofungi on the different land uses revealed a mark of 1.278 to 2.319 which can be interpreted as having a very low to low diversity index of wild plants in the different land uses based on the diversity scale of Fernando et al. (1998). The low diversity of wild plants within the different land uses may be due to climatic factors and anthropogenic activities. The study was

conducted from November to January when the climate was very dry with few rains experienced during these months. This climatic condition might have greatly affected the growth of wild edible plants. Wild edible plants require a lot of water and ideal temperature. Moreover, moist area favors them to grow faster and slower when the temperature is hot. According to Kessler (2010), other factors that may affect species diversity are the size of the area sampled, soil type, and geographic location.

In addition, it was observed that the study site specifically the different land uses was under the threat of human activities. Present disturbances, such as slash-and-burn activities and unsustainable management of the wild edible plants being collected, were some threats observed in the area. The surrounding area was being cultivated for agriculture, burned forest areas, and land conversion, and for the presence of some animals which greatly contribute to the decline of such resources in the area. These activities might have influenced the diversity of wild edible plants and macrofungi. One of the key informants explained that harvesting of wild plants and macrofungi usually happens whenever there is no available food due to financial crises and natural calamities to satisfy the needs of their families. Excess harvests were brought to market for their subsistence.

Table 2. Species Diversity of Wild Plants in Different Land Uses

Indices	Agricultural Land	Forestland	Grassland	Kaingin
Taxa_S	14	10	6	6
Individuals	240	61	46	107
Dominance_D	0.1165	0.1518	0.3526	0.321
Simpson_1-D	0.8835	0.8482	0.6474	0.679
Shannon_H	2.319	2.049	1.278	1.296
Evenness_e^H/S	0.7261	0.776	0.5984	0.609

Conservation Status, Endemism, and Utilization of Wild Plants and Macrofungi

In the study, results revealed that wild plant species belonging to 21 families and 31 genera were identified based on key informant interviews and species found in all sampling plots within the study area. It is noteworthy to mention that 13 species of edible wild plants were identified as endemic species of wild plants, other species fall under not assessed, and native species of the Philippines. It is also noteworthy to mention that three (3) of the species of wild plants, namely rattan (*Calamus microcarpus var. macrocarpus* Becc), pako (*Diplazium esculentum*), spinach (*Amaranthus spinosus*) of the family Arecaceae Athyriaceae, and Amaranthaceae were found to be an endangered species based on IUCN (2022) and DAO 2017-11. Hence, this species of wild edible plants must be conserved and protected and must be utilized through proper sustainable management.

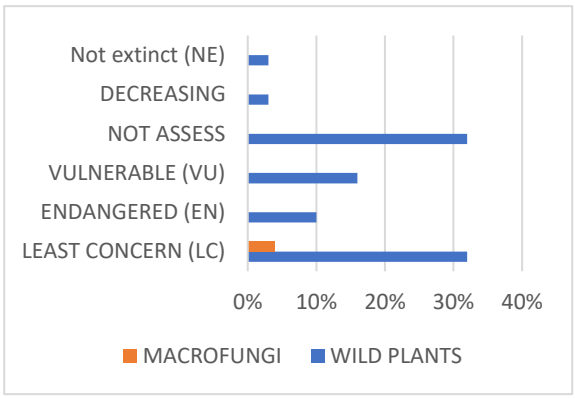

Figure 6. *Conservation Status of Wild Plants and Macrofungi*

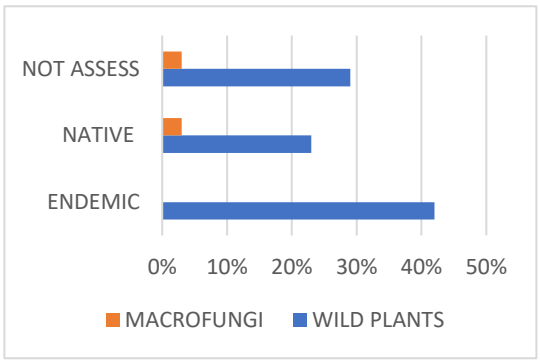

Figure 7. *Percent Endemism of Wild Plants and Macrofungi*

Out of these endemic species, a total of nine (9) species of edible wild plants had a conservation status of Least Concern (LC) based on IUCN (2022). Thus, this species of wild plants is not a focus of species conservation because the specific species is still plentiful in the wild. Likewise, they do not qualify as threatened, near threatened, or conservation dependent. Furthermore, these two (2) species of edible wild plants belong to Moraceae and Brassicaceae. These are edible with “not assessed” conservation status based on IUCN (2022). As shown in Figure 6, about 32% of the total identified species of wild plants fall under the least concern conservation status. Results of the study also showed that about 10% of the species were found to fall on an endangered conservation status. Furthermore, 16% of the total wild plants were under vulnerable status while other species fall under decreasing status (3%), and not extinct (3%). On the other side, 32% of the identified species had a “not assessed” as conservation status. On the other hand, about 42% of the total wild plant species were identified as endemic species in the Philippines, while the native species contributed to a total of 23% of wild plants being identified in the study area. Other species identified were classified under not assessed (23%) for the wild edible plants.

Species Distribution of Wild Plants and Macrofungi

The result showed that the most common species is marakamote (*Ipomoea triloba* L) with 27 individuals and was observed on the three land uses. These wild plants were found to be prevalent across various land uses due to their suitability and ideal ecological requirements for thriving and survival. Among them, genera such as Solanum, Oncosperma, Momordica, and Ficus, each comprising one species, were the most commonly found wild edible plants in the study area, with 28, 6, 11, and 5 individuals, respectively.

The lowest number of species belonged to the family Arecaceae and Fabaceae, respectively. Based on key informant interview, these families of plants were being gathered for their economic importance for they served as alternative and medicine to the local folks of Masipi East, Cabagan, Isabela. The presence of anthropogenic activities within the study area on the gathering of such wild species affected the diversity of these wild plant species.

Contribution of Wild Plants and Macrofungi to the Rural Livelihood in the Study Area

Figure 8 presents the utilization of such wild plants mainly focused on three aspects such as food, medicinal use, roofing, and basketry making. About 69% of the species of wild plants were utilized by the local populace as a source of food, especially during calamities.

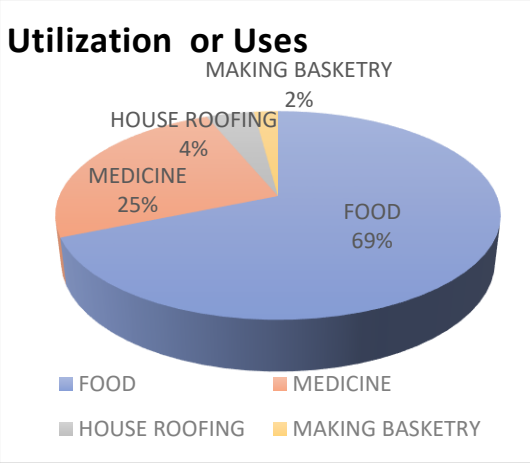

Figure 8. *Utilization of Wild Plants and Macrofungi*

Twenty-five (25%) of it was used for traditional medicine to treat different illnesses such as wounds, Urinary Tract Infections (UTI), animal bites, asthma, cough, diarrhea, and many others. Moreover, 4% of the total species were utilized for house roofing and lastly, for making basketry (2%). Medicinal and wild edible plants play a significant role in human existence. In the study area where most people do not have access to transportation, majority of the populace were dependent on traditional medicine where they used indigenous wild plants as a source of medicine. Wild plant species of the families under Amaranthaceae, Malvaceae, Zingiberaceae, Euphorbiaceae, Arecaceae, Asteraceae, Lamiaceae, Apocynaceae, and Cucurbitaceae were the main source of medicine for the local populace in treating different illnesses. Furthermore, it was also observed that wild plant species that served as the main source of food belong to families

of Moraceae, Solanacea, Moringaceaea, Araceae, Arecaceae, Convolvulaceae, Dioscoreaceaea, Poaceae, Euphorbiaceae, Anacardiaceae, Sapindaceae, Piperaceae, Bellaceae, Malvaceae, Musaceae, Brassicaceae, and Athyriacea.

Conclusion and Future Works

The study was conducted to determine the diversity and utilization of wild plants in the secondary forest at Masipi East, Cabagan, Isabela. By all counts and with proven and reliable results, the upland areas were generally high in wild plant diversity. Results also showed a diversity index of edible wild plants. This indicated that the richness and evenness of species in all plots accounted for a very low number and uneven distribution of wild plant species present in the area. Thus, the conservation and protection of these wild plant species should be addressed. However, the study area was exposed to several anthropogenic activities that greatly affected the ecosystem's goods and services especially the diversity of wild plant species. The continuous unregulated collection and ineffective management of plant species may cause habitat loss and low diversity of important wild plants species that may eventually result to a local species extinction. Such contributions of these wild plants are truly recognizable for it becomes the source of food and medicine for the local populace since time immemorial. However, there is a critical need for sustainable management of these precious resources to ensure the secure conservation and maintenance of the high diversity of wild plant species. This is essential for the ongoing enjoyment and utilization of these valuable resources.

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