

# Ethnobotanical study of the wild edible plants used by the indigenous people of Merak in Bhutan

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Manuscript received: 19 November 2022. Revision accepted: 4 January 2023.

**Abstract.** *Jigme, Yangchen K. 2023. Ethnobotanical study of the wild edible plants used by the indigenous people of Merak in Bhutan. Asian J Ethnobiol 6: 1-6.* Merak communities possess one of the oldest and most extensive cultural traditions of using plants for various ethnobotanical purposes, but this traditional knowledge still needs to be reported. As a result, this is the first ethnobotanical survey on Wild Edible Plants (WEPs) in Merak *Gewog*, Tashigang *Dzongkhag*, Bhutan. The data was obtained through an ethnobotanical survey and semi-structured interviews with 40 informants. The study identified 16 plant species from 16 genera and 16 families of WEPs consumed in Merak *Gewog*. Herbs (14 species) were found to be the most important sources, followed by shrubs (1 species) and trees (1 species). The most commonly consumed plant part(s) are leaves (8 species), followed by flowers (4 species), shoots and whole plant (with 3 species each), rhizome, and root (1 species each). Wild edible plants supplement the family diet, and their usage and collecting frequency are constrained by seasonal availability. Summer is the best time to harvest wild edible plants, followed by spring, autumn, and winter. However, many of the wild edible plants found in the Merak are under increased strain due to human and socioeconomic causes such as livestock overgrazing, habitat degradation, unsustainable harvesting, and forest fire. This has resulted in the disappearance of WEP species and the underlying indigenous knowledge. As a result, the importance of wild vegetables must be stressed and included in conservation and food security strategies.

**Keywords:** Bhutan, herbs, Merak, shrubs, trees, wild edible plants

## INTRODUCTION

Wild Edible Plants (WEPs) are plant species that are not cultivated but are edible and collected from various natural habitations (Dema and Dolkar 2022; Yangdon et al. 2022). They may be found in various habitats, including woodlands, cultivable fields, roadside ditches, and wastelands (Dema and Dolkar 2022). Several names are known for wild edible plants. WEPs are known as 'wild vegetables' (Narzary et al. 2013) and 'edible weeds' (Dop et al. 2020). They are also known as 'famine food' because they are consumed to overcome hunger (Mishra et al. 2021; Sachula et al. 2020). Wang et al. (2020) described WEPs as 'functional foods' because they contain physiologically active ingredients capable of providing health benefits beyond basic nutrition.

About 12,000 years ago, when agriculture had not yet emerged, humans could only feed on the vegetables they found in nature and the hunted products (Pereira et al. 2020). Despite the primary reliance of agricultural societies on domesticated plants and animals for food, the tradition of consuming wild edible plants has not been entirely abandoned, owing to their nutritional value and health benefits (Panda 2014; Ashagre et al. 2016; Pereira et al. 2020; Yangdon et al. 2022). According to Pereira et al. (2020), WEPs are consumed by humans in different ways. For example, they are consumed as snacks, herbal teas, salads, alcoholic beverages, and cooked in traditional recipes. Therefore, Motti (2022) stated that WEPs have

become a part of the human diet and traditional food system and play a significant role in ensuring food sovereignty and security during food crop scarcity. Similarly, Thakur et al. (2020) added that WEPs also play an important role in developing new crops through domestication, giving rise to cultivated food plants and strengthening local food security.

Tribal and rural communities mostly consume WEPs during times of food scarcity when cultivated vegetables and fruits are unavailable to meet their food requirements (Panda 2014; Yangdon et al. 2022). However, Bharucha and Pretty (2010), Cao et al. (2020), and Cheng et al. (2022) argued that eating WEPs has also become a way of life for modern and urban people. They are consumed to meet the needs of a green and healthy diet and enhance the culture of the modern diet. Similarly, Ding et al. (2021) highlighted that WEPs remain indispensable sources of vegetables and fruit in some urban areas. WEPs provide alternatives to staple foods during food deficit and a valuable supplement for a nutritionally balanced diet (Narzary et al. 2013; Haokip and Panmei 2022). Furthermore, it is one of the primary sources of income for residents in poor communities and plays an essential role in helping communities eradicate poverty (Cheng et al. 2022).

Similarly, WEPs were the major source of diet in Bhutan before agriculture (Dema and Dolkar 2022). Therefore, the WEPs collection is considered an important activity in boosting rural communities in Bhutan (Chhoeda and Yangchen 2017). However, the government's push for

commercialization and the promotion of high-yielding cultivars in recent decades has posed a significant challenge to Bhutan's traditional use of WEPs (Yangdon et al. 2022). Furthermore, dependence on wild plants is projected to shrink over time due to the easy availability of improved varieties and a reduction in species variety caused by habitat damage from deforestation and infrastructural development. As a result, indigenous knowledge and WEPs usage among younger generations are quickly disappearing (Yangdon et al. 2022). With the increasing erosion of indigenous knowledge of WEPs and increased reliance on improved vegetable varieties, there is a risk that WEPs will be completely replaced by imported and cultivated vegetables, disrupting the coexistence of people and forests and resulting in the loss of traditional knowledge. As a result, it is critical to record the diversity of species and their indigenous usage for sustainable management of natural resources before indigenous species and traditional knowledge become extinct. Although there has been some earlier research on wild vegetables, non-wood forest products, and medicinal plants in certain places in Bhutan, studies on WEPs in Merak have yet to be done.

Merak people are semi-nomadic and rely mostly on animal products and untamed natural resources. However, they have the oldest and richest cultural traditions of using plants for various ethnobotanical purposes. Although foraging for plants in the wild was a significant aspect of human sustenance, the utilization of these plants in Merak remains largely unexplored. As a result, the current study concentrated on recording the species diversity of WEPs and their ethnobotanical applications in Merak *Gewog* to enable future generations to acquire traditional knowledge associated with WEPs, to promote the conservation and sustainable use of WEPs, and to help economically backward and low-living areas to uplift themselves out of poverty and food insecurity.

## MATERIALS AND METHODS

### Study area

Merak is one of the remotest *Gewogs* located in the easternmost tip of Bhutan under Tashigang *Dzongkhag* (District) and Sakteng *Drungkhag* (Sub-district). Merak is located about 3,400-3,500 meters above sea level and has an area of 867.7 sq. km. The study area is shown in Figure 1.

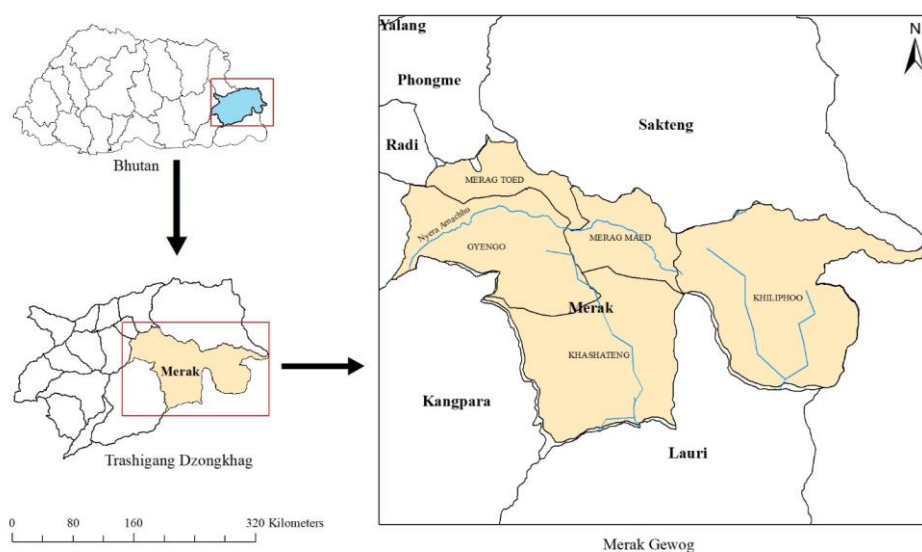
The people of Merak are called *Brokpa*. They are semi-nomadic and rely mostly on livestock and livestock products for a living. However, some bitter buckwheat and vegetables are grown in the greenhouse, but no other cereal crops can be grown at such a high altitude. They travel from one location to another with their herds of Yaks, Sheep, and Goats as the seasons change. They travel to the warmer location when it receives significant snowfall in the winter and returns when summer arrives.

### Ethnobotanical data collection

An ethnobotanical survey was conducted to document the wild edible plants used by indigenous people in Merak *Gewog*. Data were collected using semi-structured interviews with 40 informants from different age groups. Ethnobotanical data that were primarily aimed to document are local names of the plants, growth form of plants (habit), edible parts, time of collection (season), and modes of consumption.

### Plant identification

Photographs with their vernacular names were recorded based on the ethnobotanical information obtained from the informants. The identifications of the plants were based on the published guides of useful plants and trees in Bhutan, especially the Flora of Bhutan (Grierson and Long 1983). Botanical names of the plants were reported according to the Plants of the World Online (POWO).



**Figure 1.** Study map showing Merak *Gewog*, Bhutan

### Data analysis

Descriptive statistics (frequency and percentage) were used to analyze the ethnobotanical data of the reported wild edible plants and their associated indigenous knowledge. Priority ranking was employed to determine threats to wild edible plants based on their level of destructive effects. To recognize threats of wild edible plant species, we valued from 1 to 5: 1 is the least destructive threat, and 5 is the most destructive threat (Berihun and Molla 2017; Dema and Dolkar 2022).

## RESULTS AND DISCUSSION

### Taxonomic diversity of WEPs

A total of 16 plant species belonging to 16 genera and 16 families were reported as wild edible plants consumed in Merak *Gewog* (Table 1). The plants belong to different genera and different families. This finding indicates a diversity of wild edible plants in the study area. The relatively high diversity of the wild edible plants in the study area may be due to diverse agroecology and the local communities' more intensive utilization of the plants.

### Growth forms (habit) and parts used

Wild edible plants' habit/growth form consists of herbs, shrubs, and trees. The largest numbers of edible wild plant species were found to be herbs, followed by shrubs and trees (Figure 2A), comprising 14 species and 1 species, respectively. Similar findings were reported by Thakur et al. (2020) from a tribal community in the western Himalayas. However, this result conflicts with the works of Laloo et al. (2007), Ashagre et al. (2016), Berihun and Molla (2017), and Dema and Dolkar (2022). They have reported trees and shrubs as the highest growth forms/habit of wild edible plants.

Regarding parts used, 6 edible parts were recorded, such as shoot, leaves, flower, rhizome, root, and whole plant. This finding implies that the people of Merak consumed more than one part of a plant species. The most widely used edible parts are leaves (8 species), followed by the flower (4 species), shoots and whole plant (with 3 species each), rhizome, and root (1 species each) (Figure 2B). The result concurs with the works of Narzary et al. (2013), Berihun and Molla (2017), and Thakur et al. (2020). However, this finding conflicts with the work of Ashagre et al. (2016), Al-Fatimi (2021), and Dema and Dolkar (2022), who have reported stem and fruit as the most common edible plant parts followed by the leaves.

**Table 1.** Wild edible plants consumed by the indigenous people of Merak *Gewog*, Bhutan

Botanical name	Family	Local name	Habit	part(s) used	Mode of used
<i>Bambusa balcooa</i> Roxb.	Poaceae	Shey (Shar)	Tree	Shoot	The outer cover of young shoots is removed and chopped into small pieces and eaten as curry.
<i>Centella asiatica</i> (L.) Urb	Apiaceae	Mon (shar)	Herb	Leaves	Leaves are dried and used as a condiment.
<i>Chenopodium album</i> L.	Amaranthaceae	Mon (shar)	Herb	leaves and flower	Flowers are separated from the plant, dried, cooked, and consumed.
<i>Colocasia esculenta</i> (L.) Schott	Araceae	Bozong (Shar)	Herb	Rhizome	Scales on the rhizome are removed and cooked, and consumed.
<i>Cymbidium grandiflorum</i> Giff.	Orchidaceae	Olochotao (Shar)	Herb	Flower	Flowers are directly cooked as a curry.
<i>Diplazium maximum</i> (D.Don) C.Chr.	Athyriaceae	Dha-Wai (shar) Nakay (Dzo)	Herb	Young shoot or young leaves	Fronde and young leaves are sorted and cooked, and consumed.
<i>Drymaria cordata</i> (L.) Willd. ex Roem. & Schult.	Caryophyllaceae	Mon (shar)	Herb	Leaves	Leaves are cooked as curry or sometimes as a condiment.
<i>Elatostema lineolatum</i> Wight	Urticaceae	Dumroo (Dzo), Demom (shar)	Herb	Whole plant	Whole plants, except roots, are chopped into small pieces and cooked as a curry.
<i>Gentiana urnula</i> Harry Sm.	Gentianaceae	Panjen meto (Shar and Dzo)	Herb	Flower	Flowers are directly cooked or dried for future consumption.
<i>Houttuynia cordata</i> Thunb.	Saururaceae	Nombaring, Mombering (shar)	Herb	Root and leaves	Root and Leaves are chopped and cooked.
<i>Justicia adhatoda</i> L.	Acanthaceae	Khatsarim (shar), Bashaka (dzo)	Shrub	Flower	Flowers are separated from sepals and sometimes dried, then directly cooked.
<i>Nasturtium officinale</i> R.Br.	Brassicaceae	Ashi mom (shar)	Herb	Leaves	Fresh and young leaves are cooked directly as curry.
<i>Oxalis corniculata</i> L.	Oxalidaceae	Echa mon (Shar)	Herb	Leaves	Leaves are directly consumed or dried and then cooked.
<i>Paris polyphylla</i> Sm.	Melanthiaceae	Thok sam pa (shar)	Herb	Whole plant	Young plants without inflorescence are directly cooked.
<i>Plantago major</i> L.	Plantaginaceae	Mon (shar)	Herb	Whole plant	Young plants are directly cooked.
<i>Pteridium aquilinum</i> (L.) Kuhn	Dennstaedtiaceae	Dha-wai (shar), Na kay (Dzo)	Herb	Young shoot or young leaves	Fronde and young leaves are sorted and cooked, and consumed.

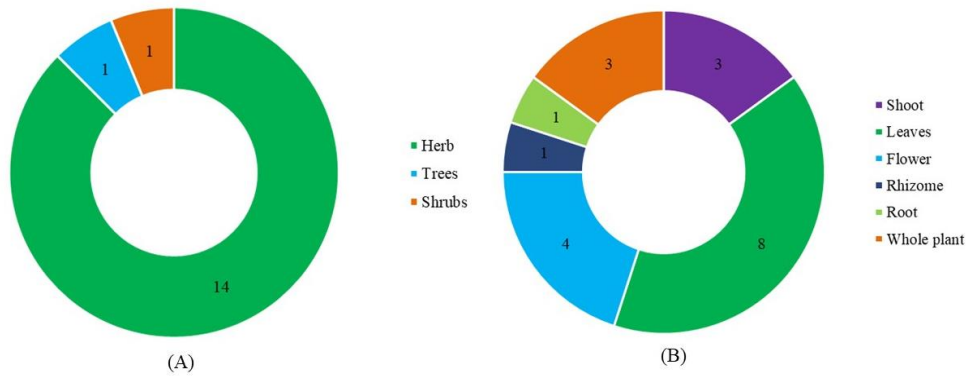


Figure 2. A. Growth forms of WEPs, B. Plant part(s) used

**Classification of WEP**

As reported in the earlier section, the different plant parts are consumed by people in the Merak. Therefore, depending on the different plant parts consumed, the WEPs in Merak are categorized into five types of wild vegetables: floral vegetables, foliage (leafy) vegetables, stem vegetables, root vegetables, and fruit vegetables (Kar 2004). The maximum of WEPs falls under foliage (leafy) vegetables, followed by the stem, floral, and root vegetables. The informants reported no fruit vegetable during the study period (Figure 3).

**Seasonal availability of WEP**

According to Chhoeda and Yangchen (2017), different plants have different growth patterns and maturity seasons. Thus, the abundance of wild vegetables changes from season to season. The study discovered that different edible plants were accessible throughout the year in the study region. The availability of the WEPs in the study area increased as the season transcended from winter to summer, and then it gradually decreased as the season transcended to winter (Figure 4). Therefore, the maximum of wild edible plants is harvested in the summer, followed by the spring, autumn, and winter. Because during the summer seasons, the climatic conditions become suitable for the growth of WEP, and the maximum number of WEPs such as *Bambusa balcooa* Roxb., *Centella asiatica* (L.) Urb., *Chenopodium album* L., *Colocasia esculenta* (L.) Schott, *Cymbidium grandiflorum* Giff., *Diplazium maximum* (D.Don) C.Chr., *Gentiana urnula* Harry Sm., *Houttuynia cordata* Thunb., and *Paris polyphylla* Sm. can be seen in these seasons. However, in the winter, the climatic conditions are not favorable for the growth of WEPs, except for *C. grandiflorum*, which starts flowering in the late winter to spring.

**Diversity of use**

The knowledge that the local communities possess about WEPs is what makes them put these plants to use in their daily lives. These communities collect various parts of these plants, like roots, leaves, shoots, stems, fruits, and flowers, as well as whole plants for daily household consumption, medicinal properties, and commercial

purposes. In this study, the majority of the WEPs (14 species) are collected for household consumption and followed by medicinal properties (4 species) and commercial purposes (3 species) (Figure 5). Some of the plants such as *D. maximum* (collected for household consumption and commercial purpose), *Elatostema lineolatum* Wight (collected for household consumption and commercial purpose), *G. urnula* (collected for household consumption and medicinal purpose in Figure 6), and *P. polyphylla* (collected for medicinal purpose and commercial purpose) are collected for multiple purposes.

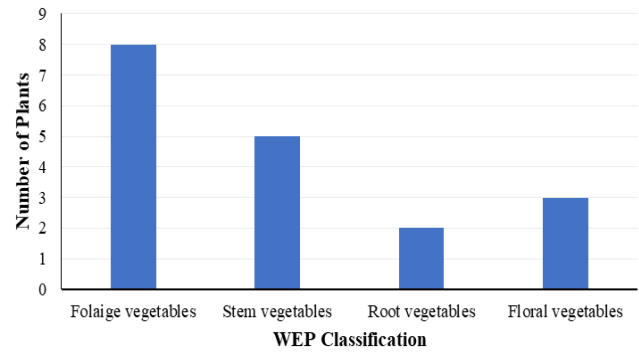


Figure 3. Classification of WEPs

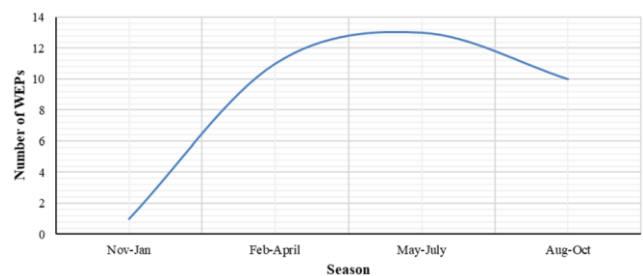


Figure 4. Seasonal availability of WEPs

The harvesting of wild vegetables in Merak remains significant because this community has limited cultivated crops, and wild edible plants are collected to add variety to their diet and generate some cash income. Similar findings are reported by Berihun and Molla (2017), Dema and Dolkar (2022), Chhoeda and Yangchen (2017), and Narzary et al. (2013). The most frequently collected WEPs for household consumption are *B. balcooa*, *C. asiatica*, *C. album*, *C. esculenta*, *C. grandiflorum*, *H. cordata*, *Justicia adhatoda* L., *Nasturtium officinale* R.Br., *Oxalis corniculata* L., and *Pteridium aquilinum* (L.) Kuhn. These WEPs significantly enhance these communities' food security and nutritional needs.

WEPs such as *D. maximum*, *E. lineolatum*, and *P. polyphylla* are sold in the market to generate cash income, while other WEPs such as *Drymaria cordata* (L.) Willd. ex Roem. & Schult., *G. urnula*, *P. polyphylla*, and *Plantago major* L. are utilized for medical purpose. The *D. cordata* treats cough and cold, and *P. polyphylla* treats diarrhea, dysentery, fever, stomachache, and wounds. The *G. urnula* is said to have a muscle-relaxing property, and the pregnant woman consumes it during maternity. The leaves of *P. major* are applied to blisters, sores, and stings. Tea prepared from *P. major* treats cough, cold, and diarrhea.

### Threats to WEPs

The threat to the wild edible plants comes from agricultural land expansions, unsustainable harvesting, fuelwood collection, habitat destruction, overgrazing, and forest fire. Berihun and Molla (2017) identify similar factors and Dema and Dolkar (2022) stated that these factors threaten the availability of wild edible plants.

The priority ranking was employed to determine the threats on the WEPs based on their level of destructive effects. Of these factors, overgrazing ranks first, followed by habitat destruction and unsustainable harvesting, and the least destructive factors are agricultural land expansion and fuel/firewood collection (Table 2). Because of the large number of cattle, the people of Merak believe that overgrazing is one of the most threatening factors to the availability of WEPs. They are highlanders who rely on livestock to make a living. They raise livestock including Yaks, Sheep, Goats, and Horses. Therefore, high livestock density has resulted in overgrazing in the community. Simultaneously, introducing new grazing ground due to high livestock density may have led to the overgrazing of huge areas. The cattle grazing of nearby forest areas either consumes or stomps the WEPs. It has resulted in the non-availability and non-sightings of some of the WEPs that were previously seen. For example, people must travel a long distance to collect the *E. lineolatum*, which is only found in areas that cattle have not reached.

Similarly, they highlighted that habitat destruction due to new developmental activities such as road construction and houses is another hazardous factor in threatening wild edible plant species because habitat destruction reduces the species' natural population. For example, orchid species are sensitive to habitat changes, and species are threatened worldwide due to habitat loss and fragmentation induced by anthropogenic activity (Dema and Dolkar 2022).

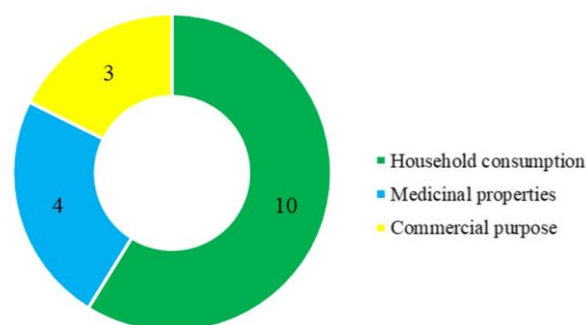
Unsustainable harvesting is also equally hazardous as overgrazing and habitat destruction. Respondents mentioned that the plants found abundantly a few years ago were hardly seen nowadays. For example, *P. polyphylla*, which used to be a popular and commonly found plant species, is hardly available where it was found before. The *P. polyphylla* is said to have significant therapeutic potential and is in considerable demand in the illegal market. Therefore, the availability of this plant species has greatly decreased due to overharvesting and commercial exploitation by the people in the community.

The people also highlighted that forest fire is another major threat to wild edible plants. Forest fires usually affect woody plant species. Forest fires have seriously impacted many woody species, with tree and shrub stands declining, and some destroyed entirely. Others are dried and collected as firewood, while freshly formed vegetative portions of woody species are over-browsed and stomped by overgrazing, causing significant damage to the species.

The people have rated agriculture land expansion and fuelwood collection as the least threats to the availability of the WEPs compared to other factors. Merak is at an elevation of 3,000 to 4,000 m above sea level, making agriculture activities difficult. Therefore, there is minimal agricultural land expansion, and it does not have a significant impact on the availability of WEPs. Similarly, the use of firewood for cooking and heating their homes has decreased dramatically due to electricity. Recently, this *Gewog* has been connected to electricity, and only a few villagers rely on firewood for cooking and heating their homes. In addition to electricity, some houses utilize Liquid Petroleum Gas (LPG) for cooking. As a result, the villagers have substantially reduced firewood consumption. Therefore, the firewood collection has a minimal impact on the availability of wild edible plants in the area.

**Table 2.** Priority ranking of threats to wild edible plants used on their degree of destructive effects

Threats	Total score	Rank
Overgrazing	146	1
Habitat destruction	141	2
Unsustainable harvesting	128	3
Forest fire	126	4
Fuel wood collection	105	5
Agriculture land expansion	98	6



**Figure 5.** Diversity of use of WEPs



**Figure 6.** *Gentiana urnula* collected for the consumption

In conclusion, an ethnobotanical study on wild edible plants used by ethnic people was conducted in Merak Gewog under Tashigang Dzongkhag. Merak is the home of *Brokpa* and relies primarily on animal products and wild edible plants for nourishment. The current study has recorded 16 wild edible plant species belonging to 16 genera and 16 families, indicating remarkable floral diversity. These plants are utilized for different purposes. Most WEPs are used for household consumption, while others are used for medical purposes, and some are sold in the market to generate income. Different parts of the WEPs are consumed, such as leaves, flowers, shoots, roots, rhizomes, and whole plants. This result indicates that the people of Merak have plentiful traditional knowledge of using wild edible plants with diversified eating parts and purposes. These WEPs have played a significant role in *Brokpas'* existence, depicting the strong relationship between the indigenous people and nature. However, many of the wild edible plants in the study area are under growing pressure due to anthropogenic and socioeconomic factors such as overgrazing by cattle, habitat destruction, unsustainable harvesting, and forest fire. This has resulted in the degradation of WEP species and the underlying indigenous knowledge. Therefore, the local regulatory system should be developed with the participation of the local people, considering their social practices and norms. Such a system might establish community-based harvesting sites and provide sustainable harvesting advice to the community to achieve food security in the future.

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