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Diversity of Wild Vegetables Based on Species and Use Values in Nepal

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Abstract

Forests are a vital source for diverse vegetables, particularly wild and non-cultivated varieties. The study assessed species richness, status, use values and availability across Nepal using focus group discussions in 30 districts (7 provinces) and key informant surveys in 11 districts. Species distribution was grouped at 500-meter altitude intervals. A total of 334 species of wild and non-cultivated vegetables, belonging to 99 families, were recorded. Bagamati reported the highest species number (174), followed by Lumbini (167), with maximum richness at 501–1000 m altitude (216 species). The availability of vegetables was high in summer and was the highest in the month of June. Among the total species, 276 were consumed fresh and 116 species were leafy vegetables. Widely and commonly used, as well as economically important vegetable species are Kaali niuro (*Tectaria coadunata),* Paani niuro *(Diplazium esculentum)*, Guchchi chyaau *(Morchella esculenta),* Bhudki chyaau *(Scleroderma citrinum),* Taamaa *(Dendrocalamus strictus),* Khole saag *(Nasturtium officinale),* Thotne *(Aconogonum molle),* Koiraalo *(Bauhinia variegata),* Sisnu *(Urtica dioica),* Kaande lunde *(Amaranthus spinosus),* Bethe *(Chenopodium album),* etc. On the other hand, Tusaa *(Arundinaria maling),* Main kaandaa *(Catunaregam spinosa),* Chhatre niuro *(Cyathea spinulosa),* Ruwaa saag *(Megacarpaea polyandra),* Baahkaane *(Clerodendrum cochinchinense),* Sipligaan *(Crateva religiosa),* Chiniyaa *(Macropanax dispermus),* etc. are highly localized and rare vegetable species. These species support indigenous and rural livelihoods and therefore require in-situ conservation and domestication for food, nutrition and health security.

Keywords: Distribution, Harvest month, Species richness, Wild vegetables

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Introduction

Nepal is situated in the central part of the Himalayas, between 26°22' and 30°27' North latitudes and 80°04' and 88°12' East longitudes. The country exhibits diverse topography and climate, encompassing 118 ecosystems and 35 forest types; 3 agroecozones and 15 agroecosystems (MoFSC, 2-14; Joshi et al., 2024). Agriculturally, 3 agroecozones are very important and they are High Hill, Mid Hill and Tarai (MoFSC, 2014).

The elevation in Nepal ranges from 60 meter above sea level (masl) in the eastern alluvial plains to 8,848 masl at Mount Everest. This wide range of altitudes contributes to significant diversity in flora and fauna. Nepal is home to a vast number of plant and animal species that hold national and global importance (Joshi, 2014, Joshi et al 2020, Upadhyay and Joshi 2003, MoFSC, 2014). The country boasts a rich variety of both cultivated and wild edible plant species, with many wild edible plants commonly collected from forests (Aryal et al., 2018, Kunwar and Bussman, 2008, Kkunwar et al., 2006, Shrestha and Dhillion, 2006, Uprety et al., 2012, Aryal et al., 2009).

Forests in Nepal serve as the most valuable asset, providing essential resources and representing the second major source of income after agriculture (Ghimiray et al., 2010). Forests serve as crucial repositories of food and other resources such as herbs, spices, timber, fuelwood, fodder, green manure, pesticides, and various other livelihood sources (MoFSC, 2014, Aryl et al., 2009, Uprety et al., 2012). The Raute, Chepang tribe in Nepal is an example of a community that still relies on forest resources for their livelihoods (Aryal et al., 2009, Libmu and Thapa, 2011).

All agro-ecozones in Nepal, except those above 5500 meters above sea level, which are permanently covered with snow (Tiwari et al., 2005), are home to various types of wild edible plants (ICIMOD, 2019, Dongol et al., 2017). People residing in rural areas and in close proximity to forests are particularly familiar with these wild edible plants. Senior citizens and indigenous ethnic communities living near forest resources possess extensive knowledge of numerous plant species that have been utilized for centuries. Many of these edible wild plants serve as staple food items, used for vegetables, Salads, pickles, beverages, fruits, spices, condiments, and medicinal purposes (Upadhya and Joshi, 2003, Aryal et al., 2018, Kunwar and Bussman, 2008, Kunwar et al., 2010).

Wild and non-cultivated edible plants, apart from timber, are naturally found in forests and the surrounding farmlands. They possess nutritive and medicinal values, and can contribute to fulfilling dietary requirements (Dangol et al., 2017, Aryal et al., 2009). According to the Food and Agriculture Organization (FAO), wild edible plants are defined as "plants that grow spontaneously in self-maintaining populations in natural or semi-natural ecosystems and can exist independently of direct human action" (FAO, 1999). These plants play a significant role in food security and livelihoods by providing staple and supplementary foods, as well as income-

generating opportunities for local communities (Aryal et al., 2009, Kunwar and Bussman, 2008). Even in the modernized world, these plants hold additional importance for rural, ethnic, poor, and marginalized populations.

Due to their wild nature, the number, abundance, density, and availability of many wild edible plants remain unknown to the general public, except for researchers and communities who have been consistently utilizing them for their livelihoods and well-being (Dongol et al., 2017, Ghimeray et al., 2010). Only a few of these plants have been domesticated for use as vegetables, spices, condiments, medicines, for religious purposes, and other food items (Upadhyay and Joshi, 2003, Joshi et al., 2022).

Among the wild edible plants, Wild and Non-Cultivated Vegetables (WnCV) hold significant importance and have been extensively used by Nepalese people since ancient times (Aryal eet al., 2018, Shrestha and Dhillion, 2006, Upadhyay and Joshi, 2003). Various types of plants found in forests, including timber and non-timber products, fungi, ferns, herbs, and creepers, are collected and utilized as vegetables. According to Dangol et al. (2017), 246 species of wild plants are used as vegetables. These vegetables can be categorized into roots and tubers, leafy vegetables, fruit vegetables, legumes, and so on. Edible form may be roots, tuber, corm, Rhizome, immature fruits, mature fruits, ripened fruits, seeds, young shoots, twigs, fronds, petioles, flowers, flower buds, inflorescence, piths etc. Some of the most popular ones include wild ferns, edible mushrooms, bamboo shoots, and wild yams. Certain vegetables also hold cultural significance, such as the consumption of wild yam during Maghe Sakranti, a festival celebrated as New Year by the Magar and Tharu ethnic communities. Bamboo shoots (Tama) are widely enjoyed by women during the Teej festival. There is also a tradition of consuming taro as a vegetable by female devotees after worshiping Rishi Panchami. The distribution, values, and harvesting months of wild and non-cultivated vegetable species vary across different districts and altitudes.

There is a pressing need to explore the largely untapped potential of wild vegetables in the face of climate change, which has severely impacted domesticated crops. With a limited number of domesticated vegetable species being cultivated globally and in Nepal, wild vegetables offer a nature-based, sustainable alternative that is more resilient and often richer in nutrients. However, these valuable species are under threat of extinction due to habitat loss, over-harvesting, and the dominance of industrial agriculture, leading to a significant loss of biodiversity. Despite their importance, there is a lack of comprehensive information on the diversity and uses of wild vegetables across Nepal, leaving a critical knowledge gap. By highlighting the diversity and use values of wild vegetables, this research aims to address species richness, distribution and, promote sustainable food systems, and improve nutrition and health outcomes in Nepal.

Methodology

This study was conducted by collecting both primary and secondary data. Primary information was collected through Focus Group Discussions (FGDs) in 30 districts based on checklist, namely Humla, Jumla, Doti, Dadeldhura, Bardiya, Baitadi, Dolpa, Gulmi, Banke, Dang, Surkhet, Rupandehi, Kapilvastu, Kaski, Lamjung, Tanahu, Gorkha, Dolakha, Kathmandu, Bhaktapur, Lalitpur, Rasuwa, Nuwakot, Dhanusha, Ilam, Sunsari, Morang, Dhankuta, Bhojpur, and Tehrathum (Figure 1). Among 30 districts, key informant interviews (KII) performed in 11 districts to verify the information generated through FGDs.

Information was gathered from three agroecozones, namely High Hill, Mid-hill, and Tarai (low belt). Purposive sampling was done to acquire data based on subjective judgment and consultation with experts. Additional information was collected from literature and online databases. A checklist was prepared, with species names documented based on data gathered through FGD, KII, and a review of existing literature. Species identification was carried out using a combination of morphological characteristics, insights from respondents, visual aids such as images, and supplementary information from relevant websites. This multi-faceted approach ensured accurate identification and documentation of the wild vegetable species. The major consulted literatures were Bastakoti and Sharma 2008, Ghimire et al. 2008, Shrestha 1998, MoFSC 2016, Malla et al. 1982, Limbu and Thapa 2011, Poudel and Joshi 2020, Acharya and Paudel 2020, Dangol et al. 2017.

From each surveyed district, the total number of species was listed, and family-wise richness was estimated. The number of species available for consumption was listed for each month, and these species were further grouped based on their use form, such as vegetables, pickles, salads, and dried. Species frequencies were estimated for different altitudes, districts, plant parts used, and different habitats/types. Altitude played a crucial role in the study of species distribution due to the microclimatic variations and diversity in vegetation types. To account for these factors, the species distribution was analyzed based on altitude ranges at 500-meter intervals, providing a detailed understanding of how altitude influences species diversity.

The availability period of each species was analyzed based on data from FGD, with the harvest month of each species considered to determine peak periods of availability in terms of both quantity and species diversity. Common and widely available species were identified by considering factors such as distribution, availability, market demand, and economic value, using insights from FGD, KII, and literature. Additionally, rare and unique species, found in specific niche areas with distinct traits, were documented.

The uses of these species were analyzed and explained based on respondents' insights, while the types of species were reported using information from literature, KII, and the authors' knowledge. Farmers were well-versed in the utilization of these species, including which parts to use and the appropriate timing for harvest.

Economic and market values of the species were assessed through FGD, and species that were most preferred by farmers and held high market value were identified and prioritized in the study.

Results

Species richness and distribution

Due to the diverse ecosystems and microclimatic variations, the number of species of wild and non-cultivated vegetables (WnCVs) varies across the districts and provinces of Nepal. A total of 334 WnCV species (Annex 1) have been identified in 30 out of the 77 districts of Nepal (Figure 1). The highest number of species was recorded in Bagmati province (174 species), followed by Lumbini (167 species) and Karnali (135 species) provinces. The lowest number of species (35) was observed in Madhesh Province. In Bagamati province, three districts; Kathmandu, Bhaktapur, and Lalitpur—have the highest number of WnCVs (96 species), followed by Kapilvastu, Rupandhei, Surkhet, Bardiya, Banke, and Dang. Dolakha and Dolpa districts reported 19 and 4 species, respectively.

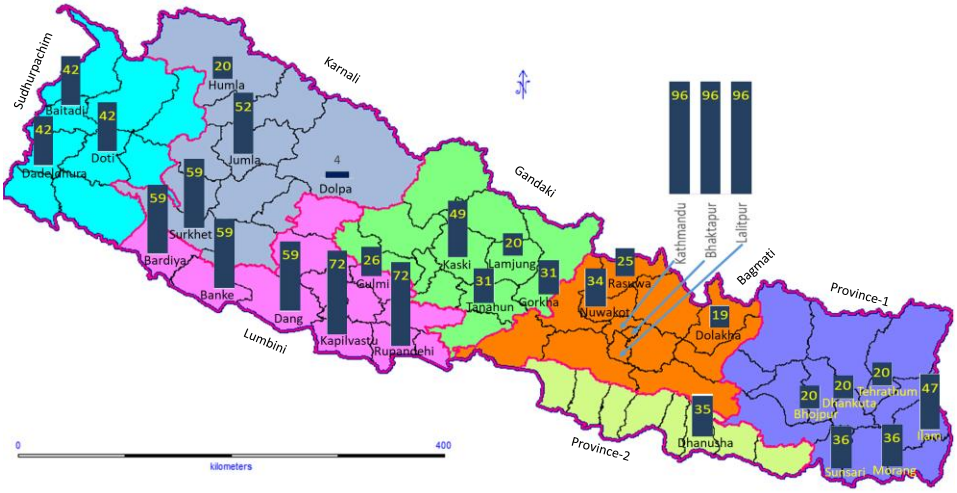

Fig. 1. Map sowing study sites (districts) with species richness of wild and non-domesticated vegetables (figures in bars)

Based on altitude, the highest number of species (216) was found within the range of 501-1000 m (Figure 2). The number of species gradually decreased with increasing altitude, with the fewest species recorded above 3500 m. Species diversity was higher in mid-range altitudes. These 334 species were distributed among 99 families. These species belong to Angiosperms (264 species from 69 families), fungi (33 species from 18 families), and pteridophytes (33 species from 12 families) (Figure 3). Among the total families, the most dominant one is Fabaceae with 21 species, followed by Polygonaceae (19 spp.), Araceae (14 spp.), Apiaceae (13 spp.),

Dioscoreaceae (13 spp.), Urticaceae (10 spp.), Amaranthaceae (9 spp.), Brassicaceae, Compositae, and Poaceae (each with 8 species). Eighteen families contain two species each, while 47 families contain a single species.

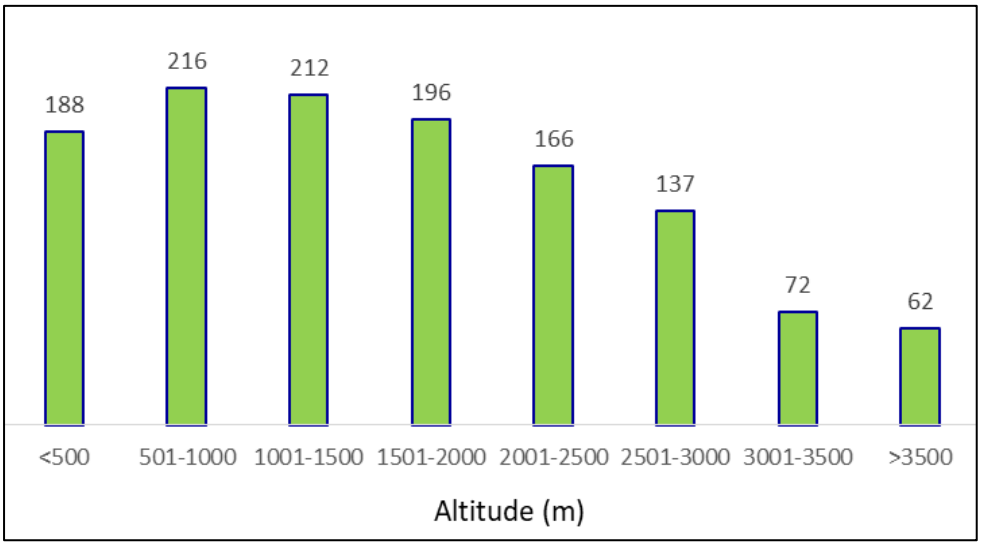

Fig. 2. Altitude wise frequency distribution of wild and non-cultivated vegetable species

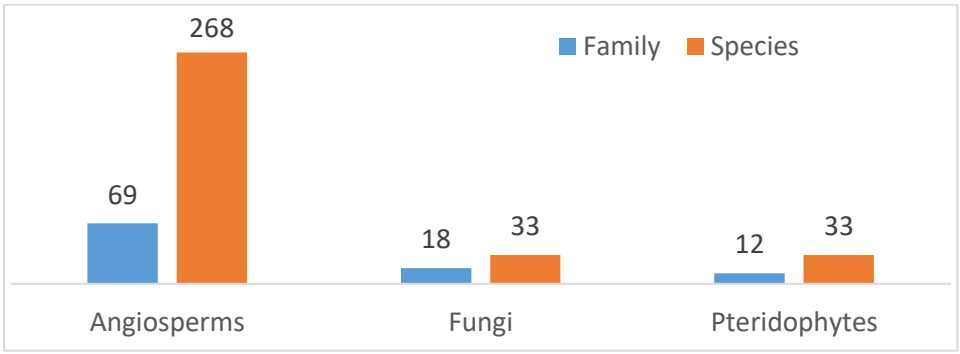

Fig. 3. Number of wild edible vegetables under different groups

Harvest period and availability

The number of WnCVs ready for harvesting in different months is depicted in Figure 4. WnCVs were available fresh throughout all 12 months in the country. The highest number of species was available in June, followed by July, May, August, and September. Conversely, the lowest number of species was available in November, followed by December. The summer season was particularly favorable for harvesting various wild vegetables, while around 50 different species could be collected during the winter season.

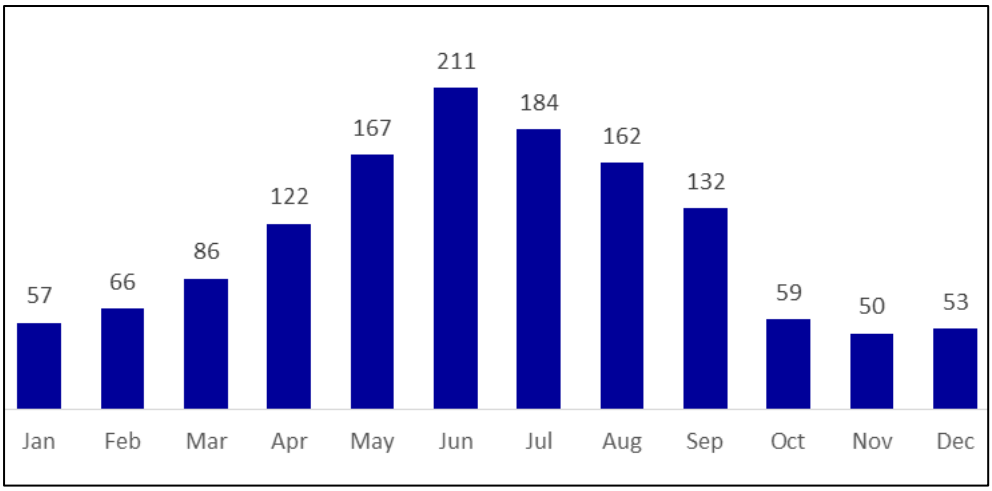

Fig. 4. Number of species available in a month for starting harvesting and collection for consumption, marketing and storage

Types and use forms

Out of the total species, herbs comprise the largest group with 165 species, followed by shrubs with 38 species (Figure 5). The remaining life forms of wild edible plants include trees (37 species), climbers (30 species), ferns, and fungi. These species were further categorized based on their use forms, such as pickles, raw consumption, spices, and cooked vegetables (Annex 1). The highest number of species (274 species) were used as vegetables (Figure 6, 7). Additionally, 35 species have been used for pickling, 19 species as spices, 16 species as staple foods, and 11 species consumed raw.

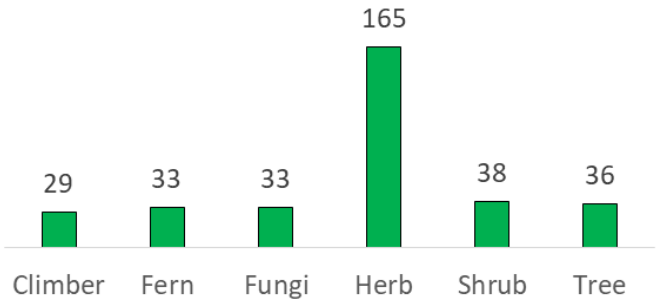

Fig. 5. Growth habit/ type-wise frequency distribution of wild vegetable species

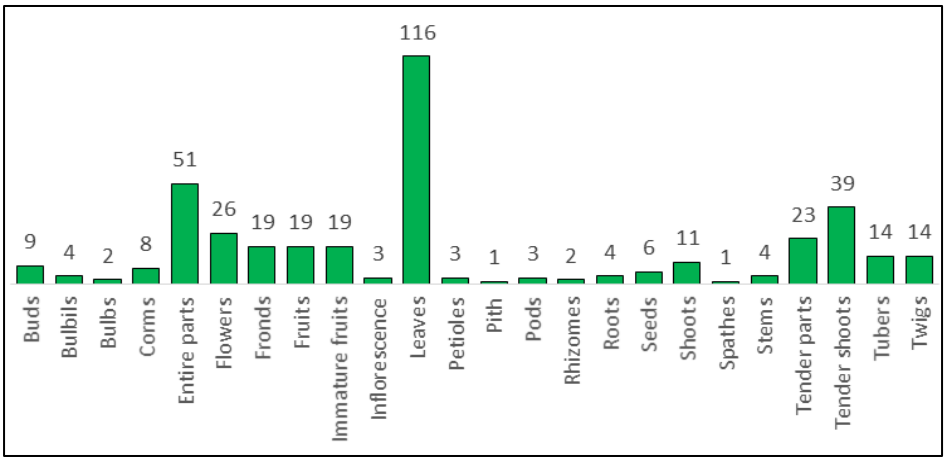

Fig. 6. Number of species based on types of part use (multiple parts of some species are being used)

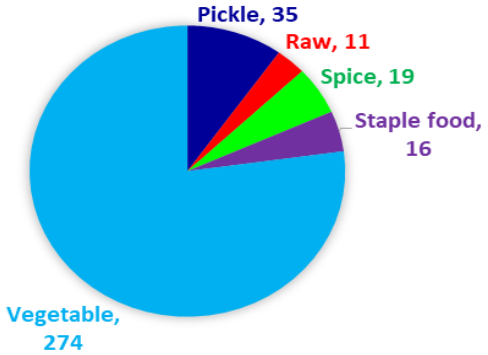

Fig. 7. Number of species used in different forms (some species have been used for more than one forms)

Economic and market value

A majority of households in the surveyed areas consumed WnCVs on a monthly basis. These vegetables played a vital role in providing tasty and organic options to many people. Some of these vegetables possess medicinal and unique values (Figure 8). The diversity of WnCVs also caters to the diverse needs of farming communities. Farmers had a deep understanding of the importance, collection time, and cooking methods associated with these vegetables. Some vegetables were dried and stored for future use or sale. Due to their natural properties, WnCVs also hold a higher market value compared to other cultivated vegetables. It was common for economically disadvantaged individuals to collect and sell WnCVs.

Among the 334 species mentioned (Annex 1), 48 species (listed below) have medicinal properties (DoPR, 2016). Traditional medical practitioners known as

"Vaidyas," who have worked in the palaces of Raajas/Mahaaraajas, have been using these plants as medicines since ancient times to treat people (DoPGR, 2016). Even today, in rural areas, more than 50% of the population relies on these plants for medicinal purposes. Elderly individuals, traditional healers known as "Dhamis" and "Jhakris," as well as ethnic communities in rural areas, who possess rich traditional knowledge, utilize these medicinal plants for various illnesses (DoPGR, 2016, Shrestha and Dhillion, 2006, Kunwar et al., 2010, Kunwar et al., 2006)). The following WnCVs are extensively used in Ayurvedic and modern medicine.

1. Aerial yam (*Dioscorea bulbifera* L.)
2. *Asparagus filicinus* Buch.-Ham. ex D.Don,
3. *Asparagus penicillatus* H. Hara,
4. *Asparagus racemosus* Willd.),
5. Bahunia *(Bauhinia malabarica* Roxb),
6. Banko (*Arisaema flavum* (Wall.) Schott)
7. Bethe (*Chenopodium album* L.)
8. Bhyakur, Kukurtarul (*Dioscorea deltoidea* Wall. ex Griseb)
9. Bir baanko, Chaite baako (*Arisaema tortuosum* (wall.) Schoot)
10. Black nightshade (*Solanum americanum* Mill.),
11. Cape gooseberry (*Physalis minima* auct.non. L.),
12. Castor oil plant (*Ricinus communis* L.),
13. Chari Amilo (*Oxalis corniculata* L.)
14. Creeping cucumber (*Solena heterophylla* Lour.)
15. Eclipta *(Eclipta*
17. Himalyan rhubarb *(Rheum australe* D. Don),
18. Jaringo (*Phytolacca acinosa* Roxb.)
19. Java fig (*Ficus lacor* Buch.-Ham.),
20. JImmu (*Allium hypsistum* Stearn)
21. Kage lasun, Jangali lasun (*Allium carolinianum* DC.)
22. Lata Kasturi *(Abelmoschus moschatus* Medik.)
23. Liquorice (*Glycyrrhiza glabra* L. Pennel),
24. Maale baanko (*Arisaema jacquemintii* Blume)
25. Malabar nut tree *Justicia adhathota* L.
26. Male fern (*Diplazium maximum* (D.Don) C.Chr.),
27. May flower (*Commelina pludosa* Blume),
28. Meda (*Polygonatum cirrhifolium* Wall. Royle),
29. Morel mushroom (*Morchella conica* Pers.),
30. Natal plum (*Carissa caranda* L.),
31. *Nun dhiki (Portulaca oleracea* L.)
32. Padamchaal *(Rheum australe* D. Don)
33. Plantago (*Plantago asiatica* subsp. erosa
34. Redball snakegourd (*Trichosanthes tricuspidata* Lour.),
35. Rough bindweed (*Smilax aspera* L.),
36. Rough bindweed *(Smilax aspera* L., *Smilax ovalifolia* Roxb. ex D. Don),
37. Rough bindweed (*Smilax ovalifolia* Roxb. ex D. Don),
38. Simal (*Bombax ceiba* L.)
39. Spanish needle (*Bidens pilosa* L.),
40. Stanley's wash tub (*Amorphophallus paeoniifolius* (Dennst.) Nicolson),
41. Taanki (*Bauhinia purpurea* L.)
42. Taapre, Chakramandi (*Senna tora* (L.) Roxb.)
43. Taarubaans (*Dendrocalamus strictus* Roxb. Nees)
44. Thotne, Thosne (*Polygonum molle* D. Don)
45. Thulo bihi (*Solanum turvum* L.)
46. Vanlasuna (*Allium wallichii* Kunth.)
47. Wild Asparagus (*Asparagus curillus* Buch.-Ham. ex Roxb.
48. Wild Garlic *(Allium*

prostrata L.), 16. Himalayan trillium (*Trillium govanianum* Wall. ex D. Don),	(Wall.) Z.Yu Li)	*carolinianum* DC.)

Morel mushroom (*Morchella conica* Pers.)

Indian pennywort (*Centella asiatica* Linn. Urbn.)

Wild edible yam (*Dioscorea hamiltonii* Hook. f.)

Himalayan bamboo shoot (*Yushania maling* Gamble)

Fig. 8. Economical, medicinal and unique WnCVs

Discussion

Diversity and distribution

The species richness of Wild and Neglected Crop Varieties/Wild and Non Culivated Vegetables (WnCVs) varies across the country. The diversity of these vegetables has been decreasing over the years, and the yield per harvest for each species is also declining. Only a few species can now be found in farming areas under the care of farmers. Comparatively, species diversity is higher in the mid-hill region compared to the high hill and Tarai regions. The mid-hill region experiences diverse climatic conditions, many niche pockets and possesses a higher variation in microclimates (Joshi et al., 2020, Dangol et al., 2017, Uprety et al., 2012).

However, due to the lack of proper guidelines and a policy framework, many species are being neglected from a conservation perspective. It is crucial to effectively manage forest areas, as well as other public spaces, to ensure the continuity of these WnCVs. Currently, approximately 44.74% of Nepal's total land area is covered by forests (mofe.gov.np). The existence of 118 different types of ecosystems plays a significant role in creating and maintaining diversity in WnCVs. These ecosystems harbor 3.2% of the world's flora, which includes 5.1% of gymnosperms and 8.2% of bryophytes (MoFSC, 2014).

Many different parts are harvested as non-timber forest products (NTFPs), including roots, tubers, leaves, bark, twigs, branches, flowers, fruits, nuts, seeds, gums, saps, resins, latex, and more (Ghimire et al 2008). In the mountains of Nepal, reports indicate that 10-100% of households are involved in the commercial collection of medicinal plants and other NTFPs. In certain rural areas, this activity contributes up to 50% of the family income (Ghimire et al. 2008.

Nepal, known for its biological and socio-cultural diversity, boasts a high diversity of NTFP species. It is estimated that there are over 2000 species of plants in Nepal are non-Timber Forest products (NTFTs) with potential usefulness, including approximately 1800 species are commonly used for medicinal purposes (Ghimire et al., 2008). Most of these plant species serve multiple purposes. Apart from medicine, around 500 plant species are estimated to be used as sources of food (Fruits, vegetable, Staple foods, pickles, salad, spice, condiments and other food additives based on field survey, experience and literature reviews during this study (Joshi et al 2020, Aryal et al., 2009, Dangol et al., 2017).

Uses and values

The diversity of WnCVs in terms of their uses and values is remarkably high. Climatic variation, traditional knowledge, and the presence of diverse ethnic communities are key factors driving this diversity. A wide range of WnCV species is consumed across the country, though their popularity and consumption patterns differ by region. Bamboo shoots (Tama/Tusa), ferns (Niuro), mushrooms (Chyau), and wild yam (Ban Tarul) are among the most commonly used and widely appreciated species throughout Nepal.

It has been reported that wild edible plants have comparable nutritive values to commercial fruits, making them a potential alternative source of nutrition for rural populations (Bajracharya, 1980b; Sundriyal & Sundriyal, 2001). WnCVs are unique in that they are freely available without any inputs or investments from humans. Farmers and consumers regularly collect these vegetables to meet their household requirements and generate income. Due to their natural origin, these vegetables are considered highly nutritious, delicious and healthy. They offer a wide range of nutritional benefits due to the diverse species and the different plant parts used as vegetables. Certain species are specifically associated with particular functions, specific consumption conditions, and special occasions.

WnCVs play a significant role in ensuring both food and nutritional security, as well as serving as a means of income generation through the collection and sale of these valuable vegetables (Aryal et al., 2009). With the increasing urbanization, a growing number of people living in urban areas are demanding forest products, including WnCVs, as they reminisce about their previous hometowns.

A study conducted by Bhandari et al. (2003) at Hokkaido University in Japan highlighted the nutritional and medicinal benefits of certain Dioscorea species,

including *Dioscorea bulbifera, D. versicolor, D. deltoida,* and *D. triphylla*, in comparison to potatoes, sweet potatoes, and Colocasia. The study found that these yam species contain approximately five times more protein than the aforementioned crops. Additionally, they were found to be rich in dietary minerals and to possess chemicals with potential therapeutic applications in treating cancer, diabetes, and heart diseases (Bhandari et al., 2003).

The study also revealed that domestic cooking methods effectively remove bitterness from bitter yams, rendering them palatable. Furthermore, the findings indicated that cooking these yams in a pressure cooker can eliminate up to 80% of toxic chemicals present in them. As a result, Nepalese wild yams have been recognized as "Health/Functional food."

In the Chepang community, the collection of various wild plant species is a common practice among households. These plants are utilized for home consumption, sale, and medicinal purposes, thereby contributing to the diverse uses and benefits of wild foods in the community (Limbu and Thapa, 2011).

It's important to note that while these findings highlight the nutritional and medicinal potential of specific Dioscorea species, our recommendations for most WnCVs include proper identification and cleaning. Some species may require processing, as well as appropriate preparation and cooking methods, to ensure safety and maximize their benefits. There are indeed numerous benefits to consuming wild edibles. Some of these advantages include (Aryal et al., 2018, Kunwar and Bussman, 2008, Uprety et al., 2012, Aryal et al., 2009):

- **Cost-effectiveness**: Wild edibles are freely available, which means they can be a cost-effective option for obtaining food.
- **Genetic Strength**: Wild edibles often possess genetic diversity and resilience, making them naturally robust and adapted to their environments.
- **Drought Resistance**: Many wild edible plants have longer root systems that enable them to withstand drought conditions better than cultivated crops.
- **Nutritional Value**: Wild plants and weeds can be more nutritious compared to hybridized store-bought produce. They often contain a variety of vitamins, minerals, and beneficial phytochemicals.
- **Immune System Support**: Consuming local wild plants exposes your body to the same organisms the plants have encountered, potentially providing benefits for your immune system.
- **Physical Activity and Exposure to Nature**: Gathering wild edibles through activities like wild crafting provides exercise and an opportunity to spend time outdoors in a natural and relaxing setting. It also allows for exposure to sunlight, which can contribute to vitamin D synthesis for urban people.

Gaps and issues

Unfortunately, there is still a lack of information on the quantity of WnCVs collected, the extent to which they meet vegetable demand, whether consumer demand for WnCVs is being fulfilled, and their contribution to the national GDP. Additionally, there are no established rules or regulations for the sustainable harvesting and management of these valuable wild vegetables.

The trade of wild and non-cultivated vegetables is poorly documented, despite ongoing collection and marketing activities throughout the country. Nepal's forestry sector contributes approximately 1.6% to the national GDP (MoALD, 2022), with about 5% of that attributed to non-timber forest products (NTFPs). Most WnCVs are classified as NTFPs. However, their trade values, health values, ecological yield, etc are not well explored and documented.

Threats and conservation approaches

Wild and non-cultivated vegetables (WnCVs) face two main threats: habitat loss and degradation, and overexploitation, including illegal harvesting. Factors like habitat destruction, invasion by non-native plant species, unplanned infrastructure development, forest fires, and unsustainable harvesting methods are leading to the loss of genetic diversity in both wild and cultivated areas. Many people remain unaware of proper collection, regeneration, and management practices, highlighting the need to raise awareness about conservation among local communities, consumers, and policymakers.

Invasive alien plant species pose another serious threat to WnCV diversity. Nepal is home to at least 219 species of non-native flowering plants (Tiwari et al., 2005; Siwakoti, 2012; Sukhorukov, 2014) and 64 animal species (Budha, 2015) that have become naturalized (Shrestha, 2016). Gravel mining from streams and riverbeds, along with the construction of large dams for hydropower projects, has also caused significant deforestation and forest degradation in the mid-hills and Siwalik regions.

Nepal’s fragile geology and steep terrain make it one of the most disaster-prone countries in the world (Dangol, 2011). Natural disasters like landslides, glacial lake outburst floods, and droughts are major threats to mountain ecosystems. Climate change, particularly in mountainous regions, is expected to have severe future impacts. Forest fires are another major issue, causing widespread ecological and economic damage, with over 30 districts in Nepal already affected. Developing an effective system for fire detection and monitoring is essential for managing forest fires and protecting WnCVs (ICIMOD, 2019).

In Nepal's federal political system, existing acts, policies, rules, and regulations aimed at promoting the sustainable collection, trade, and utilization of biological resources, including Wild and Non-Cultivated Vegetables (WnCVs), should be effectively implemented in close coordination with local authorities. It is important to highlight that the promotion, use, and marketing of indigenous vegetables can

enhance their conservation value while also helping to reduce food and nutrition insecurity, especially in rural and hilly regions of Nepal (Regmi, 2022).

Rural communities, indigenous ethnic groups, and senior citizens often hold valuable traditional knowledge about WnCVs, as these resources have been part of their livelihoods for generations. Active involvement of local communities in conservation efforts is crucial. National-level conservation strategies should be adapted to fit the unique conditions and challenges of different regions, ensuring their effective application.

Conclusion

Wild and non-cultivated vegetables play a significant role in providing nutritious natural products to human beings throughout the year. This is particularly important in countries like Nepal, where there is a high dependency on natural resources, especially in mountainous and agrarian regions. However, the high dependency on these resources also puts many species at risk of extinction, as their population sizes are commonly decreasing each year. While this study has provided a comprehensive exploration and illustration of the availability of wild and non-cultivated vegetables across the country, their nutritive value and contribution to the national economy (GDP) is still lacking, which is critical for justifying their importance. It is important for all concerned stakeholders to collaborate and make efforts to assess the nutritive and health value and economic contribution of these vegetables.

Wild and non-cultivated vegetables play a crucial role in ensuring food and nutrition security, as well as in supporting environmental sustainability. However, their management is often overlooked in many regions. Prioritizing the conservation and sustainable management of these species is essential. Many of these vegetables are suitable for domestication, which can help diversify traditional food systems. Regular monitoring of their status is necessary to implement timely and effective management practices. A comprehensive policy framework addressing the conservation and management of these species, both in the wild and on agricultural lands, is vital for their sustainable use. These valuable resources not only enhance food security and nutrition but also contribute to environmental preservation. Their proper management and conservation should be prioritized, requiring collaborative efforts to fully understand their nutritional and health value, and economic potential.

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