



Current Scenario of Wild Edible Plants (WEPs), their Importance, Possible Threats, and Conservation: A Mini Review

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Authors' contributions

This work was carried out in collaboration among all authors. Author DK conceptualize the review, RS prepare a primary manuscript. Authors AS, TJ and SR improvise the manuscript section-wise and all authors finalized the review. All authors read and approved the final manuscript.

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ABSTRACT

The knowledge of Wild Edible Plants (WEPs) is as old as human civilization and still, they are playing a supplementary role in global food security. WEPs are an integral part of their traditional food systems and have nutritional and cultural values in their routine livelihood. WEPs are increasingly considered a potential source of a naturally healthy diet. But in many cases, the available WEPs resources are under threat of various kinds like overexploitation, overgrazing, forest fires, agricultural encroachment, etc.; the changing climate also negatively impacts on WEPs. Therefore, there is an urgent need for the conservation of the diversity of WEPs and their

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sustainable management. The present mini-review is an attempt to present the current scenario of WEPs, their importance, and a potential source of nutrients for future food security, ethnic knowledge associated with them, threats encountered by WEPs, and their possible sustainable management scheme.

Keywords: Traditional food system; food security; sustainable management; ethnic knowledge.

1. INTRODUCTION

Since early civilization, humans use to consume wild edible plants (WEPs) which later became an integral part of their routine food. During their early evolutionary period, humans use to obtain their food by gathering eatable items from plants or plant parts (like roots, stems, leaves, flowers, seeds, etc.) and hunting animals. When the humans started settling by making huts and shades, they also started the domestication of some plants and animals [1]. Still, such types of traditions could be observed in different tribal communities across the globe [2].

It is now a clear fact that all the cultivated crop plants of today's era were ones known as wild edible plants (WEPs). After thousands of years of regular practice of cultivation by humans following the strategy of selecting more favorable traits of plants, some of them have reached the status of domesticated crop plants. With the emergence of domesticated crops, another term 'weed' comes into the picture. Weeds are the undesired plants growing along with crop plants. It was noted that most of the weed species are found to be the relatives of domesticated crop plants.

As per literature, the term "Wild", commonly indicates those species that grow spontaneously in self-sustaining populations outside cultivated areas, along the field margins, hedges, grasslands, and forest woodlands [3]. However, the distinction between "wild" and "domesticated" or "cultivated" is not so clear, and many WEPs fall somewhere in between these extremes depending on the degree of human intervention [4]. There are several plant species that are not domesticated to that extent but play prominent roles as good sources of food and nutrition by various local as well as tribal communities globally. There are a few examples that farmers use to grow a few wild species to meet their food and nutrition needs [5,6]. Under the WEPs, various communities across the globe consume leaves, flowers, fruits, nuts, legumes, pods, fruiting bodies of mushrooms, and other non-timber forest products [7].

The knowledge of WEPs is as old as human civilization and still, they are playing a supplementary role in global food security. But in many cases, the available WEPs resources are under threat of various kinds like overexploitation, overgrazing, forest fires, agricultural encroachment etc. Recent studies suggest that there are more than 7000 wild edible plant species that are being used for their multiple uses as food, nutrition, medicine, or environmental cause [8] and about 11% of them are under the threatened category of IUCN.

In this review, the authors tried to explain the term wild edible plants (WEPs) considering all possible dimensions [9] and elaborate on their importance to human beings and will also focus on the possible threats.

2. MATERIALS AND METHODS

For the present work, all the work related to wild edible plants (WEPs), their food values and nutrition, traditional knowledge associated with WEPs, and probable threats to the existing biodiversity of WEPs was collected from different online and offline journals included in various reputed databases like Scopus, WOS, Springer, Elsevier, etc. Later, the collected resource material was analyzed and interpreted critically and thematically presented in this mini-review. The related articles published in different databases were selected on the basis of their titles, abstracts, and text focusing on the reasons to include the reference in the present article and later screened by reading the full text and removing the references or part of it which do not meet the criteria of inclusion.

3. RESULTS AND DISCUSSION

3.1 The Importance of WEPs as a Source of Food and Nutrition

Since ancient days, wild edible plants (WEPs) continue to play a vital role as the principal provider of food and nutrition to sizable human populations particularly under the scarcity and

unavailability of main food crops. Further, many tribals and poor villagers residing in the vicinity of the forest depend on WEPs for their food, nutrition, and medicine [8–13].

The studies on various indigenous communities confirm the fact that wild edible plants (WEPs) are an integral part of their traditional food systems and have nutritional and cultural values in their routine livelihood [14]. Indigenous community peoples about 5% of the global population, are deeply connected to their land. Today these indigenous peoples are considered the sole custodians of rich and diverse traditional knowledge about how to use different plants, traditional food systems, and local biodiversity within the ecosystem range [15].

Indigenous communities also have a better ecological understanding of local environments and thus they could use the available food resources as per their requirement [16]. However, it was noted that the caloric contribution of WEPs is a little low compared to conventional staple foods [17]. But, these wild species contribute to diet diversification in many geographical regions which usually have different types of monotonous food systems, unique to that region [18-19].

The foods obtained from wild edible plants and plant parts usually contain a significant amount of mineral nutrients (Calcium, copper, iron, manganese, potash, sulfur, zinc, etc.) and different vitamins [17] required to support proper growth and development. These wild edible plants are otherwise neglected biological resources as the work in this field is comparatively less, but available reports indicate that these contain a significant amount of nutrients compared to available regional commercial crops [20,21]. If the nutritional potential of wild edible plants is properly assessed and managed, could be introduced as one of the main-stream foods; it might be a step towards food and nutrition security with nutrient adequacy. WEPs are increasingly considered a potential source of natural health products, therefore it is necessary to foster biochemical research on them and document their nutritional properties and main bioactive products [22,23].

If managed properly, Wild edible plants (WEPs) could also boost to empower the local market in turn local communities as it will reduce the distance between the producers and consumers. Further, it will also reduce the complete reliance

of the local market on the global market. Some major pieces of evidence indicate that the local trade and markets where the local minor crops, traditional varieties, and wild edible plants are traded, have the potential to empower communities and increase livelihoods in rural areas, particularly of women and youth [24-26].

The current global crisis of the Covid-19 pandemic reveals the importance of local markets and locally available wild edible plants as most of the global food systems and supply chains were affected adversely due to pandemic lockdowns [27-29]. Several workers reported that such a situation opens up opportunities for a new type of food system that supports the local traditional market [30,31]. If such situations create food shortages, peoples turn towards traditional foods and wild edible plants as an important available source of minerals and vitamins, and herbal ingredients [7-8,32,33].

3.2 Traditional Knowledge Associated with WEPs

If we knew and understand the nutritional importance of WEPs and the traditional knowledge associated with them, it might be useful that assist in the prioritization process. The availability of nutrient content and health-promoting properties of WEPs could help in developing local guidelines in different geographical patches. The collection of nutritional data from earlier references is daunting work [34]. The documentation and protection of traditional knowledge related to consumption and recipe preparation of WEPs are available largely to the local users, i.e., rural, indigenous, and forest-dependent communities, including local farmers and elder peoples. The national floras, herbaria, and ethnological studies of local ethnic groups also provide additional botanical, culinary, nutritional, and cultural information needed for research requirements to fill this knowledge gap.

Biological knowledge of individual species is also frequently lacking but particularly essential for conservation. One of the most recent and comprehensive attempts to fill the evidence gap in food composition data is provided by the GEF-supported Biodiversity for Food and Nutrition Project (BFN). Led by Brazil, Kenya, Sri Lanka, and Turkey, and implemented by Biodiversity International with support from the UN Environment Programme (UNEP) and the Food and Agriculture Organization of the United

Nations (FAO), the project has generated food composition data for 185 plant species, many of them wild, particularly in Brazil and Turkey [34,35]. Considering the significance and role of WEPs, they are considered as food for the future [36].

In a case study of Central India, authors have demonstrated that WEPs supplements significantly higher quantities of nutrients in the core zone compared to other zones. These are currently underutilized especially in buffer and transition zones and complement the local staple foods and partially supplement the essential macro- and micro-nutrients [7]. However, most of these WEPs have the potential to fulfill dietary needs and ensure balanced nutrition. Peduruhewa et. al. explained the potential of underutilized WEPs to cope with malnutrition and food insecurity, which are burning issues that need immediate attention [36]. About 71 wild edible plants (WEPs) belonging to 57 genera and 27 families from the semi-arid zone of Punjab, Pakistan were reported by Waheed et al. [35]. They further stated that most of these WEPs are also being used as ethnomedicinal plants for long and as seasonal wild vegetables that have high amounts of nutrition.

3.3 Threats to Wild Edible Plants (WEPs)

The researchers in recent past indicate that Wild edible plants (WEPs) are an integral part of local biodiversity and play a vital role in food security at the local level. Despite its importance, it was found that the diversity of WEPs is declining rapidly. To combat this issue, in 2019, the Food and Agricultural Organization (FAO) constituted "The State of World Biodiversity for Food and Agriculture (SOWBFA), an independent body to take care of and assess the diversity of food and agriculture [37].

According to the reports of FAO [37] and Royal Botanical Garden [38] changes in land use and management like conversion of forest-covered land area to agriculture, for industry and infrastructure development, habitat destruction due to grazing, forest fires, and overharvesting of forest products are some of the major causes of depletion in plant diversity including WEPs. These reasons account for about 62% of threats to WEPs which are growing beyond the range of protected forests [7]. Some workers also reported a decline in the abundance and diversity of WEPs from different areas [39,40]. Many

WEPs found to grow in agricultural lands as weeds, in hedges, as wild trees in agroforestry systems, and in some small forest patches [17]. The change in agricultural practices, including intensification, use of more pesticides, and removal of existing flora can negatively impact the existence of these biological resources [41,42].

The SOWBFA used the Sampled Red List Index for Plants prepared by the International Union for Conservation on Nature (IUCN) [41]. Under this project, a total of 822 WEPs species were considered across 7 different classes of which 73% are currently at low risk of extinction but some classes are highly threatened in the wild. However, the IUCN Red List Index for Plants includes global conservation assessments for only one-third (31%) of known WFPs. Furthermore, International Center for Tropical Agriculture (CIAT) as part of a larger study to identify conservation gaps for useful plants, an assessment of the comprehensiveness of conservation of 1587 WFP taxa was carried that showed only 3.3% of WFPs are sufficiently conserved ex-situ, while 89.1% require urgent off-site conservation measures [42]. Of the WFP taxa analyzed 42.1% are sufficiently conserved, 46.7% deserve medium priority and 11.1% require stepping up conservation measures [42]. Rapidly increasing temperatures and habitat destruction can alter the species' geographic distribution, driving them across the artificially designated boundaries of many protected areas in pursuit of favorable growing conditions.

3.4 Priorities and Integrated Approach for Conservation of WEPs

The conservation and sustainable management strategies of WFPs must include close collaboration with indigenous and local communities and tribes who are the main users and custodians of WEPs local diversity. It must have participatory research approaches that integrate traditional and scientific knowledge about WEPs; it will be most appropriate to maximize benefits for those communities or community peoples who are involved in the process. Before starting such work, the local community people should be made aware and they should agree on every aspect of the research process including methodology, analysis, and purpose of research or data collection [43].

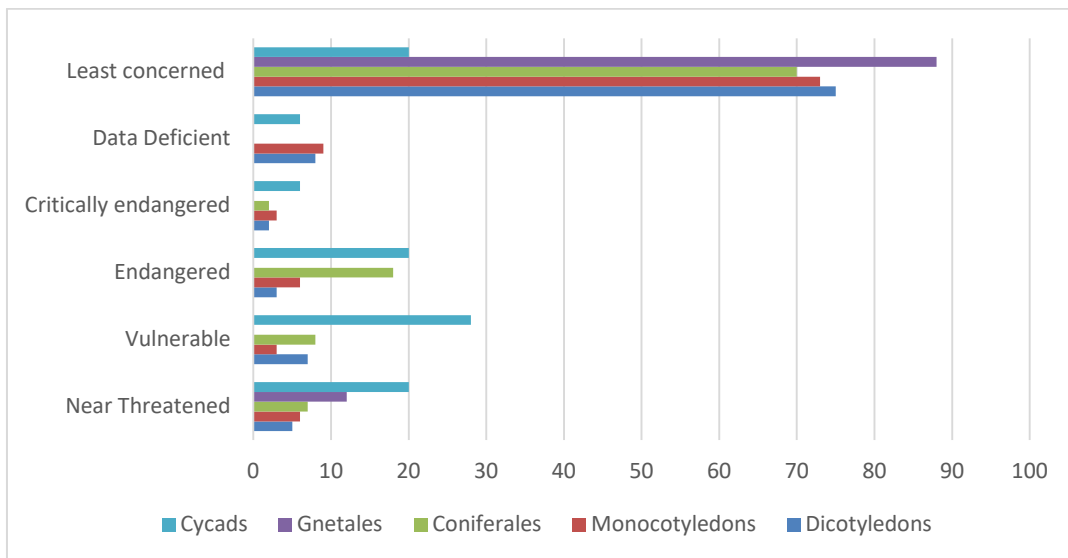


Fig. 1. Major plant groups and their IUCN status (2019)
(Note: All values are in percentage. Adopted from FAO (2019))

There are several reports on declining of WEPs from their habitats, local markets, and even from regular diets of different local communities. Therefore, their conservation and sustainable management for future food security is one of the very difficult tasks for the entire human community. For the sustainable management of WEPs, Borelli [35] proposed a highly appreciable scheme. It includes the challenges in environmental conditions, information, and infrastructure, and the practices to be conducted for sustainable management of WEPs. Reportedly there are over 20,000 species of WEPs across the globe; some of which are enlisted in the form of their respective references

in Table 1 as per the literature available [51]. Currently, we are utilizing less than 10% of these WEPs, others are declining due to mere negligence and less awareness of these species worldwide. For future food security, and to maintain the ecological balance these species must have to conserved. It is very urgent to conserve the diversity of WEPs using both in-situ and ex-situ conservation methods. For maximum utilization, we need to develop a specific knowledge system for WEPs and provide the required infrastructure and support (Fig. 2) to strengthen the developing system for the conservation and management of WEPs across the globe.

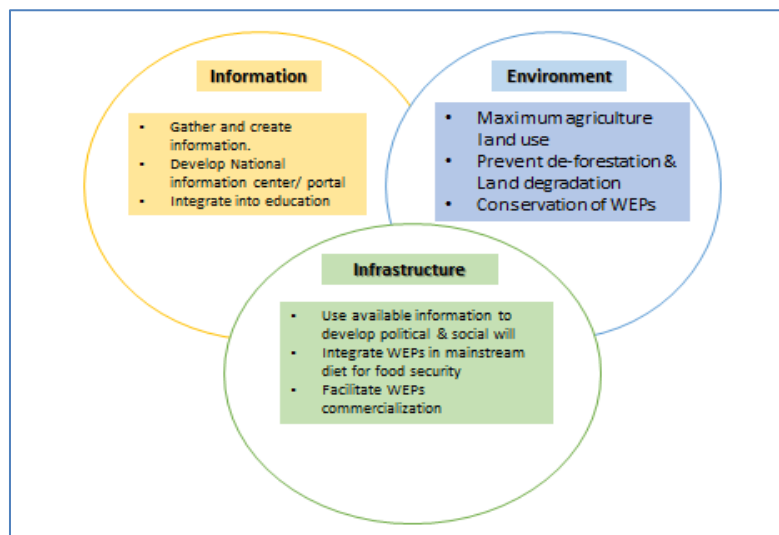


Fig. 2. Integrated approach to conserving WEPs

Table 1. Literature available on wild edible plants (WEPs) from different countries

Sr. No.	Country	Work done by
1	African countries (South Africa, Ethiopia, Kenya, Tanzania, Zambia)	[44,45,46,47,48,49,50,52]
2	America (USA)	[5,80]
3	China	[56,57,58,59,60]
4	European Countries	[61,62,63,64,65]
5	Asian Countries excluding China (India, Pakistan, Bhutan, Nepal, Srilanka, Thailand, etc.)	[53,54,55,66,67,68,69,70,71,72,73,74,75,76,77,78,79]
6	Australia	[81,82]

4. CONCLUSION

At the local level, Wild edible plants (WEPs) contribute significantly to the diets and livelihoods of millions of people worldwide. Several workers reported the importance of WEPs at the local level, but their national scenario and conservation assessment are not recorded, and thus it fails to convey the full utility of WEPs in food security and as a bioresource. As we do not explore the WEPs fully, their role in mankind is not fully appreciated and they remain neglected. There are limited cases that clearly demonstrate that the contribution of WEPs to food security, nutrition, and livelihoods is significant. Now it becomes a challenge to apply useful strategies for the conservation and sustainable management of WEPs. Further, we are unaware of how the changing climate impacts the WEPs now and in the future. For sustainable management of WEPs, we have to follow the integrated conservation approach. For the same, apart from their nutritional potential, medicinal values, and pharmacological importance must have to be considered to bridge the knowledge gap while strategic planning WEP's sustainable management. Further, it is essential to involve local communities in the conservation process of WEPs so that they could cooperate and will get the maximum benefit out of it.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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