Chapter 3
Wild Food Plants: History, Use, and Impacts of Globalization

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Abstract Wild food plants (WFPs) make significant contributions to food baskets and livelihoods of a large number of subsistence farming communities. Many rural households and forest-dwelling communities are dependent on WFPs as a subsistence strategy, especially during adverse conditions of food insecurity. WFPs have played an important role in livelihood opportunities and providing the required nutritional security to people enduring crop losses. In recent years, globalization has led to drastic changes in food systems/diets, which has had a major impact on health and malnutrition in many small and marginalized communities. Simplification and reduction in the diversity of diet, as expected of the globalization pattern, has led to food systems that are low in nutritional requirements but high in calorific value. Understanding the importance of WFP is critical for the region and the country. This chapter gives a broad overview of the importance of WFPs and their role in tackling food security and meeting the nutritional requirement of many marginalized communities. The WFPs are culturally deep-rooted in many communities across the globe. Detailed documentation on the nutritional and curative values, amount, part and time of collection, and phenology of WFPs is important. Re-establishing the intimate association with the use of traditional foods originating from trees and herbaceous plants could help in meeting the nutritional requirements. Incorporating indigenous knowledge may help in the sustainable management of WFPs along with meeting the needs of the communities. An integrated conservation approach is needed to document, protect, and promote WFP resources as well as ensure their accessibility for future generations.

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A. Kumar et al. (eds.), *Wild Food Plants for Zero Hunger and Resilient Agriculture*,
Plant Life and Environment Dynamics,
https://doi.org/10.1007/978-981-19-6502-9_3

Keywords Globalization · Wild food plants · Traditional knowledge · Socioeconomics · Sustainability

3.1 Introduction

Wild food plants (WFPs) are contribute to the diets and livelihoods of millions of people worldwide (Pfoze et al. 2012). The knowledge of their use has been passed on orally from one generation to the other (Shackleton 2003; Feyssa et al. 2012). The WFPs and the biodiversity around farms have been the only source of food and nutrition for a number of marginalized communities during crop failures caused due to droughts or floods (Ravikanth et al. 2020; Aditya et al. 2020). The term "Wild Food Plants" refers to any wild edible plants which are not cultivated but gathered or collected from natural forests and agricultural land (Cruz-Garcia et al. 2016). Many WFPs are found across different habitats with wide adaptability and high reproductive potential (Heywood 1999). The WFPs do not just provide calorific value, but are also a potential source of important nutrients and also serve as medicine for a large number of communities in rural areas (de Medeiros et al. 2021). Besides food and nutrition, WFPs also have socioeconomic value and are often associated with cultural identities (Agea et al. 2011; Harisha et al. 2021a). The WFPs are an important staple food for over 1000 million people in underdeveloped as well as in developing countries and play a vital role in their life (MEA 2005). Besides the use of the term 'WFP,' 'indigenous food plants,' 'wild edible plants,' and 'traditional plants' are also used in different regions of the world.

In this chapter, we discuss the history of WFPs and the impacts of globalization resulting in the loss of food diversity. With specific examples from southern India, we discuss the role of traditional knowledge, cultural, socioeconomic, and nutritional values associated with WFP. This chapter also provides a conceptual framework that incorporates the traditional conservation practices and tools for promoting sustainable use of WFP resources and its associated knowledge. Finally, we discuss the policy interventions needed to promote and conserve the use of WFP.

3.2 History and Culture of WFPs

A number of communities have depended on wild plants for food and other needs, much before the documentation of history (Lulekal et al. 2011). Many domesticated plants, which are now commonly cultivated, have originated from wild relatives (Zapata et al. 2014). The civilizations such as the Indus valley, Mesopotamian, Greek, Egyptian, Persian, Mayan, Roman, Aztecs, Chinese, and the Incas were centers of wild plant use and domestication (Vavilov 1935). Five centers of distribution and the origin of the domestication of food plants have been recorded in the world. These include central or southwestern Asia and mountainous regions,

South-eastern Asia, the Mediterranean region, Abyssinia and adjacent parts of North Africa, and Neotropical American highlands (Vavilov 1935).

In the early sixteenth century, a European botanist was the first to record the traditional use of plants and compiled it as a book on his observations while traveling across different continents. Linnaeus in the eighteenth century had compiled the writings of a number of herbalists and documented the collection as well as use of the plants. It was in 1855 that Alphonse de Candolle introduced the use of archaeological evidence in taxonomy and historical descriptions of plant morphology and domestication. It was later in 1952 that Hills described in chronological order, the historical use of wild plants.

In India, the Indus valley civilization was well known to be the center of the origin of plant domestication and use. A number of archaeological evidence suggests that the domestication of a number of wild plants occurred across the region around the river valleys. Apart from rice, barley, and wheat which were a staple diet, horse gram, black gram, wild mung bean, and pigeon pea were cultivated much before 5000 BC (Nene 2006). Through most of the subcontinent, agriculture was well-established by 6000–5000 BC. In 3000 BC, the central Indian plains across the Ganga River valley were the center of origin of the domestication of plants (Gupta 2004). In southern India, the domestication of legumes and finger millet has been documented independently in the Tamil cultural texts (Fuller 2011).

The Rigveda and the Atharvaveda, the ancient Indian manuscripts, have documented wild plant usage. However, many of these have largely focused on the therapeutic values and the medicinal properties of wild plants (Jain 1991). The Indian ethnobotany documented by Jain in1991 has described over 1500 wild plants and related traditional knowledge on their use (Jain 1991). Similarly, in Ayurveda, the history of plant usage has been documented, which also refers to the center of agro-diversity (Reddy and Vijaya 2002).

Around the world, many cultures have been identified by their affiliations to a particular region or to an animal or plant species (Cocks 2006; Madegowda 2009; Kothari et al. 2012). The dependence of humans and their survival has depended on the biodiversity of the region. People were largely dependent on the plant species that were found around them for food, shelter, and medicine, and this had direct relevance in recognition of peoples' life (Gadgil et al. 2000; Shackleton and Shackleton 2006; Sommano et al. 2011). The plant species around them have also played a significant role in shaping the cultural identities of the people and these are also called 'cultural keystone' species (Cristancho and Vining 2004). These cultural keystone species vary from one region to another and from one culture to another. However, many indigenous communities are closely associated with few species and depend upon them most extensively to meet their daily needs (Garibaldi and Turne 2004). Many of these species are rooted in their cultural traditions and have been inevitable components of social activities (Smith et al. 2019).

3.3 Documenting the Use of WFPs

Many WFPs have high cultural significance, indicating their major role in the traditional food systems of many indigenous communities. The critical role played by the WFP to rural livelihoods on a daily basis has been well documented. These WFPs have often served as a safety net in times of famine/distress to many indigenous communities. India is a biodiversity hotspot with a rich culture and indigenous knowledge among its 550 indigenous communities and 227 linguistic groups, who inhabit varied climatic and geographic zones (Grover et al. 2002; Scoones et al. 1992). Like other many south and southeast Asian countries, the indigenous communities in India depend on WFPs resources to meet their food need (Jain 1991; Ghosh 2003; Muthu et al. 2006; Shrestha and Dhillion 2006). For example, in a study conducted across eight villages in MM Hills Wildlife Sanctuary in Southern India, Harisha and Padmavathy (2013) documented a large number of WFPs being used by two forest-dwelling Soliga and Bedagampana communities. Their study using free listing exercises, household surveys, focused group discussions, and key informant interviews obtained both qualitative and quantitative data on WFP across these communities (Harisha and Padmavathy 2013; Harisha et al. 2021b). Their study revealed that these communities use over 126 plants for food and about 68 species for medicine, apart from using 32 species for making agricultural implements and in-house construction; they also trade 14 species for obtaining cash income and 26 species for cultural and spiritual activities (Harisha and Padmavathy 2013). Among the 126 WFP species recorded, 103 species (83.7%) were common across land use and forest types. There were 96 (78.5%) and 91 (73.9%) species distributed within the non-forest and forest habitats, respectively (Harisha and Padmavathy 2013). The largest number of leafy vegetables and fruits (81 species) were available and collected during the monsoon (May to October). Most tubers were collected in summer (February to April), and shoots and flowers were obtained in the winter season (November to January). The usage and seasonal availability of WFP were positively correlated (Harisha et al. 2021b). Thus, dependency and use of knowledge on WFP not only provide a safety net for rural households but also provides an opportunity for agro-forestry-based species conservation (Srivastava 2008; Ravikanth et al. 2020).

In another study on the cultural importance value of WFP using quotations, availability, and utilization frequency, Harisha et al. (2015) documented the parts used and multifunction food use indices in the same landscape. They documented the cultural index value, which captures the theoretical importance of a plant for two forest-dwelling Soliga and Bedagampana communities, whereas the index of relative importance value documents the multiple uses and intensity of plant use in daily life (Harisha and Padmavathy 2013; Puri 2015). However, the cultural index score of a plant might change independently from the relative importance of a plant or the economic value index. For example, depending on the availability of a species, there could be differences between the economic and cultural indices. Among the two species, *Acacia farnesiana* and *Dacalepsis hamiltoni* are culturally more valuable

than economic terms. The leafy vegetables scored high cultural index values followed by fruits and tubers. *Jasminum ritchiei* scored very high in cultural index value (2086.6), whereas *Blepharis maderaspatensis* (3.6) had the minimum cultural index value (Harisha et al. 2015). The mean cultural index was 365.0 ± 4.7 and more than 93 species scored greater than 100 cultural index value. Thus, it was seen that most WFP species used by the community had significant cultural importance (Harisha et al. 2015).

Based on quantitative relative cultural importance indices, the contrasting cultural significance of plant species to human cultures has been recognized (Garibaldi and Turne 2004; Reyes-Garcia et al. 2006). The acceptance of WFP with a very high to moderate cultural index could be delineated based on the relative high quotation, availability, partly used as well as multifunctional food use indices. For instance, many WFP collected and consumed as leafy vegetables have a bitter taste (*Senna hirsuta*), but scored high taste appreciation in MM Hills (Harisha et al. 2015). The older generation tended to appreciate their bitter taste and often related it to their medicinal value and health (Reyes-Garcia et al. 2006; Agea et al. 2011). On the other hand, the younger generation tends to ignore such bitter-tasting plants.

Many local communities have a number of ways of using WFP resources to meet their day-to-day requirements and overcome the ramifications by trial and error (Donovan and Puri 2004). As a result, they have rich knowledge of the usage of plant resources around their habitat (Bussmann 2006). Local traditional knowledge and practices can help in understanding and adaptive management and socio-ecological systems (Narayanan and Anil Kumar 2007; FAO 2014). However, local traditions of medicinal plant use and knowledge have been devalued and replaced by the modern allopathic system and state-sponsored practices of conservation. The institutional takeover of resources by the state/private sector, including the displacement or infiltration of local village institutions and market forces, further erodes traditional knowledge systems (Peters 1996). The erosion of traditional knowledge on WFP directly leads to negative consequences on biodiversity, especially in the case of common property resources like forests, wetlands, and sacred species (Ayyanar and Ignacimuthu 2005). In recent years, a number of efforts are being made to protect and revive traditional knowledge. For instance, traditional knowledge digital library has been created in India to document traditional ecological knowledge systems through nonspatial means.

3.4 Socioeconomic Status of WFPs

Rural livelihoods are characterized by the extent of contribution of each livelihood activity in the form of monetary or nonmonetary benefits. A monetary contribution to household livelihood comes from formal cash income through local wages, pensions, livestock, NTFPs collection, and seasonal migration as laborers to urban areas, etc. (Puri 1997; Lele 1998). A number of studies have shown that nonfarm activities contribute to more than 70% of the total livelihood of households in the

country (Rathore 2009). Historically, subsistence farming, collection of WFP for own consumption, and other forest resources used in day-to-day needs constitute nonmonetary benefits. The contribution of nonmonetary benefits to the total household's income is critically important (Reyes-Garcia et al. 2006). Specific linkages between a household's social, economic, and cultural factors play a significant role in resource use and have large implications for policy and livelihood opportunities for poor households (Shackleton and Shackleton 2006; De Laucena et al. 2007). However, there is a lack of detailed knowledge, resulting in a large number of WFPs being ignored in socioeconomic valuations and in the policy framework.

In India, WFPs are an important source to many rural households; unfortunately, their values are not accounted in for the economic analysis of natural resources (Puri 2015; Harisha et al. 2015). In a recent study, Harisha et al. (2021a) estimated the source of income at the household level for both the Soliga and Bedagampana communities. The income per capita per year from WFP income was ₹1459.6 for the Soliga communities and ₹1508.5 for the Bedagampana communities. It shows that income through WFP is as important as income from agriculture. The study also divulged that both communities equally rely on WFP for their dietary, therapeutic, and nutritional needs. Statistically, there was no significant difference in per capita income across both communities to the total household income (Mann–Whitney pairwise comparison, $p > 0.05$). Harisha et al. (2021a, b) study also revealed that WFPs are mainly used to supplement the staple diet and fill dietary gaps. The greater number of plant citations by both factions indicates a large consumption level and knowledge of these plants. At times of seasonal food shortages when household stocks are vacant and the new crop is still in the field, are the times of intensive collection and consumption of WFP.

The economic values of WFP have not been documented at the international or national or state level (Dovie et al. 2008). Many attempts have been made to assess the economic benefits of WFP (Bharucha and Pretty 2010). However, only a few studies have fully documented the economic valuation of WFP with the complexity of the quantitative assessment. Most of the data that is available has been secured from case studies carried out with individual local communities or community groups (Bussmann 2006; Eyong 2007). Moreover, many plant species collected are consumed through sharing or bartering and offering (Sundriyal and Sundriyal 2003; Scherrer et al. 2005). Therefore, it is essential to assess the economic value of WFP consumption in forested communities (Reyes-Garcia et al. 2006; Agea et al. 2011).

WFPs have been providing economic supplements for many generations in rural households. As agricultural yields have failed to meet dietary needs, increasing the use of WFP in the diet becomes crucial. The importance of evaluating the dependency and the economic value of lesser-known WFP is crucial and has been realized to a greater extent by the scientific world in recent years.

3.5 Impacts of Globalization and WFPs

Globalization refers to the increasing homogenization of the world's economy through the removal of barriers in international trade. Through globalization, regional economies, cultures, and societies have become integrated through transportation, communication, and trade. For the largest part of human history, information and knowledge about the WFP have been transmitted orally and by observation. However, globalization has changed the ways in which food is consumed (or what type of food is consumed), and this has profoundly affected ecosystems and human health. Globalization has led to accelerated loss of food biodiversity and degraded most ecosystems. A large proportion of the world's population in the tropical region suffers from hunger, and twice as many are devoid of a nutrient-filled diet. Simplification of diets, distinctive of the globalization pattern, has led to diets that are low in nutritional diversity but high in calorific value. While this food provides the required energy, they do not solve the problems of malnutrition and micronutrient deficiencies, particularly among poor segments of the population in developing countries. Intimate associations with the use of traditional foods originating from trees and herbaceous plants were lost because of globalization and industrialized approaches to farming led by corporate agribusiness. The loss of WFP consumption could also be attributed to social migration and rapid urbanization, which has had a severe impact on the dislocation of families and a significant increase in hunger, malnutrition, environmental degradation, and climate change. This has also led to the loss of traditional knowledge associated with the collection, processing, and consumption of WFPs.

Globalization has led to a significant change in food habits, lifestyle, and, more importantly, perceptions of using WFP. In a recent study, 89.5 ± 2.3% of people expressed a lack of sharing traditional knowledge across generations (Harish et al. 2021). Changes in lifestyle (84.5 ± 1.8% of people) and changes in food habits (71.0 ± 3.6% of people) were the major reasons for the change in the use of WFP. Despite the benefit of WFP in meeting food and nutritional as well as financial needs, changing lifestyles have resulted in a negative perception of WFP consumption. The younger generation has a negative perception with respect to WFP; consumption of it is considered uncivilized and a display of their poverty. Socioeconomic changes, in turn, have influenced consumption habit in cities and rural areas. Other studies too have reported a similar trend of the use of WFP as an indication of social backwardness (Agea et al. 2011). Several studies across the globe have shown higher reliance on store-bought food and marginalization of wild foods in many regions of the world (Orech et al. 2007; Centinkaya 2009).

In another study, both the Soliga and Bedagampana communities in Southern India depend on WFP resources that have been a part of their social and economic supplement (Harisha and Padmavathy 2013). However, changing socioeconomic conditions have resulted in a significant difference in traditional knowledge on the usage of wild plants across age class (68%), and gender (32.6%). There is also a significant difference in traditional knowledge on the usage of wild plants between

educated (61.5%) and uneducated people (38.5%), as well as between farming (58.4%) and nonfarming households (41.6%) in both communities. However, there was no difference in usage between low-income and high-income households. Their study showed a significant positive correlation between the number of WFP listed by people and age ($r = 0.696, p < 0.05$) indicating that the younger generation is less fond of WFP than the older generation. The local community gained knowledge about WFP utilization, processing, and management through experience. However, the younger generation seems to have less interest both in acquiring knowledge and in imparting the knowledge across generations.

Food sharing is another social characteristic of the indigenous food system that has been severely impacted by globalization. Harisha et al. (2021b) reported that the traditional communities, on average, shared 15 WFP with their neighbors in the village, eight species between villages, and five species between relatives or friends living in distant villages/towns. Regularly, eight species of greens, three species of fruits, three species of tuber, and one species of the shoot were shared. During drought or failure of food crops and economic or social or environmental crisis, sharing of WFP would happen more frequently (especially during rainy and summer seasons) than on normal days. Most members of the community (89%) felt that sharing is a part of their culture which was practiced by their ancestors and 11% of them reported that sharing WFP provides an opportunity to express their love and care between them. However, in recent years, this culture of sharing among the communities has gradually decreased despite their increased connectedness.

These prosocial interactions not only influence the welfare of the community but are also encouraged as social and ethical obligations (Agea et al. 2011). Food sharing has traditionally been considered a characteristic feature of human societies and morality since early hominids to modern humans, from hunting and gathering to agricultural practices (Agea et al. 2011). Sharing web is a social fabric that served as a safety net between families, households, relatives, and even across communities (Srivastava 2008). Sharing resources and information has been identified as a long-term strategy to balance and manage risk in the traditional knowledge system (Madegowda and Usha Rao 2014; Chaubey et al. 2015). However, over the years, the tradition of sharing has gradually decreased.

3.6 Health and Nutritional Benefits

Despite over a thousand species of plants being listed as edible globally, only 120 species are cultivated today. It is well known that only nine plants meet 75% of the human diet and over half of the human diet is composed of only three species such as rice, wheat, and maize (Redzic 2006; FAO 2014). This decreasing diversity and reliance on very few species has largely contributed to malnutrition and is making communities more vulnerable to climate change impacts (Pinela et al. 2017). Half of the 35 biodiversity hotspots are located in regions with over 20%

malnutrition representing one-quarter of the malnourished people in developing countries.

Over centuries, people have relied on WFP resources as a source of several important micronutrients. WFPs are nutritionally loftier than some of the cultivated crops (Parvati and Kumar 2002; Toledo and Burlingame 2006). Globally, insufficient use of fruit and vegetables has led to malnutrition causing 1.7 million deaths (Vishwakarma and Dubey 2011; Sansanelli and Tassoni 2014). There is a strong and direct relationship between a low intake of fruits and vegetables to higher mortality as well as a higher risk to major chronic diseases such as cardiovascular diabetes and others (Grivetti and Ogle 2000; Addis et al. 2005). WFPs provide low cost but quality nutrition and high food therapeutic value for large parts of the population in rural areas.

In the MM Hills region, Harisha et al. (2015) estimated 65% of the WFP as critical supplements of micronutrients. The majority of the WFP provided nutrient supplements of zinc and iron, especially in the leaves and shoots (Sudarshan 1998). Most fruits are rich in macronutrients and provide rare micronutrients such as calcium, phosphorus, and vitamins B and C (Grivetti and Ogle 2000; Parvati and Kumar 2002). Similarly, in summer, tubers provide the required carbohydrates (starch) and other micronutrients at the time of shortage of nutritive foods. The relative frequency citation index value of WFP ranged from 0.250 to 0.598 (Harisha et al. 2015). For 19 species, they evaluated the leaves and shoots, fruits from eight species, and tubers, flowers, and bark were evaluated from four species. *Boerhavia diffusa, Acacia farnesiana, Alternanthera sissilis,* etc. frequently used as vegetables, were reported to increase iron in the blood, reduce blood pressure, and improve eyesight, and in addition, were laxative and diuretic. Both communities have adopted WFP as a common ailment for many common sicknesses like fever, cold, cough, headache, stomach ache, ulcer, and skin allergies. Many researchers across India and other countries disclosed that WFPs are an important source of nutritional security (Dovie et al. 2007; Bhattarai et al. 2009; Sneyd 2013; Aditya et al. 2020). Harisha et al. (2015) also found that many fruits, leafy shoots, and tubers are vital nutritional supplements to the people's diets, especially during food scarcity. Their study revealed that many of these provide critical nutritional supplements, especially to women during their puberty as well as during childbirth.

3.7 Diversity and Food Security

Of 300,000 known higher plant species, 5000 are being used and of these only 20–30 species are regarded as a staple food for all of the human population (Cotton 1996; Heywood 1999). On the other hand, thousands of WFP species are used by humans. However, food security policies all over the world have not completely acknowledged the significance of the diversity of WFP, and this has often limited food security and biodiversity conservation. Recent studies have stressed that the drastic decline in biodiversity and the increase in global food insecurity should be addressed

together (Puri et al. 2006; Ravikanth et al. 2020). Tropical countries have potential genetic diversity of WFP, which can serve as food for the entire world if they are conserved and a systematic domestication process is undertaken (Delang 2006). The decline in biodiversity has led to lower dietary diversity and the elimination of essential food and nutrient sources, particularly for rural people (Gadgil and Guha 1995; Malik et al. 2001; Burlingame 2000). For example, in the MM Hills region, previous studies have documented 126 WFP species, belonging to 94 genera and 58 families (Harisha and Padmavathy 2013; Harisha et al. 2021a). An average of 50 species of WFP collected are from farmland, 64 species from forests, and 12 species from other land use. The six plant species which have the highest relative frequency citation (RFC) scoring are *Jasminum ritchiei*, *Cocculus villosus*, *Canthium parviflorum*, *Holostemma annulare*, *Celosia argentea*, and *Solanum nigrum* (Harisha et al. 2021a). Both Bedagampana and the Soliga communities consume a high proportion of wild leaves as greens which fall under the category of weeds (83%) and are often collected from forests, farms, wasteland, and kitchen gardens. Though weeds unlike invasive species are a human-perceived ecological concept, 88% reported that these plants have high nutritional value and since they have a high reproductive capacity, rapid growth, and a high range of adaptation to different environmental conditions, they could be harvested multiple times in a season.

Their study also indicated that fruits and tender leafy shoots were the most commonly used parts of WFP (78%), while flowers, tubers, and roots were the least used parts (Harisha et al. 2015). The WFP species belong to different lifeforms: trees, shrubs, herbs, climbers, and grass. The trees contributed 48%, while the grasses contributed only 1.5% of all the identified species. Herbs comprised 42.8% of WFP, most of which are seasonal leafy vegetables. Trees comprised around 26.9% of which are seasonal fruit-bearing trees, which are regarded as healthy by the tribal communities and a few are marketable. Shrubs (17.4%) were largely for seasonal fruits, followed by 11.1% climbers, which are seasonal tubers, greens, and fruits. The raw fruits were eaten, and others (herbs/shrubs and leafy shoots) were cooked before consumption. Trees (34%), shrubs (22%), and herbs (54%) were often the most frequently used as WFP (Fig. 3.1).

The diversity in the diet or dietary diversity increases the probability of consuming sufficient amounts of all food components essential to health (Bhattacharjee 2006; Pinela et al. 2017). Dietary diversity is defined as the total number of food groups consumed by an individual or household in a given period (Godfray et al. 2010; Muller and Almedom 2008). As human societies in developing countries suffer from malnutrition, enhancing dietary diversity would enhance health (Pardo-De-Santayana et al. 2005; Godfray et al. 2010). The community perceived dietary diversity practices in the indigenous food system as the most common adaptive mechanism that served as therapeutic ailments or medicine to many common diseases.

Other than the environmental factors and biology of the species, anthropogenic factors have a large influence on the distribution and diversity of WFP (Saha et al. 2014). Local communities have learned to use local WFP species, which are hardly

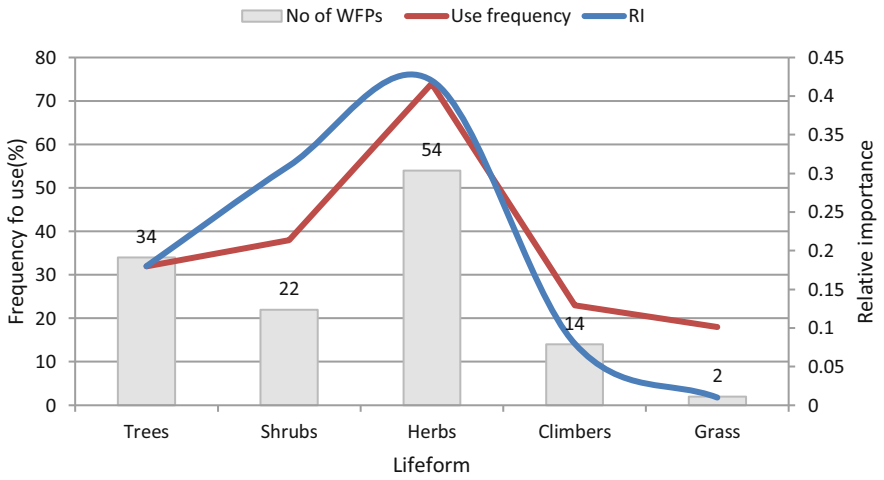

Fig. 3.1 The use frequency and relative importance across lifeforms of WFP species (Adapted and modified from Harisha et al. 2021b)

studied; even their identification and classification are in considerable confusion in the scientific community. The importance of these resources in a complex livelihood network, agroecosystems, economics, and restoration potentials are little known (Bawa et al. 2007; Bharucha and Pretty 2010). Therefore, most of the species which are documented have never been cultivated or domesticated, and agronomy is virtually unknown.

3.8 Conservation and Sustainable Use

Since WFPs are easily accessible, a lack of study on the community perceptions, practices, and monitoring has resulted in a poor understanding of the knowledge of WFP resources and their importance in the livelihood of the local community (Ghosh et al. 2007; Hamilton et al. 2016). There is a real danger of genetic erosion, which in turn calls for the need to assess the conservation status and threat of WFP. For the conservation of vulnerable WFP species, cultivation is often considered an alternative to wild collection (IUCN 2001). There is considerable interest in bringing endangered WFP and important therapeutic species into cultivation to reduce the pressure on wild populations.

A combination of scientific and traditional knowledge is required for the effective conservation of wild plant resources (Malik et al. 2001; Chaubey et al. 2015). It is important to involve the stakeholders and recognize their knowledge and practices to achieve sustainable use of natural resources and conservation. The intervention of new technologies and the neoliberal economy have been motivating exotic genetic resources' conservation rather than indigenous genetic resources. Indigenous

knowledge of WFP production, preservation, use, and therapeutic values are no longer transmitted to the next generation and are disappearing drastically. Overlooking of WFP is unfortunate since they have historically been better adapted to the local climatic condition than the introduced exotic vegetable crops.

3.9 Monitoring and Co-management

Local people gain knowledge on the use of WFP through their day-to-day interaction and experience with the resources they depend on. People's perception and their indigenous knowledge give more insight into the status and condition of the resources. This knowledge plays an important role in understanding and developing conservation protocols and management practices. There is a lack of research on the monetization aspect of WFP and the importance of local people's traditional practices and knowledge in the management of these resources (Mandal et al. 2010). There is no sufficient database on the conservation status, issues, and management practices of WFP species, which are common and open sources subject to over-utilization and poor management (Bawa et al. 2007; Christensen et al. 2008). Moreover, these resources are highly neglected and ignored in the conservation and socioeconomic assessment. These species are disappearing at an alarming rate in many parts of the world because of climatic variation, invasive proliferation, and anthropogenic and biological impacts (Castro and Espinosa 2015).

Many studies revealed that the intimate knowledge held by the forest-dwelling communities had been gained from generations with continuous interaction and observation (Rao et al. 2003; Donovan and Puri 2004). Many studies have suggested that communities' knowledge has been useful in the monitoring and management of the species under threat and in developing management practices (Acharya and Acharya 2010; Sinu 2013). It is important to engage the local people and their intimate knowledge in addressing conservation issues and better management of WFP resources. The fallow land and cattle sheds in the forest are in-situ conservation areas where the communities have been conserving WFP species by traditional practices. The backyard and farmland could be considered ex-situ conservation areas.

3.10 Challenges Ahead

Changed perception in the local community from a subsistence agriculture system to an economic and intended business system, and rapid development activities have led to changes in a microhabitat that has affected WFP resources in the landscape. Major changes in occupation, from traditional agricultural practices to migration and business, have increased the erosion of indigenous knowledge on the use of WFP. The loss of knowledge and WFP resources has resulted in reliance on store-bought

foods that have changed the diet composition of the local communities. These changes have led to the phenomenon of 'nutrition transition', which contributes to several public health problems and further burdens the food security of the local community, aggravating malnutrition.

There has been definite erosion of traditional knowledge and the disappearance of many WFPs due to modernization, globalization, and climate change. The WFP and related traditional knowledge systems have an important role in biodiversity conservation and sustainability in an era of global climate change. Nevertheless, it is underestimated and neglected in the economic assessment at the state and national levels. The local knowledge derived from long-term nature-society interactions has been extremely useful in validating scientific hypotheses and suggesting new research directions. The combined potential of traditional and scientific knowledge should be harnessed to validate, protect, promote, and develop a sustainable use strategy for WFP resources and related traditional knowledge. It would be an important tool to develop adaptation strategies to mitigate climate change impact and enhance the health of the environment and human well-being.

Understanding the distribution patterns, ecology, and ecosystem service of WFP is crucial for the region and the country. WFPs are the potential sources to tackle food security and potential sources of rare micronutrients apart from their established role in the sociocultural system. The local communities and policymakers together must lay down integrated scientific and traditional principles for a holistic approach to the conservation of WFP and ecosystem management. In-depth documentation on the therapeutic values, collection methods, phenology, and monitoring and non-monitoring values of WFP is important. Incorporating indigenous knowledge expands human understanding and may enhance biodiversity and resource sustainability for future generations.

3.11 Policy and Interventions

Until the neoliberal era, rural people had a simple linear integrated life with available natural resources and were satisfied with minimum components of human well-being. The bare necessities were fulfilled by natural resources using their traditional knowledge, which had been passed through generations. After globalization and privatization, traditional knowledge was opened up to the global market, making an impact on rural livelihoods that became inter-reliant and complex. In India, many policies about natural resource management and conservation strategies are based on separating the local people from their environment. Many conservation policies fail to address the linkages between the local people and their indigenous knowledge of ecosystem functioning, development, and human well-being. Policies that integrate scientific and local knowledge systems are vital for conserving and managing WFP resources. Effective implementation of such policies through local institutions is crucial and the best management strategy. Paying attention to the linkages and knowledge systems, which exist between local communities and the government,

would be the best practice to address the needs of the local communities successfully and to achieve sustainability goals in ecosystem management. Retrieving traditional knowledge systems through the provisions provided in the inclusive policies at the national level, and as indicated globally in the CBD, SDGs, and MEAs, would help conserve and promote WFPs. At present, there are three policy tools such as the Biological Diversity Act, the 2002 Forest Rights Act, 2006, and the legal framework of the Intellectual Property Rights (IPR) Act. These can be used to discuss ways in which traditional knowledge about the collection, use, and cultivation of WFP can be protected and promoted.

3.12 Conclusions

The dependency on WFP resources is inevitable and critically important to meet the dietary, therapeutic, socioeconomic, and cultural practices. The economic value of WFP for households is as important as the crops grown for subsistence. It revealed that households, which follow the traditional occupation, were still dependent on WFPs for food and other uses than households with nontraditional occupations. The reliance on WFPs is, therefore, a safety net and potential source of nutrition. Emphasizing the improvement of nutrition and health through initiatives that protect WFP diversity and related traditional knowledge systems is critically important. Towards this, a systematic review of WFP resources at the regional and national level with local consultation is necessary. Understanding the role of WFPs in the food, nutrition, culture, and economics of the local communities is very important. The benefits of WFP resources to the forest-dependent community in the semi-arid tropical region of the country are enormous and can no longer be neglected in national and regional resource accounting. Most importantly, to address the challenges posed by recent climate change issues, the financial crisis, and their implications on food and nutritional security, the use of WFP in the diet becomes crucial. Documenting the traditional knowledge of WFP use is necessary to gain information, facilitate its sustainable use, and increase its positive impact on community resilience. A better understanding of the degree of their significance in the new globalization, climate change, and policies has major implications for the socio-ecological system to achieve sustainable development goals (SDGs).

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