SUSTAINING LIVELIHOODS IN THE ARID MARGINS: ASSESSING THE DIVERSITY AND UTILIZATION OF WILD PLANT SPECIES IN LESSER CHOLISTAN, PUNJAB, PAKISTAN

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Abstract

Despite being in a fragile environment with a mostly heterogeneous ethnic group, the Lesser Cholistan desert rangeland has a high diversity of wild plant uses and a rich cultural background. The study's objective was to identify potential wild plant species, explore their socioeconomic applications, and understand their contributions to household income. The data were gathered through a questionnaire by interviewing local residents during a field survey of 95 respondents, employing methods such as group discussion, household surveys, key informant interviews, market surveys, and informant consensus. Statistical tools like Relative Frequency Citation (RFC) and Frequency of Citation (FC) were used for data analysis. Informants from Lesser Cholistan reported the use of 55 wild plant species from 25 families, comprising 8 tree species, 17 shrubs, 19 herbs, 10 grasses, and one mushroom species. The Poaceae family was predominant (6 spp.), followed by Chenopodiaceae (5 species) and Mimosaceae (4 species). These plant species served various purposes, with a strong emphasis on their use as livestock fodder (61.8%) and traditional medicine (60%). More than half of the species (52.7%) had multiple uses, with 36% used as human food (vegetables, fruits, and salad), 21.8% for firewood, 18.2% for sale in local markets, and 9.1% for ritual purposes. Certain plants, *including Capparis decidua, Prosopis cineraria, Zizyphus nummularia,* and *Calligonum Polygonoides,* stood out due to their versatility, serving as fodder, food, healthcare, and fuelwood while also contributing to income generation. These plants are considered prime candidates for domestication and further development. The present study reveals that the respondents used various wild plants for different purposes, helping them save money and earn additional income by selling the byproducts of local plants.

Key Words*:* Cash generation, Food security, Lesser Cholistan, Livelihood, Medicinal uses, Wild flora

INTRODUCTION

Nutrition and food security is a major problem that our planet is currently facing. Around two billion people are predicted to have micronutrient deficiencies, which increase their risk of health problems and act as a significant roadblock to economic growth (FAO 2012). Pakistan is facing acute food security issue as it is at 11th number among the most food insecure countries. However, the ecological zone of Pakistan shows exceptionally biodiverse climate with significant wild vegetation, which are frequently dismissed (Sunderland 2011). Poor individuals in rural regions have utilized a variety of strategies to overcome the adverse effects of poverty and improve their well-being. Most of these methods have focused on agricultural and nonagricultural natural resources of income, food, and housing (Mdiya et al. 2021).

People have a long history of adapting to natural environments and connecting with nature and other people. Wild flora had a significant influence in this. "Wild plants" are species that can be used by humans in a variety of natural or semi-natural settings but have not been cultivated or

domesticated (Aryal et al. 2018). These plants could be significant for household food security, health, nutrition, social security, and income generation, in addition to adding diversity to local food systems, enhancing culture, and contributing to diversity in farming systems (Aryal et al. 2009). Many wild flora parts, including delicate buds, fruits, nuts, roots, and leaves, are collected by the residents. These harvested plants are an essential source of energy and micronutrients for many aspects of rural living, and they also provide diversity to the human diet. Additionally, they have cultural importance; some are revered and used in rituals related to religion and culture (Pieroni et al. 2005; Powell et al. 2015; Shin et al. 2018).

Thorough study of the literature revealed contribution of wild vegetation in supporting the livelihoods and daily subsistence of residents from generations (Mwajombe et al. 2021). Natural forests provide 28% to 77% of family income, according to certain research (Angelsen et al. 2014). The compilation of case studies that explore natural earnings and their relevance to livelihoods encompasses both natural forests and the non-forest environment, which have a favorable impact on the diversification of rural livelihoods (Ellis 1998; Hickey et al. 2016; Broegaard et al. 2017). Seasonality, adaptive behavior, heterogeneous labor markets, inter-temporal savings, flaws in credit market, risk, and investment strategies, in particular, frequently diversify rural livelihoods (Ellis 1998). The level to which natural resources are utilized to raise living standards is determined by the markets that decide their exploitation (Feyssa et al. 2011).

Desert rangelands are used for a variety of reasons, including medicinal plants, thatch grass, grazing, wood for fuel and wild fruits. Thus, rangelands are important in supporting rural lives because they provide food security in terms of quantity and quality, as well as a source of financial revenue (Muregerera 2008; Vetter 2013). It does not have any exceptions, Cholistan desert rangeland have diversified xerophytic flora. In addition to being a source of food, fuel, and building materials, these xerophytes also act as a cure for locals' illnesses. Some of the plants are rapidly growing in economic significance because of pharmaceutical importance. For example, they can earn income and employment by selling fruits, leaves or other wild products. However, they are undervalued and contribute to livelihoods in a way that is not generally known and documented. This is due to the fact that most analyses of livelihood strategies focus on marketed products of cattle and crop production (Medias et al. 2021).

Resource extraction is hindered by remoteness due to higher expenses and a decreased likelihood of being entitled to wild resources and forest (Mamo et al. 2007). The use of wild plant species in relation to proximity to markets and wild resources is not well understood. In addressing this gap, we seek to advance discussion on the contribution of wild flora to household livelihood of people living to adjacent lesser Cholistan areas. Hence, this study is designed to discover possible wild plant species, as well as their socioeconomic applications and direct and indirect contributions to household income of peoples. The findings may help social workers, policymakers and program designers in developing a development strategy for the overall socioeconomic development of poor rural people through cultivation and conservation of potential wild resources. This study is also based on the framework shown in Figure 1, and the findings were analyzed using this framework.

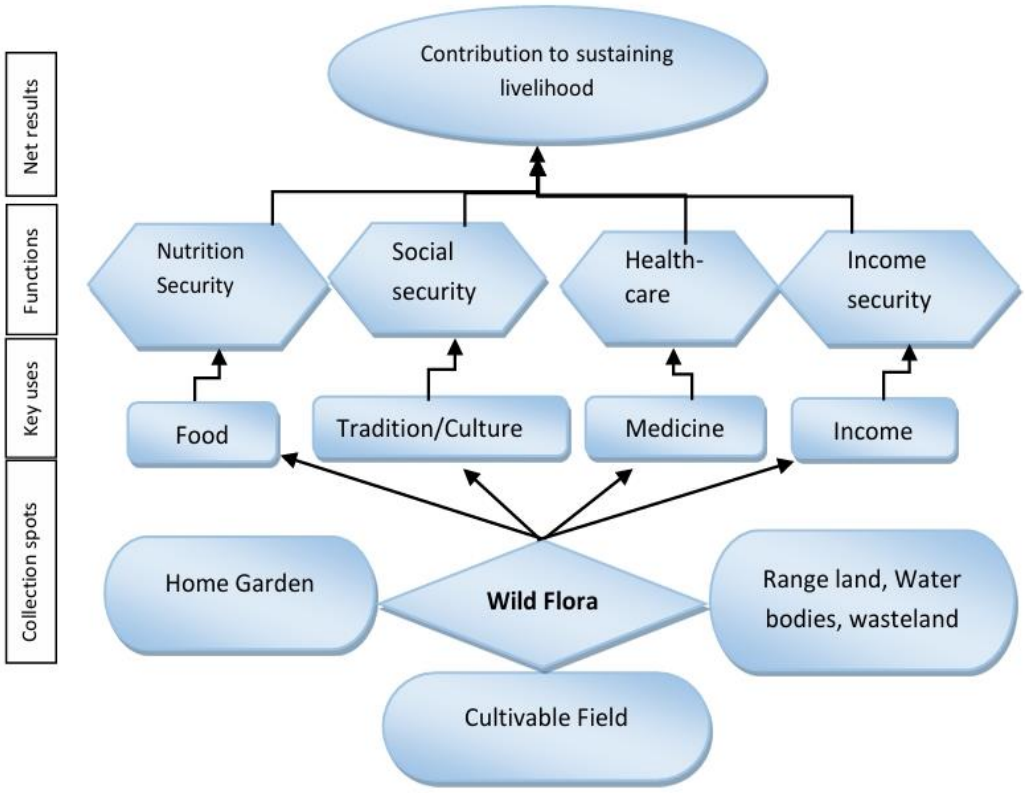

Figure 1: Multifunctional role of wild flora in livelihood support (Source: Modified and adapted from Ogle et al. 2001)

MATERIALS AND METHODS

General overview and geography of Cholistan desert

Cholistan Desert Rangeland was selected for this study since it is Pakistan's biggest desert rangeland in the south-eastern corner of Punjab province. This 26,000-square-kilometer rangeland geographically located at right ascension of 27°42' and 29°45' N ,69°52' and 75°24' declension east, located 112 meters above sea level (Arshad et al. 2008). The climate in this land goes from extremely hot in summer to mild in winter, with temperatures reaching above 50°C, with irregular rainfall which is unpredictable and scarce, typically ranging from 100 to 250 mm and falling generally throughout the monsoon season (July to September) (Akbar et al. 1996, Akbar and Arshad 2000). The region is separated into two geomorphic zones based mostly on soil, parent material and vegetation. The area divided into two geomorphic areas based mostly on parent material, soil, and vegetation. The northern section, which comprises the desert edges, is bounded by canal-irrigated lands covering around 0.78 million hectares known as lesser Cholistan (Akbar and Arshad 2000, CDA 2000).

The bulk of Cholistan area is in the district of Bahawalpur. As a result, the Bahawalpur district was specifically chosen for this study, with a predicted population of 1.55 million, accounting for 67.54% of the total area (Haider et al. 2021), and the research was conducted in permanent settlements at various range sites in the lesser Cholistan areas. Seven locations were selected from tehsil Yazman at different community level such as (Bawaria,

Muslim, non-Muslim, and Hindu Marwari) with the help of the local institutes or through the administrative staff of agriculture department at study area (Figure 1). The locals speak Sairiki and have shifted from livestock rearing to agricultural farming after Pakistan's Independence in 1947. However, animal husbandry is still the most common job in Cholistan region.

Sampling design and Research tools

From March 2021 to April 2022, a survey was conducted in rural regions of the Lesser Cholistan region. Group discussion, Household survey, Key informant interviews, Market surveys and informant consensus were used as research tool. Using random sampling method, ninety-five respondents (42 men and 53 women) were interviewed within the chosen area to gather information on wild plants, their uses and their socio-economic significance. Initially the well-equipped questionnaire was made in Urdu for easier recording with the participants. The questionnaire had three parts. The first part of the survey looked at household demographic and socioeconomic information's, such as gender, wealth, education, major occupation, age, and food sufficiency. The second portion discussed about direct and indirect uses of wild flora species and the third section devoted to knowledge regarding to their economic uses.

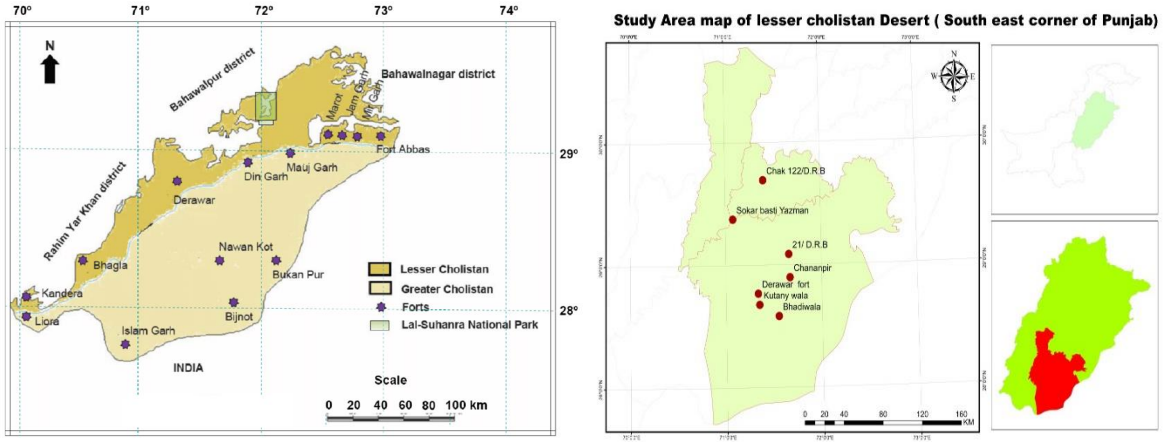

Figure 2: Area map of Lesser & Greater Cholistan (Mansoor Hameed et al. 2011)

In order to have a thorough discussion about the indigenous people's knowledge of using wild plants and local culture, 7–14 participants were purposefully chosen for the group discussion. The village chairman/numberdar was also present. Additionally, key informant interviews were conducted with significant informants including local species dealers, traditional healers, and farmers. The snowball method was used to select these 18 key informants (Leighton et al. 2021). Separate structured questionnaires were used for interviewing. The discussion location and time were chosen based on the informants' preferences. The economic importance of recorded species was also assessed based on their commercial and market level assessment. These Rural roadside markets offer valuable information on indigenous plant, their market rates, and usage trends. Data on socioeconomic conditions, cultural characteristics, and byproducts is obtained through observations, questionnaires, and interviews with plant dealers and consumers at market.

Data collection, preservation and identification:

Significant wild plants and their parts were gathered from the field surveys and labelled with local names. Standard botanical and ethnobotanical protocols were followed when collecting plant specimens and the species were identified with the help of rural residents and experts, while those that required more assistance and could not be readily identified were taken to the Cholistan Institute of Desert Studies (CIDS) at Islamia University Bahawalpur. The scientific names were obtained by consulting the literature (Abdullah 2020). A statistical record in terms of basic averages, percentiles, frequency of citations, and the relative frequency of citations were used to describe the research variables (McCullough and Heiser 2008). Additionally, the data was presented using the graphs, images and tables.

Frequency citation (FC)

According to Munir et al. (2022) the information provided by informants regarding local uses for a particular plant was regarded as a frequency citation.

Relative Frequency of Citation (RFC)

The importance of each wild species in the area was shown using relative citation frequency (Vitalini et al. 2013; Aziz et al. 2018).

$$RFC = FC / N \quad (0 < RFC < 1)$$

For each species of wild flora, the FC is the total number of peoples who declared it. There were N persons interviewed in total for this study.

RESULTS

Demography and food security

The analysis of the surveyed household data revealed that 55.8% (N = 53) of respondents were females while, 44.2% (N = 42) were males. The respondents' average age was 41.8 years. Furthermore, the majority of respondents were belonging to Muslim community share of more than 80 % followed by non-Muslim communities (Hindu, Christians and Bawaria). In terms of income source, education level, gender, age, and food sufficiency, residents of the chosen communities live in a variety of socioeconomic circumstances. Education level ranged from no formal education (53.7 %) followed by primary scholars (29.5%) and secondary scholars (11.6%) and lastly, tertiary scholars (post-secondary) (5.3%). Animal husbandry (41.1%) and agriculture farming (31.6%) were the primary sources of income for the studied families. The major crops of the area are mustard, barely, wheat, and cotton (Table 1). The income generate from these resources was not sufficient to sustain their livelihood throughout the year (Table 2). However, solitary 9% of households had enough food for the whole year, including the sailing of agriculture and livestock goods, gathering or sealing of wild flora species and other wool products.

Table 1: Demographic characteristic of key respondents in present study area (n=95)

Age (year)	No of respondents	Percentage	Education	No of respondents	Percentage
20-35	24	25.3%	Illiterate	51	53.7%
36-50	45	47.4%	Primary	28	29.5%
51-65	19	20%	Secondary	11	11.6%
66-80	7	7.4%	Post-secondary	5	5.3%

Table 2: Main income sources and food sufficiency level

Income source	No of respondent	Percentage	Food sufficiency /Months	No of respondents	Percentage
Agriculture	31	32.6%	1-3 months	7	7.4%
Animal husbandry	39	41.1%	4-6 months	23	24.2%
Labour	13	13.6%	7-9 months	56	58.9%
Business	7	7.4%	> 10months	9	9.4%
Jobs	5	7.3%			

Floristic composition

Informants consulted in lesser Cholistan region mentioned the use of 55 wild plants from 25 families of which 8 tree species, 17 shrubs, 19 herbs, 10 grasses and mushroom specie have been identified. In this study, informants consulted in lesser Cholistan region reported the use of 55 wild plant species from 25 families of which 8 tree species, 17 shrubs, 19 herbs,10 grasses and one mushroom specie have been identified (Table 3). The family poaceae contributed most to the total complement (6 spp.), followed by Chenopodiaceae (5 spp.) and Mimosaceae (4). Among the use categories, major proportion of these plant species are used as fodder (61.8%) for their livestock and followed by use as native medicine (60%).Twenty nine plant species(52.7%) are used for multiple purposes, twenty (36%) are used as human food (vegetable, fruit, salad) twelve(21.8%) for firewood ,ten (18.2%)are used for market sale and ,five (9.1%)are used for ritual values (Figure 3) and their life form frequency according to their use values are given(Figure 4). The multipurpose use of wildest flora is a distinct feature of the available knowledge such as *Capparis decidua (Forsskal.) Edgew, Prosopis cineraria (Linn.) Druce and Calligonum Polygonoides Linn* are used for fodder, food, human health care, fuel wood and are also source of income generation which made them highest among the prospective species for domestication, variety and perfection.

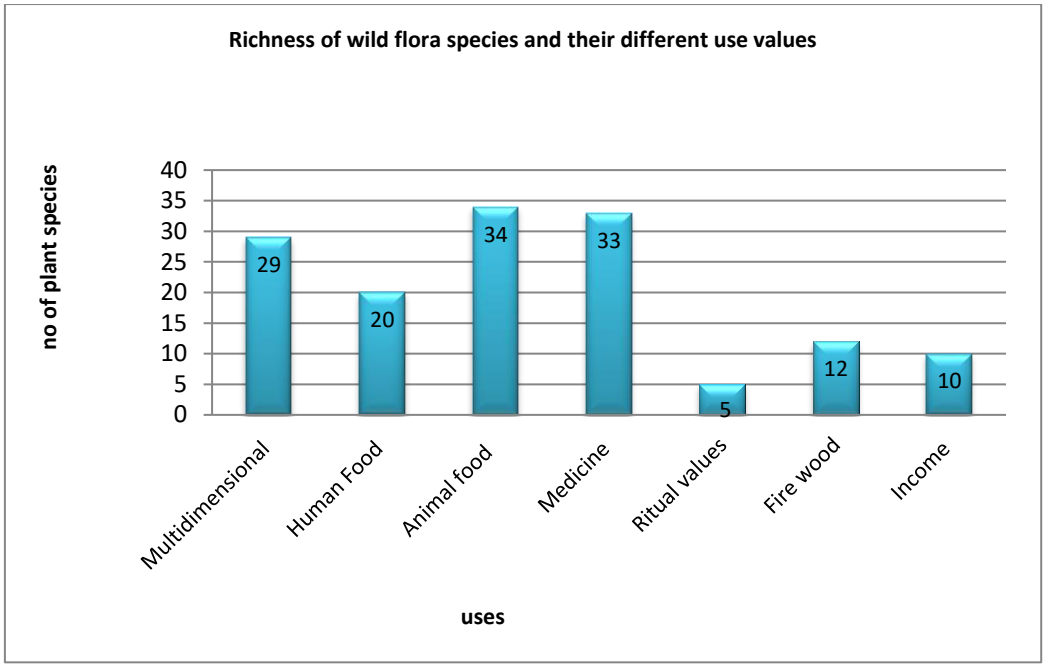

Figure 3: Different use values of wild flora species

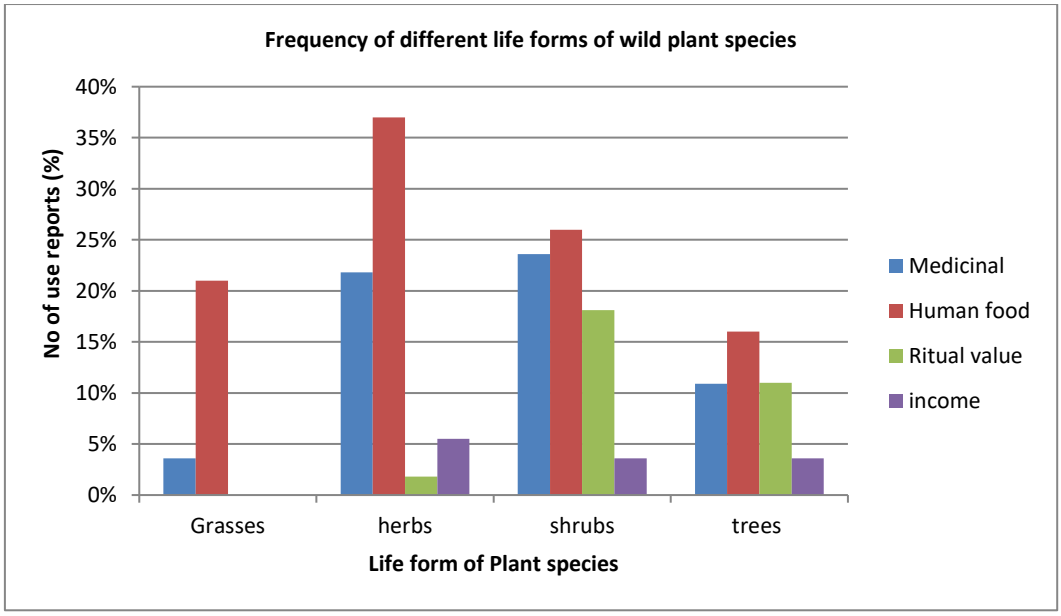

Figure. 4 Frequency of different life forms of wild plant species

Table 3: Diverse uses of wild Flora species reported in study area

Botanical Name		**Uses**					
	Habit	Human Food	Animal Food	Medicinal	Fire wood	Ritual use	Income Generation
***Calotropis procera* (Ak)**	Shrub		+	+	+		
***Withania somnifera* (Aksen)**	Shrub		+	+			
***Tribulus longipetalus* (Bakhra)**	Herb	+	+	+			
***Panicum turgidum Forssk.* (Bansi ghaa)**	Grass	+			_		
***Acacia jacquemontii* (Banwli)**	Shrub		+	+			
***Chenopodium album Linn.* (Bathu)**	Herb	+					+
***Corchorus depressus* (Bohphali)**	Herb			+			
***Aerva persica* (Bui)**	Shrub		+	+	+		
***Crotalaria burhia* (Chag)**	Shrub				+		
***Neurada procumbebns* (Chappari)**	Herb			+			+
Cucumis melo var.* (Chibbar*)	Herb	+		+	_		
***Ochthochloa compressa* (Chimbar)**	Grass		+				
***Zizyphus spina Christi* (Christ's-thorn)**	Shrub		+				
***Capparis decidu* (Deela ,Karir)**	Shrub	+	+	+	+		+
Ceschrus ciliarus (Dhaman)	Grass	+	+	+	_		
***Aloe barbadensis miller* (*Aloe vera*)**	Shrub		+	+			
***Tamarix aphylla* (Frash)**	Tree		+	+	+	+	
***Blepharis sindica* (Gandi buti)**	Herb			+			
***Dactyloctenium aegyptium* (Ghandhala Ghaa)**	Grass		+				
***Rhynchosia capitate* (Ghory wal)**	Herb			+			+
***Abutilon muticum* (Gidarwar, Akari)**	Shrub		+	+			
***Euphorbia prostrata* (Hazar-dani)**	Herb		+	+			
Zaleya pentandra	Herb		+	+			
***Salvadora oleoides* (Jal,wan)**	Tree	+	+	+			
***Prosopis cineraria* (Jandi)**	Tree	+	+	+	+		+
***Praecitrullus fistulosus* (Jangli Tendy)**	Herb	+	+				

Tephrosia uniflora Pers **(Jill)**	Shrub		+				
Sesbania bispinosa **(Jintar*)***	Legume		+				
Suaeda fruticose **(Kali Lani)**	Shrub		+	+			
Solanum surattense **(kanderi)**	Herb	+					
Abutilon muticum **(Kanghi buti)**	Shrub		+			+	
Haloxylon recurvum Bunge. **(khar)**	Shrub		+	+			+
Cymbopogon jwarancusa **(Khavi)**	Grass		+	+			
Leptadenia pyrotecnica **(Khip)**	Shrub		+	+	+		
Agaricus bisporus **(Khumbhi mushroom)**	Mushroom	+					+
Acacia nilotica **(Kikar)**	Tree	+	+	+	+		
Capparis spinosa **(Kubber)**	Shrub	+	+	+			
Haloxylon salicornicum **(Lana)**	Shrub	+	+	+	+		
Salsola baryosoma **(Lani)**	Shrub		+	+			
Portulaca oleracea **(lonak)**	Herb	+					
Stipagrostis plumose **(Lumb)**	Herb		+				
Solanum nigrum **(Mako)**	Herb			+			
Zizyphus nummularia **(Mallah)**	Tree	+	+	+	+	+	+
Prosopis juliflora **(Maskit)**	Tree		+		+		
Cenchrus biflorus (Muhabbat Butti)	Grass	+					
Panicum antidotale **(Murrat)**	Grass	+			_		
Withania coagulans **(Paneer)**	Herb			+			+
Ficus religiosa **(Peepal)**	Tree					+	
Calligonum Polygonoides **(phog)**	Shrub	+	+	+	+		+
Caralluma edulis (Seetu)	Herb	+					+
Lasiurus scindicus **(Ghorka)**	Grass		+				
Ocimum tenuiflorum **(Tulsi)**	Herb					+	
Citrullus colocynthis **(Tumma)**	Herb		+	+			
Echinops echinatus Roxb. **(Unt-Katara)**	Herb			+			
Prosopis juliflora **(Vilayati Kikar)**	Tree		+				

Medicinal use

Of the species documented in the study area, 33 wild plant species distributed in 19 families (Figure 7) were identified as potential sources of health care at the home level (Table 4). The ailments treated in the research locations using the indigenous knowledge system were classified as snake bites, wound healing, diabetes, fever and cough, stomach, renal disorders, skin diseases, arthritis, muscular contraction, and constipation. The most often used plant components were the whole plant (48%) followed by leaves (39%), and fruit (18%) (Figure 6) . Some species are preferred over the other because of their high economic use values and including *Echinops echinatus Roxb* (RFC= 0.30), *Cassia italic subsp*. *Italica* RFC=0.36), *Salvadora oleoides Decne* RFC=0.28), and *Neurada procumbebns* (RFC=0.27). Herbalists make traditional medicines, which are the most popular treatments for common ailments, while regional plant dealers sell flora to local markets to make money.

A: Field observation & Data Recording	B: Household Survey
	
C: *Morphological assessment of a wild medicinal plants*	D: Edible Fruiting part of *Calligonum Polygonoides*
	

Figure 5: Photographs view during field and household survey

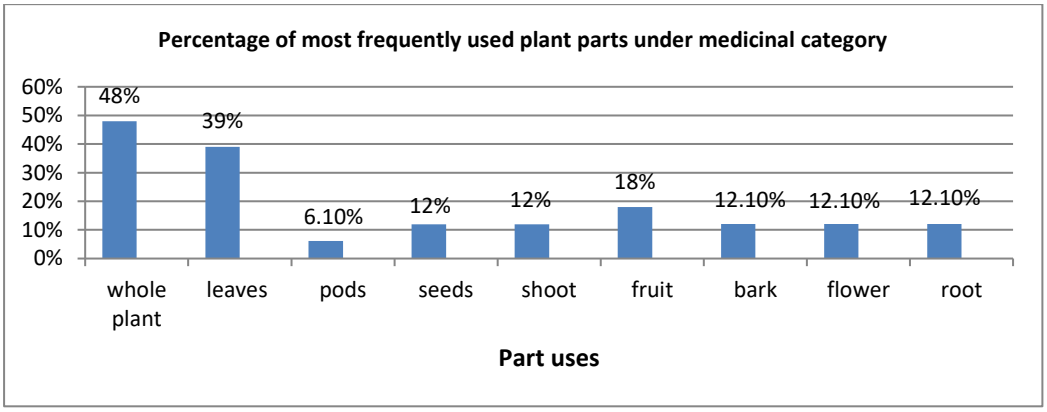

Figure 6: Most frequently used plant parts under medicinal category

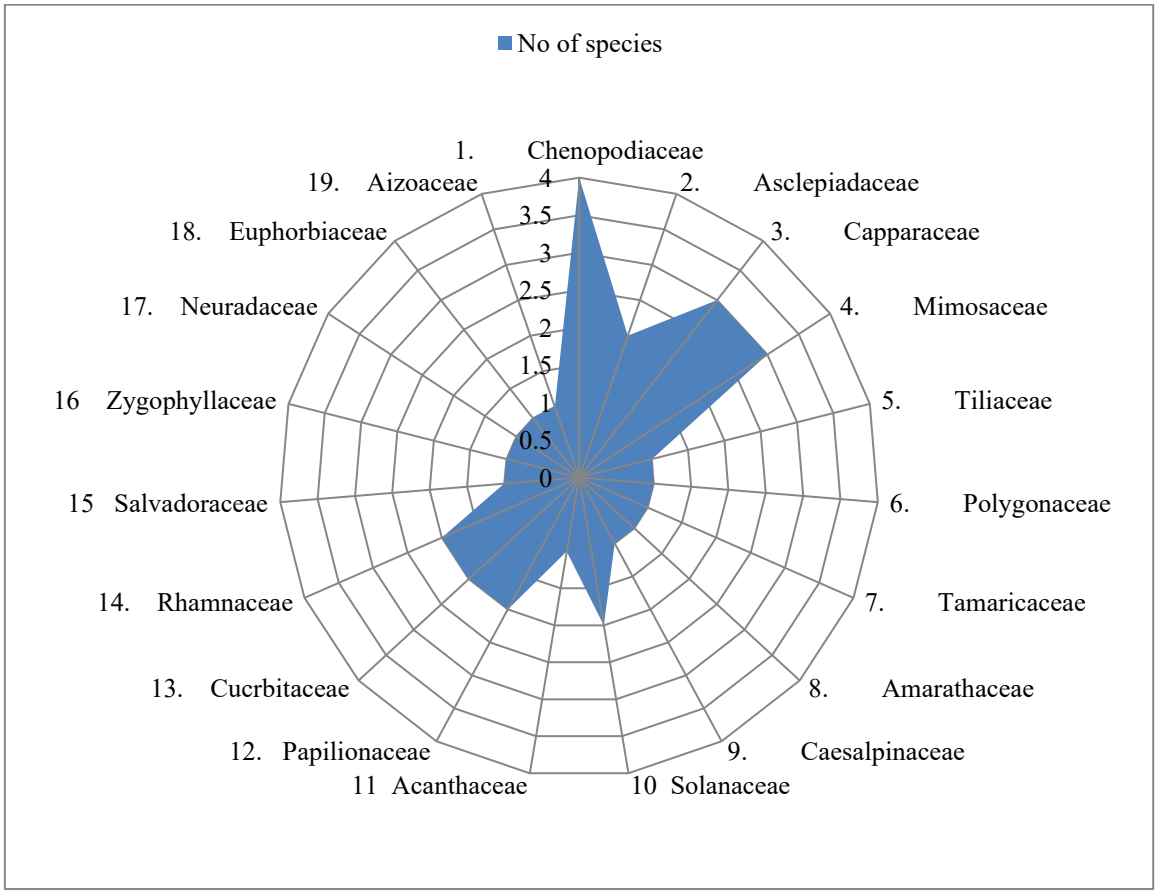

Figure 7: Families of plant species used for human health care

Table 4: Ten most frequently citied wild medicinal plant species for health care

Sr. No	Family	Scientific and local name	Plant Type	Coll. place	Part use	Remarks	Mar.	FC	RFC
1	Asteraceae	*Echinops echinatus Roxb.* (Unt-katara)	Herb	Wild	Whole plant	Used against jaundice ,liver disorder and for inappropriate diet	_	29	0.30
2	Caesalpinaceae	*Cassia italica subsp. Italica* (Ghoray-wall)	Herb	Wild	Whole plant	Used to cure joints pain, snake bite infection and constipation.	+	35	0.36
3	Malvaceae	*Echinops echinatus* (Gidarwar, Akari)	Shrub	Wild	Arial part	As medicine used to treat intestinal ulcers and urine infection.	_	33	0.34
4	Mimosaceae	*Acacia nilotica* (kiker)	Tree	Wild	Leafs, Pods, Seeds, gum	Use for skin disease and diarrhea. For sore eyes Leaves are used	+	25	0.27
5	Neuradaceae	*Neurada procumbebns* (Chappari buti)	Herb	Wild	Whole plant	As medicine. Used for low blood presser and heart disease.	+	26	0.27
6	Rhamnaceae	*Zizyphus nummularia (Burm. f.) (Mallah)*	Tree	Wild	Fruit seed, bark, leave	Used as medicine. Help out in wound healing or diarrhea.	_	29	0.31
7	Rhamnaceae	*Zizyphus mauritiana (*Beri)	Tree	Wild	Leave, fruit, seed	As medicine used to treat high blood sugar and hair roughness.	_	25	0.26
8	Salvadoraceae	*Salvadora oleoides (*Pelu)	Tree	Wild	Bark, flower and leaf	As medicine used to treat high blood sugar and stomachache and used for skin diseases.	_	27	0.28
9	Solanaceae	*Withania somnifera (*Aksen)	shrub	Wild	Fruit ,leaf and roots	As medicine used to treat knees pain, kidney problems and also used to enhance sex ability.	_	22	0.23
10	Tamaricaceae	*Tamarix aphylla* (Frash)	Tree	Wild	Whole plant	As medicine, used for leaver and skin problems and for sexual weakness.	_	25	0.26

Coll. place= collection place, Mark. = Marketing, RFC = Relative frequency of Citation, FC= Frequency citation, + = marketable, - , = nonmarketable

Human Food

We found that twenty of the 55 plant species were utilized as human food in different ways, including fruits, vegetables, pickles, spices, and bread (Table 5). *Calligonum polygonoides* (0.73), locally known as "phog," is the most prevalent and often utilized shrub as human food in the Cholistan desert with greater commercial cost. Collectors collect it and sell it for US$ 6.5/kg and its flower buds were used to form a highly appetizing meal known locally as "phugusi". *Capparis deciduas* (RFC=*0.63), Caralluma edulis* (RFC=0.52), *Cordia myxa* (RFC=*0.52), Chenopodium album* (RFC=0.42), *Salvadora oleoides* (RFC=*0.38)* and *Prosopis cineraria* (RFC=0.31), are the most often utilized edible plant species as per FC and RFC. Agaricus bisporus (RFC =0.53) is a high-value edible fungus. Collectors gather it and sell it to dealers for US$ 2.61/kg, who then sell it for more than double the price. Due to harsh conditions in the desert areas, the production of native edible fruit trees is incredibly poor. This could be one of the main reasons residents choose wild fruits and vegetables as a nutritional supplement.

Domestic and ritual use values

For domestic and ritual uses informants reported 18 plant species 13 for domestic use and 5 for ritual value , such tanning (*Calligonum polygonoides*), soda and soap manufacturing (e.g., *Haloxylon recurvum*), fuel wood (e.g ., *Haloxylon salicornicum)* rope and handicraft materials (e.g., *Phoenix dactylifera*) roofing ,house construction (e.g ., *Prosopis juliflora ,Leptadenia pyrotecnica, Calligonum polygonoides Linn, Acaica nilotica ,Tamarix aphylla .)* and for ritual use *Ocimum tenuiflorum* were recorded from the non- Muslim community present in study location as its considered as holy plant for them (Table 6).

Income from wild plants

The cash income analysis of wild flora species in current study allowed, determination of a span of 9 different wild plant species and 1 species of mushroom of high income generation in the Cholistan region (Table 7). The importance of these plants as cash income generators is based on their actual or potential value chain as vegetables (e.g.., *Prosopis cineraria*, *Calligonum polygonides, Agaricus bisprous, Caralluma edulis, Cucumis melo)* fruit (e.g., *Zizyphus nummularia)* , handicrafts (e.g ., *Phoenix dactylifera)* and medicine (e.g., *Rhynchosia capitate, Neurada procumbens Linn.)*.

Plant part usage for cash:

During the local market survey of lesser cholistan region, many different types of wild edible plants were noticed. These plants can be eaten and used for medicines. These comprised several kinds of raw flash fruits(*Capparis decidua), (Cucumis melo var.),* (*Zizyphus nummularia (Burm. f.*), (*Calligonum polygonides*),(*Caralluma edulis*), *(Phoenix dactylifera)* pods *(Prosopis cineraria).* Some plants also have a wide range of eatable greens, such as shoots leaves and stems such as (*Rhynchosia capitate), (Neurada procumbens Linn.*) and (*Aloe barbadensis miller).* Researchers noticed that wild vegetables and medicinalplants are only available during certain ti mes of the year, and that they were sparse for the majority of the year. The wild vegetables were normally not farmed, but instead collected from different places, including rangelands, arable fields, and even anthropogenic ally damaged regions like as roadsides and wastelands, during prolific seasons. A mushroom species (*Agaricus bisprous)* is very common and frequently appeared after rainy season.

Table 5: Ten most frequently citied wild edible plant species for food security

Family	Scientific and local name	Plant Type	Coll. Season	Coll. place	Collector	Remarks	Mar.	FC	RFC
Capparaceae	*Capparis decidua* (Karir)	Shrub	Apr-Nov	wild/ cultivateareas	Women	Fruit part used for making vegetables and pickles	+	60	0.63
Mimosaceae	*Prosopis cineraria* (Jandi)	Tree	Apr-May	Wild	Men	Dry fruit eating and pods are used as vegetable	+	30	0.31
Polygonaceae	*Calligonum Polygonoid* (Phog)	Shrub	April-Jun	Wild	Women and Men	Its fruit is called phugusi which is used as vegetable.	+	70	0.73
Amaranthaceae	*Chenopodium album* (Bathu)	Herb	Nov-Jan	wild weed interfere wheat crop	women	Leaves and stem used as vegetable	+	40	0.42
Mimosaceae	*Salvadora oleoides* (Jal,Pilu)	Tree	April-May	wild	Women & Children	Fruit bark, leaves are Edible	-	37	0.38
Apocynaceae	*Caralluma edulis* (Seetu,Pippun)	Herb	April	Wild	Men	Fruit for making vegetable and pickles	+	50	0.52
Boraginaceae	*Cordia myxia (Lasora)*	Tree	May-Juy	Wild/ Cultivated	Women	Barrie are used for making pickle	-	50	0.52
Capparacea	*Capparis spinosa* (Kubber)	Shrub	Apr-Nov	Wild	Men and women	Fruit and flowers for Cooking Vegetable	_	22	0.23
Agaricaceae	*Agaricus bisporus* (Khumbhi Mushroom)	Mushroom	July-Aug	Wild	Men	Fruit body used as Vegetable	+	50	0.53
Rhamnaceae	*Zizyphus nummularia (Beri)*	Tree	Dec-Jan	Wild	Children ,Men & Women	Fruit edible	+	12	0.13

Coll. place= collection place, Mark. = Marketing, RFC =Relative frequency of citation, FC= Frequency citation, + = marketable, - = nonmarketable

Table 6: Wild Flora used for Domestic and Ritual values

Family	Scientific and local name	Plant Type	Coll. place	Collector	Function	Remarks	Mar.	FC	RFC
Asclepiadaceae	*Leptadenia pyrotecnica* (Khip)	Shrub	Wild	Women	Fuel & Roofing	Used for house construction and fire wood	-	30	0.32
Polygonaceae	*Calligonum polygonoides Linn* (Phog)	Shrub	wild	Men, women	Fuel & Roofing	Used for tanning house construction and fire wood	-	40	0.42
Papilionaceae	*Crotalaria burhia* (Chag)	Shrub	Wild	Women	Fuel	Used as fire wood	-	20	0.21
Mimosaceae	*Acacia nilotica (Linn.)* (Kikar)	Tree	Wild	Men, women	Fuel & Roofing	Making room roof and fire wood	+	45	0.45
Amarathaceae	*Aerva javanica* (Bui)	Shrub	Wild	Men	Fuel & Roofing	Making room roof and fire wood	_	12	0.12
Mimosaceae	*Prosopis cineraria* (Jandi)	Tree	Wild	Men, women	Fuel & Roofing	Making room roof and fire wood	-	35	0.36
Mimosaceae	*Prosopis juliflora* (Maskit)	Tree	Wild	Men	Fuel & Roofing	Making room roof and fire wood	+	50	0.52
Salvadoraceae	*Salvadora oleoides Decne.* (Pilu,jal)	Tree	Wild	Men, women, kids	Fuel & Both for domestic and ritual value	Making room roof and fire wood and it's also ritually used to create a chunk stick referred to as miswak	_	29	0.31
Tamaracaceae	*Tamarix aphylla* (Frash)	Tree	Wild	Men	Both for domestic and ritual value	For bad evils they used *tamarix* wood to create. Making room roof and fire wood	+	60	0.63
Asclepiadacease	*Calotropis procera* (Aak)	Shrub	Wild	Men	Fuel	Used as fire wood	_	16	0.17
Capparidaceae	*Capparis decidua* (Karir)	Shrub	Wild	women	Fuel	Use as fire wood	_	19	0.2
Malvaceae	*Abutilon muticum* (Kanghi buti)	Herb	Wild	Men	Fuel	Use as fire wood	_	12	0.12
Chinopodiaceae	*Haloxylon salicornicum* (Lana)	Shrub	Wild	Men, women	Fuel	After drying Used as fire wood	+	50	0.52
Rhamnaceae	*Zizyphus mauritiana* (Beri)	Shrub	Wild	Men	Both for domestic and ritual value	wood use as fire wood and Leaves are used to bathe the deceased	+	70	0.73

Chinopodiaceae	*Haxloxylon Recurvum* (Khar)	Shrub	Wild	Men, women	Domestic use	Whole plant Used to make detergent	+	19	0.12
Lamiaceae	*Ocimum tenuiflorum* (Tulsi)	Shrub	Home garden/ Roadside	Men, Women kids	Ritual value	Hindus used Leaves as religious offer to gods and goddesses. Every morning and evening, most of women's worship it	_	14	0.14
Moraceae	*Ficus religiosa* (Peepal)	Tree	Road-side	Men, women, kids	Ritual value	Non-Muslim Women's worshiped to get rid of enemies.	_	14	0.14
Arecaceae	*Phoenix dactylifera* (Date palm)	tree	Cultivated	Men and women	Domestic use	Mat making	+	20	0.21

Coll. place= collection place, Mark. = Marketing RFC= Relative frequency of citation, FC= Frequency citation, + = marketable, - = nonmarketable

Table 7: Income from wild plants selling at local markets

Scientific name	**Collection time**	**Local price/per kg**	**Price US$/kg**	**Scientific name**	**Collection time**	**Local price/ per kg**	**Price US$/kg**
Prosopis cineraria	April-May	500	1.62$	*Neurada procumbens*	February - September	1500	4.87$
Calligonum polygonides	April-Jun	2000	6.58$	*Zizyphus nummularia*	December -January	100	0.32$
Agaricus bisprous	Frequently appeared after rainy season	800	2.59$	*Cucumis melo*	September-October	100	0.32$
Caralluma edulis	April	500	1.62$	*Phoenix dactylifera*	March – August	700	2.27$
Rhynchosia capitata	May -July	1200	3.89$	*Aloe barbadensis miller*	May – September	850	2.75$

DISCUSSION:

The present study determined the role of various vegetation species on the livelihood among the inhabitants of Cholsitan desert. The study depicted four major aspects on which local inhabitants were dependent upon wild vegetation resources. The most dominant was the medicinal use (60%) of wild plants for local health care, followed by food security (52.7%), during dry season and income generation by selling it for quick money. Our findings are consistent with similar research done in dry tropical deserts all around the world. For example, various studies conducted in Africa depicted that the local communities due to inaccessibility, poor infrastructure and lack of modern technology tend to depend upon wild plant resources for disease treatment income generation and cultural norms (Maroyi 2022, Semenya et al. 2020, Constant and Tshisikhawe 2018; Muregerera 2008).

Gender, education, age, and livelihood significantly impact indigenous knowledge, with women having a broader understanding of wild plant uses. However, most informants are illiterate, and the number of plants known to respondents decreases with higher education levels. This finding is consistent across various studies or research and depicted that knowledge is declining because of the new generation's lack of interest in this knowledge (Mosaddegh et al. 2012, Dulal et al. 2022).

The region displayed rich floral species (55) that belonged mainly to 25 families. Various studies in cholistan revealed a higher proportion of local vegetation species that could be related to tropical arid climate providing habitat for various xerophytic plant species (Malik et al. 2015). Species belonging to poaceae and Chenopodiaceae families were the most dominant as also confirmed by studies conducted in Cholsitan, Thal and Thar Desert (Asif et al. 2023, Ali et al .2023, Qureshi et al. 2008). It is due to the fact that the domination of these families is attributed to the endemic nature of these species and their traditional uses for the indigenous tribes for several reasons are obvious such as for livestock fodder (61.8%), fuel (21.8%) and construction (23.6%).

Most of the wild species obtained from the survey had significant medicinal values for socioeconomic uplift of communities and used to cure different aliments such as snake bites, wound healing, diabetes, fever, cough, stomach, skin diseases and many more by following specific traditional recipes. Similar used reports have been reported by other scholars while studying native flora of Cholsitan region, predicted the use of *Neurada procumbens* for sexual dysfunction and debility, as a cooling agent and for the stomach and the majority of locally available medicinal herbs had an anti-diabetic potential (Hameed et al.2011, Qureshi et al.2011, Shamim et al. 2022). Unfortunately, modernization has begun to erode interest in traditional methods, and it has been determined that many native species are endangered because of overharvesting, grazing, and low rates of reproduction under harsh environmental conditions (Hameed et al. 2011).

Global food and nutrition security is ensured by plant biodiversity (Gee et al. 2020). The indigenous edible wild plant can supply consumers with a more diversified variety of nutritionally high-quality components (Datta et al. 2019) and can boost the nutrient content of low nutrient diets (Pereira et al. 2011), resulting in health advantages (Marrelli et al. 2020, Mateos-Maces et al. 2020). According to my latest findings, around 45% of respondents in the study area relied on wild plant species to cover their yearly food needs for 1-3 months. This highlights

the role of wild flora in supplementing the diet and contributing to the nutritional well-being of local people in Cholsitan. These findings support the importance of conserving and commanding native wild edible plants is promoted to enhance food availability and nutritional value locally.

Some extant wild-range plant species (18.2%) have commercial importance, get access to markets, and some offer significant revenue for harvesters, while others provide additional, typically seasonal, income. Our results are in accordance with other studies conducted in many parts of Brazil (Gonçalves et al. 2021), China (Cheng et al. 2022), India (Panda et al. 2023), and Pakistan (Yaseen et al. 2018), which revealed that gathering wild plant products is an important way for rural livelihood. Moreover, the sale of these wild species at local markets functions as a notable forum for the transmission of traditional knowledge between sellers and buyers.

We acknowledge that respondents in the research area of the lesser Cholistan region have used uncultivated resources for a variety of reasons, including their close ties with nature and natural systems, as well as their nomadic lifestyle. Furthermore untrained collectors over-exploit valuable wild plant species, e.g., plants uprooting, wood cutting for fuel, desertification , overgrazing, urbanization and drought phenomena , all are contribute considerably to species decrease. Policy support mechanisms are insufficient, especially for sustainable management and protection of wild species (Malik et al. 2015, Ali et al. 2023) and there is a comprehensive need to develop a rational analytical framework to evaluate both direct and indirect services of wild flora to local livelihoods and the national economy.

CONCLUSION

The present study revealed that indigenous knowledge regarding wild plant use remains prevalent among communities in the lesser Cholistan region, where animal husbandry and agriculture are primary income sources, supplemented by wild plant collection. Respondents utilizing wild plants for food, healthcare, and domestic purposes also generated additional income by selling local plant products.

Species such as *Prosopis cineraria*, *Calligonum polygonoides*, *Agaricus bisporus*, *Caralluma edulis*, *Cucumis melo*, *Zizyphus nummularia*, *Phoenix dactylifera*, *Rhynchosia capitata*, and *Neurada procumbens* are sold in local markets and directly contribute to household income. Uncultivated foods serve as essential dietary supplements for communities facing food insecurity in fragile desert environments. Despite the potential of wild plant harvesting as a livelihood enterprise, barriers such as scarce productive land and limited financial inputs hinder commercial cultivation. Integrated research and development programs are needed. The contribution of uncultivated plants must be included in agricultural planning to promote resource development and poverty alleviation.

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CONFLICTS OF INTEREST

"The authors declare no conflict of interest."

REFERENCES

Abdullah, Khan, S. M., A. Pieroni, Z. U. Haq, Z. Ahmad. 2020. Mazri (*Nannorrhops ritchiana* (Griff) Aitch.): a remarkable source of manufacturing traditional handicrafts, goods and utensils in Pakistan. *Journal of Ethnobiology and Ethnomedicine*, 16(1): 45.

Ahmed, N., A. Mahmood, S. S. Tahir, A. Bano, R. N. Malik, S. Hassan, A. Ashraf. 2014. Ethnomedicinal knowledge and relative importance of indigenous medicinal plants of Cholistan desert, Punjab Province, Pakistan. *Journal of Ethnopharmacology*, 155(2): 1263-1275.

Akbar, G. 2000. Developing sustainable strategies for Cholistan desert: opportunities and perspectives. *Science Vision*, 5: 77-85.

Akbar, G., T. N. Khan, M. Arshad. 1996. Cholistan Desert, Pakistan. Rangelands, 18(4): 124-128.

Ali, E., M. F. Azhar, R. W. Bussmann. 2023. Ethnobotanical inventory and medicinal applications of plants used by the local people of Cholistan desert, Pakistan. *Ethnobotany Research and Applications*, 25.

Angelsen, A., P. Jagger, R. Babigumira, B. Belcher, N. J. Hogarth, S. Bauch, S. Wunder. 2014. Environmental income and rural livelihoods: a global-comparative analysis. *World Development*, 64: S12-S28.

Aryal, K. P., S. Poudel, R. P. Chaudhary, N. Chettri, P. Chaudhary, W. Ning, R. Kotru. 2018. Diversity and use of wild and non-cultivated edible plants in the Western Himalaya. *Journal of Ethnobiology and Ethnomedicine*, 14(1): 10.

Aryal, K., A. Berg, B. Ogle, B. 2009. Uncultivated plants and livelihood support–a case study from the Chepang people of Nepal. *Ethnobotany Research and Applications*, 7: 409-422.

Ashraf, M. (2008). Edaphic factors and distribution of vegetation in the Cholistan desert, Pakistan. *Pak. J. Bot.,* 40(5): 1923-1931.

Asif, M., J. H. Kazmi, A. Tariq. 2023. Traditional ecological knowledge based indicators for monitoring rangeland conditions in Thal and Cholistan Desert, Pakistan. *Environmental Challenges*, 13: 100754.

Azhar, M. F., A. Aziz, M. Hussain, S. A. Pirzada, I. Ahmad, F. Rasool. 2017. Ethnobotanical studies of *Capparis decidua* (forsk.) with special reference to Cholistan desert, *Pak. J. Agr. Res.*, 55(4): 611-618.

Bongaarts, J. 2007. Food and Agriculture Organization of the United Nations: the state of food and agriculture: agricultural trade and poverty: can trade work for the poor?. *Population and Development Review*, 33(1): 197-198.

Broegaard, R. B., L. V. Rasmussen, N. Dawson, O. Mertz, T. Vongvisouk, K. Grogan. 2017. Wild food collection and nutrition under commercial agriculture expansion in agriculture-forest landscapes. *Forest Policy and Economics*, 84: 92-101.

Cheng, Z., X. Lu, F. Lin, A. Naeem, C. Long. 2022. Ethnobotanical study on wild edible plants used by Dulong people in northwestern Yunnan, China. *Journal of Ethnobiology and Ethnomedicine*, 18(1): 3.

Constant, N. L., M. P. Tshisikhawe. 2018. Hierarchies of knowledge: ethnobotanical knowledge, practices and beliefs of the Vhavenda in South Africa for biodiversity conservation. *Journal of Ethnobiology and Ethnomedicine*, 14(1): 56.

Datta, S., B. K. Sinha, S. Bhattacharjee, T. Seal. 2019. Nutritional composition, mineral content, antioxidant activity and quantitative estimation of water soluble vitamins and phenolics by RP-HPLC in some lesser used wild edible plants. *Heliyon*, 5(3): E01431.

Dulal, K., S. Chaudhary, Y. Uprety, N. Shrestha, S. Shakya, N. Munankarmi. 2022. Ethnomedicinal plants used by the local people of Changunarayan Municipality, Bhaktapur, Nepal. *Ethnobotany Research and Applications*, 23: 1-27.

Ellis, F. 1998. Household strategies and rural livelihood diversification. *The Journal of Development Studies*, 35(1): 1-38.

Feyssa, D. H., J. T. Njoka, Z. Asfaw, M. M. Nyangito. 2011. Seasonal availability and consumption of wild edible plants in semiarid Ethiopia: Implications to food security and climate change adaptation. *Journal of Horticulture and Forestry*, 3(5): 138-149.

Gee, E., T. Borelli, D. M. de Oliveira Beltrame, C. N. S. Oliveira, L. Coradin, V. Wasike, D. Hunter. 2020. The ABC of mainstreaming biodiversity for food and nutrition: Concepts, theory and practice. In *Biodiversity, Food and Nutrition* (pp. 85-186). Routledge.

Gonçalves, P. H. S., C. V S. da Cunha Melo, C. de Assis Andrade, D. V. B. de Oliveira, V. de Moura Brito Junior, K. F. Rito, U. P. Albuquerque. 2022. Livelihood strategies and use of forest resources in a protected area in the Brazilian semiarid. *Environment, Development and Sustainability*, 24(2): 2941-2961.

Haider, S., S. M. Malik, B. Nadeem, N. Sadiq, A. S. Ghaffari. 2021. Impact of population growth on the natural resources of Cholistan desert. *PalArch's Journal of Archaeology of Egypt/Egyptology*, 18(10): 1778-1790.

Hameed, M., M. Ashraf, F. Al-Quriany, T. Nawaz, M. S. A. Ahmad, A. Younis, N. Naz. 2011. Medicinal flora of the Cholistan desert: a review. *Pak. J. Bot*, 43(2): 39-50.

Hickey, G. M., M. Pouliot, C. Smith-Hall, S. Wunder, M. R. Nielsen. 2016. Quantifying the economic contribution of wild food harvests to rural livelihoods: A global-comparative analysis. *Food Policy*, 62: 122-132.

Hussain, W., L. Badshah, M. Ullah, M. Ali, A. Ali, F. Hussain. 2018. Quantitative study of medicinal plants used by the communities residing in Koh-e-Safaid Range, northern Pakistani-Afghan borders. *Journal of Ethnobiology and Ethnomedicine*, 14(1): 30.

Leighton, K., S. Kardong-Edgren, T. Schneidereith, C. Foisy-Doll. 2021. Using social media and snowball sampling as an alternative recruitment strategy for research. *Clinical Simulation in Nursing*, 55: 37-42.

Malik, S., S. Ahmad, A. Sadiq, K. Alam, H. M. Wariss, I. Ahmad, M. Mukhtar. 2015. A comparative ethno-botanical study of Cholistan (an arid area) and Pothwar (a semi-arid area) of Pakistan for traditional medicines. *Journal of Ethnobiology and Ethnomedicine*, 11(1): 31.

Mamo, G., E. Sjaastad, P. Vedeld. 2007. Economic dependence on forest resources: A case from Dendi District, Ethiopia. *Forest policy and Economics*, 9(8): 916-927.

Maroyi, A. 2022. Traditional uses of wild and tended plants in maintaining ecosystem services in agricultural landscapes of the Eastern Cape Province in South Africa. *Journal of Ethnobiology and Ethnomedicine*, 18(1): 17.

Marrelli, M., G. Statti, F. Conforti. 2020. A review of biologically active natural products from Mediterranean wild edible plants: Benefits in the treatment of obesity and its related disorders. *Molecules*, 25(3): 649.

Mateos-Maces, L., J. L. Chávez-Servia, A. M. Vera-Guzmán, E. N. Aquino-Bolaños, J. E. Alba-Jiménez, B. B. Villagómez-González. 2020. Edible leafy plants from Mexico as sources of antioxidant compounds, and their nutritional, nutraceutical and antimicrobial potential: A review. *Antioxidants*, 9(6): 541.

McCullough, B. D., D. A. Heiser. 2008. On the accuracy of statistical procedures in Microsoft Excel 2007. *Computational Statistics & Data Analysis*, 52(10): 4570-4578.

Mdiya, L., A. Taruvinga, A. Mushunje, K. Mopipi, S. Ngarava. 2021. Rural community use and perception of rangeland products in Eastern Cape Province, South Africa. *African Journal of Science, Technology, Innovation and Development*, 13(6): 757-768.

Mosaddegh, M., F. Naghibi, H. Moazzeni, A. Pirani, S. Esmaeili. 2012. Ethnobotanical survey of herbal remedies traditionally used in Kohghiluyeh va Boyer Ahmad province of Iran. *Journal of ethnopharmacology*, *141*(1), 80-95.

Munir, M., S. Sadia, A. Khan, B. Z. Rahim, B. Gagosh Nayyar, K. S. Ahmad, R. Qureshi. 2022. Ethnobotanical study of Mandi Ahmad Abad, district Okara, Pakistan. *Plos One*, 17(4): e0265125.

Muregerera, H. 2008. The importance of communal rangelands: A case study of three districts in Zimbabwe. *Unpublished Doctoral thesis, University of Fort Hare, South Africa*.

Mwajombe, A., D. Mwiturubani, E. Liwenga. 2021. The influence of proximity to wild resources

and markets on the utilization of wild edible plants in Kondoa District, Tanzania. *Tanzania Journal for Population studies and Development*, 28(1): 64-85.

Panda, T., N. Dikshit, N. Mishra, S. Rahimuddin, B. K. Pradhan, R. B. Mohanty. 2023. Wild and cultivated plant collections from marketplaces of Odisha, India and their role in livelihood support. *Ethnobotany Research and Applications*, 26: 1-23.

Pereira, C., L. Barros, A. M. Carvalho, I. C. Ferreira. 2011. Nutritional composition and bioactive properties of commonly consumed wild greens: Potential sources for new trends in modern diets. *Food Research International*, 44(9): 2634-2640.

Pieroni, A., S. Nebel, R. F. Santoro, M. Heinrich. 2005. Food for two seasons: culinary uses of non-cultivated local vegetables and mushrooms in a south Italian village. *International Journal of Food Sciences and Nutrition*, 56(4): 245-272.

Powell, B., S. H. Thilsted, A. Ickowitz, C. Termote, T. Sunderland, A. Herforth. 2015. Improving diets with wild and cultivated biodiversity from across the landscape. *Food security*, 7(3): 535-554.

Qureshi, R., G. R. Bhatti. 2008. Ethnobotany of plants used by the Thari people of Nara Desert, Pakistan. *Fitoterapia*, 79(6): 468-473.

Qureshi, R., M. Maqsood, M. Arshad, A. K. Chaudhry. 2011. Ethnomedicinal uses of plants by the people of Kadhi areas of Khushab, Punjab, Pakistan. *Pak. J. Bot.*, 43(1): 121-133.

Semenya, S. S., M. J. Mokgoebo. 2020. The utilization and conservation of indigenous wild plant resources in the Limpopo Province, South Africa. In *Natural Resources Management and Biological Sciences*. IntechOpen.

Shamim, T., H. M. Asif, G. Shaheen, L. Sumreen, S. Ayaz, T. Qureshi, J. Kaleem. 2022. Anti-diabetic potential of indigenous medicinal plants of Cholistan Desert, Pakistan: A review. *The Review of Diabetic Studies: RDS*, 18(2), 93.

Shin, T., K. Fujikawa, A. Z. Moe, H. Uchiyama. 2018. Traditional knowledge of wild edible plants with special emphasis on medicinal uses in Southern Shan State, Myanmar. *Journal of Ethnobiology and Ethnomedicine*, 14(1), 48.

Sunderland, T. C. 2011. Food security: why is biodiversity important?. *International Forestry Review*, 13(3): 265-274.

Vetter, S. 2013. Development and sustainable management of rangeland commons–aligning policy with the realities of South Africa's rural landscape. *African Journal of Range & Forage Science,* 30: (1-2): 1-9.

Vitalini, S., M. Iriti, C. Puricelli, D. Ciuchi, A. Segale, G. Fico. 2013. Traditional knowledge on medicinal and food plants used in Val San Giacomo (Sondrio, Italy)—An alpine ethnobotanical study. *Journal of Ethnopharmacology*, 145(2): 517-529.

Yaseen, G., M. Ahmad, D. Potter, M. Zafar, S. Sultana, S. Mir. 2018. Ethnobotany of medicinal plants for livelihood and community health in deserts of Sindh-Pakistan. In *Plant and Human Health, Volume 1: Ethnobotany and Physiology* (pp. 767-792). Cham: Springer International Publishing.