

Application of the Participatory Rural Appraisal (PRA) to assess the ethnobotany and forest conservation status of the Zarghoon Juniper Ecosystem, Balochistan, Pakistan

Uso del enfoque de valuación rural participativa (PRA) para evaluar el estado de conservación del bosque y etnobotánica del Ecosistema de Junípero Zarghoon, Balochistan, Pakistan

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Abstract. The data collection approach called Participatory Rural Appraisal (PRA) was used in five villages: Killi Tor Shore; Medadzai; Ghunda; Kala Ragma, and Killi Shaban. Up to five groups were sampled in each village, comprising a total of 17 villages within the Zarghoon Juniper ecosystem. This area is rich both historically and culturally for using medicinal plants, mostly by women (60%). In this study, 26 species of medicinal plants fit in 20 genera and 13 families. They are used by aboriginal people via the indigenous knowledge they have for the treatment of many diseases. About 60, 35, and 5% of the medicines are prepared to be used orally, topically and boiled to inhale, respectively. Percentage distribution of plant parts used with purpose is 57, 26, 10 and 7% for leaves, seeds, flowers and roots, respectively. It is important to preserve the indigenous knowledge that people have for using vegetation as medicines for a sustainable utilization of the renewable natural resources. The PRA tools used consisted of social maps, transit walks, structured and semi-structured interviews, and pie diagrams. The socio-economic conditions revealed around 20000 people living in 400 households distributed in 17 villages, and livelihood depended on the forest. The community lacks basic amenities of life. The major sources of income (90%) are agriculture and livestock raising, and only 10% comes from trade, services and labor. The current high anthropogenic pressure on the ecosystem can be reduced by regulation, service implementations and financial assistance. This should contribute to sustainable resource utilization in the unique juniper ecosystem of Zarghoon.

Keywords: Juniper ecosystem; Zarghoon; PRA; Ethnobotany; Medicinal plants; Biodiversity.

Resumen. El enfoque de recolección de datos llamado Valuación Rural con Participantes (PRA) se utilizó en cinco villas: Killi Tor Shore; Medadzai; Ghunda; Kala Ragma y Killi Shaban. En cada villa se muestrearon hasta cinco grupos, comprendiendo un total de 17 villas en el ecosistema de junípero de Zarghoon. Esta área es rica tanto histórica como culturalmente por el uso de plantas medicinales, principalmente por mujeres (60%). En este estudio, 26 especies de plantas medicinales pertenecieron a 20 géneros y 13 familias. Estas son utilizadas por aborígenes a través del conocimiento indígena que ellos tienen para el tratamiento de varias enfermedades. Cerca de 60, 35 y 5% de las medicinas son preparadas para su uso oral, como tópico y hervidas para inhalar, respectivamente. La distribución porcentual de las partes vegetales usadas con este propósito es de 57, 26, 10 y 7% para hojas, semillas, flores y raíces, respectivamente. Es importante mantener el conocimiento indígena que tiene la gente para usar la vegetación como medicinas para una utilización sustentable de los recursos naturales renovables. Las herramientas utilizadas en el programa PARA incluyeron el uso de mapas sociales, sendas efectuadas por caminatas, entrevistas estructuradas y semi-estructuradas, y diagramas circulares. Las condiciones socio-económicas revelaron cerca de 20000 personas habitando 400 viviendas distribuidas en 17 villas, y su subsistencia dependió del bosque. A la comunidad le faltan cosas básicas para vivir. Las fuentes principales de ingreso económico (90%) son la agricultura y la cría de ganado, y solo un 10% proviene de intercambios, servicios y trabajo. La alta presión antrópica actual sobre el ecosistema puede ser reducida por regulaciones, implementación de servicios y asistencia financiera. Esto debería contribuir a una utilización sustentable de los recursos en el único ecosistema de junípero de Zarghoon.

Palabras clave: Ecosistema de junípero; Zarghoon; PRA; Etnobotánica; Plantas medicinales; Biodiversidad.

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Recibido / Received 9.IV.2012. Aceptado / Accepted 15.IX.2012.

INTRODUCTION

The Juniper forest ecosystem in the Province of Balochistan, Pakistan, is the second largest in the world, the first being in California. It is one of the places having the oldest slow growing juniper trees of the world. It has trees as old as 900 years old. Population growth and urbanization are among the major causes of deforestation (Marcoux, 2000). Balochistan is the largest province, representing 44% of the land in Pakistan. The rapid degradation of juniper forests is correlated with human disturbances (Ahmed et al., 1990).

Geo-Climate of Zarghoon region. Zarghoon region is located in the southern part of Quetta valley (30° 39' N, 67° 15' E). It covers an area of about 354 square miles. Of these, 86 sq miles are piedmont, 101 square miles is valley floor and the rest is high mountain land (Hunting Survey Corporation, 1960). The locality has a tremendous variation from the hill tops to the valley bottoms, and there are gentle slopes with grasses and scattered trees. Rain and snow fall occur in winter; the mean maximum temperature in summer is 25 °C, and the mean minimum temperature in winter is -15 °C.

Few previous ethnobotanical studies were conducted in Balochistan. Shinwari & Malik (1989) studied plant richness of the Dera Bugti area, and Malik et al. (1990) collected little initial ethnobotanical information from different districts of Balochistan. Loporatti & Lattanzi (1994) studied 27 medicinal plants in Makran. Tareen et al. (2002a, 2002b) conducted ethnobotanical studies of medicinal and aromatic plants in the Shireen valley and juniper forest of Ziarat. Shah et al. (2006) used ethnobotanical knowledge to investigate the flora of Musakhail and Barkan areas in Balochistan. Achakzai & Bazai (2006) used PRA to study the use and effects of wastewater irrigation on vegetables in Quetta City.

The current study was conducted to investigate the cultural aspects, livelihood pattern and people behavior towards plants by the use of different tools like questionnaires, social map, semi-structured interviews (SSI), and focus group discussions (FGDs) (i.e., the famous data collection technique called participatory rural appraisal: PRA) (Mukherjee, 1994). The aim of this survey was to provide insight of different aspects of medicinal plant use and their socio-economic influence on them.

MATERIALS AND METHODS

Reconnaissance of the area was conducted by a team of six members including males and females. The notables were contacted to get the entry points. There are 17 villages in Zarghoon area and five clusters were made, each composed of community members from 3 villages. PRA was conducted in five villages: Killi Tor Shore; Medadzai; Ghunda; Kala Ragha, and Killi Shaban, each as a central place of five clusters which comprised the

total 17 villages in the Zarghoon Juniper ecosystem. Different tools of PRA were applied like semi-structured interviews (SSI) conducted with different groups, and social maps were made as a useful basis for identifying problems in different households, their strengths and characteristics. The individual interviews, key-informant interviews, group interviews, pie charts, transect walks and focus group discussions revealed many facts.

Medicinal plants. Women involved in medicinal plant collection and its utilization were interviewed by female members of the team to get acquainted with their indigenous plant knowledge. This ethnobotanical study helped to prioritize the medicinal plants in need of urgent conservation by using Ethnobotanical knowledge and making recommendations.

Identification of plants. The plants were collected from hills, plains and watercourses. Identification of plants followed the Flora of Pakistan (Nasir & Ali, 1970-1979, 1980-1989; Ali & Nasir, 1989-1992; Ali & Qaiser, 1993-2009).

RESULTS

Socio-economic findings by using Participatory Rural Appraisal (PRA). Results showed that more than 20000 people lived in the Zarghoon area in approximately 400 households distributed in 17 villages. The community is deprived of basic life requirements like (1) clean drinking water, (2) gas as an energy source in winter, (3) health facilities, (4) telephone, (5) educational institutes etc. The community is totally dependent on the forest for their different needs.

It is also dependent on the medicinal plants and berries of juniper for treatment of diseases, as the allopathic medicines are mostly unavailable, and poor communities are not capable of taking patients to other cities for proper medical treatment. The major source of income is agriculture but only few people are land owners; most of the farmers are tenants. On average, 50, 33, 11 and 6% of the people have agriculture, livestock production, services and trade, respectively, as their way of livelihood (Fig.1).

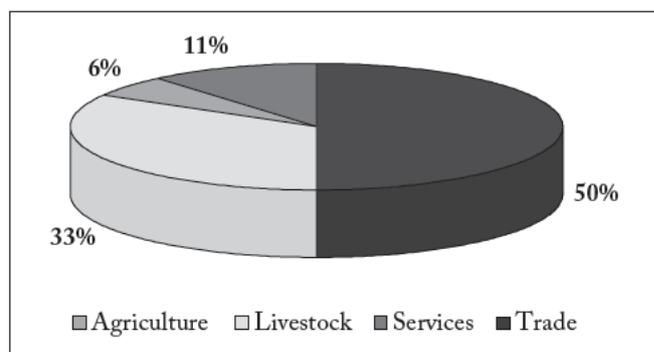


Fig. 1. Average Income sources of the community in percentage. Fig. 1. Fuentes de ingreso promedio de la comunidad en porcentaje.

The information collected via the PRA indicated that the community consumption of the wood products is much greater than the regeneration capacity of the forest, and the situation is further aggravated by the smuggling of the juniper wood and other natural and anthropogenic changes in the environment.

It is estimated through PRA studies that approximately 15000-18000 trees are used annually by the community; the total amount of wood used daily is approximately 7000 kg. This figure will increase in the future with the (1) unchecked population growth in the area and (2) the increase in the illegal logging business. A large proportion of the community uses forest wood for fuel, by cutting the stems or branches. Many use the bark of the Juniper trees, which make them vulnerable to diseases, and ultimately to death. Juniper trees are also used for making fences around the cultivated areas and poles.

Ethnobotanical aspects. Women have a major role in preserving the ethnobotanical knowledge about the local herbs and their usefulness (Fig. 2). This is not only useful knowledge but a cultural and historical heritage. However, an alarming issue is that the local communities of the area consider the plant resources as limitless, and they use plants beyond their natural regeneration capacity. The number of illiterate people in the communities is large and they have no knowledge about the importance of conserving the plant species (e.g., by growing them domestically or commercially).

The community used the medicinal plants for treating some common illnesses like cough, cold, stomachache and other pains. Other serious diseases like asthma, high blood pressure, diabetes, etc. can also be treated using the medicinal plants from the valley. The medicines were mostly known by the older women in the families as they were responsible for taking care of men and the young people. Overall, 60% of women, and only 40% of men had some ethnobotanical knowledge.

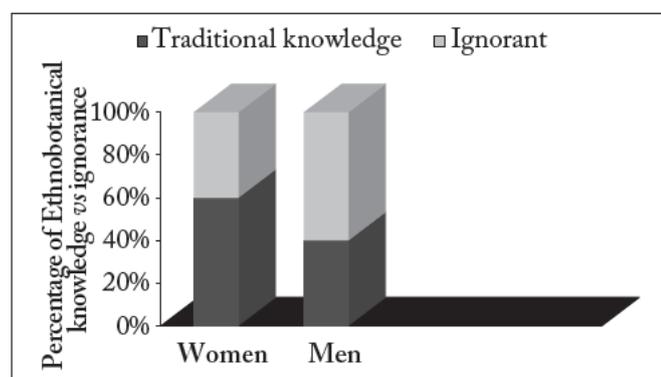


Fig. 2. Bar chart showing percentage of men/women with respect to ethnobotanical knowledge/ignorance.

Fig. 2. Diagrama en barras que muestra el porcentaje de hombres/mujeres con respecto a su conocimiento/ignorancia etnobotánico/a.

Mode of administration of different medicinal preparations. The medicinal preparations are used with various purposes by the community. They have this knowledge from their forefathers and use it in the same way. Most of the preparations are used orally (i.e. 60%), while 35% of them are used topically. Moreover, 5% of the medicines are boiled and inhaled to heal ailments (Fig. 3).

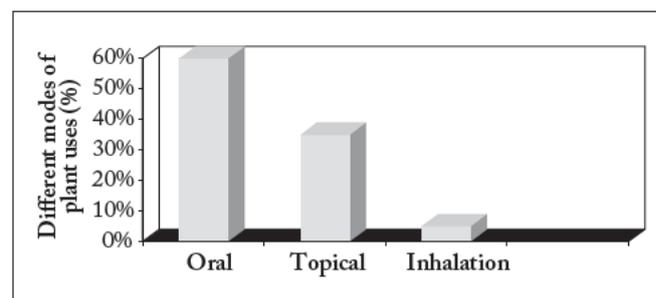


Fig. 3. Bar chart showing %age of Different Routes of Administration. Fig. 3. Diagrama en barras mostrando el porcentaje de varios modos de administración.

Some medicinal plants used by local inhabitants for treatment of different diseases. There are 26 medicinal plant species which fit in 20 genera and 13 families. They are used by aboriginal people via indigenous knowledge for the treatment of many diseases. About 60, 35, and 5% of the medicines are prepared to be used orally, topically and boiled to inhale, respectively. These medicines are prepared using 57, 26, 10 and 7% of leaves, seeds, flower and roots, respectively. It is inevitable to preserve the indigenous knowledge for the sustainable utilization of the renewable natural resource (i.e., vegetation). A detailed description of all 26 medicinal plants used in the area (in terms of botanical and vernacular names, family, plant parts used, and folk medicinal uses) is given in Table 1.

DISCUSSION

Pakistan has an exceptional biodiversity, encompassing 9 ecological zones with around 6000 plant species, out of which 400-600 of these species are considered medicinally important (Hamayaun et al., 2005). Despite having a wide variety of medicinal plants, Pakistan still imports a fair amount of products for its industry, which has a great potential. In the Zarghoon area, any disease is treated by using plants, and women possess the ethnobotanical knowledge which is passed from generation to generation. Earlier ethnobotanical and medicinal plant utilization studies in Pakistan and Balochistan are rarely in agreement with the current study. The present study showed that roots and sap of *Berberis baluchistanica* can be used for the treatment of internal injuries and joint pain. This is in accordance with reports of Inam et al. (2000), Shah & Khan (2006); Hussain et al. (2008) and Abbasi et al. (2009). Seeds

Table 1. A detailed taxonomic description of medicinal plant species used in the study area in terms of their parts and folk medicinal uses. **Tabla 1.** Descripción taxonómica detallada de especies de plantas medicinales utilizadas en el área de estudio en términos de sus partes y usos medicinales tradicionales.

S. No.	Botanical Name	*Vernacular Name	Family	Part Used	Folk Medicinal Uses
1	<i>Achillea santolina</i> (L.)	Brinjas	Asteraceae	Leaves	Plant extract is given to children to treat stomach ache and indigestion. Also used as blood purifier and refrigerent. It is used to treat diabetes and also as a cooling medicine to reduce heart shocks.
2	<i>Achillea wilhelmsii</i>	Boh-e-madran	Asteraceae	Whole plant	Whole plant is soaked in water or boiled to obtain the extract, and it is used to treat stomachache, diabetes, gastric troubles, fatness, and used as a blood purifier.
3	<i>Artemisia maritime</i> (L.)	Tarkha	Asteraceae	Whole plant	Plant extract is used as a blood purifier and heart tonic. Also useful for treating pain in joints, fever, and, stomach ache/indigestion.
4	<i>Berberis baluchistanica</i> Ahrendt	Zarlog	Berberidaceae	Roots and sap	Roots are boiled to make decoction, which is used to heal internal injuries in man and cattle. Also for the relief of joint pain.
5	<i>B. callobotrys</i>	Khar Zaaulg	Berberidaceae	Leaves and sap	Plants are used to treat jaundice. Leaf extracts are used as a blood purifier and for the treatment of acne.
6	<i>Bunium persicum</i>	Tora Zirak	Plantaginaceae	Leaves and sap	Fruits are aromatic and used as spice.
7	<i>Centaurea phyllocephala</i> , Boiss.	Talkha	Asteraceae	Leaves	It is used to treat stomach ache, swelling up of body, and wounds in cattle.
8	<i>Ephedra foliate</i> , Boiss and Kotschy	Oman	Ephedraceae	Whole plant	It's a source of ephedrine, a well known alkaloid. It is used to treat heart diseases, high fever and asthma. Seeds are used as a cooling medicine. Stem is used to heal the wound of ear piercing.
9	<i>E. intermedia</i> , Schrenk and Meyer	Oman	Ephedraceae	Whole plant	The plant is used for the extraction of ephedrine. Used for asthma and cough, and to heal wounds.
10	<i>Ferula oopoda</i>	Hing	Apiaceae	Seeds, leaves and sap	Boiled seeds and decoction for infant cough, and stems to kill intestinal worms. Sap locally called Ingapatric is used for toothache.
11	<i>Juniperus excelsa</i> Boiss	Obusht	Cupressaceae	Seeds and leaves	Oil is obtained from berries (fruit), which is carminative, diuretic and stimulant.
12	<i>Lepidium repens</i> , Boiss	Garbust Bashka	Brassicaceae	Leaves	It is used to treat skin infections. Leaves are cooked and eaten to warm the body.
13	<i>Malva neglecta</i>	Khatmi	Malvaceae	Whole plant	It is useful to treat cough; roots are used as a cooling medicine; leaves are cooked and eaten to treat gynecological disorders, and boiled leaves are applied to the body for treating sterility.
14	<i>Mentha longifolia</i>	Vialani	Lamiaceae	Leaves and roots	Leaves are used to treat gastric troubles, diarrhea. Juice of leaves is mixed with raw apple juice to treat motion and vomiting.
15	<i>Nepeta practervisa</i>	Simsok	Lamiaceae	Leaves	For treatment of flu, cough. Leaves are used to make tea which is useful to warm the body.
16	<i>Peganum harmala</i>	Kisankoor/spanda	Zygophyllaceae	Leaves and seeds	Seeds are used to treat indigestion, stomach ache. Used to treat diabetes, joints ailments and measles. Seeds are mixed in bathing water to treat pain.
17	<i>Perovskia abrotanoides</i> Karel	Gowaridaranoi	Lamiaceae	Leaves, flower and seeds	Flower and leaves are used for the treatment of typhoid and headache. Whole plant is ground and soaked for vomiting.
18	<i>Pistacia atlantica</i> ssp., <i>Stocks Pistacia cabulica</i> Stocks.	Sharawan	Anacardiaceae	Leaves, fruits and gum	Leaf extracts are used to treat indigestion. Oil is obtained by grinding the seeds, and the oil is used for cooking. It warms the body and treat cough when applied on to the skin. Oil is used for many other purposes.
19	<i>Plantago lanceolata</i>	Ispaghol/ Phidori	Plantaginaceae	Seeds	Seeds are useful in constipation, purgative and to control fatness. Leaves are applied to wounds.
20	<i>Plantago major</i> (L.)	Bar-e-tang	Plantaginaceae	Seeds	Seeds are cooked with sugar and butter, and fed to infants to control appetite. Also used to control phlegm, cough. Seed tonic useful for dysentery, chest congestion and cough.

21	<i>Salvia cabulica</i>	Metetay	Lamiaceae	Leaves	It is used to treat stomachache and indigestion.
22	<i>Salvia glutinosa</i> (L.)	Gul-e-Kakar	Lamiaceae	Leaves and flowers	Used to treat Jaundice and as refrigerant.
23	Whole plant	Tora mouri	Lamiaceae	Whole plant	Plant is ground and the oil is added to cure typhoid fever. Decoction is used for cough.
24	<i>Viola kunawarensis</i> Royle	Gul-e-Banafsha	Violaceae	Leaves and sap	Useful to treat pain and swelling of liver. Also to treat stomachache.
25	<i>Ziziphora clinopodioides</i> Lam	Spina mourai	Laminaceae	Whole plant	Whole plant is soaked in water, and decoction is given to children to reduce their thirst. Good for motion and gastric problems.
26	<i>Z. tenuior</i> (L.)	Mourai	Laminaceae	Seeds	Seeds are used to cure dysentery.

* Vernacular name is in Pashto, Pushto or Pakh

and leaves of *Peganum harmala* are good for stomach and leg problems, and measles in Zarghoon. This plant is also useful for asthma and bone fractures (Shah et al., 2006). The indigenous knowledge about *Ziziphora clinopodioides* in Zarghoon is that it is used for motion and vomiting; an analogous utilization was reported by Ali & Qaiser (2009). Seeds of *Plantago major* are cooked with sugar and butter, and fed to infants to control appetite, phlegm and cough. Tonic made from seeds is useful for dysentery, chest congestion and cough. Abbassi et al. (2005) also reported that *P. major* is used to control cough, asthma and phlegm.

Conclusions and recommendations. The previous discussion clearly indicates that local people are intensively dependent on the Juniper ecosystem either for fuel wood or medicinal plants. However, its utilization is not sustainable because natural resources of the area are heavily exploited. The juniper forest is under a major threat of degradation due to the (1) high rate of deforestation, and (2) comparatively low rate of regeneration.

The study area encompasses a rich biodiversity that includes a large variety of medicinal and other useful plants. Growing medicinal plants both *in situ* and *in vitro* is inevitable for the development and conservation of the area. Extensive research must be carried out in the fields of pharmacology, biotechnology and biochemistry. If it continues, the tremendous decrease in the transmission of knowledge from local Herbalists to local people can reduce the knowledge of aboriginal people about their natural resources. The community should be aware of the importance of the (1) forest, (2) medicinal plants, and (3) current vulnerability of the forest due to the community activities. The community should be trained about the sustainable use of products other than those provided by the tree forest, particularly medicinal plants and their commercialization, which might contribute to raise their economy.

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