INT. J. BIOL. BIOTECH., 4 (1): 51-55, 2007.

AN EVALUATION STUDY OF IMPACT OF FUEL EFFICIENT STOVE ON JUNIPER (*Juniperus excelsa)* TRACT, BALOCHISTAN

M. Y. Musakhe[1], Abdul Jabbar[2], R. B. Tareen[1] and Z. A. Bazai[1]

[1]*Department of Botany, University of Balochistan, Quetta, Pakistan.*
[2]*Balochistan Forest and Wildlife Department, Quetta, Pakistan.*

ABSTRACT

In the current evaluation study the impact assessment of Fuel Efficient Stove (FES) on the Juniper forest of Balochistan was investigated during the year 2003- 2004. Fuel-efficient stove technology was introduced in the area during 1999-2000 with an aim to conserve the national heritage (Juniper trees) from fire ash. Assessments were carried out with the forest users based on indicators identified by them. Substantial efficiency in fuel wood consumption decreased in all communities. The general findings revealed intra and inter diverse impacts are of FES user communities, but have been generally positive, in term of improved level and security of the forest and social life. Fuel efficient stove retaining better and smoke free heat and workload of fuel wood collection reduced its burden on women of these communities, the general health and hygienic conditions improved. Nevertheless, impacts to date are below their potential level and the needs of rural households require more investigation to determine what further opportunities exist and how policy could be prepared for conservation and sustainable use of natural resources.

Key words: Juniper, Fuel Efficient Stove, Fuel wood, National Heritage, Conservation, Sustainable

INTRODUCTION

The Juniper Forests of Balochistan represents one of the largest remaining tracts of pure *Juniperus excelsa* in the world. Juniper trees are among the slowest growing trees and known as living fossils on the earth. The mature trees are three to four thousand years of age, Siddiqui (1998). Since centuries the local communities are dependent on these forests for fuel wood, shelter, grazing, and collection of medicinal plants. The other additional values of the forest like; xeric nature, very long life, survival mainly due to vegetative multiplication, monumental and heritage significance, watershed, scientific, educational and recreational.

Juniper is a large genus of about 25 species, four of which are found in Pakistan and India in the Himalayan Mountains including the one spreading down south to Balochistan. The only species found in Balochistan province is *Juniperous excelsa* (Himalayan Pencil Ceder). It is a small or medium sized tree with reddish brown fibrous, vertically fissured bark, exfoliating in fibrous strips (Champion *et al.,* 1965).

Junipers are found in Ziarat, Loralai, Pishin, Killa Saifullah, Kalat, Quetta and Mustang Districts of the province covering approximately an area of about 121457 hectares., Rao (1991). The largest component block of Juniper lies in Ziarat district covering an area of about 100,000 hectares. The associated flora and fauna in these forests are unique in certain ways. The area falls under dry temperate climatic zone with an average snow and rainfall of 328-mm/ year and is characterized by extreme cold during winter. Temperature ranges from –16ºC to 20ºC. Snow falls from December to March but due to continuous drought prevailing in the area as well as in the province since last five years, the snowfall is almost vanished and the summer season is very pleasant in the area. The elevation of the juniper forest ranges from 1980- 3350 meters.

Fuel Efficient Stove technology was first introduced in Pakistan at Gilgit. The FES cooking stove metal topsides with inter locking bricks lining (Code 2.1.6) with 18" – 12' width, 32-½ length and 9 height. Its shape is tapered, non-welded, top controlled smoke, longer in length, can be used long wood pieces and less wood consumption. Interlocking bricks lining to reduce heat radiation during summer.

The aims and objectives of the provision of FES was to; create the spirit of national heritage conservation, improving the socio- ecological and socio- economic conditions decrease the workload of fuel wood collection of local population, create the sense of ownership and awareness raising about wise use of natural resources. Thereafter, on the success full experimentation, the communities will be able to replicate FES in most of the villages of Juniper tract through community mobilization and motivation. The idea behind the FES distribution in Juniper forest was to establish and enhance the awareness of communities regarding fuel efficient practices and conserve more energy by consuming less firewood thereby reducing the direct pressure on local forests, and the conservation of unique Juniper ecosystem and its biodiversity would be made easy.

MATERIALS AND METHODS

Fuel Efficient Stove study of Juniper tract was carried out during the year 2003-2004 in Sagran, Sra Ghara., Spaizandi and Lailgat Frequent field visits in various intervals of time and seasons were undertaken. A questionnaire was developed and interviews were taken regarding forest, socio-economic and socio-ecological conditions. FES study information was collected from various villages of selected areas of the forest. By using the "Quota Sampling Method" a 20% random sample of household were taken out of all households in a village to represent the true data.

RESULTS AND DISCUSSIONS

Fuel Efficient Stove study of Juniper tract shows that four plant species, *Juniperus excelsa*, *Caragna ambigua, Berberis balochistanica* and *serphidium sleneocphalum* belonging to four families are traditionally consumed by the local inhabitants for fuel wood in the area (Table 1). Juniper is the most common utilized specie during all four seasons. The area has a great potential for its natural resources. The data of fuel wood consumption was taken from four-sites which vary from site to site. The difference obtained in each investigation taken out has shown in (Figure 1). During the whole duration of FES provision, out of four sites, decrease in forest cutting was about 436.025 Tons, or 4360 trees of Juniper. In other words Fuel Efficient Stove saved 30,000 years. Capacities build of the communities of study areas in forest management, decision-making, user organization, cohesion, communication, awareness, livelihood, community development, linkages and network development (Table 2). FES users trained at various interval of time so that they boost the process in neighbor communities are shown in (Table 3).

Table 1. Plant species used as fuel wood in the area.

S#	Scientific name	Vernacular name	Family	Occurrence	Preference
1	*Juniperus excelsa*	Obusht	Cupressaceae	V*. Common	First
2	*Caragna ambigua*	Makhai	Papilionaceae	V. Common	Second
3	*Berberis baluchistanica*	Zarlog	Berberidaceae	Common	Second
4	*Seriphidium stenocephalum*	Tarkha	Asteraceae	V. Common	Use with other wood

*Very

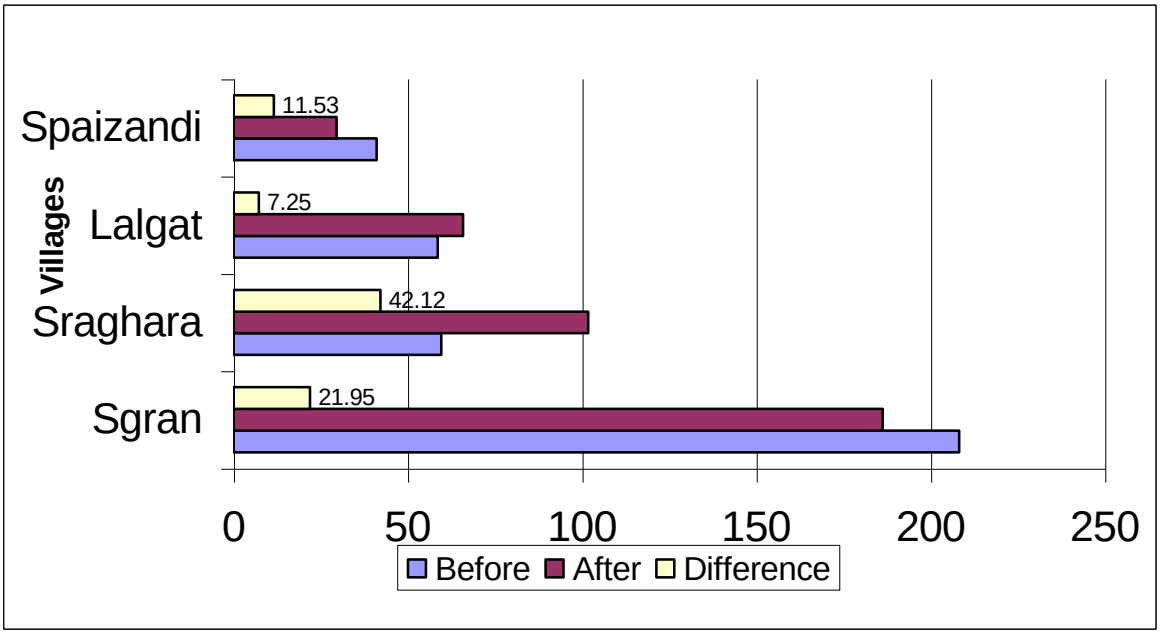

Fig. 1. Impacts of FES on Juniper Forest Monde/ Month/ Household (Average)

Persha (2002), observed 20 - 33% decrease in fuel wood consumption in 10 villages of Chome ward (Gawana) East Africa. Khan (2001) reported that in Bulashbar (Gilgit) after installation of FES, decreased in fuel wood consumption about 337-kg/ households and totally in a village 185 tons per month or 2224 tons/ year. The type of work has not been done by any other institution in Balochistan province. The impacts of FES technology are diverse both within and between FES users community, but have been generally positive in terms of improved levels and security of forest products and benefit flows. Various households' income misuse saved support for community infrastructure and improved social life. The FES approach changed the local and social context. An out part of policy is, raising of awareness and understanding amongst local people about wise use of natural resources especially 'Juniper Trees'.

In Balochistan Juniper ecosystem is highly disturb due to human influences such as, deforestation, over exploitation, unwise land development, livestock rearing, road and building construction, fuel wood consumption, settlements and up-rooting of plants for medicinal purposes. The Juniper ecosystem, if depleted or destroyed, it is difficult to restore, regenerate and impossible to recreate with all its components because germination in these forests (Juniper) is nominal due to nonviable embryo. The same way all the associated species with these trees will be on the stage of destruction The local people save the rooms from water drops in long snowfall, by using bark of Juniper trees. Bark and even cambium is removed for thatching of huts and rooms. The removing of cambium results in the death while the removal of bark exposes the trees to vagaries of extreme climatic conditions, obviously affecting their health and growth. The other hazardous, Juniper forest is facing great threats of a parasitic disease called Mistletoe (*Arceuthobium oxycedri)*. Beg and Repp., (1966) first observe the parasitic attack on week trees of Juniper. It is not easily detectable and destroys the trees within a very short term. Fungal attack is very common in Juniper trees, which causes die back of mature trees.

The preservation of the Juniper forest is considered essential to several sectors of local economy and human environment. This includes energy, housing, agriculture, forestry, animal husbandry, nature conservation and tourism. The presence of these forests will fulfill the needs of timber, fencing, materials, bark for thatching of huts, medicinal plants, these are important for water and soil conservation as they grow in the catchment's areas. Comparison of the above threats and deforestation for sake of fuel wood, is in conformity with the findings of a number of workers Beg and Repp., (1966), Singh and Kumar, (1981), Stewart (1982), Siddiqui (1998), Abbasi (2001) and Khan (2001).

ACKNOWLEDGMENTS

The financial support of World Wide Fund for Nature Pakistan, Quetta Office in connection with study of Fuel Efficient Stove in Juniper tract (Sagran, Sraghara, Lalgat and Spaizandi) is highly acknowledged.

Table 2. Capacity building of FES users communities**.**

Process	Process indicators	FES Users Communities			
	√: Good,~: Medium, x: Poor	**Sagran**	**Spaizandi**	**Sraghara**	**Lalgat**
User organization and cohesion	Legitimate users include in FES communities	√	**~x**	√	**√ x**
	Sense of ownership of forest amongst users	√	√	√	√
	Users united with common purpose and trust	√	**~ x**	√	√
Forest management	Effective forest management	√	x	√	~
	Forest condition good and improving	√	X	√	~
	Community forest boundary defined	√	X	√	X

Decision making and implementation	Active forest management	√	X	√	~
	Regular committee and assembly interaction	√	X	~	√
	Effective leadership & decision making	√	X	~	~
	Political Interference	√ X	√	~	~
	Participation of FES users in Activities	√	~ X	√	√
Communication and awareness	Information Flow &Communication in FES users	√	√	√	√
	Awareness raising	√	√	√	√
Livelihood & community development	Saved income Spent on Fuel wood.	√	~	√	~ √
	Social structure of community improved	√	X	√	~
	Health & Hygiene level improved	√	√	√	√
Linkages & network development	Link with line agencies and NGOs	√	√	√	√
	Relation with DFO/ RFO and F. Guard	√	√	√	√

Table 3. Trained FES users during 2000- 2003.

COMMUNITY	No. of trained persons									
	2000		2001		2002		2003		TOTAL	
	M	F	M	F	M	F	M	F	M	F
Sagran	5	8	11	6	15	12	8	4	39	30
Spaizandi	4	5	6	7	5	5	2	6	17	23
Sraghara	6	3	3	6	5	6	4	3	18	18
Lalgat	4	3	2	7	5	5	5	2	16	17

REFERENCES

Abbasi, I. K, (2001). *Workshop report on Partnership for conservation and development*. Agha Khan and WWF- Pakistan, Gilgit.Pakistan, pp. 4-13.

Ahmed, S. F and I.K. Abbasi (2001). *Fuel wood consumption practices, intervention for fuel wood conservation at the domestic house hold level and relative impacts on conservation of forests and wood resources in Northern areas of Pakistan*, P.F.I. Peshawa.r, pp 6-9.

Beg A. R. and G. I. Repp. (1966) *Preliminary ecological observation in the Juniper forest of Ziarat Silvi Conference*. pp 245 – 253.

Champion, H. G., S. K. Seth, and G. M. Khattak (1965). *Forest types of Pakistan*. P.F.I. Peshawar, Pakistan.

Khan, E. A. (2000). *Report on Fuel Efficient stove, provided to the communities in the WWF sites*. WWF, Gilgit Office. Pp. 8-15.

Khan, S. (2001). *Report on Evaluation of Fuel Efficient Stoves provided to three project sites of WWF- P Northern areas, Pakistan. Printed at WWF- Pakistan, Peshawar*, pp. 7-9.

Persha, L. (2002). Follow-up survey Report of Chrome ward fuel efficient Stove a UNDP/GEF East African Cross Borders biodiversity funded project ,pp3-5.

Rao. A. L. (1991). A Preliminary study on Juniper Ecosystem in Balochistan Pakistan. pp. 9-31 and 40-41.

Roberts. T. J (1995). *Wild flowers of Pakistan*. Oxpord University Press, at Karachi. Pp: 261.

Siddiqui, KM. (1998). *Properties and Uses of Pakistani Timber, Forest Products Research Division*, Pakistan Forest Institute Peshawar. Pp. 3-5.

Singh. And K. Agia, (1981) *A contribution to the ethnobotany of Sub Hamalian Region of Eastern Uther Perdash*. India, pp. 237-246.

Stewart, R. R. (1982). *History and exploration of plants in Pakistan and Adjoining areas*. P.186-188, National Harberium, NARC Islamabad.

Tareen, R.B., M.I. Zaidi, M.A.K., Malghani, Q.A. Ali, M. Asif (2002). Ethno botanical studies of Medicinal and Aromatic plants of Juniper Forest, District Ziarat, Balochistan, *Research J.University of Balochistan*, 1(2): 2002.

Zakaaullah and K. Badash (1977). Survey of juniper dwarf mistletoe in Sasnamana State Forest of Balochistan. *Pak. J. For*., 27: 143-146.

(*Accepted for publication December 2006*)