



Flora of Ziarat: Ethnobotanic and Medicinal Importance



Hertia intermedia (Boiss) O.Ktze



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Preface:

This report details on identifying the potentials of flora in Ziarat as a source of ethnobotanic and medicinal purposes and the availability of opportunities for supporting livelihood.

This document could be a supportive tool for policy makers, conservationist, and developmental sector to identify the need for managing the resource by adopting sustainable practices. The information gathered in this document is assessed both qualitatively and quantitatively and would definitely help all the stakeholders to recognize the importance of ecologically vulnerable floral resource.

This write up is a result of gathering information from the secondary source, field visits and number of consultative meetings with the stake holders. The recommendation of this report is the clear reflection of serious approach of the implementers of the project towards recognition of the wise use of resources for their future.

Acknowledgements:

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Acronyms:

ABS	Access on Benefit Sharing
CBD	Convention on Biological Diversity
CCAs	Community Managed Areas
CMPAs	Co-managed Protected Areas
EVM	Ethnovetnary medicine
GEF	Global Environmental Facility
GOP	Government of Pakistan
IUCN	International Union for the Conservation of Nature
NTFPs	Non Timber Forest Products
Unani	Eastern Medicine
UNDP	United Nations Development Programme
WHO	World Health Organization
ZJFC	Ziarat Juniper Forest Complex

Summary:

Flora contributes the main ingredients of medicines in traditional systems of healing and has been the source of inspiration for several major pharmaceutical drugs. Roughly about 1 in 6 of all species has been used medicinally. The WHO estimates that a minimum of 20 000 plant taxa has recorded medicinal uses. It is estimated that up to 70 000 plant species are used in folk medicine and a majority of these species are found in the Asia-Pacific region.

More than 80 % of Asia's population (WHO) cannot afford or access formal health care systems and are dependent on these culturally familiar, technically simple, financially affordable and effective traditional medicines. In developing countries it is estimated that traditional birth attendants assist in up to 95 % of rural and 70 % of urban births and mainly relies on traditional medicines as pre and post maternity care.

It has been estimated that around 95 % of the medicinal plants are harvested and collected in wild. In this practice wild collection exceed the quantity available from natural resources and ultimately over time it is threatening to some plant species.

A focus on medicinal plants raises some major questions of conservation. Conservation and livelihoods are closely linked with medicinal plants. If conserved, medicinal plants will continue to be available to provide continuing benefits for healthcare, income and support of cultural heritage. They can also be seen as an opportunity to restrict the overexploitation of habitat interms of farm conversions. The role of flora in "ethnoveterinary" practices offer viable alternatives or complement to conventional, western style veterinary medicine - especially where the latter is unavailable or inappropriate. The use of medicinal plants constitutes major part of ethnoveterinary medicine (EVM) in Pakistan.

Challenges of conservation and sustainable utilization of biological resources still exist in Pakistan. Degradation in natural resources is visible, caused by increased human activities related to the growing population coupled with, human destruction of natural habitats, migration of human population resulting in the change of land use pattern, invasive species, the growing demand for natural resources and its inappropriate management. In addition, no systematic work has been carried out on the status and threats to ecosystems, and also the effects of global climate change are poorly understood.

Balochistan, with an area of 347, 200 square kilometres, makes up 44% of Pakistan with its variation deserts, a coastal zone, uplands, plains, diverse plants and wildlife, and climatic extremes. It is often inhospitable, constrains settlement patterns and limits the growth of economic sectors, such as agriculture and forestry. The natural landscape dictates the movement of people and livestock. The mountains divide the province into distinctive cultural, socio-economic and ecological regions.

Ziarat one of the smallest districts in Balochistan lies at an altitude of almost 8000 feet above sea level. The climate is extremely cold in winters while summers are pleasant. It is rich in biodiversity with a large variety of fauna and indigenous medicinally important flora. The evergreen *Juniperus excelsa* forest here is the second largest forest of the world.

The forests in Ziarat are under stress from a range of factors, both natural and human induced. Local people are dependent on these forests to fulfil their livelihood demands posing pressure on various other forest products. Applications of the indigenous knowledge of mountain people in relation to biodiversity resource management remain a key issue.

The information about the vegetation of Ziarat is very scanty and not much of the published data was available; either there were no information available or it would be too superficial and old. Generating primary information requires tremendous resources in terms of time, effort and cost. The data gathered as a result of this study was comprised of two sets, i.e post (Early Fall 07) and pre (Late Spring) rain situations. The first study was conducted in the end of July 2007referred here as Fall 07; whereas the second study was conducted in

May 2008 referred as Spring 08. The studies were conducted in Khoski, Batatair, Nishpa, North and South of Ziarat and North and South of Chautair.

A floristic list of the area was prepared. The quantitative data were collected using plotless sampling method of random pairs. The data sets were then classified on the basis of spatial and temporal distribution of the vegetation (ground strata). The data set was then subject to a series of calculations resulting in defining the IVI (Importance value index) and Y3 (Importance value) of the species present in the particular habitat. The abundance value of the species was estimated using IVI (Importance Value Index) as a variable.

The Ziarat Juniper Forest not singly caters the natural needs of the communities living in the area but also offers a conducive situation for the growth of a wide variety of herbs and shrubs, which are medicinally and ethno botanically important. The available qualitative data set revealed the presence of some 54 species belonging to some 25 families more than half of them are known for their medicinal/ ethnobotanic importance.

The Ziarat juniper ecosystem has evolved in an unusual combination of soil and climate, highly calcareous, stony and shallow soil, receiving very low precipitation. Along with tree form *Juniperus excelsa*, most of the short stature shrubs are co-dominant in these areas including *Sophora mollis*, *Artemisia sp.*, *Perviskia abrotanoides* and *Thymus linearis* as ground cover.

The set of extreme conditions pushes the vegetation to develop mechanisms for their survival; these stress responses are usually benefited the mankind in the form of variety of products used in medicine. This has been observed that the plants adapted in specific habitat allowed to grow under optimal conditions (Greenhouse) grow healthy; but lose their ethnobotanic value.

The approximate length of the stretch of landscape that constitute Ziarat and Chautair valley falls around 40-45 Kms. The flora present in the stretch gives a unique pattern. The pre rain (Spring 08) set of ground vegetation was dominated by *Andracnae*, *Bromis*, *Convolvulus*, *Artimisia*, *Stachys* and *Sophora* on the northern side of the valley; whereas *Hertia*, *Perviskia*, *Thymus* and *Artimisia*, *Sacchrum*, *Sophora* on the southern part of the valley.

The post rain (Early Fall) composition of the flora for northern part was represented by *Artimisia*, *Polygonum*, *Perviskia* and *Stachys*, *Artimisia*, *Caragna*. The southern part was dominated by *Juniperus*, *Perviskia*, *Polygonum* and *Perviskia*, *Sophora* and *Artimisia* in the order of dominance.

The pre rain (Late Spring) floristic composition in Khoski, Bataytair and Nishpa is represented by *Sophora*, *Olea*, *Taraxicum*, *Perviskia*, *Stachys*, *Caragna*, *Hertia*, *Sophora* and *Stachys* respectively; whereas the post rain (Early Fall) composition for the same was *Sophora*, *Juniperus*, *Caragna*, *Perviskia*, *Berberis*, *Caragna* and *Sophora*, *Juniperus*, *Phlomis* respectively.

Species listed in view of the suitability of habitat and handling and can be subjected to carry forward to ascertain the opportunities for improving the livelihoods of the communities and help them in adopting diversified trade to minimize the burden on Juniper ecosystem. This would be helpful in reducing the change in land use pattern by providing the enhanced value of the existing farm. The set of flora recommended below are significantly represented in the central asian part of the continent and in common ethnobotanic uses.

Ziziphora tenuior, *Thymus linearis*, *Thymus vulgaris*, *Nepeta glomerulosa* Proposed as potential herbal tea. Whereas; *Berberis lyceum*, *Berberis callobotrys*, *Berberis balochistanicus* *Caragna ambigua*, *Perviskia abrotanoides*. Could be used for potential

shelter belts and other ethnobotanic purpose in medium term. *Erumurus stynophyllus*, *Rosa sp.*, *Prunus sp.*, *Pegnum hermala*, *Artimisia maritime*, *Onosma hispid*, *.Onosma baractiatum*, *Mentha logifolia*, *Foeniculum vulgare*, *Plantago ovata* are already known for their uses in Ziarat but need attention to be exploited as potential supporting crops. *Pistacia Khinjuk*, *Juniperus excelsa polycarpus* (Berry harvest) also have prospects of commercial value.

Ziarat has all good conditions to offer a good model for ABS concept. The community would be benefited by having additional income from the resources which are Ziarat specifics. The other good aspect of doing this would reduce the change in land use pattern of the area; since the medicinal plants can be easily grown and harvested in the existing farmlands; thus enabling the community to use common resource for their income support. It has been observed that the recent introduction of apiculture in the area would also attract people to have medicinal honey besides having cross pollinating their orchids.

1.0 Introduction:

Flora contributes the main ingredients of medicines in traditional systems of healing and has been the source of inspiration for several major pharmaceutical drugs. Roughly about 1 in 6 of all species has been used medicinally. This represents by far the biggest use of the natural world in terms of number of species.

The WHO estimates that a minimum of 20 000 plant taxa has recorded medicinal uses. It is estimated that up to 70 000 plant species are used in folk medicine and a majority of these species are found in the Asia-Pacific region. However, the use of medicinal plants is faced with many constraints. Some of these constraints include: plants with medicinal values not fully identified, inventoried and characterized, information and knowledge not being adequately documented and disseminated, many issues are not addressed and resolved (i.e. equity and sustainability), and the alarming commercial over-exploitation and consequent genetic erosion of medicinal plants.

There are more than 8,000 plants species in South Asia with known medicinal uses and are an essential part of traditional health care systems. More than 80 % of Asia's population (WHO) cannot afford or access formal health care systems and are dependent on these culturally familiar, technically simple, financially affordable and effective traditional medicines. In developing countries it is estimated that traditional birth attendants assist in up to 95 % of rural and 70 % of urban births and mainly relies on traditional medicines as pre and post maternity care.

The medicinal plants have been used by humans from the pre-historical times. Studies have pointed out that many drugs that are used in commerce have come from folk-use and use of plants by indigenous cultures (Anon 1994). About 50 drugs have been discovered from ethnobotanical leads by translating folk knowledge into new pharmaceuticals. Some examples of medicinal plant from the Asia-Pacific region are of species such as *Rauvolfia*, *Hyoscyamus*, *Cassia*, *Atropa*, *Podophyllum*, *Psoralea*, *Catharanthus*, and *Papaver*. However, relatively few medicinal and aromatic plant species have been brought into cultivation worldwide and most of these species continue to be harvested from their native habitats (Gupta and Chadha 1995; Salleh *et al.* 1997; Gautam *et al.* 1998). Very little work has been undertaken on their selection and improvement, for developing suitable varieties.

Around 100 plant species have contributed significantly to modern drugs. The use of medicinal plants is increasing worldwide, related to the persistence and sometimes expansion of traditional medicine and a growing interest in herbal treatments.

Traditional Greek (Unani) medicine is quite a popular practice here. It originated in Greece, founded by old ancient Greeks, and was developed and documented by Muslims during the glorious period of Islamic civilization. This trade of medicine was introduced to the subcontinent by Muslim scholars and practiced successfully for centuries. In subcontinent it gets benefited from the Ayurvedic system of medicine, which was an important component of Hindu civilization and all these system of healing greatly depend on wild plant collections.



It has been estimated that around 95 % of the medicinal plants are harvested and collected in wild. In this practice wild collection exceed the quantity available from natural resources and

ultimately over time it is threatening to some plant species. The alarming levels of deforestation and ecosystem degradation have severely reduced the availability of medicinal plant and the overall environmental sustainability of the region. The market and community demand has been so great that there is a great risk that many medicinal plants today, face either extinction or loss of genetic assortment (Lucy and DaSilva 1999, Personal communication Dean of Eastern Medicine at Hamdard University).

Most of these plants have remarkable medicinal and economic value, often only known to indigenous communities. Unfortunately, very little attention has been paid to the ethnobotanical aspect of plants as hakims are only concerned with the floral and vegetative parts of medicinal plants without any regard to their botanical characteristics, or distribution in the various ecological zones of Pakistan. Herbs are not only used in the ayurvedic system of treatment but in the preparation of many allopathic and homeopathic drugs: no wonder these herbs are now being commercially exploited for the extraction of various ingredients.

A focus on medicinal plants raises some major questions of conservation. Conservation and livelihoods are closely linked with medicinal plants. If conserved, medicinal plants will continue to be available to provide continuing benefits for healthcare, income and support of cultural heritage. They can also be seen as an opportunity to restrict the overexploitation of habitat interns of farm conversions.

There is a growing trend of widespread interest in promotion of traditional health care systems and there is a strong and sustained public support for it. The collection and cultivation of medicinal plants besides health benefits also provides a vital livelihood options for millions in rural communities, especially landless and low-income farmers. In India, it is estimated that the collection and processing of medicinal plants contributes to at least 35 million workdays of employment per annum (Karki, 2002).

Priority in the sustainable management of medicinal flora includes the conservation of this biological diversity at the level of ecosystem, species and genetic sources. It is only possible through the involvement of all stakeholders and interested parties to take it of utmost importance. Pakistan is among the moderately diverse countries in biological resources, where people's reliance on natural sources for sustenance and well-being is immensely strong. The country has rich and unbroken tradition of the use of medicinal plants and other natural resources for healthcare needs. (Siddiqui, B.S and M.I. Chaudhary 2001). It has been observed that livestock raisers and healers everywhere have traditional ways of classifying, diagnosing, preventing and treating common animal diseases. Many of these "ethnoveterinary" practices offer viable alternatives or complement to conventional, western style veterinary medicine - especially where the latter is unavailable or inappropriate. The use of medicinal plants constitutes major part of ethnoveterinary medicine (EVM) in Pakistan .Use of medicinal plants as an anthelmintic (de-wormer) has been given as an example. (Zafar Iqbal etal 2005)

Pakistan has almost half of its listed flora recognised as ethnobotanically important. Around 300 species are reported be used in traditional medicine (Haq, 1998; Perveen & Hussain, 2007); However, 1010 species have been identified for their medicinal properties, which makes around 16.8% of the total listed flora (Shinwari 2005). There are 86 registered organizations involved in preparing herbal/ eastern medicine; offering around 300-400 products. There is a growing demand of raw material majority of which is imported (around 90%) (Aslam, M 2008). The system of eastern medicines caters around 50% of the population. The parctioners of traditional medicines in Pakistan are around 50,000. The importance of medicinal herbs and spices have not been given due attention besides having great economic value and a great potential to support the ecosystem in which they are growing, by conserving soil, water and providing a habitat for other species. In addition, have considerable value in social terms as well.

Pakistan, though, not among the biodiversity hot spots of the world, still faces immense challenges of conservation and sustainable utilization of biological resources. Degradation in natural resources is visible, caused by increased human activities related to the growing population coupled with, human destruction of natural habitats, migration of human population resulting in the change of land use pattern, invasive species, the growing demand for natural resources and its inappropriate management. In addition, no systematic work has been carried out on the status and threats to ecosystems, and also the effects of global climate change are poorly understood. The management of an appropriate combination of resources, in various locations and under diverse conditions would be one of the efficient ways to conserve ecosystem that offers the medicinal wealth.

1.1 The area:

The total area of Pakistan is 87.98 mh, out of which 88% is classified as arid and semi-arid and only 12% is humid and sub-humid, mainly located in the Himalayas and Karakoram ranges. The area covered by forest is 4.579 mh (5%) out of which 1.958 mh is classified as temperate conifer forest and 1.702 mh as sub-tropical forest.

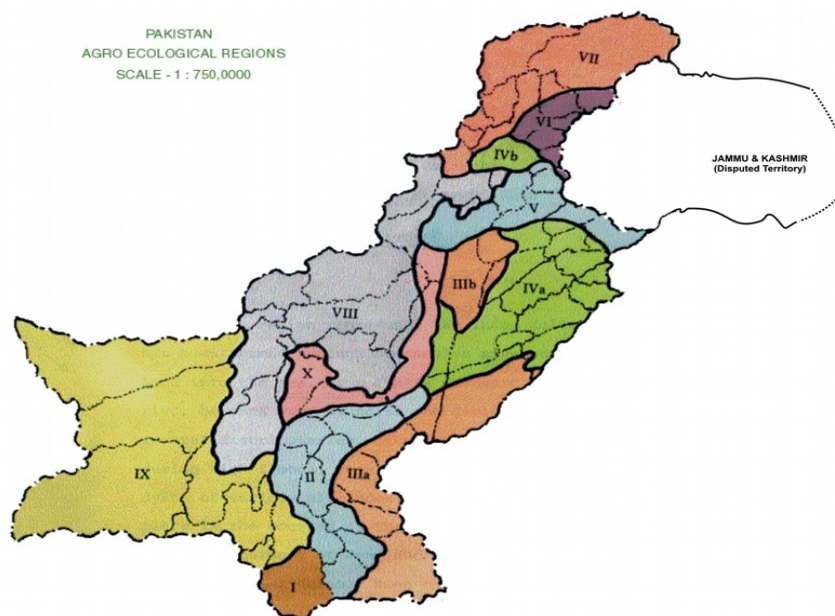


Fig.1 Agroecological zones of Pakistan.

Balochistan is a land of striking contrasts and contradictions that defies easy description. It has deserts, a coastal zone, uplands, plains, diverse plants and wildlife, and climatic extremes. This semi-arid land provides for all the needs of the people. The soils on which to grow crops and the natural vegetation on which to graze animals. The land provides for a broad diversity to serve many human needs. It influences climate, and in turn, the rivers and groundwater resources. It also provides a source of raw materials that underpin economic growth. But has its limits. It is often inhospitable, constrains settlement patterns and limits the growth of economic sectors, such as agriculture and forestry. The natural landscape dictates the movement of people and livestock. The mountains divide the province into distinctive cultural, socio-economic and ecological regions and limit communication. Balochistan, with an area of 347, 200 square kilometres, makes up 44% of Pakistan. It is the largest province.

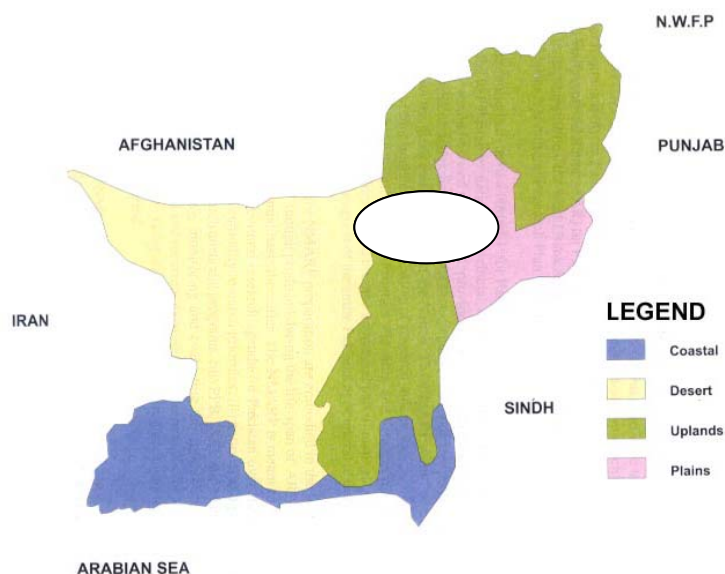


Fig.2. Major ecological divisions in Balochistan.

Ziarat in Balochistan lies at an altitude of almost 8000 feet above sea level. The climate is extremely cold in winters while summers are pleasant. It is rich in biodiversity with a large variety of fauna and indigenous medicinally important flora. The evergreen *Juniperus excelsa* forest here is the second largest forest of the world. These are the oldest living species on the planet and are also known as living fossils, their age is estimated as 2000 years. They have a slow growth rate and a low potential for regeneration. Its berries have long been in use in folk medicine for kidney disorders and other diseases.

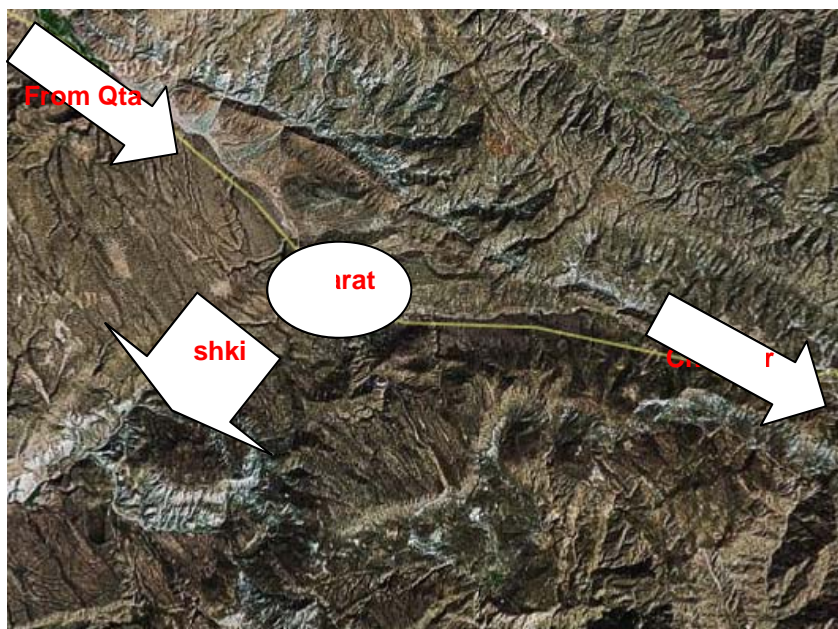


Fig.3. Satellite image of Ziarat.

According to Champion, Seth & Khattak (1965), the Juniper Tract falls within the dry temperate forest region. The average annual rainfall is 269 mm with a maximum of 74 mm in July and a minimum of 3 mm in January. The hottest month is July (27.4 °C), the coldest is January (7.9 °C). Relative humidity ranges from 35

% in January to 60 % in September. Snow occurs between November and April with a maximum (68 cm) in February (data from Ziarat).

The area supports tropical steppe flora (below 1,500 m) and open xeric woodlands (1,500 to 2,000 m). The vegetation consist of open woodlands of pistachio (*Pistachia atlantica*, *P. khinjuk*), almond (*Prunus rosaceae*, *P. eburnea*), barberry (*Berberis*), sage or wormwood (*Artemesia* spp.), and juniper (*Juniperus macropoda*, *J. semiglobosa*, and *J. excelsa*). The transitional woodland between the subtropical woodlands and the alpine vegetation of sclerophyllus forest supports the olive (*Olea cuspidata*). The ground layer that dominates areas within the woodlands south of the ecoregion is composed of perennial grasses, tropical shrubs, and *Artemisia maritima*, perennial grasses of *Poa* and *Bromus* spp., and bulbous plants such as *Iris*, *Tulipa*, and *Allium* spp. are also found on these slopes.

1.2 The Scenario

The forests in Ziarat are under stress from a range of factors, both natural and human induced. Local people are dependent on these forests to fulfil their livelihood demands posing pressure on various other forest products. Applications of the indigenous knowledge of mountain people in relation to biodiversity resource management remain a key issue.

The decline in biodiversity of the area due to number of extrinsic and intrinsic factors was alarming in the country. This has been reflected in the case of Ziarat valley as well.

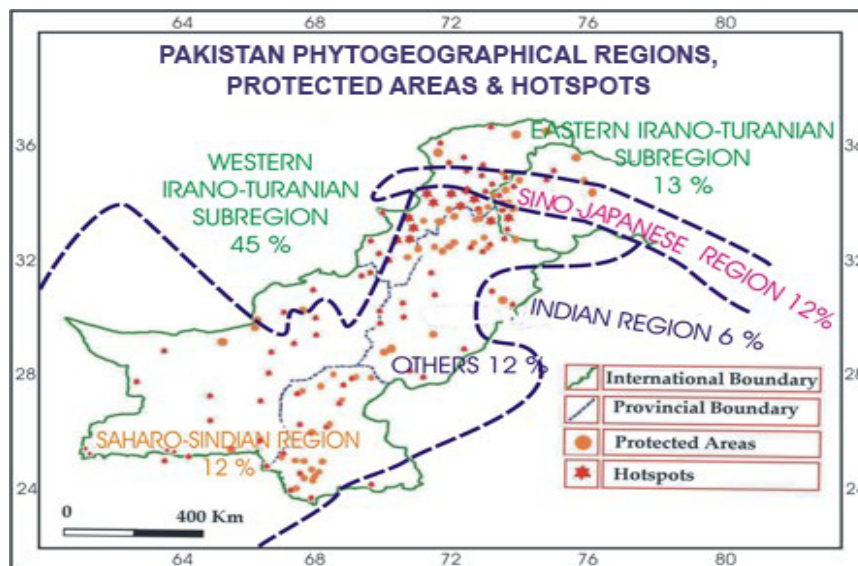


Fig.4. Subregional divide of ecological zones showing diversity hotspots and their relative percentage composition from Shinwari, Z. K. 2009.

Ziarat falls under Western Irano-Turanian subregion representing around 45% of the floral diversity as described by Shinwari 2009. The area is exposed to a number of stresses like continued spell of drought coupled with political instability in the vicinity which over burdened the habitat by the nomads and the marginalized communities to use it to subsidize impoverished incomes ultimately causing the indiscriminate and over-collection of plants material.

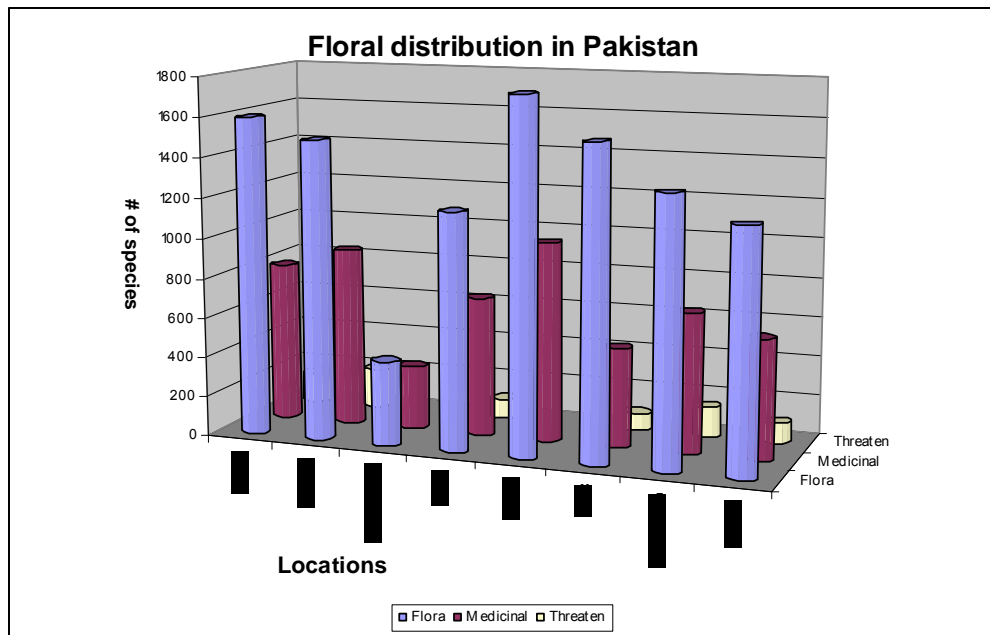


Fig. 5: Total Flora and medicinal plants of the hotspots of Pakistan and their current status (from Shinwari, Z.K. 2009).

Shinwari 2009 in his document listed a number natural resource on which the livelihood of the communities are directly or indirectly dependent. The case of wild pomegranate (*Punica granatum*) locally known as "anar dana" found in Pakistan is among them to be presented.

These anar dana are used in cooking as it has been used as taste enhancer for the dishes; besides having medicinal value. The tree of the wild pomegranate grows naturally in sub-mountainous tracts of the country from 900 to 1,800 m. Reported from Ziarat, and other parts of the Pakistan. Approximately 4,500 to 5,000 people are involved in the collection and processing of wild pomegranate and there were more than 100 dealers only in NWFP who purchase the fresh pomegranate fruit. Women were earning Rs. 300 to 500 for each 40 kg of seed extraction. The unit price of the wild pomegranate is 150 to 200 per kg. The total production of wild pomegranate was 69,000 tonnes in the country in 1999-2000 (Agriculture Statistic of Pakistan, 99-00). This shows the livelihood dependence of the communities on one of the floral resource; one can imagine the cumulative effect of all such available resources.

The rapid degradation of floral and cultural diversity, coupled with increasing rate of poverty make it imperative to find solutions to sustain the valuable resource; involvement of indigenous experience making decisions to manage the resource. Studies offering solutions for managing the natural resources will help in providing food security, nutrition and health care to the indigenous population and to public in general. Also help transpire local ethnobotanical knowledge.



There is a huge crude drug (Pansara) market system that is almost entirely dependent on wild flora and caters the financial need of thousands of worker involved in the trade. Both human and animal ailments are treated through the use of medicinal herbs.

A very little is documented and known about the associated flora of Ziarat Juniper Forest ecosystem and with the particular reference of its uses; it is imperative to have an updated document on the representative floristic list defining the ethno botanic and medicinal importance of the flora represented in Ziarat Juniper Forest. This study is an effort to address the need.

2.0 Methodology

The information about the vegetation of Ziarat is very scanty and not much of the published data was available; either there were no information available or it would be too superficial and old. Generating primary information requires tremendous resources in terms of time, effort and cost. The data gathered as a result of this study was comprised of two sets, i.e post and pre rain situations. The first study was conducted in the end of July 2007 referred here as Fall 07; whereas the second study was conducted in May 2008 referred as Spring 08.

2.1 Sample areas:

Koshki valley lies in the south of Ziarat town and is famous for the shrine of famous sufi saint Kharwari Baba. Koshki valley supports good patches of Juniper forests. This valley consists of 9 main villages. The main sources of livelihoods are agriculture and livestock. Both of these livelihood sources have suffered heavily in the drought in recent past.

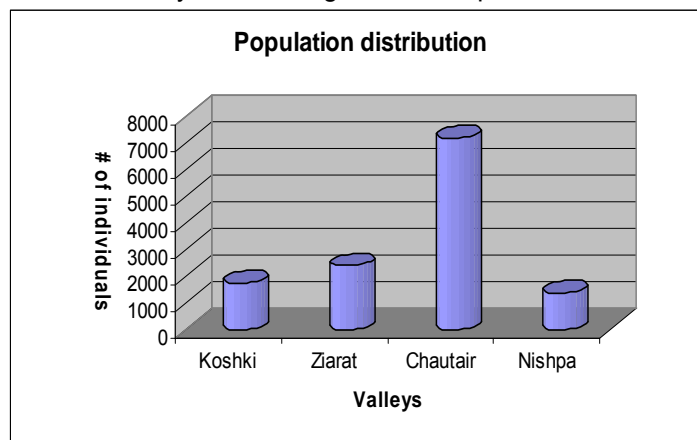


Fig.6. Population dispersion in different sub valleys of Ziarat.

Main Ziarat valley stretches from the Ziarat Tangi to the divide between Ziarat and Chautair valleys. Besides the main Ziarat town there are 6 villages in this valley. In the main Ziarat valley unlike other valleys, livelihood sources show a mix including agriculture, livestock, government and private services, daily wage labour and business.

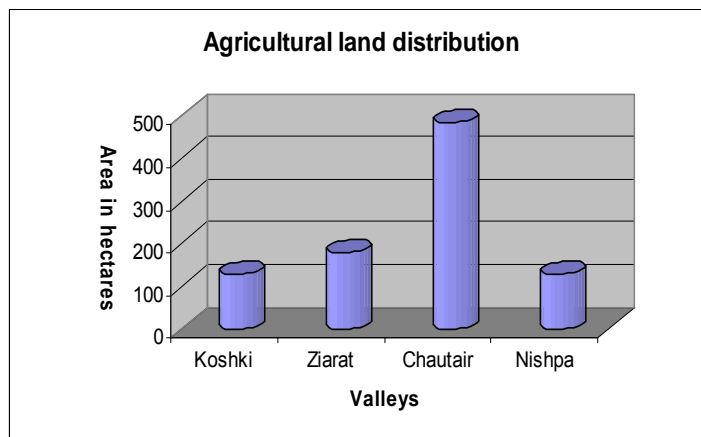


Fig.7. Agriculture land distribution in different sub valleys of Ziarat.

Main Chautair valley starts from the Ziarat – Chautair divide and extends upto Thanda Wani village. It is a long valley with good forest cover. This valley consists of 9 main villages. In the main Chautair valley inhabitants like other valleys are dependent upon agriculture and livestock for their livelihoods.

Nishpa valley is situated on the east of Koshki valley beyond the Malikat mountainous rugged hilly area and on the south of Chowtair valley. This valley consists of 7 main villages. Population has a migratory behaviour during winter to the low land area. Agriculture and livestock are the main sources of livelihoods and have suffered adversely during the recent drought.

2.2 Floristic list:

The flora was listed based on identification keys and published information, alternatively taxon were collected with all relevant information recorded. The collected specimen were analysed and identified by phytotaxonomist of Karachi University herbarium for the validation of their nomenclature.

2.3 Quantitative inference:

The quantitative data were collected using plotless sampling method of random pairs. The data sets were then classified on the basis of spatial and temporal distribution of the vegetation (ground strata). The area sampled were Koshki, Ziarat, Nishpa /Batyair and finally Chautair valley. Ziarat and Chautair valleys were relatively of larger size therefore were divided into strata of south and north facing sides. The data set was then subject to a series of calculations resulting in defining the IVI (Importance value index) and Y3 (Importance value) of the species present in the particular habitat. The abundance value of the species was estimated using IVI (Importance Value Index) as a variable. The density and cover per acre of a species were also estimated using different phytosociological formulae including Simpson and Shannon indices were also calculated with slight modifications to assess the degree of diversity in the area they can be calculated based on following relationship:

$$\text{Simpson's index } D = \sum (n_i / N)^2$$

$$\text{Shannon's index } H = -\sum n_i / N \log_e n_i / N$$

2.4 Detail floristic information:

The qualitative information like morphology, phenology, ethnobotnic uses and medicinal value, conservation status etc were listed by holding individual and group meetings with the locals and the people engaged in the discipline. Information gathered locally has been traced and verified from the available published information and publications around the world. Based on collated information a relatively detail species information sheet were prepared for medicinally important selected species.

2.5 Estimation of the value of the available resource:

The economic aspect of the herbal trade in Ziarat area was also assessed analysed and discussed. Based on the information gathered locally and from the markets of the nearby areas and major economic centers in the country, some of the recommendations were made to address the sustainability of the resources giving due consideration to the conservation status and livelihoods of the native people.

2.6 Propogation mechenism:

2.6.1 Sexual propogation (Seed)

Seeds produce many plants at once and they can be collected and transported very easily. The main problems that it may encounter with seed propagation are failure to germinate and loss through transplanting. Both of these problems can be reduced with careful nursery stock management. Many seeds are best-sown fresh and do not survive if they are allowed to dry-out. Always check that the seed is free from pests and disease. Even if an often a result of

- a) A natural chemical inhibitor in the seed or
- b) The having a physical inhibitor i.e. a hard seed coat. These inhibitors are designed to protect the seed from germinating in an unsuitable environment.

To succeed with these kinds of seeds it may need to experiment to find out what kind of inhibitor the seed has, sometimes they have both. The main method of breaking down the chemical inhibitor is by soaking the seeds in water. This can wash away a chemical inhibitor. A physical inhibitor requires scarifying. This is the use of abrasion to break through the hard outer coat of the seed without damaging the seed itself. Hard-coated seeds may also respond to overnight soaking in water. The prepared seeds should be distributed uniformly over the seedbed. After sowing rake the soil over lightly to ensure good seed-soil contact. If the seeds are very large it may choose to plant them individually. The general rule is to plant a seed at a depth equal to the size of the seed itself. The seeded areas should be watered carefully. Avoid waterlogging and the displacement of seeds with careless watering.

When planting seeds into polythene bags the soil in the bags should be moist. The seed should be planted at a depth of 2cm or so. If in doubt about which way up to plant the seed place the seed flat in the soil at a depth that is the same as the thickness of the seed. Alternatively, seeds can be planted by digging a hole and dropping

two seeds in with the pointed ends upwards. The holes are then covered up with soil. At the four-leaf stage, remove one seedling, leaving the stronger seedling to grow.

2.6.2 Vegetative propagation:

This is when it takes a vegetative part of the plant, stem or piece of root and grows new plants from it directly i.e. not seed. By rooting cuttings on the nursery it is not necessary to rely on the parent plant producing seed and it can overcome many of the problems that it may have with trying to get seeds to germ innate successfully. Vegetative cutting mean that it can select plant that is best for the needs i.e. the individual plant that it know to be particularly potent and valuable for medicine rather than leaving this to be the chance with a random selection of seedlings.

2.6.2.1 Stem cuttings

Commonly, the vegetative part of the plant used for propagation is the stem. Collect small branches of vigorous growth, which shows no sign of pest or disease, and make every effort to prevent this from wilting. When it collects the cutting materials avoid the heat of the day as this is when the plant is losing a lot of its moisture. Do not keep the material in a polythene bag, as it will overheat very easily. Once in the nursery, find s shaded area and prepare the cuttings. It may like to have a bucket of cold water standing by to receive the trimmed cuttings. Take a moderately vigorous shoot and cut to a length of between 2.5-12cm long.

The length of stem it required depends on the length of internodes (the space between the leaves). A node is the point at which the leaf meets the stem and a cutting is measured by the number of nodes it has. For example, a single node cutting is suitable from plants where the internodes space is no less than 1.5cm. In this case it should be cut just above the node and then insert that end into the compost. Two-node cuttings are taken from plants where there is a shorter distance between the nodes. Cut just under a node, as this is a good place for roots to be formed. Many node cuttings are for species that have very short internodes and lots of small leaves. These are best taken at 5-15cm long.

If the stem is leafy this is usually known as a softwood cutting. Most tropical trees can be propagated from softwood cutting. Using a clean knife, remove all but the top two leaves of the cutting. Trim each leaf down by half. It is preferable to dip the stem base into a hormone solution or powder to encourage rooting. However, this is not absolutely necessary. Insert two thirds of the stem into the prepared cutting bed or polythene bags of compost and gently press the compost down to firm it in. Water and keep shaded. To avoid drying breezes make sure that the cuttings are sheltered by palm leaves or by some other kind of structure. It is important that the new cuttings are kept cool and do not dry out. The leaves of the cutting should never wilt. The best

way to stop the leafy soft woodcuttings drying-out is to build a small propagator. This can be as large or as small as it require. The purpose of the propagator is to maintain high air humidity.

If it takes a cutting from a stem of a plant, which is leafless this is usually known as a hardwood cutting. If there are leaves still on the cutting these can be cut off using a sharp knife leaving a very few leaves at the tip. The wood is usually firmer and there is less danger of the cutting drying out. These cuttings are usually much larger than softwood cuttings (as much as 1-2 meters) and can usually be planted directly into the ground but will take longer to root. The cutting should have an inactive bud, as it is better for the new shoot growth to begin after rooting.

2.6.2.2 Root cuttings:

These can be cut from the main plant without destroying it. A piece of stem be cut as long and as thick as the index finger. Do not use any growth hormone, as this will stop the root growing. Place the root cutting horizontally in a polythene bag full of compost or directly into the nursery beds. Cover with a light layer of soil and firm down. Watering is done as and when necessary. Roots develop between 4-8 weeks after planting.

2.6.2.3 Tubers:

Take these cuttings when the plant is not actively growing i.e. when it is dormant. Cut small piece of the tuber, which should include a bud. Do not use any growth hormone. To allow it to harvest some of the plants tubers later without destroying the whole plant, it will be beneficial to plant this cutting into a raised bed or individual mound as for ginger.

2.6.2.4 Suckers:

Suckers are the shoots that are produced from the roots. Treat these as either uprooted cuttings or separate them from the main plant keeping a piece of root attached. Avoid these suckers drying out by preparing the planting ground in advance and water them as soon as it have planted them.

2.6.2.5 Offsets:

These are the little clumps of new shoots that form clumps or sets of buds at the base of some species e.g. banana and plantain. Separate these from the main plant and divide them into individual plants or small clumps. Do not allow these to dry out or be left in the sun. Plant these clumps into the nursery beds or into their final planting position and water them well.

2.6.2.6 Undercutting seedbeds:

Drawing the blade of a machete at ground level, under a raised bed of cultivating plants, is known as 'undercutting.' This is a useful technique when growing cultivating plants in

the nursery to help them to develop a very fibrous root system. This results in good plant establishment when they are transplanted to their final planting site. Undercutting promotes vigorous fibrous roots and prevents the roots from penetrating too far down into the nursery bed. Undercutting can only be done on a raised bed that is twice the width of a machete.

2.6.3 Post Planting care

Potting-on is what it do when the seeds or cutting have established an adequate rooting system to sustain them and it need to move them into a bigger pot or to a larger site where they can grow on for a little while longer. It is the point at which they have developed roots and are ready to start growing into cultivating plants. The correct time for potting-on seedlings are when the first set of true leaves have grown. The correct time for cutting is when the roots are visible through the holes in the bottom of the pot or, if they are directly planted into beds, when they show signs of independent growth in the form of a new flush of leaves. Lifting these delicate cultivating plants and potting them into new pots or a new piece of ground is a most stressful time for the cultivating plant. Water the plants it intends to move the day before the operation. Handle the rooting ball compost rather than pulling them. Ensure that it loosen the soil around the plant using a stick or other small utensil before lifting it from the bed. Hold the cultivating seedling by the first two seed leaves not by the stem or roots. If it bruise the neck of the soft stem, the plant us likely to rot.

If in pots, gently loosen the root ball in the pot before tapping the whole root ball into the upturned hand. Always carry out his operation in the cool of the day and in the shade. Do not handle the plant too often and try to keep the roots cool throughout the operation. Prepare the new planting area before initiating the transplanting. Have the compost ready mixed or the bed already dug –over and raked level in expectation of the transplanting. Water the newly transplanted plants thoroughly to ensure that the roots are in close contact with the soil around them. The plants must not be allowed to dry out or the roots be unduly damaged or broken. All newly potted-on plants should be watered well and shaded for a few days after potting-on.

3.0 The Results:

The Ziarat Juniper Forests are under considerable pressure from a range of threats including over use for fuel, wood, brush fencing, construction timber, roof thatching etc and natural threats such as Dwarf mistletoe (*Arceuthobium oxycedri*), fungal die-back, fire and the largely unknown impacts of climate change. Strengthened protection is therefore warranted.

The Ziarat Juniper Forest not singly caters the natural needs of the communities living in the area but also offers a conducive situation for the growth of a wide variety of herbs and shrubs, which are medicinally and ethno botanically important. The available qualitative data set revealed the presence of some 54 species distributed as follows in Fig. and listed below in the table.

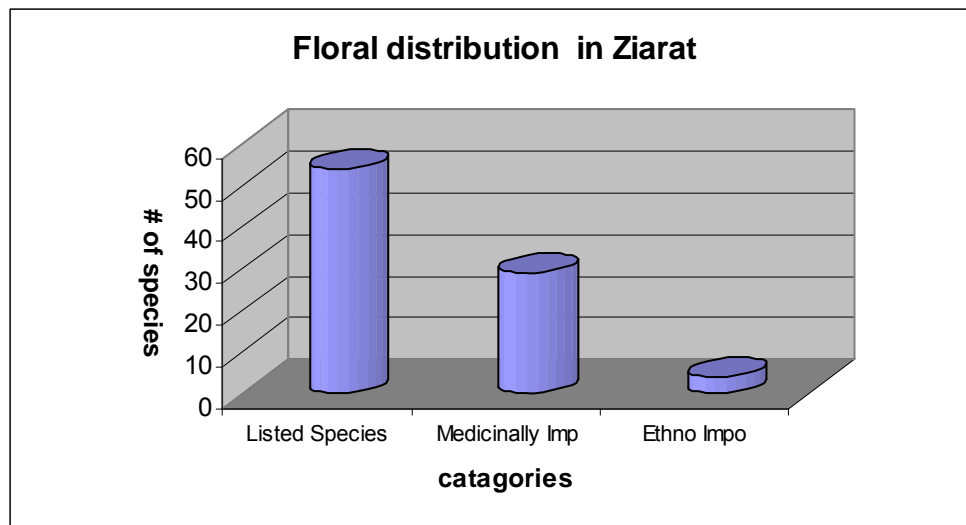


Fig.8. Floral distribution in Ziarat.

Table 1: -A generalized floristic list of Ziarat valley.

#	Taxon	Vernacular name	Family
01	<i>Pistacia Khinjuk</i> Stocks.	Buzgai	Anacardiaceae
02	<i>Coriandrum sativum</i> Linn.	Dhanya	Apiaceae
03	<i>Foeniculum vulgare</i> Mill.	Kumala	Apiaceae
04	<i>Trachyspermum baluchistanicum</i> E.Nasir.		Apiaceae
05	<i>Eremurus persicus</i> (Jaub.& Spach) Boiss		Asphodelaceae
06	<i>Eremurus stenophyllus</i> (Boiss.& Bushe) Baker	Shezgi	Asphodelaceae
07	<i>Artemisia maritima</i> Linn	Tarkha sperah (Zeher)	Asteraceae
08	<i>Artemisia stricta</i> Edgew	Zhusane Turkha	Asteraceae
09	<i>Conyza bonariensis</i> (Linn.) Cronquist		Asteraceae
10	<i>Lactuca orientalis</i> (Boiss.)Boiss.		Asteraceae
11	<i>Lactuca sarriola</i> Linn.		Asteraceae
12	<i>Sonchus asper</i> (Linn) Hill.		Asteraceae
13	<i>Xanthium strumarium</i> Linn	Chota	Asteraceae
14	<i>Berberis baluchistanica</i> Ahrendt.	Tor zaralga	Berberidaceae
15	<i>Berberis calliobotrys</i> Aitch.& Koehne	Shin zaralga	Berberidaceae
16	<i>Berberis densiflora</i> Boiss.& Bushe	Soor zaralga	Berberidaceae
17	<i>Onosma hispida</i> Wall.ex G.Don.	Yarilang	Boraginaceae
18	<i>Carthamus oxyacantha</i> M. Bieb.		Campanulaceae
19	<i>Chenopodium foilosum</i> Aschers.	Goosefoot	Chenopodiaceae
20	<i>Salsola paulsenii</i> Litv.	Jaghun	Chenopodiaceae
21	<i>Hertia intermedia</i> (Boiss) O.Ktze.	Munglian	Companulaceae
22	<i>Convolvulus arvensis</i> Linn.	Bachki	Convolvulaceae
23	<i>Convolvulus spinosus</i> Brum.f.	Vatke	Convolvulaceae
24	<i>Ephedra intermedia</i> Schrenk.	Uman	Ephedraceae
25	<i>Ephedra procera</i> Fisch. & May	Uman	Ephedraceae
26	<i>Andrachne telephoides</i> Linn	Ghuazarpara	Euphorbiaceae
27	<i>Astragalus tribuloides</i> Del.		Fabaceae
28	<i>Caragna ambigua</i> Stocks.	Makhi	Fabaceae
29	<i>Medicago sativa</i> Linn	Spishta	Fabaceae
30	<i>Sophora mollis</i> (Royle) Baker	Zagherah	Fabaceae
31	<i>Marrubium vulgare</i> Linn.		Lamiaceae
32	<i>Mentha longifolia</i> (Linn)		Lamiaceae
33	<i>Nepeta glomerulosa</i> Boiss	Chingan buti	Lamiaceae
34	<i>Peroviskia abrotanoides</i> Karel.	Shinshobay	Lamiaceae
35	<i>Phlomis spectabilis</i> Falc.ex Benth	Kundulay	Lamiaceae
36	<i>Phlomis stewartii</i> Hook.f.		Lamiaceae
37	<i>Stachys parviflora</i> Benth.	Randukay	Lamiaceae
38	<i>Teucrium stocksianum</i> Boiss	Kerpola	Lamiaceae
39	<i>Thymus linearis</i> Benth		Lamiaceae
40	<i>Ziziphora clinopodiodes</i> Lam.	Purchink Maurai	Lamiaceae
41	<i>Malva neglecta</i> Wallr	Kukra	Malvaceae
42	<i>Mimosa pudica</i> Linn	Sarma buti	Mimosaceae
43	<i>Olea ferruginea</i> Royle	Zaitoon (kahu)	Oleaceae
44	<i>Plantago erosa</i> Wall.	Bartang	Plantaginaceae
45	<i>Plantago lanceolata</i> Linn.	Bartang	Plantaginaceae
46	<i>Saccharum griffithii</i> Munro ex Boiss		Poaceae
47	<i>Polygonum aviculare</i> Linn		Polygonaceae
48	<i>Ziziphus mauritiana</i> Lam	Ber	Rhamnaceae
49	<i>Rhamnus persica</i> Boiss		Rhamnaceae
50	<i>Rosa lacerans</i> Boiss & Bushe	Suraya	Rosaceae
51	<i>Solanum nigrum</i> Linn	Karezgi (Mako)	Solanaceae
52	<i>Daphne oleoides</i> Schreb.	Leghunae	Thymeleaceae
53	<i>Fagonia bruguieri</i> DC		Zygophyllaceae
54	<i>Peganum hermala</i> Linn.	Ispanda	Zygophyllaceae

View of the dominant ground flora of the Ziarat .



Peroviskia abrotanoides Karel



Hertia intermedia (Boiss) O.Ktze.



Malva neglecta Wallr



Sophora mollis (Royle) Baker



Ephedra intermedia Schrenk

Herb: Zhong Ma Huang,
Local Name: Uman
Family: Ephedraceae

Medicinal use:

Members of this genus contain various medicinally active alkaloids (but notably ephedrine) and they are widely used in preparations for the treatment of asthma and catarrh. Ephedrine has a similar effect to adrenaline in the body. It acts promptly to reduce swellings of the mucous membranes and has antispasmodic properties, thus making it valuable in the treatment of asthma. This species contains between 0.7 and 2.33% alkaloids, of which 10% is ephedrine. The whole plant can be used at much lower concentrations than the isolated constituents - unlike using the isolated ephedrine, using the whole plant rarely gives rise to side-effects. The plant also has antiviral effects, particularly against influenza. The stems are a pungent, bitter, warm herb that dilates the bronchial vessels whilst stimulating the heart and central nervous system. The stems are also antidote, diaphoretic, diuretic, vasoconstrictor and vasodilator. They are used internally in the treatment of asthma, hay fever and allergic complaints. They are also combined with a number of other herbs and used in treating a wide range of complaints. This herb should be used with great caution, preferably under the supervision of a qualified practitioner. It should not be prescribed to patients who are taking monoamine oxidase inhibitors, or suffering from high blood pressure, hyperthyroidism or glaucoma. Ephedrine is seen as a performance-boosting herb and, as such, is a forbidden substance in many sporting events such as athletics. The stems can be harvested at any time of the year and are dried for later use. The root is antihydrotic; it lowers blood pressure and dilates the peripheral blood vessels. It is used in the treatment of night sweating and spontaneous sweating.

Description of the plant:

Plant	Height
Evergreen Shrub	100 cm (3 1/4 foot)

Habitat of the herb:

Mountain slopes at low elevations. Grasslands, deserts, river valleys, floodlands, cliffs, other dry, sandy or rocky places, 100 - 4600 metres.

Edible parts:

Fruit - raw or cooked. The fruit is about 7mm in diameter.

Propagation of the herb:

Seed - best sown as soon as it is ripe in the autumn in a greenhouse. It can also be sown in spring in a greenhouse in sandy compost. Prick out the seedlings into individual pots as soon as they are large enough to handle and grow them on for at least their first winter in a greenhouse. Plant out in the spring or early summer after the last expected frosts and give some protection in their first winter. Division in spring or autumn. Layering.

Cultivation:

Mountain slopes at low elevations. Grasslands, deserts, river valleys, floodlands, sandy beaches, cliffs, other dry, sandy or rocky places, 100 - 4600 metres.

Known hazards of *Ephedra intermedia*:

None known



Sophora mollis (Royel) Baker

Synonyms: Edwardsia mollis
Local Name: Zagherah
Family: Leguminosae

Edible parts of *Sophora mollis*:

There are reports saying that the plant has edible qualities but does not say what part of the plant is eaten.

Description of the plant:

Plant	Height	Flowering
Deciduous Shrub	2 m (6 1/2 foot)	April-May

Habitat of the herb:

Rocks in dry valleys, 1200 - 2000 metres. Often gregarious on hillsides.

Other uses of *Sophora mollis*:

The seed is considered useful for destroying vermin. Wood - hard. Mainly used as a fuel.

Propagation of the herb:

Seed - best sown as soon as it is ripe in a greenhouse. Pre-soak stored seed for 12 hours in hot (not boiling) water and sow in late winter in a greenhouse. Prick out the seedlings as soon as they are large enough to handle into individual pots in the greenhouse, and grow them on for 2 years under protected conditions. Plant them out into their permanent positions in early summer of their third year. Cuttings of young shoots with a heel, July/August in a frame. Air-layering.

Cultivation:

Rocks in dry valleys, 1200 - 2000 metres. Often gregarious on hillsides.

Medicinal use of the herb:

None known

Known hazards of *Sophora mollis*:

The plant contains cytosine, which resembles nicotine and is similarly toxic.



Berberis lycium Royle.

Local name: Soor Zaralg
Family: Berberidaceae (Barberry Family)

Medicinal use of Berberis lycium:

The roots are aperient, carminative, febrifuge and ophthalmic. They are used in the treatment of eye complaints, menorrhagia, chronic diarrhoea and piles. The leaves have been used in the treatment of jaundice. Berberine, universally present in rhizomes of Berberis species, has marked antibacterial effects. Since it is not appreciably absorbed by the body, it is used orally in the treatment of various enteric infections, especially bacterial dysentery. It should not be used with Glycyrrhiza species (Liquorice) because this nullifies the effects of the berberine. Berberine has also shown antitumour activity.

Description of the plant:

Plant	Height	Flowering
Evergreen Shrub	3 m (9 ³ / ₄ foot)	May to June

Habitat of the herb:

Open hillsides, usually on hot dry slopes, to 3000 metres.

Edible parts of Berberis lycium:

Fruit - raw or cooked and made into preserves. Fairly juicy with a nice slightly acid flavour. The fruits are about 8mm long. Leaves and young shoots - cooked. Sometimes leaves are used as tea substitute.

Other uses of the herb:

A yellow dye is obtained from the root.

Propagation of Berberis lycium:

Seed - best sown as soon as it is ripe in a cold frame, when it should germinate in late winter or early spring. Seed from over-ripe fruit will take longer to germinate, whilst stored seed may require cold stratification and should be sown in a cold frame as early in the year as possible. The seedlings are subject to damping off, should be kept well ventilated. When the seedlings are large enough to handle, pick them out and grow them on in a cold frame. If growth is sufficient, it can be possible to plant them out into their permanent positions in the autumn, but generally it is best to leave them in the cold frame for the winter and plant them out in late spring or early summer of the following year. Cuttings of half-ripe wood, July/August in a frame. Cuttings of mature wood of the current season's growth, preferably with a heel, October/November in a frame.

Cultivation:

Shrubberies and open hillsides, usually on hot dry slopes, to 3000 metres.



Thymus vulgaris Linn.

Herb: Common Thyme
 Local Name: Shin Moray
 Family: Lamiaceae

Medicinal use of Common Thyme:

Common thyme has a very long history of folk use for a wide range of ailments. It is very rich in essential oils and these are the active ingredients responsible for most of the medicinal properties. In particular, thyme is valued for its

antiseptic and antioxidant properties, it is an excellent tonic and is used in treating respiratory diseases and a variety of other ailments. The flowering tops are anthelmintic, strongly antiseptic, antispasmodic, carminative, deodorant, diaphoretic, disinfectant, expectorant, sedative and tonic. The plant is used internally in the treatment of dry coughs, whooping cough, bronchitis, bronchial catarrh, asthma, laryngitis, indigestion, gastritis and diarrhoea and enuresis in children. It should not be prescribed for pregnant women. Externally, it is used in the treatment of tonsillitis, gum diseases, rheumatism, arthritis and fungal infections. The plant can be used fresh at any time of the year, or it can be harvested as it comes into flower and either be distilled for the oil or dried for later use. Thyme has an antioxidant effect, thus regular use of this herb improves the health and longevity of individual body cells and therefore prolongs the life of the body. The essential oil is strongly antiseptic. The whole herb is used in the treatment of digestive disorders, sore throats, fevers etc. The essential oil is one of the most important oils used in aromatherapy. Its keyword is "Bacterial". It is used especially in cases of exhaustion, depression, upper respiratory tract infections, skin and scalp complaints etc. The oil can cause allergic reactions and irritation to the skin and mucous membranes.

Description of the plant:

Plant	Height	Flowering	Scent
Evergreen Shrub	20 cm (7 ³ / ₄ inch)	June to August	Scented Shrub

Habitat of the herb:

Dry slopes, rocks. Always found on clay or limestone soils.

Edible parts of Common Thyme:

Leaves and flowering tops - raw in salads, used as a garnish or added as flavouring to cooked foods, going especially well with mushrooms and courgettes. It is an essential ingredient of the herb mix "bouquet garni". It retains its flavour well in long slow cooking. The leaves can be used either fresh or dried. If the leaves are to be dried, the plants should be harvested in early and late summer just before the flowers open and the leaves should be dried quickly. A nutritional analysis is available. An aromatic tea is made from the fresh or dried leaves. Pungent and spicy.

Other uses of the herb:

An essential oil from the leaves is frequently used in perfumery, soaps, toothpastes, mouthwashes, medicinally etc. It has fungicidal properties and is also used to prevent mildew. The leaves are dried and used in pot-pourri. The plant makes an attractive ground cover for a sunny position. Plants are best spaced about 30cm apart each way. The dried flowers are used to repel moths from clothing whilst the growing plant is said to repel cabbage root fly.

Propagation of Common Thyme:

Seed - sow spring in a cold frame. Seed can also be sown in autumn in a greenhouse. Surface sow or barely cover the seed. Germination can be erratic. When they are large enough to handle, prick the seedlings out into individual pots and grow them on in the greenhouse for at least their first winter. Plant them out into their permanent positions in late spring or early summer, after the last expected frosts. The seed can keep for three years in normal storage. Division in spring or autumn. Larger divisions can be planted out direct into their permanent positions. We have found that it is best to pot up smaller divisions and grow them on in light shade in a greenhouse or cold frame until they are growing away well. Plant them out in the summer or the following spring. Cuttings of young shoots, 5 - 8cm with a heel, May/June in a frame. Cuttings of half-ripe wood, 5 - 8cm with a heel, July/August in a frame. Layering.

Cultivation of the herb:

Dry slopes, rocks. Always found on clay or limestone soils.

Known hazards of *Thymus vulgaris*:

A comment has been made in one report on medicinal uses that the plant should be used with caution. No explanation was given. It quite possibly refers to overuse of the essential oil. All essential oils, since they are so concentrated, can be harmful in large doses.



Foeniculum vulgare Mill.

Herb: Fennel
 Local name: Kmala
 Synonyms: *Foeniculum officinale*
 Family: Umbelliferae

Medicinal use of Fennel:

Fennel has a long history of herbal use and is a commonly used household remedy, being useful in the treatment of a variety of complaints, especially those of the digestive system. The seeds, leaves and roots can be used, but the seeds are most active medicinally and are the part normally used. An essential oil is often extracted from the fully ripened and dried seed for medicinal use, though it should not be given to pregnant women. The plant is analgesic, anti-inflammatory, antispasmodic, aromatic, carminative, diuretic, emmenagogue, expectorant, galactagogue, hallucinogenic, laxative, stimulant and stomachic. An infusion is used in the treatment of indigestion, abdominal distension, stomach pains etc. It helps in the treatment of kidney stones and, when combined with a urinary disinfectant like *Arctostaphylos uva-ursi*, makes an effective treatment for cystitis. It can also be used as a gargle for sore throats and as an eyewash for sore eyes and conjunctivitis. Fennel is often added to purgatives in order to allay their tendency to cause gripe, and also to improve the flavour. An infusion of the seeds is a safe and effective cure for wind in babies. An infusion of the root is used to treat urinary disorders. An essential oil obtained from the seed is used in aromatherapy. Its keyword is "Normalising". The essential oil is bactericidal, carminative and stimulant. Some caution is advised, see notes above on toxicity.

Description of the plant:

Plant	Height	Flowering	Scent
Evergreen Perennial	150 cm (5 feet)	August to October	Scented Perennial

Habitat of the herb:

Found most often in dry stony calcareous soils.

Edible parts of Fennel:

Leaves - raw or cooked. A delicious aniseed flavour, the young leaves are best since older ones soon become tough. They are often used as a garnish on raw or cooked dishes and make a very pleasant addition to salads. They help to improve digestion and so are particularly useful with oily foods. The leaves are difficult to store dried, though this does not really matter since they can often be harvested all year round, especially if the plants are in a warm, sheltered position. Leaf stalks and flower heads - raw or cooked. A similar aniseed flavour to the leaves. The aromatic seeds are used as flavouring in cakes, bread, stuffings etc. They have a similar flavour to the leaves and also improve the digestion. The sprouted seeds can be added to salads. An essential oil from the fully ripened and dried seed is used as food flavouring in similar ways to the whole seed. Root - cooked. Somewhat parsnip-like. The leaves or the seeds can be used to make a pleasant-tasting herbal tea.

Other uses of the herb:

The seed yields up to 5% of an essential oil. This is used medicinally, as a food flavouring, in toothpastes, soaps, perfumery, air fresheners etc. The flavour of fennel oil

depends upon its two main constituents. "Fenchone" is a bitter tasting element whilst "anethole" has a sweet anise-like flavour. The proportions of these two ingredients vary according to strain and region. Plants growing in the Mediterranean and southern Europe usually have sweet oil whilst plants growing in central and northern Europe usually produce more bitter oil. The quality of the oil also depends upon how well the seed has been dried - the oil from fully ripened and dried seeds being much sweeter and more fragrant. The dried plant is an insect repellent; the crushed leaves are effective for keeping dogs free of fleas. The plant was formerly used as a strewing herb. Yellow and brown dyes are obtained from the flowers and leaves combined.

Propagation of Fennel:

Seed - best sown in early spring in situ. The seed can also be sown in situ in the autumn. In many gardens it self sows freely. Division in March as the new growth appears. The plants are very tolerant of disturbance; we have found divisions to take well at any time of the year, though these divisions are never as good as seed-sown plants.

Cultivation of the herb:

Found most often in dry stony calcareous soils near the sea.

Known hazards of *Foeniculum vulgare*:

Skin contact with the sap or essential oil is said to cause photo-sensitivity and/or dermatitis in some people. Ingestion of the oil can cause vomiting, seizures and pulmonary oedema.



Coriandrum sativum Linn.

Local Name: Dhania; Coriander

Family: Umbelliferae

Medicinal use of Coriander:

Coriander is a commonly used domestic remedy, valued especially for its effect on the digestive system,

treating flatulence, diarrhoea and colic. It settles spasms in the gut and counters the effects of nervous tension. The seed is aromatic, carminative, expectorant, narcotic, stimulant and stomachic. It is most often used with active purgatives in order to disguise their flavour and combat their tendency to cause gripe. The raw seed is chewed to stimulate the flow of gastric juices and to cure foul breath and will sweeten the breath after garlic has been eaten. Some caution is advised, however, because if used too freely the seeds become narcotic. Externally the seeds have been used as a lotion or have been bruised and used as a poultice to treat rheumatic pains. The essential oil is used in aromatherapy. Its keyword is "Appetite stimulant".

Description of the plant:

Plant	Height	Flowering	Scent
Annual	45 cm (1 foot)	June to July	Scented Annual

Habitat of the herb:

Waste places and arable land, often by the sides of rivers.

Edible parts of Coriander:

Leaves - raw or cooked. They are used as flavouring in salads, soups etc and the fresh leaves are probably the most widely used flavouring herb in the world. The leaves have an aromatic flavour. It is foetid according to another report, whilst another says that the fresh leaves have a strong bedbug-like smell. The leaves should not be eaten in large quantities. The fresh leaves contain about 0.012% oxalic acid and 0.172% calcium. Seed - cooked. It is used as a flavouring in many dishes including cakes, bread and curries, it is also widely used to flavour certain alcoholic liquors. The fresh seed has a disagreeable and nauseous smell, but when dried it becomes fragrant, the longer it is kept the more fragrant it becomes. Plants yield about 1– tonnes per acre of seed. The root is powdered and used as a condiment. An essential oil from the seed is used as a food flavouring

Other uses of the herb:

An essential oil from the seed is used as a food flavouring, in perfumery, soap making etc. It is also fungicidal and bactericidal. The growing plant repels aphids. A spray made by boiling of one part coriander leaves and one part anise seeds in two parts of water is very effective against red spider mites and woolly aphids. An oil from the seed is used for making soap. The report does not make it clear if the essential oil or the fixed oil is used. The seed contains about 20% fixed oil, this has potential for industrial use in Britain, it could become an alternative to oilseed rape though the oil content is a bit on the low side at present (1995). The oil can be split into two basic types, one is used in making soaps etc, whilst the other can be used in making plastics. The dried stems are used as a fuel.

Propagation of Coriander:

Seed - sow April in situ. The seed is slow to germinate and so on a garden scale it can also be sown in March in a cold frame. Sow a few seeds in each pot and then plant them out when they are growing away strongly in May. The seed can also be sown in situ in the autumn. Autumn sown plants will grow bigger and produce more seed.

Cultivation of the herb:

Waste places and arable land, often by the sides of rivers.

Known hazards of *Coriandrum sativum*:

The plant can have a narcotic effect if it is eaten in very large quantities.



Onosma hispida Wall.ex.G.Don.

Local Name: Yarilang
Family: Boraginaceae (Borage Family)

Medicinal use of *Onosma hispida*:

One report says that the plant has medicinal properties but gives no details. It has been reported as a precursor of one of the vital preparations of eastern medicine (Unani).

Description of the plant:

Plant	Height	Flowering
Perennial	40 cm (1 foot)	Sept-Oct

Habitat of the herb:

Dry, rocky and savannah slopes, 1700 - 2000 metres also reported in Kashmir. Found at elevations up to 4000 metres.

Edible parts of *Onosma hispida*:

Root. Used as a flavouring.

Propagation of the herb:

Seed - we have no information on this species but suggest sowing the seed in a greenhouse in early spring. Prick out the seedlings into individual pots as soon as they are large enough to handle and grow them on in the greenhouse for at least their first winter. Plant them out in early summer. Cuttings in a frame in the summer. Shade them for the first 10 - 12 days.

Cultivation of *Onosma hispida*:

Dry, rocky and savannah slopes, 1700 - 2000 metres in Kashmir. Found at elevations up to 4000 metres.

Known hazards of *Onosma hispida*:

There are no reports of toxicity for this species, but the following report for *O. echioides* should be borne in mind. The bristly stems and leaves can cause a good deal of irritation to the skin.

Convolvulus arvensis Linn.



Field Bindweed

Family: Convolvulaceae (Morning-glory Family)

Medicinal use of Field Bindweed:

The root, and also a resin made from the root, is cholagogue, diuretic, laxative and strongly purgative. The dried root contains 4.9% resin. The juice of the root is used in the treatment of fevers. A tea made from the floers is laxative and is also used in the treatment of fevers and wounds. A cold tea made from the leaves is laxative and is also used as a wash for spider bites or taken internally to reduce excessive menstrual flow.

Description of the plant:

Plant	Height	Flowering	Scent
Perennial	2 m	June to	Scented
Climber	(6 1/2 foot)	September	Perennial Climber

Habitat of the herb:

Hedgerows, fields, waste places, fences etc, it can be a troublesome weed of agriculture.

Edible parts of Field Bindweed:

The plant has been used as a flavouring in a liqueur called "Noyeau". No details are given as to which part of the plant is used.

Other uses of the herb:

The stem is used as a twine for tying up plants etc. It is fairly flexible and strong but not long-lasting. A green dye is obtained from the whole plant.

Propagation of Field Bindweed:

Seed - best sown in situ as soon as it is ripe, it germinates in the autumn. This species can become a real pest in the garden so it is unwise to encourage it.

Cultivation of the herb:

Hedgerows, fields, waste places, fences etc, it can be a troublesome weed of agriculture.

Known hazards of Convolvulus arvensis:



None known.

Marrubium vulgare Linn

Herb: White Horehound

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Family: Lamiaceae

Medicinal use of White Horehound:

White horehound is a well-known and popular herbal medicine that is often used as a domestic remedy for coughs, colds, wheeziness etc. The herb apparently causes the secretion of a more fluid mucous, readily cleared by coughing. The leaves and young flowering stems are antiseptic, antispasmodic, cholagogue, diaphoretic, digestive, diuretic, emmenagogue, strongly expectorant, hepatic, stimulant and tonic. Horehound is a very valuable pectoral, expectorant and tonic that can be safely used by children as well as adults. It is often made into a syrup or candy in order to disguise its very bitter flavour, though it can also be taken as a tea. As a bitter tonic, it increases the appetite and supports the function of the stomach. It can also act to normalize heart rhythm. The plant is harvested as it comes into flower and can be used fresh or dried. The root is a remedy for the bite of rattlesnakes; it is used in equal portions with *Plantago lanceolata* or *P. major*.

Description of the plant:

Plant	Height	Flowering	Scent
Perennial	50 cm (1 foot)	June to November	Scented Perennial

Habitat of the herb:

Downs, waste places and roadsides probably introduced during the colonial time as it is native to south coast of England.

Edible parts of White Horehound:

The leaves are used as a seasoning. Bitter and pungent, they are sometimes used to flavour herb beer or liqueurs. Horehound ale is a fairly well-known drink made from the leaves. A mild pleasantly flavoured tea is made from the fresh or dried leaves, it is a favourite cough remedy.

Other uses of the herb:

An essential oil is obtained from the plant and used as a flavouring in liqueurs. The plant has been used as a cure for cankerworm in trees. No more details are given but it is probably a strong infusion of the flowering shoots, or the essential oil, that is used. The growing plant repels flies.

Propagation of White Horehound:

Seed - sow April/May or August/September in a cold frame. Germination can be slow and erratic. Prick out the seedlings into individual pots when they are large enough to handle and plant them out in the following spring. Basal cuttings in late spring. Harvest the shoots with plenty of underground stem when they are about 8 - 10cm above the ground. Pot them up into individual pots and keep them in light shade in a cold frame or greenhouse until they are rooting well. Plant them out in the summer. Division in spring. Larger clumps can be replanted direct into their permanent positions, though it is best to pot up smaller clumps and grow them on in a cold frame until they are rooting well. Plant them out in the spring.

Cultivation of the herb:

Downs, waste places and roadsides

Known hazards of *Marrubium vulgare*:

Not known.



Artemisia maritime Linn

Herb: Sea Wormwood

Synonyms: *Seriphidium maritimum*

Family: Asteraceae

Medicinal use of Sea Wormwood:

Sea wormwood is not much used in herbal medicine, though it is often used domestically. Its medicinal virtues are similar to wormwood, *A. absinthum*, though milder in their action. It is used mainly as a tonic to the digestive system, in treating intermittent fevers and as a vermifuge. The leaves and flowering shoots are anthelmintic, antiseptic, antispasmodic, carminative, cholagogue, emmenagogue, febrifuge, stimulant, stomachic, tonic and vermifuge. The plant is harvested as it comes into flower and is dried for later use. The unexpanded floral heads contain the vermicide "santonin".

Description of the plant:

Plant	Height	Flowering	Scent
Deciduous Shrub	60 cm (2 feet)	August to September	Scented Shrub

Habitat of the herb:

Drier parts of salt marshes in sand and shingle.

Edible parts of Sea Wormwood:

The leaves are occasionally used as flavouring. Some caution is advised; see the notes above on toxicity.

Other uses of the herb:

The growing shoots are said to repel insects and mice, they have also been used as a strewing herb. An infusion is said to discourage slugs and insects.

Propagation of Sea Wormwood:

Seed - surface sow from late winter to early summer in a greenhouse, making sure that the compost does not dry out. When large enough to handle, prick the seedlings out into individual pots and grow them on in the greenhouse for their first winter. Plant out in late spring or early summer. Cuttings of half-ripe wood, July/August in a frame. Division in spring or autumn.

Cultivation of the herb:

Drier parts of salt marshes in sand and shingle.

Known hazards of *Artemisia maritima*:

The following notes are from a report on the closely related *A. absinthum*, they quite possibly also apply to this species. The plant is poisonous if used in large quantities. Even small quantities have been known to cause nervous disorders, convulsions, insomnia etc. Just the scent of the plant has been known to cause headaches and nervousness in some people.



Mentha longifolia (Linn)

Herb: Horsemint

Synonyms: *Mentha incana*, *Mentha sylvestris*

Family: Lamiaceae

Medicinal use of Horsemint:

Horsemint, like many other members of this genus, is often used as a domestic herbal remedy, being valued especially for its antiseptic properties and its beneficial effect on the digestion. Like other members of the genus, it is best not used by pregnant women because large doses can cause an abortion. The leaves and flowering stems are antiasthmatic, antispasmodic, carminative and stimulant. A tea made from the leaves has traditionally been used in the treatment of fevers, headaches, digestive disorders and various minor

ailments. The leaves are harvested as the plant comes into flower and can be dried for later use. The essential oil in the leaves is antiseptic, though it is toxic in large doses.

Description of the plant:

Plant	Height	Flowering	Scent
Perennial	100 cm (3 1/4 foot)	August to September	Scented Perennial

Habitat of the herb:

Waste places and damp roadsides.

Edible parts of Horsemint:

Leaves - raw or cooked. Peppermint-scented, they are used as flavouring in salads, chutneys and cooked foods. A herb tea is made from the leaves. An essential oil obtained from the leaves and flowering tops is used as a food flavouring in sweets etc. A peppermint-like taste.

Other uses of the herb:

The leaves contain about 0.57% essential oil. It is sometimes used as a substitute for peppermint oil in confectionery. Rats and mice intensely dislike the smell of mint. The plant was therefore used in homes as a strewing herb and has also been spread in granaries to keep the rodents off the grain.

Propagation of Horsemint:

Seed - sow spring in a cold frame. Germination is usually fairly quick. Prick out the seedlings into individual pots when they are large enough to handle and plant them out in the summer. *Mentha* species are very prone to hybridisation and so the seed cannot be relied on to breed true. Even without hybridisation, seedlings will not be uniform and so the content of medicinal oils etc will vary. When growing plants with a particular aroma it is best to propagate them by division. Division can be easily carried out at almost any time of the year, though it is probably best done in the spring or autumn to allow the plant to establish more quickly. Virtually any part of the root is capable of growing into a new plant. Larger divisions can be planted out direct into their permanent positions. However, for maximum increase it is possible to divide the roots up into sections no more than 3cm long and pot these up in light shade in a cold frame. They will quickly become established and can be planted out in the summer.

Cultivation of the herb:

Waste places and damp roadsides.

Known hazards of *Mentha longifolia*:

Although no records of toxicity have been seen for this species, large quantities of some members of this genus, especially when taken in the form of the extracted essential oil, can cause abortions so some caution is advised.



Plantago lanceolata Linn

Herb: Ribwort Plantain
Family: Plantaginaceae (Plantain Family)

Medicinal use of Ribwort Plantain:

Ribwort plantain is a safe and effective treatment for bleeding; it quickly staunches blood flow and encourages the repair of damaged tissue. The leaves contain mucilage, tannin and silic acid. An extract of them has antibacterial properties. They have a bitter flavour and are astringent, demulcent, mildly expectorant, haemostatic and ophthalmic. Internally, they are used in the treatment of a wide range of complaints including diarrhoea, gastritis, peptic ulcers, irritable bowel syndrome, haemorrhage, haemorrhoids, cystitis, bronchitis, catarrh, sinusitis, asthma and hay fever. They are used externally in treating skin inflammations, malignant ulcers, cuts, stings etc. The heated leaves are used as a wet

dressing for wounds, swellings etc. The root is a remedy for the bite of rattlesnakes; it is used in equal portions with *Marrubium vulgare*. The seeds are used in the treatment of parasitic worms. Plantain seeds contain up to 30% mucilage which swells up in the gut, acting as a bulk laxative and soothing irritated membranes. Sometimes the seed husks are used without the seeds. A distilled water made from the plant makes an excellent eye lotion.

Description of the plant:

Plant	Height	Flowering
Perennial	45 cm (1 foot)	April to August

Habitat of the herb:

Grassland, roadsides etc, a common weed of lawns and cultivated ground, on neutral and basic soils.

Edible parts of Ribwort Plantain:

Young leaves - raw or cooked. They are rather bitter and very tedious to prepare, the fibrous strands are best removed prior to eating. The very young leaves are somewhat better and are less fibrous. Seed - cooked. Used like sago. The seed can be ground into a powder and added to flours when making bread, cakes or whatever.

Other uses of the herb:

A good fibre is obtained from the leaves, it is said to be suitable for textiles. Mucilage from the seed coats is used as a fabric stiffener. It is obtained by macerating the seed in hot water. Gold and brown dyes are obtained from the whole plant.

Propagation of Ribwort Plantain:

Seed - sow spring in a cold frame. When they are large enough to handle, prick the seedlings out into individual pots and plant them out in early summer. A sowing can be made outdoors in situ in mid to late spring if you have enough seeds.

Cultivation of the herb:

Grassland, roadsides etc, a common weed of lawns and cultivated ground, on neutral and basic soils.

Known hazards of *Plantago lanceolata*:

Not known.



Polygonum aviculare Linn

Herb: Knotweed

Synonyms: *Polygonum heterophyllum*, *Polygonum littorale*

Family: Polygonaceae (Buckwheat Family)

Medicinal use of Knotweed:

Knotweed is a safe and effective astringent and diuretic herb that is used mainly in the treatment of complaints such as dysentery and haemorrhoids. It is also taken in the treatment of pulmonary complaints because the silicic acid it contains strengthens connective tissue in the lungs. The whole plant is anthelmintic, astringent, cardiogenic, cholagogue, diuretic, febrifuge, haemostatic, lithontripic and vulnerary. It was formerly widely used as an astringent both internally and externally in the treatment of wounds, bleeding, piles and diarrhoea. Its diuretic properties make it useful in removing stones. An alcohol-based preparation has been used with success to treat varicose veins of recent origin. The plant is harvested in the summer and early autumn and is dried for later use. The leaves are anthelmintic, diuretic and emollient. The whole plant is anthelmintic, antiphlogistic and diuretic. The juice of the plant is weakly diuretic, expectorant and vasoconstrictor. Applied externally, it is an excellent remedy to stay bleeding of the nose and to treat sores. The seeds are emetic and purgative. Recent research has shown that the plant is a useful medicine for bacterial dysentery. Of 108 people with this disease, 104 recovered within 5 days when treated internally with a paste of knotweed.

Description of the plant:

Plant	Height	Flowering
Annual	30 cm (11 ³ / ₄ inch)	June to October

Habitat of the herb:

Waste places, roadsides. A common garden weed.

Edible parts of Knotweed:

Young leaves and plants - raw or cooked. Used as a potherb, they are very rich in zinc. A nutritional analysis is available. Seed - raw or cooked. Rather small and fiddly to utilize, they can be used in all the ways that buckwheat (*Fagopyrum esculentum*) is used, either whole or dried and ground into a powder for use in pancakes, biscuits and piñole. The leaves are a tea substitute.

Other uses of the herb:

Yields a blue dye that is not much inferior to indigo. The part used is not specified, but it is likely to be the leaves. Yellow and green dyes are obtained from the whole plant. The roots contain tannins, but the quantity was not given.

Propagation of Knotweed:

Seed - sow spring in a cold frame. Germination is usually free and easy. When they are large enough to handle, prick the seedlings out into individual pots and plant them out in the summer if they have reached sufficient size. If not, leave them in winter in a cold frame and plant them out the following spring after the last expected frosts. Division in spring or autumn. Very easy, larger divisions can be planted out direct into their permanent positions. We have found that it is better to pot up the smaller divisions and grow them on in light shade in a cold frame until they are well established before planting them out in late spring or early summer.

Known hazards of *Polygonum aviculare*:

Although no specific mention has been made for this species, there have been reports that some members of this genus can cause photosensitivity in susceptible people. Many species also contain oxalic acid (the distinctive lemony flavour of sorrel) - whilst not toxic this substance can bind up other minerals making them unavailable to the body and leading to mineral deficiency. Having said that, a number of common foods such as sorrel and rhubarb contain oxalic acid and the leaves of most members of this genus are nutritious and beneficial to eat in moderate quantities. Cooking the leaves will reduce their content of oxalic acid. People with a tendency to rheumatism, arthritis, gout, kidney stones or hyperacidity should take especial caution if including this plant in their diet since it can aggravate their condition.



Malva neglecta Wallr.

Herb: Dwarf Mallow

Family: Malvaceae (Mallow Family)

Medicinal use of Dwarf Mallow:

All parts of the plant are antiphlogistic, astringent, demulcent, diuretic, emollient, expectorant, laxative, salve. The leaves and flowers can be eaten as part of the diet, or a tea can be made from the leaves, flowers or roots. The leaves and flowers are the main part used, their demulcent properties

making them valuable as a poultice for bruise, inflammations, insect bites etc, or taken internally in the treatment of respiratory system diseases or inflammation of the digestive or urinary systems. They have similar properties, but are considered to be inferior to the marsh mallow (*Althaea officinalis*), though they are stronger acting than the common mallow (*M. sylvestris*). They are seldom used internally. The plant is an excellent laxative for young children.

Description of the plant:

Plant	Height	Flowering
Annual	60 cm (2 feet)	June to September

Habitat of the herb:

Waste and cultivated ground, usually on dry soils, frequently in coastal habitats, on dry walls or as a weed of cultivated ground.

Edible parts of Dwarf Mallow:

Leaves and young shoots - raw or cooked. A mild pleasant flavour, they are said to be highly nutritious. They can be added in quantity to salads, and make an excellent lettuce substitute, they can also be cooked as greens. The leaves are mucilaginous, when cooked in soups etc they tend to thicken it in much the same way as okra (*Abelmoschatus esculenta*). Some people find this mucilaginous texture unpleasant, especially if the leaves are cooked. Immature seeds - raw or cooked. A pleasant nutty flavour, they are nice as a nibble but too small for most people to want to collect in quantity. A decoction of the roots is used as an egg-white substitute for making meringue. The roots are brought to the boil in water and then simmered until the water becomes quite thick. This liquid can then be whisked in much the same way as egg whites. A tea can be made from the dried leaves.

Other uses of the herb:

Cream, yellow and green dyes can be obtained from the plant and the seed heads. The root is used as a toothbrush.

Propagation of Dwarf Mallow:

Seed - sow early spring or autumn in situ. Germination should take place within 2 weeks. The seed germinates in the autumn in the wild.

Cultivation of the herb:

Waste and cultivated ground, usually on dry soils, on dry walls or as a weed of cultivated ground.

Known hazards of *Malva neglecta*:

When grown on nitrogen rich soils (and particularly when these are inorganic), the plant tends to concentrate high levels of nitrates in its leaves. The leaves are perfectly wholesome at all other times.

4.2 The Quantitative analysis:

The spatial distribution of species showed a distinct pattern. Ziarat north exhibited highest rate of plant diversity; probably due to the reason that it included some protected patches of conserved landscape. Chautair north and Chautair south had almost similar value of plant diversity. Batatair being the smallest among all others showed the lowest value for floristic diversity. Fig. 9. The interpretation in the figure below is based on cumulative data of fall 07 and spring 08.

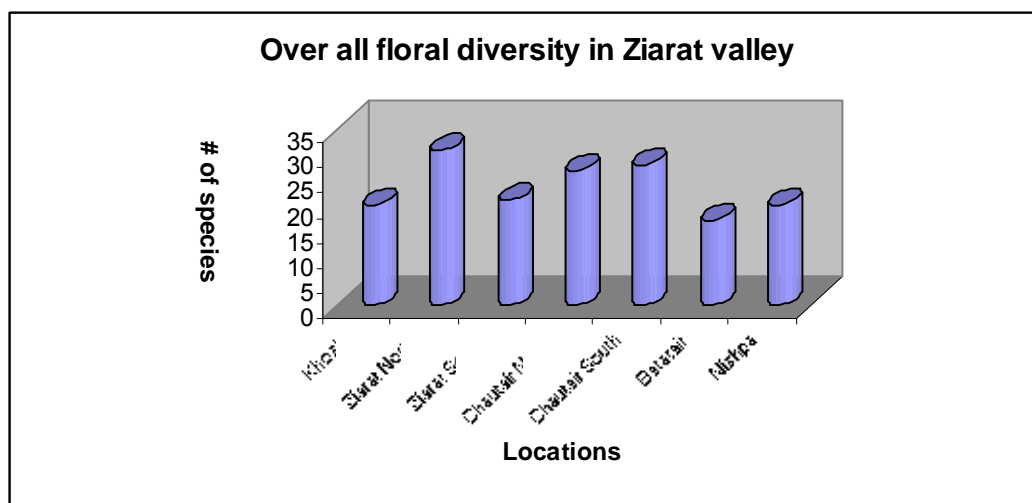


Fig.9. Overall floral diversity in sub valleys of Ziarat.

The comparative data of same locations but in different seasons followed almost the similar pattern. The only change is the intensity of floral diversity which appeared diluted. Ziarat north showed almost consistently the highest value for floral diversity for both seasons. In fall 07 the lowest contributor in floral diversity was Ziarat south; whereas Khoski was the lowest in Spring 08. Fig.10.

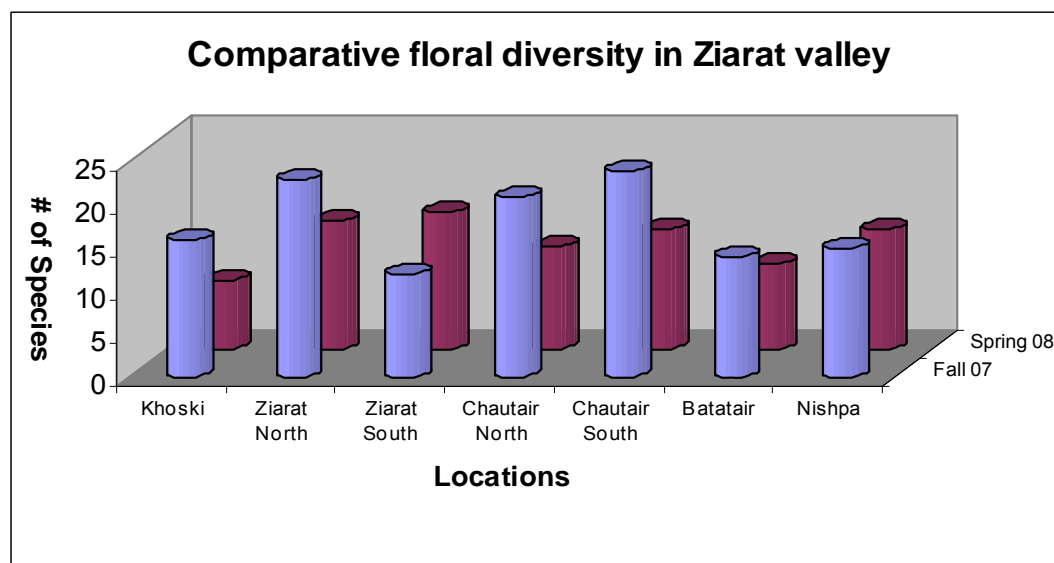


Fig.10. Temporal comparative floral diversity in sub valleys of Ziarat.

4.2.1. Khoski:

This represents a small area with a limited water resource; the temporal distribution of flora is quite evident of the fact that once the area receive rain allowing variety of species to grow and compete for the resources, *Sophora mollis* use to be consistently represented species in pre and post rain scenario. The difference in intensity and resilience are evident while comparing the data set (Fig 11 and 12) and their analysis.

Sophora mollis is considered to be a supportive species for ethnovetnery purpose; thus reflecting well on the findings that 95% livestock of the valley survives on open field grazing. (Assessment report)

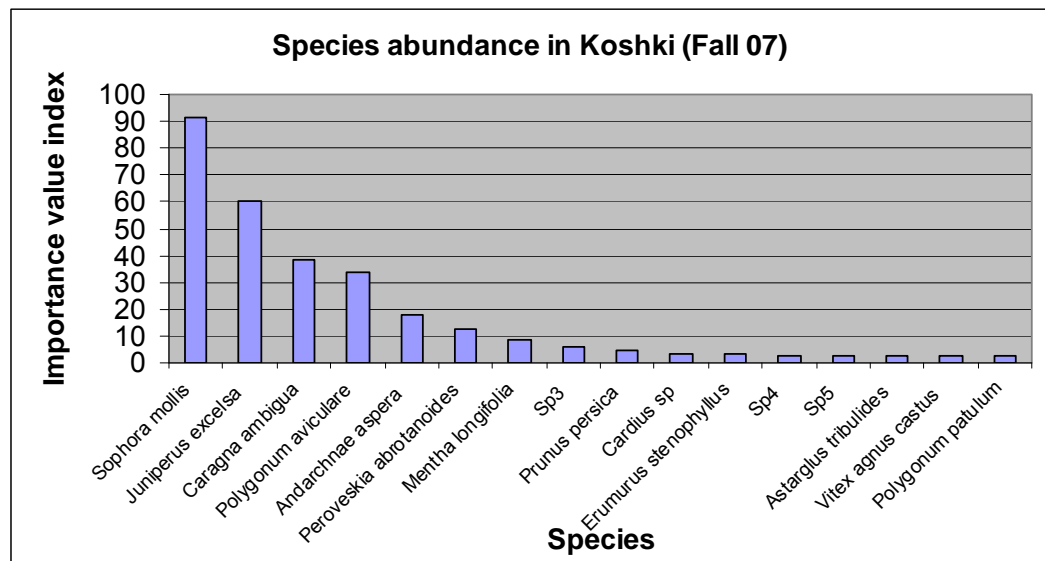


Fig.11. Species abundance in Koshki (Fall 07).

The diversity pattern shows a clear trend in pre and post rain scenarios. The vegetation in August showed more diverse representation with a diluted intensity of IVI. The abundance pattern can be simply regarded as low equitability and high dominance model.

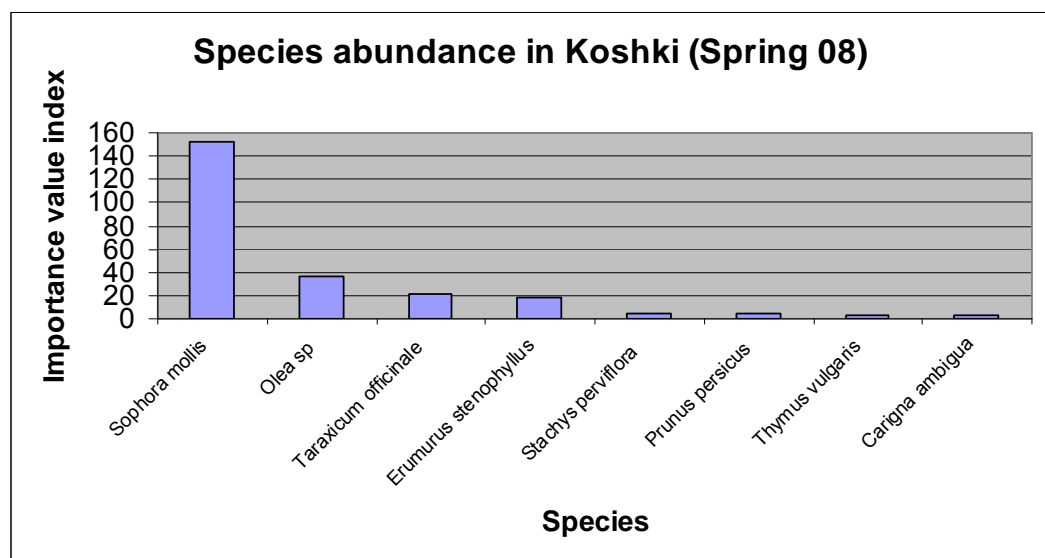


Fig.12. Species abundance in Koshki (Spring 08).

The statistics of density/ acre for any species was calculated and *Sophora mollis* which was estimated as around 301 individuals of *Sophora mollis* and cover/ acre came out to be 43 ft² which is a smaller value reflecting on the size of the life form; whereas *Juniperus excelsa* showed an elevated value as 405 ft² with only 8 individuals in an acre, simply reflects the size and phenology of the life form.

Table.2. Major dominant species with comparative density and cover/ acre in Koshki.

#	Species	Density/acre (Fall 07)	Density/acre (Spring 08)	Cover/ acre (Fall 07)	Cover/ acre (Spring 08)
1	<i>Sophora mollis</i>	300.736	14631.03	43.15819	65.52704
2	<i>Juniperus excelsa</i>	8.128	-	405.1984	-
3	<i>Caragna ambigua</i>	24.384	232.2385	213.0223	7.569139
4	<i>Polygonum aviculare</i>	113.792	-	3.257222	-
5	<i>Andarchnae aspera</i>	56.896	-	4.234389	-
6	<i>Peroveskia abrotanoides</i>	40.64	-	4.234389	-
7	<i>Mentha longifolia</i>	24.384	-	1.628611	-
8	Sp3	16.256	-	3.338653	-
9	<i>Prunus persica</i>	8.128	232.2385	14.57607	15.44722
10	<i>Cardius sp</i>	8.128	-	4.560111	-
11	<i>Erumurus stenophyllus</i>	8.128	1393.431	2.524347	14.87861
12	Sp4	8.128	-	1.547181	-
13	Sp5	8.128	-	1.140028	-
14	<i>Astarglus tribulides</i>	8.128	-	0.732875	-
15	<i>Vitex agnus castus</i>	8.128	-	0.162861	-
16	<i>Polygonum patulum</i>	8.128	-	0.081431	-
17	<i>Taraxicum officinale</i>	-	1393.431	-	46.76639
18	<i>Stachys perviflora</i>	-	232.2385	-	30.27656
19	<i>Thymus vulgaris</i>	-	232.2385	-	12.51225
20	<i>Olea sp</i>	-	232.2385	-	632.7183

4.2.2. Ziarat North:

This represents northern side of the vally facing south; the temporal distribution of flora is quite evident of the fact that once the area receive rain allowing variety of species to grow and compete for the resources, *Artimisia quentensis* use to be represented but with varying intensity in pre and post rain scenarios. *Artimisia quentensis* was replaced by *Andrachnae aspera* The difference in intensity and resilience are evident while comparing the data set (Fig 13 and 14) and their analysis.

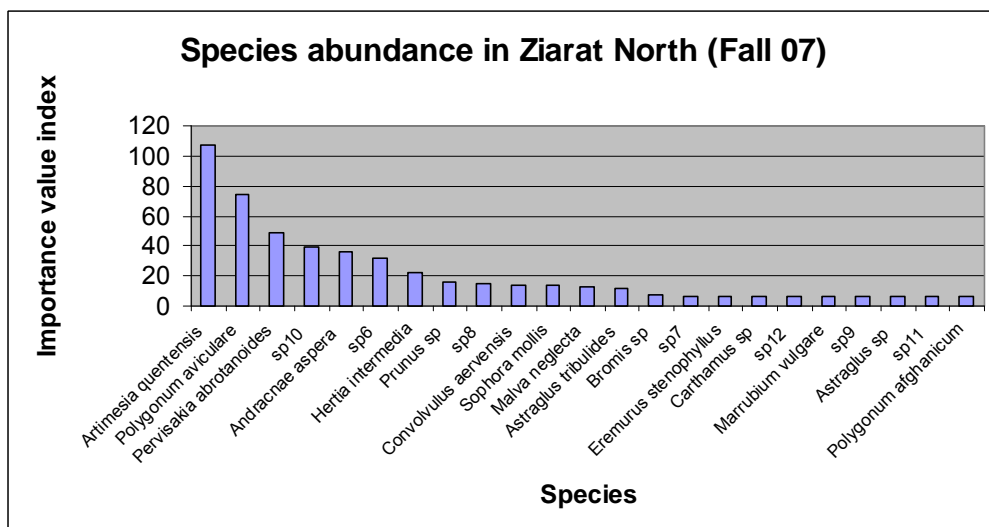


Fig. 13. Species abundance in Ziarat north (Fall 07).

The diversity pattern shows a clear trend in pre and post rain scenarios. The vegetation in August showed more diverse representation however the intensity of IVI does not follow the expected pattern. It is observed that IVI_{max} for August reaches above 100; whereas the in case of May did not exceed to more than 45. The abundance pattern can be simply regarded as low equitability and high dominance model.

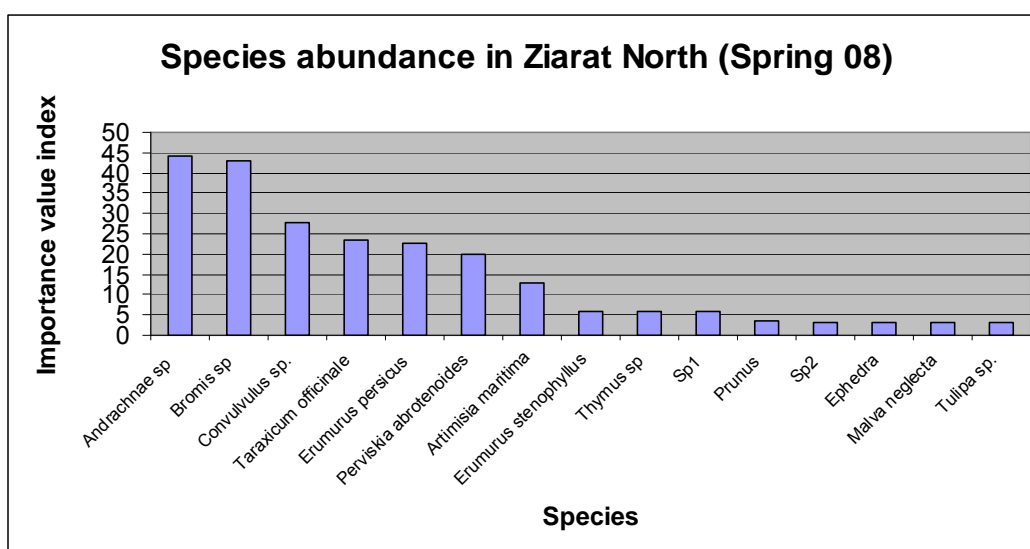


Fig. 14. Species abundance in Ziarat north (Spring 08).

The density/ acre for the species was calculated and which was estimated as around 138 individuals of *Artimesia quentensis* top the list and cover/ acre came out to be 110 ft² which is a smaller value reflecting on the size of the life form; whereas

Andracnae sp dominated the flora with the density/ acre as over 2761 individuals and cover value as 312 ft² in an acre in pre rain setup.

Table.3. Major dominant species with comparative density and cover/ acre in Ziarat North

#	Species	Density/acre (Fall 07)	Density/acre (Spring 08)	Cover/acre (Fall 07)	Cover/acre (Spring 08)
1	Artimesia quentensis	137.7075	690.202	109.791	78.08367
2	Polygonum aviculare	128.527	-	5.53174	-
3	Pervisakia abrotanoides	91.805	1207.854	22.59575	80.56721
4	sp10	55.083	-	11.71979	-
5	Andracnae aspera	55.083	2760.808	3.28154	312.0049
6	sp6	45.9025	-	7.031872	-
7	Hertia intermedia	9.1805	-	40.97238	-
8	Prunus sp	9.1805	172.5505	26.06481	38.16138
9	sp8	27.5415	-	5.906773	-
10	Convolvulus aervensis	27.5415	1898.056	2.906507	136.4044
11	Sophora mollis	18.361	-	4.40664	-
12	Malva neglecta	18.361	172.5505	2.906507	11.54382
13	Astraglus tribulides	18.361	-	0.937583	-
14	Bromis sp	9.1805	2243.157	2.906507	353.6809
15	sp7	9.1805	-	1.781408	-
16	Eremurus stenophyllus	9.1805	345.101	1.593891	16.45155
17	Carthamus sp	9.1805	-	1.312616	-
18	sp12	9.1805	-	1.312616	-
19	Marrubium vulgare	9.1805	-	0.937583	-
20	sp9	9.1805	-	0.656308	-
21	Astraglus sp	9.1805	-	0.375033	-
22	sp11	9.1805	-	0.375033	-
23	Polygonum afghanicum	9.1805	-	0.281275	-
24	Eremurus persicus	-	1380.404	-	83.17884
25	Ephedra sp	-	172.5505	-	18.69908
27	Tulipa sp.	-	172.5505	-	9.540346
28	Taraxicum officinale	-	1552.955	-	62.04318
29	Thymus sp	-	345.101	-	15.0205
30	Sp1	-	345.101	-	12.38837
31	Sp2	-	172.5505	-	21.46578

4.2.3. Ziarat South:

This represents southern side of the valley facing north; the temporal distribution of flora is quite evident of the fact that once the area receives rain allowing variety of species to grow and compete for the resources, *Juniperus excelsa* with a very slight difference of IVI with *Perviskia abrotanoides*. Dominated the floral list in post rain scenario *Hertia intermedia* replaced the dominance of the above two and took the lead in pre rain situation. The difference in intensity and resilience are evident while comparing the data set (Fig 15 and 16).

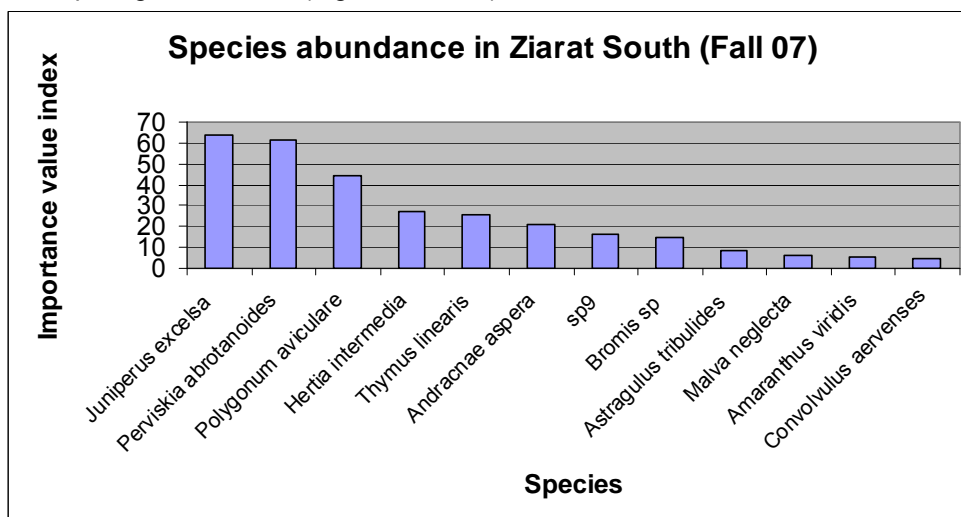


Fig.15. Species abundance in Ziarat south (Fall 07).

The diversity pattern shows an unexpectedly deviated result in the sense of high diversity before rain and low diversity after rain, this could be due to topographic variations in pre and post rain scenarios. The vegetation in August showed less diverse representation with an intense value of IVI. The abundance pattern can be simply regarded as low equitability and high dominance model.

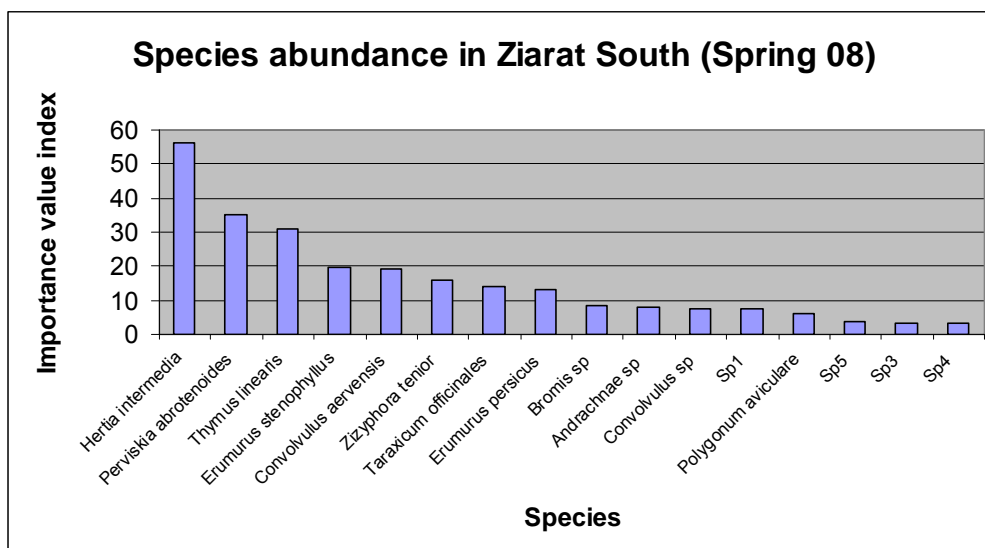


Fig.16. Species abundance in Ziarat south (Spring 08).

The density/ acre for the species was calculated and *Perviskia abrotanoides* which was estimated as around 189 individuals in post rain condition and around 2848 individuals in pre rain condition top the list in density/ acre with almost equal value i.e. 91ft² / acre of cover for both conditions.

Table.4. Major dominant species with comparative density and cover/ acre in Ziarat South

#	Species	Density/acre (Fall 07)	Density/acre (Spring 08)	Cover/acre (Fall 07)	Cover/acre (Spring 08)
1	<i>Juniperus excelsa</i>	8.988	-	447.2429	-
2	<i>Perviskia abrotanoides</i>	188.748	2848.448	91.40796	91.36755
3	<i>Polygonum aviculare</i>	152.796	438.2228	8.988	7.495803
4	<i>Hertia intermedia</i>	44.94	2848.448	96.621	1879.063
5	<i>Thymus linearis</i>	80.892	2410.225	13.9314	221.898
6	<i>Andracnae aspera</i>	71.904	657.3341	15.09984	36.42891
7	sp9	35.952	-	40.71564	-
8	<i>Bromis sp</i>	53.928	219.1114	9.34752	436.1293
9	<i>Astragalus tribulides</i>	26.964	-	1.7976	-
10	<i>Malva neglecta</i>	17.976	-	5.03328	-
11	<i>Amaranthus viridis</i>	17.976	-	0.80892	-
12	<i>Convolvulus aervenses</i>	17.976	1752.891	3.5952	38.32588
13	<i>Erumurus stenophyllus</i>	-	1314.668	-	122.0682
14	<i>Taraxicum officinale</i>	-	1095.557	-	45.08288
15	<i>Erumurus persicus</i>	-	219.1114	-	775.3411
16	<i>Ziziphora teniour</i>	-	1533.78	-	7.830169
17	Sp3	-	219.1114	-	23.74482
18	Sp4	-	219.1114	-	1.938353
19	Sp1	-	657.3341	-	14.7716
20	Sp5	-	219.1114	-	43.73408
21	<i>Convolvulus sp</i>	-	438.2228	-	119.8981

4. Chautair North:

This represents northern side of the Chautair vally facing south; the temporal distribution of flora is quite evident of the fact that once the area receive rain allowing variety of species to grow and compete for the resources, *Artimisia quantensis* and *Stachys perviflora* use to dominate the pre and post rain floristic list but with varying intensity in two different scenarios. The two species occupy the second position in cris cross fachion. (Fig 17 and 18).

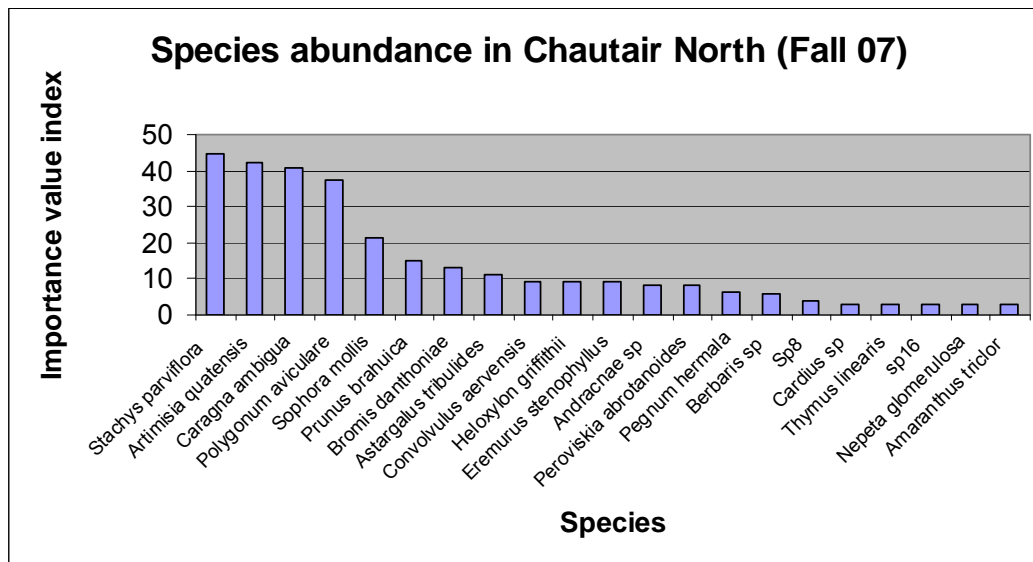


Fig.17. Species abundance in Chautair north (Fall 07).

The diversity pattern shows a clear trend in pre and post rain scenarios. The vegetation in August showed more diverse representation with a diluted intensity of IVI. The abundance pattern can be simply regarded as low equitability and high dominance model.

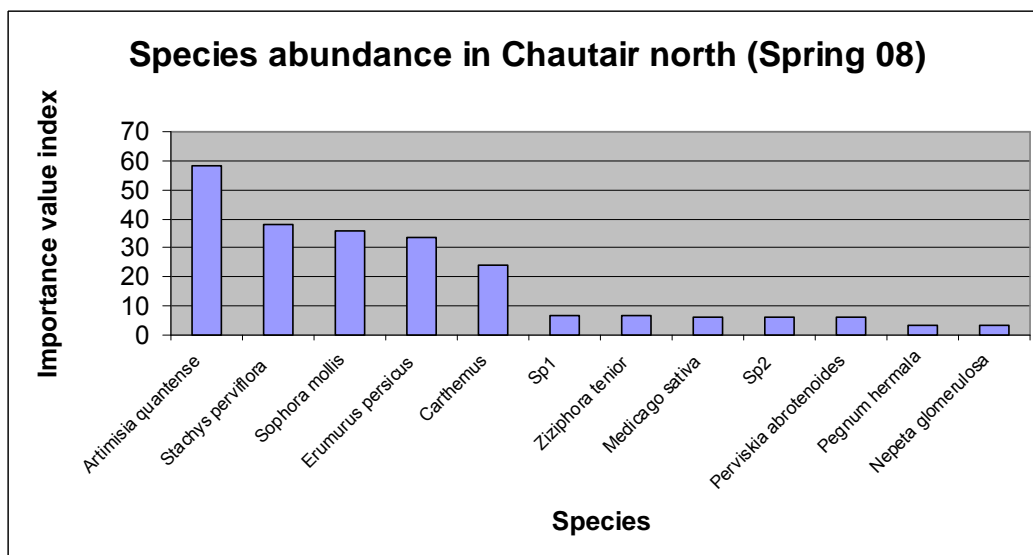


Fig.18. Species abundance in Chautair north (Spring 08).

The density/ acre for the species was calculated and *Artimisia quantensis* which was estimated as around 81 individuals in post rain and 3120 individuals in pre rain condition top the list cover/ acre came out to be 29 ft² in post rain and 287 ft² in pre rain condition.

Table.5. Major dominant species with comparative density and cover/ acre in Chautair north

#	Species	Density/acre (Fall 07)	Density/acre (Spring 08)	Cover/acre (Fall 07)	Cover/acre (Spring 08)
1	Stachys parviflora	54.27625	2126.936	74.19563	58.35753
2	Artimisia quatensis	81.41438	3119.507	28.92924	287.2404
3	Caragna ambigua	10.85525	-	135.4735	-
4	Polygonum aviculare	81.41438	-	5.590454	-
5	Sophora mollis	32.56575	1701.549	20.7878	98.5794
6	Prunus brahuica	5.427625	-	47.60027	-
7	Bromis danthoniae	21.7105	-	15.14307	-
8	Astargalus tribulides	21.7105	-	1.139801	-
9	Convolvulus aervensis	16.28288	-	5.373349	-
10	Heloxylon griffithii	10.85525	-	14.38321	-
11	Eremurus stenophyllus	14.38321	-	14.38321	-
12	Andracnae sp	16.28288	-	1.628288	-
13	Peroviskia abrotanoides	16.28288	283.5915	6.133216	1.836922
14	Pegnum hermala	10.85525	141.7958	3.365128	11.28947
15	Berberis sp	5.427625	-	11.8865	-
16	Sp8	5.427625	-	3.853614	-
17	Cardius sp	5.427625	-	1.682564	-
18	Thymus linearis	5.427625	-	1.682564	-
19	sp16	5.427625	-	0.379934	-
20	Nepeta glomerulosa	5.427625	141.7958	0.217105	6.350327
21	Amaranthus tricolor	5.427625	-	0.162829	-
22	Erumurus persicus	-	1843.345	-	93.9334
23	Carthemus sp.	-	850.7745	-	233.3511
24	Ziziphora tenuior	-	283.5915	-	15.57959
25	Sp1	-	283.5915	-	20.32907
26	Sp2	-	283.5915	-	2.565093
27	Medicago sativa	-	283.5915	-	5.422081

4. Chautair South:

This represents southern side of the Chautair vally facing north; the temporal distribution of flora is quite evident of the fact that once the area receive rain allowing variety of species to grow and compete for the resources, *Perviskia abrotanoides* with *Sophora mollis* dominated the post rain; whereas *Artimisia quentensis* use to be represented in pre rain . The varying intensities of IVI in pre and post rain scenarios are quite identical. (Fig 19 and 20)

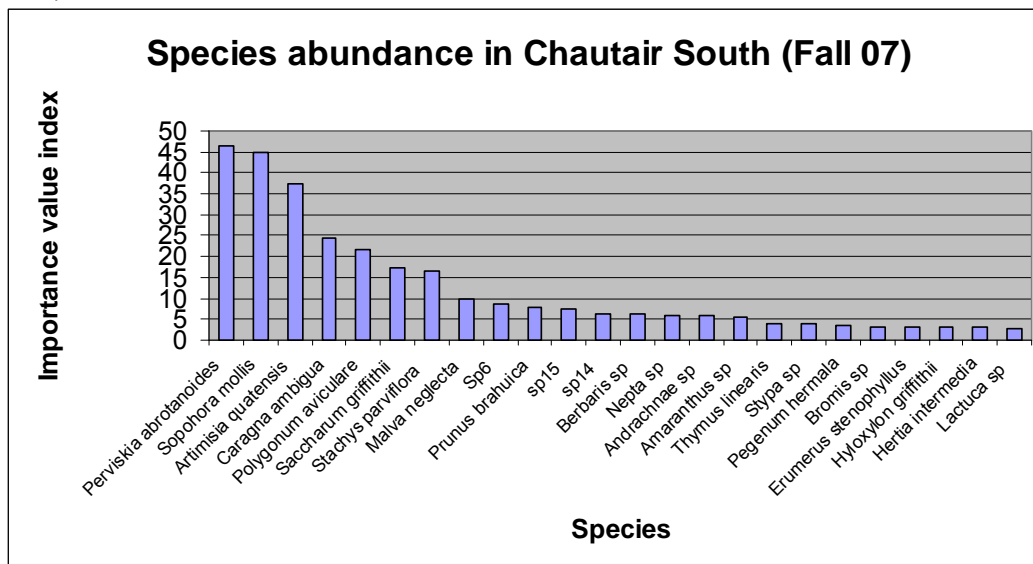


Fig.19. Species abundance in Chautair south (Fall 07).

The diversity pattern shows a clear trend in pre and post rain scenarios. The vegetation in August showed more diverse representation with a diluted intensity of IVI. The abundance pattern can be simply regarded as low equitability and high dominance model.

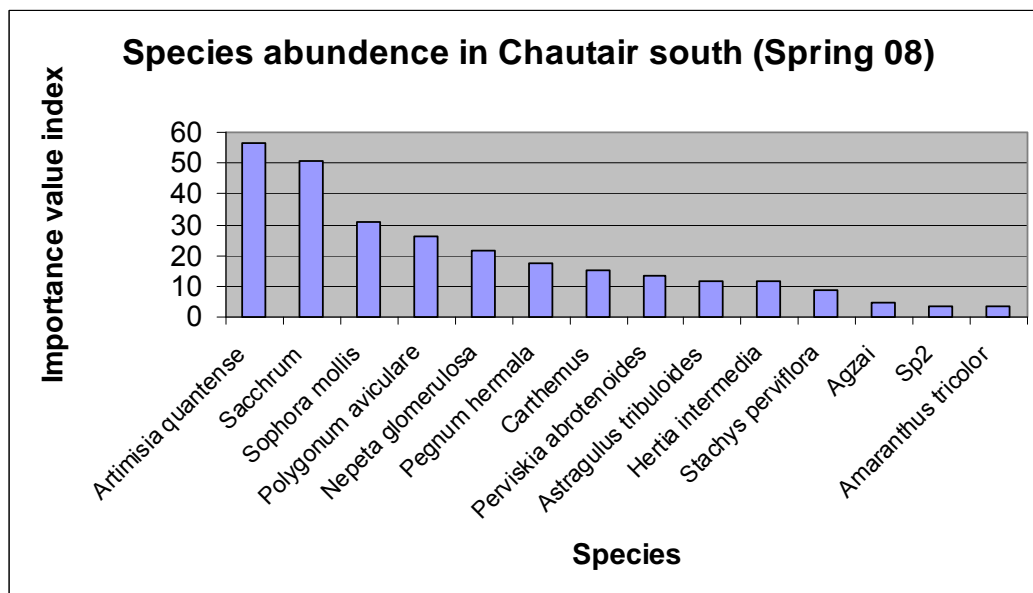


Fig.20. Species abundance in Chautair south (Spring 08).

The density/ acre for the species was calculated and *Artimisia quentensis* which was estimated as around 56 individuals in post rain has gone high in pre rain situation with a value of 1222 individuals/ acre, the cover/ acre came out to be 16 ft² and 302 ft² in post and pre rain conditions.

Table.6. Major dominant species with comparative density and cover/ acre in Chautair south.

#	Species	Density/ acre (Fall 07)	Density/ acre (Spring 08)	Cover/acre (Fall 07)	Cover/acre (Spring 08)
1	<i>Perviskia abrotanoides</i>	55.5555	257.2713	43.3759821	101.073
2	<i>Sopohora mollis</i>	42.735	514.5426	53.2050224	91.90422
3	<i>Artimisia quatensis</i>	55.5555	1222.039	15.8974043	301.9292
4	<i>Caragna ambigua</i>	4.2735	-	56.0255296	-
5	<i>Polygonum aviculare</i>	34.188	514.5426	2.69230234	134.6378
6	<i>Saccharum griffithii</i>	8.547	836.1317	34.5298458	1375.47
7	<i>Stachys parviflora</i>	17.094	192.9535	14.4444157	15.3394
8	<i>Malva neglecta</i>	17.094	-	1.36751865	-
9	Sp6	12.8205	-	1.62392839	-
10	<i>Prunus brahuica</i>	8.547	-	9.61536549	-
11	sp15	8.547	-	5.55554451	-
12	sp14	8.547	-	2.47862755	-
13	<i>Berberis sp</i>	8.547	-	2.43589259	-
14	<i>Nepeta sp</i>	8.547	450.2248	1.41025361	22.66872
15	<i>Andrachnae sp</i>	8.547	-	0.68375932	-
16	<i>Amaranthus sp</i>	8.547	64.31783	0.38461462	2.275931
17	<i>Thymus linearis</i>	4.2735	-	3.034182	-
18	<i>Stypa sp</i>	4.2735	-	2.69230234	-
19	<i>Pegenum hermala</i>	4.2735	321.5891	2.39315763	114.6431
20	<i>Bromis sp</i>	4.2735	-	1.32478369	-
21	<i>Erumerus stenophyllus</i>	4.2735	-	1.02563899	-
22	<i>Hyloxylon griffithii</i>	4.2735	-	0.72649428	-
23	<i>Hertia intermedia</i>	4.2735	192.9535	0.64102437	57.46908
24	<i>Lactuca sp</i>	4.2735	-	0.25640975	-
25	<i>Carthemus sp</i>	-	257.2713	-	16.59793
26	(Aghzai)	-	64.31783	-	75.24797
27	Sp2	-	64.31783	-	2.275931
28	<i>Astragalus tribuliodes</i>	-	192.9535	-	64.96632

5. Batatair:

This represents a sub valley having mountainous ridges on north and south. On the southern side is the Uch Ghairga of Loay Ghar and on northern part is Choutair mountain ridge. Soil was eroded and denuded on northern aspect while on southern aspect soil is deep and vegetation cover is dense the temporal distribution of flora followed the identical pattern. *Perviskia abrotanoides* dominated both set of vegetation with assistance of *Berberis* and *Stachys* respectively for post and pre rain set of conditions. (Fig 21 and 22)

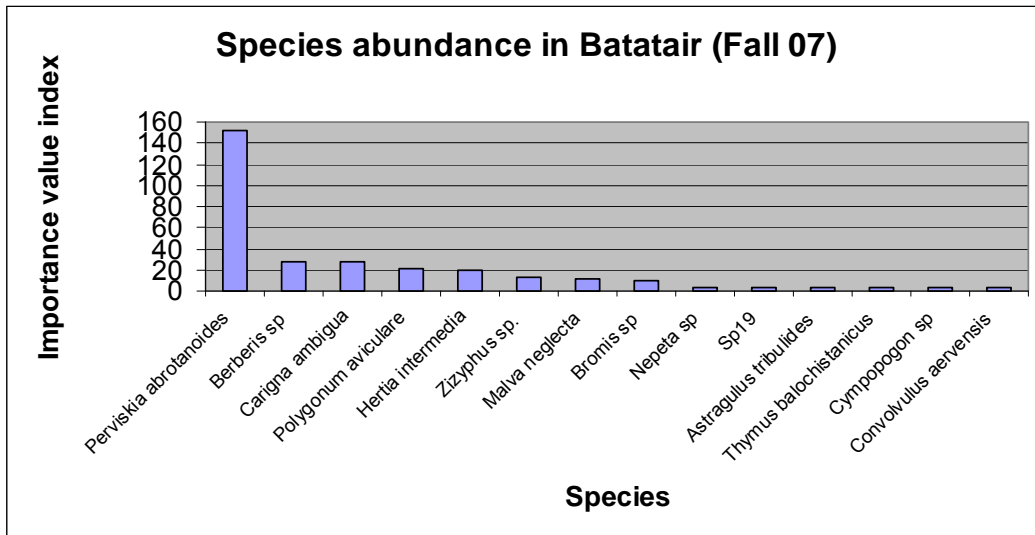


Fig.21. Species abundance in Batatair (Fall 07).

The diversity pattern shows a clear trend in pre and post rain scenarios. The vegetation in August showed more diverse representation with a diluted intensity of IVI. The abundance pattern can be simply regarded as low equitability and high dominance model.

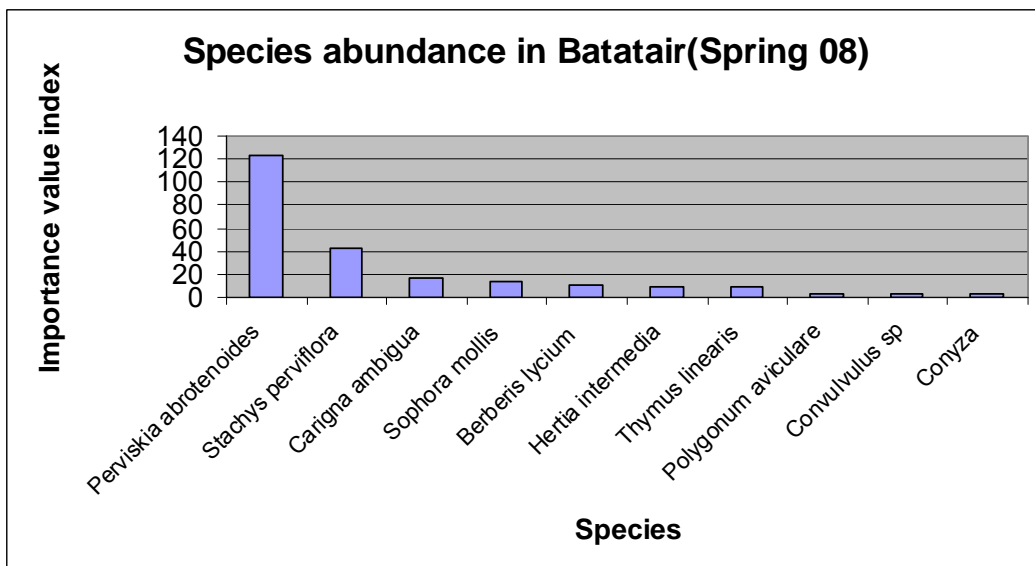


Fig.22. Species abundance in Batatair (Spring 08).

The density/ acre for the species was calculated and *Polygonum aviculare* dominated the post rain density/ acre with value 1720 and *Perviskia abrotanoides* with 14450 individuals in pre rain setup. *Perviskia abrotanoides* dominated both pre and post rain cases with highest cover value in both. 5003 ft² and 399 ft² respectively in post and pre rain conditions.

Table7. Major dominant species with comparative density and cover/ acre in Batatair

#	Species	Density/acre (Fall 07)	Density/acre (Spring 08)	Cover/acre (Fall 07)	Cover/acre (Spring 08)
1	<i>Perviskia abrotanoides</i>	11793.732	14450.05	5002.508	399.4032
2	<i>Berberis</i> sp	737.10825	277.8855	2707.644	352.9145
3	<i>Carigna ambigua</i>	737.10825	555.771	2417.715	531.9506
4	<i>Polygonum aviculare</i>	1719.9193	277.8855	206.3903	34.4578
5	<i>Hertia intermedia</i>	1228.5138	555.771	1000.01	173.7081
6	<i>Zizyphus</i> sp.	245.70275	-	1250.627	-
7	<i>Malva neglecta</i>	982.811	-	127.7654	-
8	<i>Bromis</i> sp	737.10825	-	117.9373	-
9	<i>Nepeta</i> sp	245.70275	-	113.0233	-
10	Sp19	245.70275	-	41.76947	-
11	<i>Astragalus tribulides</i>	245.70275	-	29.48433	-
12	<i>Thymus lineris</i>	245.70275	833.6565	24.57027	91.43007
13	<i>Cymopogon</i> sp	245.70275	-	14.74216	-
14	<i>Convolvulus aervensis</i>	245.70275	277.8855	9.82811	15.2837
15	<i>Stachys perviflora</i>	-	3334.626	-	27.19241
16	<i>Sophora mollis</i>	-	1389.428	-	15.5492
17	<i>Conyza</i>	-	277.8855	-	5.609395

6. Nishpa:

The Nishpa is located between two mountain ridges; Loay Ghar on south and Shawanzai on north. On west is Ghuzza and on east is Gherga area. Foothills have bluish to green shale sometimes exposed due to erosion. On the north side of the valley the rocks were layered making a wall like formation. The dominated life form is represented by *Sophora mollis* in post rain and *Hertia intermedia* in pre rain conditions intensity of the vegetation in two different cases remain equal in pre and post rain scenarios. (Fig 23 and 24)

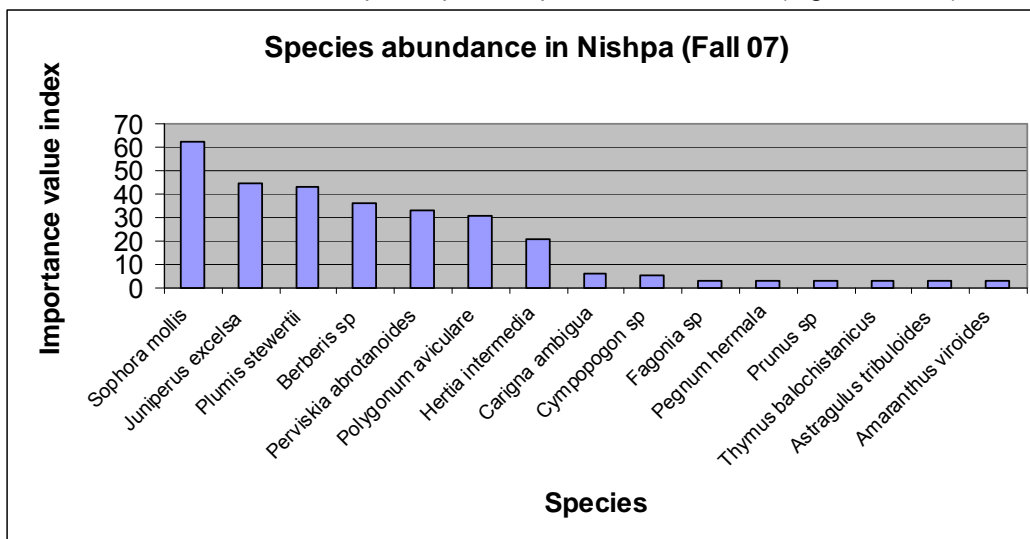


Fig.23. Species abundance in Nishpa (Fall 07).

The diversity pattern shows similar trend in pre and post rain scenarios. The vegetation in August represented by a set of 15 species whereas representation in May was contributed by some 13 species with a almost equal intensity of IVI. The abundance pattern can be simply regarded as low equitability and high dominance model.

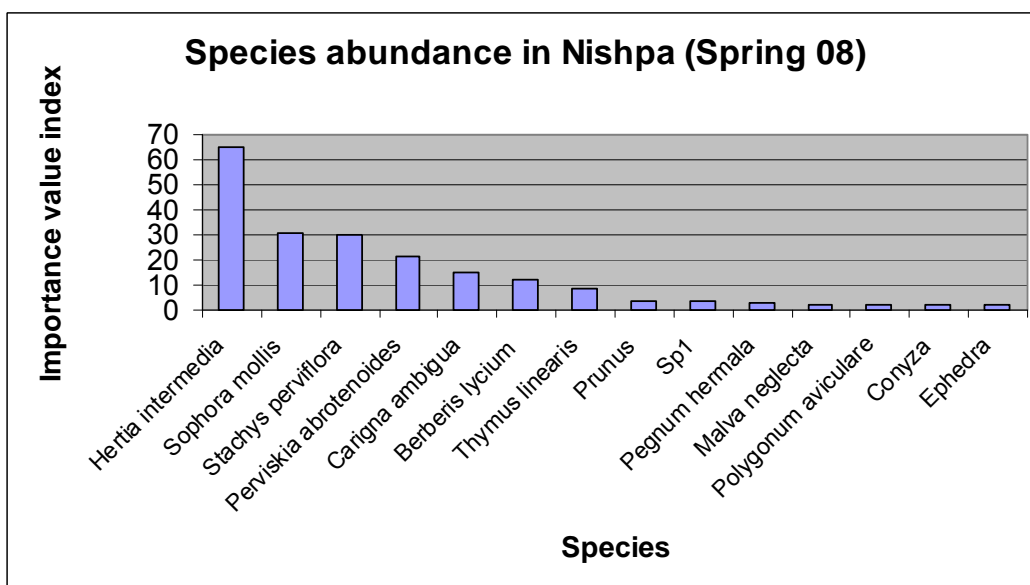


Fig.24. Species abundance in Nishpa (Spring 08).

The density/ acre for the species was calculated and *Sophora mollis* which was estimated as around 4976 individuals in post rain conditions and 20 individuals in pre rain condition. The cover/ acre came out to be 3659 ft² by *Perviskia abrotanoides* in post rain conditions replaced by *Hertia intermedia* with a value of 1287 ft² in pre rain scenario.

Table.8. Major dominant species with comparative density and cover/ acre in Nishpa.

#	Species	Density/acre (Fall 07)	Density/acre (Spring 08)	Cover/acre (Fall 07)	Cover/acre (Spring 08)
1	<i>Sophora mollis</i>	4975.632	19.55589	1129.882968	168.4042
2	<i>Juniperus excelsa</i>	414.636	-	13036.15432	-
3	<i>Plumis stewertii</i>	3317.088	-	1109.15117	-
4	<i>Berberis sp</i>	207.318	3.911177	11157.85346	175.6485
5	<i>Perviskia abrotanoides</i>	1865.862	9.777943	3659.162273	204.9504
6	<i>Polygonum aviculare</i>	2487.816	0.977794	165.8543806	5.023609
7	<i>Hertia intermedia</i>	1451.226	9.777943	1490.616246	1286.576
8	<i>Carigna ambigua</i>	207.318	1.955589	1192.078361	285.6655
9	<i>Cympopogon sp</i>	414.636	-	55.97585346	-
10	<i>Fagonia sp</i>	207.318	-	184.5129984	-
11	<i>Pegnum hermala</i>	207.318	0.977794	109.8785272	28.93605
12	<i>Prunus sp</i>	207.318	0.977794	39.3904154	51.95389
13	<i>Thymus balochistanicus</i>	207.318	3.911177	29.02451661	87.90539
14	<i>Astragulus tribuloides</i>	207.318	-	24.87815709	-
15	<i>Amaranthus viroides</i>	207.318	-	4.146359516	-
16	<i>Stachys perviflora</i>		21.51147		161.9709
17	<i>Ephedra</i>		0.977794		3.460021
18	<i>Conyza</i>		0.977794		4.379049
19	<i>Malva neglecta</i>		0.977794		7.234037
20	Sp1		1.955589		2.511895

4.0 The Discussions:

4.1 The vegetation:

The Ziarat juniper ecosystem has evolved in an unusual combination of soil and climate, highly calcareous, stony and shallow soil, receiving very low precipitation (200-350 mm per annum) mainly dominated by xerophytes. Snow has been seen as the major contributor of precipitation in such ecosystem. The altitude of 2449 meters above sea level seems another driving factor of xeric conditions. The survival of land plants in such areas relies on the availability of water and their adaptation to stress (Kramer, 1984). Along with tree form *Juniperus excelsa*, most of the short stature shrubs are co-dominant in these areas including *Sophora mollis*, *Artemisia sp.*, *Perviskia abrotanoides* and *Thymus linearis* as ground cover. The presence of such arid communities depends upon soil moisture condition which strongly correlates with plant cover (Branson *et al.*, 1976). Plants grow sparsely leaving a wide area of bare soil (Hussain, 1989) that is the characteristic feature of arid environments (Burke & Mennheimer, 2003).

The set of extreme conditions pushes the vegetation to develop mechanisms for their survival; sometimes they produce shiny flowers to attract insect which would help them in pollination, produce osmotica to maintain their internal osmotic potential, reduce leaf area to minimize the loss of water; in some cases they produce strong aroma. These stress responses are usually benefited the mankind in the form of variety of products used in medicine. This has been observed that the plants adapted in specific habitat allowed to grow under optimal conditions (Greenhouse) grow healthy; but lose their ethnobotanic value.

The approximate length of the stretch of landscape that constitute Ziarat and Chautair valley falls around 40-45 Kms. The flora present in the stretch gives a unique pattern. The pre rain set of ground vegetation was dominated by *Andracnae*, *Bromis*, *Convolvulus*, *Artemisia*, *Stachys* and *Sophora* on the northern side of the valley; whereas *Hertia*, *Perviskia*, *Thymus* and *Artemisia*, *Sacchrum*, *Sophora* on the southern part of the valley.

The post rain (Early Fall) composition of the flora for northern part was represented by *Artemisia*, *Polygonum*, *Perviskia* and *Stachys*, *Artemisia*, *Caragna*. The southern part was dominated by *Juniperus*, *Perviskia*, *Polygonum* and *Perviskia*, *Sophora* and *Artemisia* in the order of dominance.

The pre rain (Late Spring) floristic composition in Khoski, Bataytair and Nishpa is represented by *Sophora*, *Olea*, *Taraxicum*, *Perviskia*, *Stachys*, *Caragna*, *Hertia*, *Sophora* and *Stachys* respectively; whereas the post rain composition for the same was *Sophora*, *Juniperus*, *Caragna*, *Perviskia*, *Berberis*, *Caragna* and *Sophora*, *Juniperus*, *Phlomis* respectively.

The temporal variation was dominating the phenology of the vegetation, the pre rain conditions promoted the yellow set of flowers to bloom; whereas the post rain conditions allow the blue pigment to dominate. That is why one can recall the Ziarat valley as the valley of changing colours.

This temporal and spatial variability also determines the specific time for the harvest of medicinal wealth in the area.

4.2 Trade of Herbal Medicine

4.2.1 International Scenario:

The trade volume of medicinal plants at global level is estimated around US\$ 60.0 billion and expected to reach 5.0 trillion by the year 2050 (Karki 2002). The US market itself has a huge size of around \$500 million; France and Germany have considered as substantial markets. The estimated import of herbal products from Africa and Asia to Europe, annually, land around US\$ 1 billion. UK has relatively a smaller share in the import bill of Europe for herbal products. M. Rafiq .

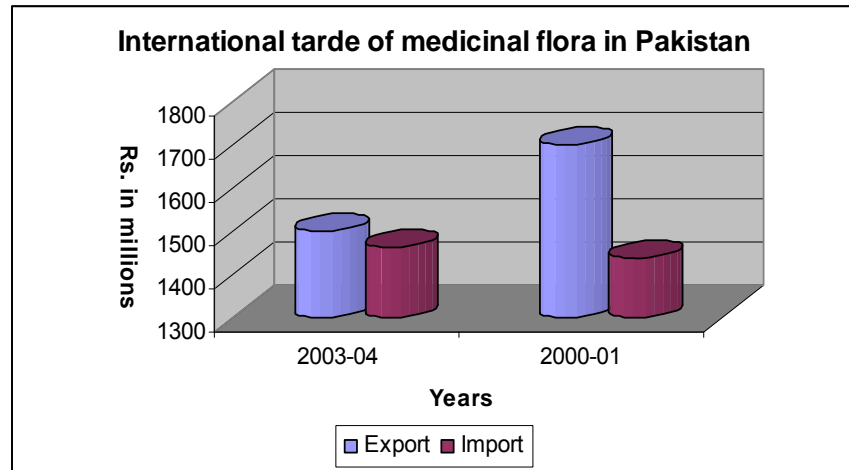


Fig. 25. Trade volume of medicinal resources in Pakistan.

Plants that have proved beneficial as pain killers are the herbs which are likely to play a prominent part in the market. It was stated that a plant called (*Hydrastis canadensis* L.) goldenseal, which has healing properties, is grown for its roots and can fetch a price of UK £150 per kg. Harvested from the wild.



4.2.2. Status of Medicinal Plant Resources in Pakistan:

Around 400 plant species are used extensively traditional practitioner in Pakistan (N.I.H.), Tibbi Pharmacopoeia of Pakistan (Pharmacopoeia of Traditional Drugs compiled by the Tibbi Board) has listed around 900 single drugs and about 500 compound preparations made out of medicinal plants.

There are nearly 86 registered manufacturers of herbal medicines of which 27 are relatively large manufacturers in Pakistan, which produce Unani medicines on commercial scale. The annual turnover of some large herbal manufacturers is comparable to multinational companies in Pakistan. The large manufacturers are able to produce as many as 300-400 products.

The estimated number of individuals practicing traditional medicines has reached to over 50,000 in Pakistan. This includes homeopaths as well. These traditional practitioners cater about 60% of the population, especially to the rural population. The other convincing fact of the popularity of these practitioners is the cost of treatment which has been estimated as Rs. 85 as compared to allopathic treatment which cost around Rs. 450 per person. (K. Usmanghani et al 2007).

Crude plant-based drugs worth about Rs. 120 million per year are used in Pakistan. This is a good indicator of the potential economic value of medicinal plants. Aromatic and medicinal plants of Pakistan have a market of considerable size both nationally and internationally. The trade of the crude medicinal drugs and the number of personnel involved in the collection, distribution, trade and consumption are quite sizable. A quick glance at the export business of this sector is self-explanatory,

Table 9: Export performance of leading companies producing herbal products.

Companies	Export in million US\$
Hamdard Laboratories	1.450
Herbion Pvt. Ltd.	0.900
Hashmi Surma	0.135
Qarshi Industries Pvt. Ltd.	0.050
Tayyebi Dawakana	0.020
Marhaba	0.020
Medics	0.015
Others	0.800
TOTAL	3.390

Source: Medicinal herbs Market Analysis for Karachi 2006. K. Usmanghani, Abdul Hannan and M. Aslam Gill

Over 85% of the medicinal plants used in Pakistan are collected from the wild. The cultivation caters only to a very small portion of the market. This not only emphasizes the importance of conserving the wild plant resources in the country but also the need of greater cultivation efforts to reduce the pressure on natural resources. Considering their widespread use the cultivation/propagation and procurement of medicinal plants is very important both from economic and therapeutic points of view. Countries like Nepal, Sri Lanka, India, China, Kenya, Uganda, etc. are growing a variety of medicinal plants for internal use as well as for export purpose. It is estimated that in the Soviet Union over 20,000 tons of wild medicinal plants are collected each year and an equal amount is cultivated

Table 10: Important medicinal plant species of Baluchistan and their approximate yield.

Plant names	Parts used	Approximate national Annual Yield (tons)
<i>Artemisia vulgaris</i>	Leaves/ shoots	148
<i>Berberis lycium</i>	Roots	300
<i>Thymus serpyllum</i>	Leaves	7

Source: Siddiqui, B.S and M.I. Chaudhary 2001.

4.2.3. Major Markets:

Main markets of the crude herbal drugs are in Mingora, Dir, Peshawar, Rawalpindi, Bahawalpur, Lahore, Faisalabad, Multan, Sukkar, Hyderabad and Karachi. Peshawar market acts as a supply center of herbal drugs to various markets in Pakistan. This market procures herbal material not only from Pakistan but also from Afghanistan and other Central Asian Republics. The market in Balochistan is relatively of smaller volume but gaining size with a rapid rate after the disturbance in NWFP; Quetta market is serving as an alternate to Peshawar market also catering the central asian trade goods to get access. This is clearly visible by observing the growing business of Pansara in Quetta.

Threats to Medicinal flora of Pakistan:

Pakistan has already practically lost many species of medicinal plants such as *Saussurea costus*, *Podophyllum hexandrum*, *Dioscorea deltoidea*, *Valeriana wallichii*, etc. (Siddiqui, B.S and M.I. Chaudhary 2001). Root causes of the extinction of medicinal and aromatic plants of commercial importance, depletion of medicinal plants re-sources and pressure on many other species of medicinal plants are mainly over-exploitation of resources due to increasing demand of their products all over the world, increasing human population, uncontrolled urbanization, growing industrialization and extensive destruction of plant rich habitats due to various massive developmental projects.

Local communities have no active involvement in whatever meager conservation efforts are made. However, it is now realized by the scientists that the indigenous knowledge of the identity, efficacy and utility of medicinal plants has to be preserved and a systematic documentation of ethno-botanical information is an important priority.

Table.11. Vulnerable Medicinal Plants of Pakistan also found in Balochistan (Siddiqui, B.S and M.I. Chaudhary 2001)

Plants	Local name	Consumptions in tons/year approx.	Ecological regions
<i>Artemisia spp.</i>	Afsantin	100-150	Hindukush, Karakoram, Balochistan
<i>Berberis lycium</i>	Dardald	300-400	Hindukush, Himalaya, Balochistan

Conservation of Medicinal Plants:

Although there is no reliable data available as to which species of medicinal plants require conservation, there is an overwhelming agreement among the experts in the country that most threatened ecosystems are temperate Himalayan forests in the upland areas. There is also an agreement that almost all forests of Pakistan have been exploited heavily during last two decades including Ziarat Juniper Forest.

Table12: List of medicinal plants collected from the wild in Pakistan in significant amount.

Species	Family	Country(ies of collection)
<i>Artemisia maritima</i>	Compositae	PAK, VIE
<i>Ephedra gerardiana</i>	Gnetaceae	PAK
<i>Glycyrrhiza glabra</i>	Leguminosae	PAK, CPR

(Source: Papers presented at the First Asian Symposium on Industrial Processing and Utilization of Medicinal and Aromatic Plants, 1996)

5.0 Recommendations:

The following in the order of preference are few listed species that can be subjected to carry forward to ascertain the opportunities for improving the livelihoods of the communities and help them in adopting diversified trade to minimize the burden on Juniper ecosystem. This would be helpful in reducing the change in landuse pattern by providing the enhanced value of the existing farm.

The set of flora recommended below are significantly represented in the central asian part of the continent due to the reason of presence of identical habitat. The first category listed below has been found in the Persian and central asian languages; but unfortunately a very scanty information is available in English.

5.1 Tea preparation:

Ziziphora tenuiflora.

Thymus linariifolius

Thymus vulgaris.

Nepeta glomerulosa

5.2 Shelter belt/ medicinal and ethnobotanic importance:

Berberis lycium

Berberis callobotrys

Berberis balochistanicus

Caragana ambigua.

Peroviskia abrotanoides.

5.3 Other ethnobotanic importance:

Erumurus stynophyllus

Rosa sp.

Prunus sp.

Pegnum hermala.

Artemisia maritima.

Onosma hispidum.

Onosma baractiatum.

Mentha longifolia

Foeniculum vulgare

Plantago ovata

5.4 Trees

Pistacia Khinjuk

Juniperus excelsa polycarpus (Berry harvest)

5.5 ABS Concept;

Ziarat has all good conditions to offer a good model for ABS concept. The community would be benefited by having additional income from the resources which are Zaiarat specifics. The other good aspect of doing this

would reduce the change in land use pattern of the area; since the medicinal plants can be easily grown and harvested in the existing farmlands; thus enabling the community to use common resource for their income support.

It has been observed that the recent introduction of apiculture in the area would also attract people to have medicinal honey besides having cross pollinating their orchids.

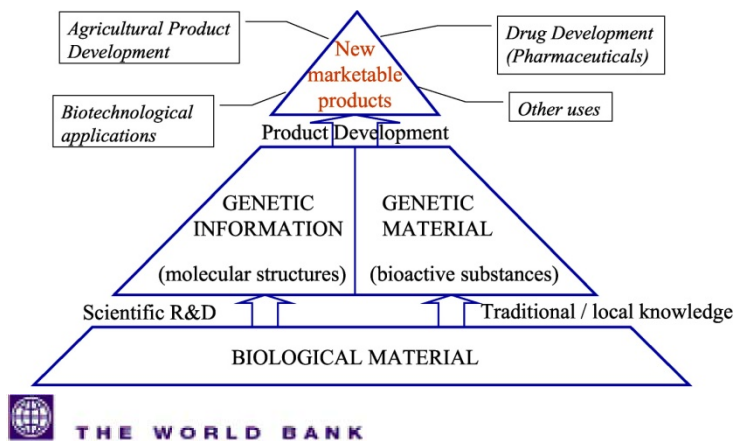


Fig.26. Bioprospecting model from The World Bank.

The philosophy of ABS concept has been interpreted by The World Bank. They referred it to as Bioprospecting, giving due considerations to the indigenous knowledge and their link with scientific research and development organizations.

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Annexure:

1- ToR's of the study:

- i. Prepare a complete list of all medicinal plants present in the project area.
- ii. Provide information on abundance of these medicinal plants
- iii. Provide information on ethno-botanical aspects of the medicinal plants.
- iv. Provide information on the economic importance including valuation of the resource and marketing of these medicinal plants.
- v. Prepare set of recommendations for artificial propagation of these plants at community level in household nurseries.
- vi. Any other task assigned by the Project Management.

2- List of Tables:

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Table 3. Major dominant species with comparative density and cover/ acre in Ziarat north

Table 4. Major dominant species with comparative density and cover/ acre in Ziarat south

Table 5. Major dominant species with comparative density and cover/ acre in Chautair north

Table 6. Major dominant species with comparative density and cover/ acre in Chautair south

Table 7. Major dominant species with comparative density and cover/ acre in Batatair

Table 8. Major dominant species with comparative density and cover/ acre in Nishpa.

Table 9: Export performance of leading companies producing herbal products.

Table 10: Important medicinal plant species of Baluchistan and their approximate yield

Table 11. Vulnerable Medicinal Plants of Pakistan also found in Balochistan (Siddiqui, B.S and M.I. Chaudhary 2001)

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- Fig.26. Bioprospecting model from The World Bank.

4- Cultivation Economics of Some Medicinal Plants (Per Acre) MINFAL 2004.

(This matrix has been placed here to evaluate and compare the estimated economic benefits of having medicinal crops.)

Medicinal herbs	Input cost (Rs)	Yield per Acre (KG)	Rate per kg (Rs)	Output (Rs)
Parsley (<i>Petroselinum crispum</i>)	7600	2200 - 2500	30	67400
Pudina (<i>Mentha rotundifolia</i>)	7300	2000 - 3000	18	46700
Salad (<i>Lactuca sativa</i>)	8400	3200 - 3500	20	61600
Karafis / celery (<i>Apium graveolens</i>)	9400	1500 - 1800	55	89600
Adrak (<i>Zingiber officinale</i>)	12800	2800	35	85200
Haldi (<i>Curcuma longa</i>)	9900	2600	40	94100
Chamomile (<i>Matricaria chamomila</i>)	8500	250 - 280	150	33500
Aiwani Khurasani (<i>Hyoscyamus niger</i>)	5300	650 - 750	55	35950
Sage (<i>Salvia officinalis</i>)	8700	800 - 1200	40	39300
Babchi (<i>Psoralea corylifolia</i>)	6000	1700	40	62000
Sounf (<i>Foeniculum vulgare</i>)	5900	330 - 370	50 - 60	16300
Thukhm -e – Balanga (<i>Lallemantia royleana</i>)	5800	200 - 240	100 - 120	23000
Maithee (<i>Trigonella foenum</i>)	5050	800	20	50950
Dhania (<i>Coriandrum sativum</i>)	5600	400 - 500	40	14400
Isbaghol (<i>Plantago ovata</i>)	6400	400 - 430	80	28000
Til (<i>Sesamum indicum</i>)	6000	1500	45	61500
Patwa (<i>Hibiscus sabdariffa</i>)	6400	600	45	20600
Desi Ajwain (<i>Trachyspermum ammi</i>)	6400	800	80	57600
Kalongi (<i>Nigella sativa</i>)	5500	300 - 400	60	18500
Kosumba (<i>Carthamus tinctorious</i>)	5100	250 - 300	60	12900
Amla (<i>Phyllanthus emblica</i>)	9300	3100	18	46500
Isgandh (<i>Withania somnifera</i>)	6400	200 - 250	155	32350
Lemongrass (<i>Cymbopogon citratus</i>)	7100	1500	30	37900
Senna (<i>Cassia angustifolia</i>)	6100	800 - 1000	20	13900
Tulsi (<i>Ocimum basilicum/ sanctum</i>)	8600	3500	25	78900
Aloes / Gheekwar (<i>Aloe barbadensis</i>)	26300	800	220	149700
Khatmi (<i>Althea officinalis</i>)	6600	1000	75	68400

Image on title page
***Hertia intermedia* (Boiss) O. Ktze**
The plant is locally known as
Munglian in Balochistan
Plant is used as cure for boils,
pimples and headache
Photo Credit: Rafiul Haq