Structure and Species Composition Analysis of Shaban Forest Zarghun Mountains, Quetta-Pakistan

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Abstract

   Structure and species composition of Shaban Juniper forest, was analysed. The study was conducted during June and July 2019, twenty-five stands were sampled. The aim of this research indicates the associated flora, density ha^{-1}, basal area m^2 ha^{-1}, size class structure, sex distribution and physicals condition and soil analysis. On the basis of average relative frequency values herbs (57%), shrubs (31%) and grasses (12%) were accounted across all the sampling stands. The mean density of Juniper trees (> 6 cm DBH) was (152 ± 63) ha^{-1} with a range from (26 - 269) trees ha^{-1} and with a mean of (58 ± 16) basal area m^2 ha^{-1}. Density and basal area of Juniper trees were poorly correlated (r = 0.148) at significant level (p < 0.05). Density of seedling (< 6 cm DBH) also varied among the stands and range from (21-231) individuals ha^{-1} with a mean of (96 ± 65) individuals ha^{-1}. The combined data display a balanced size class structure. Sex ratio indicated male (51%) predominance, followed by female (32%) while bisexual was (17%) in a population. In the present condition *Juniperus excelsa* showed an adequate recruitment and does not confront any immediate danger, however if grazing stops in the future. Soil variables were free from salinity, calcareous in nature and basic in reactions.

   Keywords: Density and Basal Area; Ground Flora; Size Class Frequency; Sex Distribution; Physical Condition and Soil Analysis

Introduction

   Baluchistan is the largest province, cover the land about (44%) of Pakistan. Juniper forest ecosystem is the second largest in the world present in the province of Baluchistan and the first Juniper forest has in California. It is one of the oldest slow growing Juniper trees of the world having trees as old as (700 - 900) years.

   Forest of Juniper is not only a lack of genetic resource but this is also one of our national and biological heritage of Baluchistan, Pakistan. It is one of the largest in the world, oldest, drought resistant and slow growing trees species therefore, also called "Living Forest Fossil" [1]. The diverse topographic features of climate like mountains and plain has a various type of vegetation in this province. Study and protection of biodiversity and natural plant community factors of edaphic are essential in the earlier and ongoing in future.

   In province of Baluchistan the Junipers forest is presented in Ziarat, Kalat and district of Quetta. Quetta is situated in northern Baluchistan. Juniper's forest of Shaban forest Zarghun Mountains their tree population and diversity were considered in the study area [2]. Beg., *et al.* [3] was carried the vegetation composition of Quetta, its wastelands [4], assessment were carried out by Khilji [5]. Pishin area and the Hazar Ganji vegetation were reported by following researchers [6-11]. A clear picture from these works at the vegetation of the hills of District Quetta does not materialize.

The distribution of forest in Afghanistan and Indian Himalayas described by Champion., *et al.* [12], to elevate the structure population and diversity of floristic with to its natural environment. Wahab., *et al.* [13] have perform many works on the aspect of vegetation on many various regions. Regeneration with poor occurrence has led the forest tree toward the large numbers of mature and over mature trees as a result reduced the number of young trees in the forest. Qadri., *et al.* [14] was presented the population structure of planted tree species of Quetta. Population structure of *J. excela* M.B. was described by Ahmed (1988) while the structure dynamics of *Pinus gerardiana* wall. Ex lamb, from Baluchistan was showed by Ahmed., *et al.* [15], Kakar., *et al.* [16] respectively.

These researchers which works on various location of Pakistan other than no comprehensive quantitative studied were carried that to explain the different population structure and forest communities in the various regions of Pakistan. *Juniperus excelsa* plant species was majority found in the various region of the world like in Macedonia, Turkey, eastern Mediterranean, Cauca-sus, a cross Greece, Pakistan and Afghanistan to Iran. Sheikh [1] reported that *J. excelsa* is found from Afghanistan to Turkey.

The number of forests reduced due its poor regeneration and pre dominance of over mature trees. The anthropogenic disturbance is badly affected the natural regeneration and development of the forest, which may result decline the resources and confirming change in the physio-chemical properties of forest soil. The present study describes the population structure, floristic diversity, soil analysis and also recommended the future threats of *J. excelsa* of Shaban areas at Zarghun Mountains Quetta, Baluchistan.

Study area

Shaban is a small valley located in Zarghun Mountains near the Quetta city and has a rout through Hanna Urak. It is surrounded by the Juniper forest and is a famous tourist attraction in the summer season because of its ice-cold waterfalls and beautiful landscapes. The whole sampling area occurs at elevation between (2197 - 2796m) and extended from latitude ($30^0.10'$- $10^0.93'$) North, ($67^0.28'$- $27^0.45'$) East. The climate is characterized by dry temperate type by Champion [12]. The area has excessive cold during winter and pleasant in summer [17]. Average annual precipitation of is about (260) mm/year is mainly received during winter in the form of snow [18]. Monsoon rainfall occurs in the month of July and August while winter rainfall occurs in the month of February and March.

Temperature extremes are the characteristics feature of the climate with average maximum temperature around (30^0C) in July and August whereas the mean minimum temperature around (-6^0C) in February. The lowest mean relative humidity (21%) in October whereas the highest of (63%) in December were recorded. Geographical substrate included, rocks of sedimentary, between from cretaceous to recent in age [19]. In the area parent material is shallow, lime stone and soil is sandy, clay-loam in texture.

Materials and Methods

Quantitative field surveys were conducted during (2019 - 2020) at various locations of Zarghun mountains areas near Quetta. A stand was selected with a least distributed for data collection. Sampling of the data of vegetation used according to Ahmed [10] that selected those stands which show no mark of disturbance and could cover the area at least two hectares.

Method applied for the analysis of phytosociological features was described by Ahmed and Shaukat [20], could be used for trees (stand density ha^{-1}, basal area m^2 ha^{-1}) and for seedlings (stand density ha^{-1}, basal area cm^2 ha^{-1}). Trees of the sampling greater than (6 cm DBH) dimeter at the breast height. In each stand (10) points were taken with every (25) meters interval from one point to other with a random way. The following method of Mueller Dombois and Ellenberg [21] and Ahmed and Shaukat [20] was be used for the calculation of tree density ha^{-1} and basal area m^2 ha^{-1}.

Circular plots (1.5) meter diameter method used for recorded the seedlings density and absolute frequencies of shrubs, herbs and grasses at a single PCQ (Point Center Quadrat Method) point in the sampling sites. Species identification followed by Stewart [22] while field pictures documented by using digital camera. Diameter size-class frequency distribution of tree (> 6 DBH) and seedlings (< 6 cm DBH) was obtained. Diameter at breast height of trees in stand was divided in to (10 cm) DBH size classes and overall size class structure

of Juniper trees or seedlings were presented of each stand. GPS was used for elevations, stands position and also for aspect of the site whereas by the help of slope meter, slope degree was recorded. Overall size classes with a diameter above (6 cm) of all the stands were plotted through MS Excel bar chart plotting command. Statistical analysis was applied using different software SSP etc.

Soil chemical characteristics and physical were analysed. Soil with composite sample (0 - 25 cm) was taken from a single point of each stand. The samples of soil separated from gravel soil passed through a (2 mm) sieve. For chemical analysis and physical, the portion of soil finer than (2 mm) was used. Soil texture, pH of soil samples and water holding capacity determined according to the method of Bouyoucos [23], Hussain [24], Jackson [25] respectively. Electrical conductivity of saturated soil extract measured by CM-(30) ET digital conductivity meter. Ignition method was used for the determination of organic matter and (5g) of soil taken in crucible and placed in muffle Furness at (500^0C) for (254) hours. $CaCO_3$ was determined by rapid (Titration Method Kumar, 2006).

Result

Juniperus excelsa and associated vegetations grow at elevation which range from (2796 - 2197m) on the top of ridges and moderate (20) steep to (30) slopes and forms dense, pure and open vegetations without any stratification. In the field study, the *Juniperus excelsa* is a single dominated and mono-specific forest therefore these forests are described on the basis of density, basal area for both trees and seedlings of Juniper. During study, density ha^{-1}, basal area m^2 ha^{-1}, regeneration, size class frequency distribution, sex ratio, physical conditions, soil analysis, were reported. Ground flora on the forest floor were also listed and classified on the basis of mean relative frequency level. Main location, longitude, latitude, elevation, slope and aspect of each stand are given in table 1.

S. No	Site Name	Site Code	Long.	Lati.	Elevation (m)	Slope	Aspect
1	Obloon Area 1	SOA	$67^0.32'$	$30^0.91'$	2528	15	N
2	Obloon Area 2	SOA	$67^0. 32'$	$30^0.65'$	2550	12	N
3	Maghzi Area1	SMA	$67^0.45'$	$30^0.55'$	2672	20	NE
4	Maghzi Area 2	SMA	$67^0 .45'$	$30^0.47'$	2760	24	NE
5	Kasoona Area 1	SKA	$67^0.38'$	$30^0.42'$	2793	30	NW
6	Kasoona Area 2	SKA	$67^0.28'$	$30^0.36'$	2796	18	NW
7	Kasoona Area 3	SKA	$67^0.44'$	$30^0.61'$	2715	14	W
8	Tore Shore 1	STS	$67^0.44'$	$30^0.49'$	2736	10	W
9	Tore Shore 2	STS	$67^0.39'$	$30^0.85'$	2406	30	E
10	Jang Meena 1	SJM	$67^0.39'$	$30^0.89'$	2511	30	ES
11	Jang Meena 2	SJM	$67^0.33'$	$30^0.48'$	2416	30	ES
12	Loi Zawar 1	SLZ	$67^0.33'$	$30^037'$	2771	20	EW
13	Loi Zawar 2	SLZ	$67^0.33'$	$30^0.93'$	2613	20	S
14	Loi Zawar 3	SLZ	$67^0.26'$	$30^0.41'$	2534	20	S
15	Chamani Area 1	SCA	$67^0.42'$	$30^0.33'$	2573	12	SW
16	Chamani Area 2	SCA	$67^0.42'$	$30^0.93'$	2528	12	SW
17	Chamani Area 3	SCA	$67^0.28'$	$30^0.80'$	2409	12	E
18	Chamani Area 4	SCA	$67^0.48'$	$30^0.13'$	2372	12	E
19	Shaikhan Kass 1	SSK	$67^0.48'$	$30^0.79'$	2470	15	NE
20	Shaikhan Kass 2	SSK	$67^0.36'$	$30^0.78'$	2535	15	NE
21	Maller Kottay 1	SMK	$67^0.36'$	$30^0.29'$	2197	15	NW
22	Maller Kottay 2	SMK	$67^0.36'$	$30^0.37'$	2324	18	NW
23	Maller Kottay 3	SMK	$67^0.28'$	$30^0.72'$	2453	18	S
24	Zawar Maghzi 1	SZM	$67^0.45'$	$30^0.56'$	2445	18	SW
25	Zawar Maghzi 2	SZM	$67^0.45'$	$30^0.34'$	2547	10	SE

Table 1: *Ecological characteristics of stands and site of samplings at shaban forest.*

Density and basal area

Density ha^{-1} and basal area m^2 ha^{-1} of *Juniperus excelsa* including tree (> 6 cm DBH) and seedling (< 6 cm DBH) were recorded in the study area. The density ha^{-1} and basal area m^2 ha^{-1} values largely differed from site to site (Table 2). In the site of Zawar Maghzi 1 (stand 24) has showed highest density (269) individuals ha^{-1} which facing southwest slope at elevation (2445m) whereases the site Kasoona Area 3 (stand 7) facing west slope at elevation (2715m) had lowest stand density (26) stems ha^{-1}. Although, the stand of Maller Kottay 1 (stand 21) also indicates highest density (268) individuals ha^{-1}. Generally, the mean density of *Juniperus excelsa* was (152) stems ha^{-1} in table 3. The basal area m^2 ha^{-1} of *Juniperus excelsa* varied from (13.53 - 85.26) with an average of (58) m^2 ha^{-1}. Similarly, the highest density of seedling observed in the site of Shaikhan Kass 2 (stand 20) (231) individuals ha^{-1} while the lowest density displayed by Tore Shore 2 (stand 9) (21) individuals ha^{-1}. The basal area cm^2 ha^{-1} of seedling ranged between (1057.65 - 134.26) cm^2 ha^{-1}.

S. No	Site Name	Elevation (m)	Aspect	Tree (> 6 cm dbh)		Seedling (< 6cm dbh)	
				Density ha^{-1}	Basal area m^2 ha^{-1}	Density ha^{-1}	Basal area cm^2 ha^{-1}
1	Obloon Area 1	2528	N	94	67.17	62	175.37
2	Obloon Area 2	2550	N	103	74.89	80	312.51
3	Maghzi Area1	2672	NE	118	72.87	38	270.6
4	Maghzi Area 2	2760	NE	80	64.87	142	645.34
5	Kasoona Area 1	2793	NW	133	72.81	74	325.16
6	Kasoona Area 2	2796	NW	135	85.26	45	135.24
7	Kasoona Area 3	2715	W	26	72.67	172	857.12
8	Tore Shore 1	2736	W	237	13.53	98	422.34
9	Tore Shore 2	2406	E	140	47.96	21	135.33
10	Jang Meena 1	2511	ES	203	39.98	208	665.38
11	Jang Meena 2	2416	ES	84	49.24	180	690.58
12	Loi Zawar 1	2771	EW	110	69.99	129	395.71
13	Loi Zawar 2	2613	S	195	73.00	85	260.64
14	Loi Zawar 3	2534	S	84	57.26	69	386.91
15	Chamani Area 1	2573	SW	182	51.84	59	165.72
16	Chamani Area 2	2528	SW	100	52.25	40	975.44
17	Chamani Area 3	2409	E	104	62.07	27	128.87
18	Chamani Area 4	2372	E	234	33.88	216	486.12
19	Shaikhan Kass 1	2470	NE	176	38.19	173	596.23
20	Shaikhan Kass 2	2535	NE	173	58.31	231	1057.65
21	Maller Kottay 1	2197	NW	268	49.65	64	188.13
22	Maller Kottay 2	2324	NW	189	46.28	24	134.26
23	Maller Kottay 3	2453	S	197	65.51	98	285.62
24	Zawar Maghzi 1	2445	SW	269	81.34	48	166.34
25	Zawar Maghzi 2	2547	SE	170	54.30	36	214.47
Over all mean values				152 ± 63	58 ± 16	96 ± 65	403 ± 275

Table 2: *Summary of Juniperus tree/seedling density ha^{-1} and basal area m^2 ha^{-1} from 25 stands at the study area.*

S. No	Sp. Name	Family	Local Name	P.O. O	F_1	F_r	Ranking
1	*Actaea spicata* L.	Ranunculaceae	Pasta Makhi	40	410	0.038	
2	*Achillea wilhelmsii* C. Koch.	Asteraceae	Zawal	17	130	0.012	
3	*Berberis baluchistanica* Ahrendt.	Berbaridaceae	Kori	55	360	0.033	
4	*Capsella bursa* L.	Brassicaceae	Morri	120	700	0.065	
5	*Caragana ambigua* Stocks.	Papilionaceae	Khara Makhi	170	975	0.091	3rd
6	*Cyanus depressus* L.	Asteraceae	Koorugh	85	540	0.050	
7	*Cynodon dactylon* L.	Gramineae	Spara Ghazi	115	632	0.059	
8	*Dephne mucronate* Scherb.	Thymelaceae	Walghuna	50	340	0.031	
9	*Ephedra procera* Fish. & Mey.	Ephedraceae	Oman	70	123	0.011	
10	*Epimedium alpinum* L.	Berberidaceae	Lash ta	61	200	0.018	
11	*Malva neglecta* Walls.	Malvaceae	Taki	230	1523	0.143	1st
12	*Medicago sativa* L.	Fabaceae	Spasta	73	212	0.019	
13	*Melica persica* Guss	Gramineae	Lavani Boti	30	453	0.042	
14	*Mentha royleana* Benth.	Lamiaceae	Villuna	15	70	0.006	
15	*Nepeta juncea* Benth.	Lamiaceae	Chanjan Boti	80	110	0.010	
16	*Pegnum harmala* Linn.	Zygophyllaceae	Spanda	221	1376	0.129	2nd
17	*Perovskia abrotanoides* Kar.	Lamiaceae	Shan Shumba	34	120	0.011	
18	*Plantago coronopus* L.	Plantaginaceae	Spanda	110	184	0.017	
19	*Polygonum aviculare* L.	Polygenaceae	Gungu	89	245	0.023	
20	*Rosa beggeriana* Boiss & Bush.	Rosaceae	Suri	20	89	0.008	
21	*Sacchrum griffthii* Munro ex Aitch.	Gramineae	Sarghasi	56	137	0.012	
22	*Salvia verbenaca* L.	Lamiaceae	Ghora Spari	75	436	0.041	
23	*Sonchus maritimus* L.	Solanaceae	Sheergu	140	567	0.533	
24	*Sophora mollis* (Royle) Baker.	Fabaceae	Ghoraza	90	564	0.053	
25	*Xanthium strumarium* L.	Asteraceae	Kungli	23	60	0.005	
26	*Xanthium spinosum* L.	Asteraceae	Shashgi	20	78	0.007	

Table 3: *Summary of floristic list of circular plot quadrat method of 25 stands in Juniperus/ Shaban forest at Zarghun Mountains.*

Note: P.O.O. = Point of occurrence in which species occurs; F_1 = Frequency; F_r = Mean relative frequency and ranking represents the dominated species in the sampling area.

Plant association

The associated flora on the forest floor including seedlings of Juniper assessed by the help of circular plot sampling method. Overall, (26) species of herbs, shrubs and grasses were recorded in the current study area. Generally, on the basis of relative frequency values herbs were (57%), shrubs (31%) while grasses (12%) were reported in the sampling area across all the stands (Figure 1). The number of plant species varied from (1- 4) in each family. On the basis of mean relative frequency values, Asteraceae (4 Spp), Lamiaceae (4 Spp) were found dominant families and Gramineae (3 Spp) was the second dominated family. The Berbaridaceae and Fabaceae were the third dominated families with each contain (2 Spp) respectively. The remaining families such as Ranunculaceae, Brassicaceae, Papilionaceae, Thymalaceae, Ephedraceae, Malvaceae, Zygophylaceae, Plantaginaceae, Polygonaceae, Rosaceae and Solanaceae were contained single species (Figure 2).
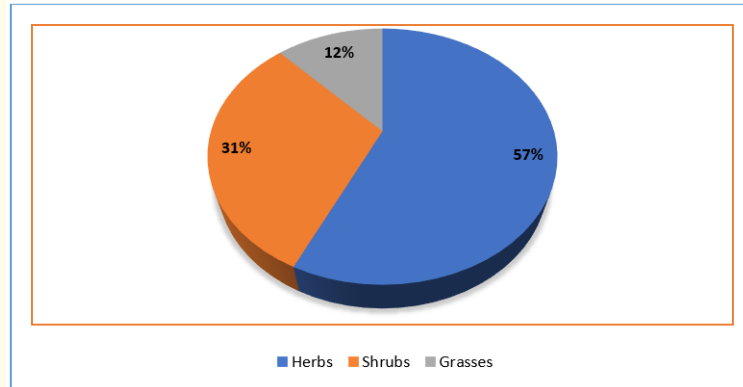
Figure 1: Overall mean percentage values of associated flora in the sampling area.
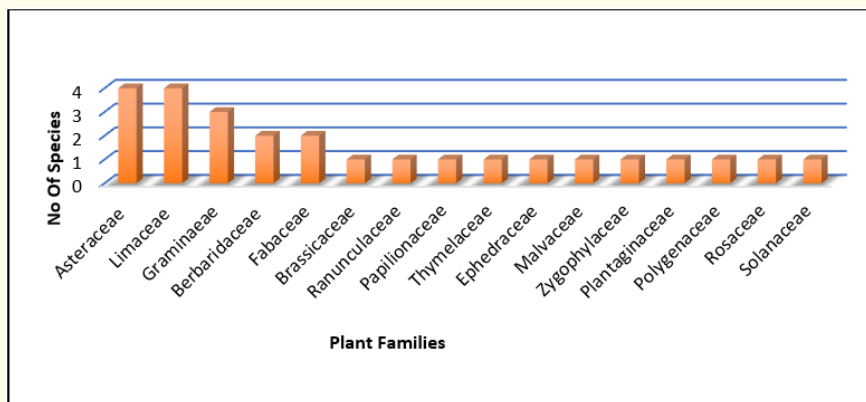

Figure 2: No of plant species of studied families in the study area.

Size class frequency distribution

Distribution of size class frequency was observed in various localities of the study area. A total size class frequency distribution of *Juniperus excelsa* resemble, a reverse J-shaped distribution. Mostly fell in small size classes indicating better present progressive recruitment of trees (> 6 cm DBH), however their number gradually increased in the larger size classes (Figure 3). Similarly, the seedlings size class structure (< 6 cm DBH) indicated uneven distribution patterns mostly. A large density stands had a skewed size frequency distribution with the mode in the smallest size class. A moderate density stands indicated intermediate size class frequency distribution normally. Stands with low density showed flatter structure with many modes mostly (Figure 4). Overall data indicate balance size class structure. Around (55%) of the trees fell in small size class structure (1 - 5). All the stands showed gaps in their size class structure which means individuals are missing in some classes. Specific seedling size class indicates either regeneration potential is low or collapse at some stage in the distinct phase of the year.

Figure 3: Size class frequency distribution of juniper density ha-1 in the study area. Size structure of trees were > 6 cm shown in 12 classes intervals (6.1 cm - 126 cm).
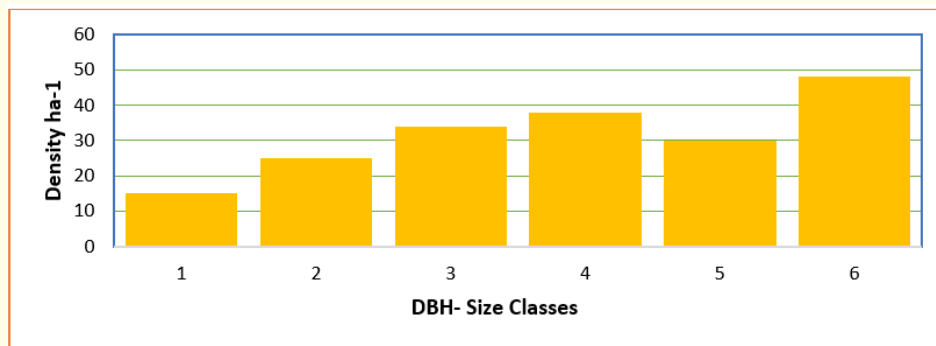
Figure 4: Size class frequency distribution of juniper seedlings density ha-1 in the study area. Seedling size class structure (0.5 cm - 6 cm Dbh) is shown in 6 classes intervals.

Sex distribution

The distribution of sex parameters such as male, female and bi-sexual were estimated in the study area. These parameters of Junipers varied from site to site on the basis of relative abundance. In some stands male plants predominated while in others female plants has greater density. Bi-sexual plants observed rare, containing about (17%) of the total samples. Generally, in the population the sex ratio of male exhibited predominance about (51%) while the sex ratio of female was recorded about (32%) in the study area (Figure 5).

Physical conditions

A large number of Juniper plants were noted in alive conditions about (94%) while (2.7%) identified standing dead and (3.2%) were observed logged stumps in the present study. Generally, the individual healthy plants which were in best condition with their branches bearing living leaves about (39%) whereas, the twisted and hollow stems of over mature of Juniper trees found (18%) in a population. The unhealthy individuals (14%), disturbed (9%), cut stumps (10%) and die-back (4.1%) were recorded in the study area (Figure 6).
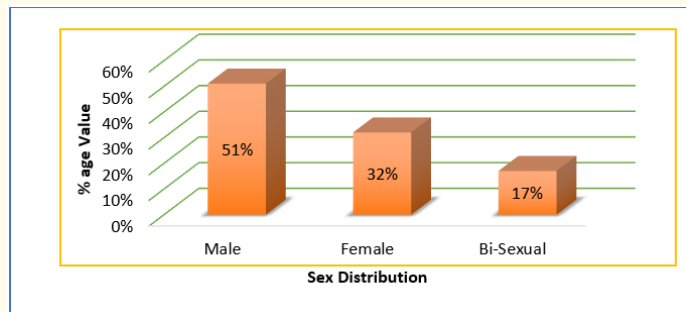
Figure 5: *Sex distribution ratio of juniper in 25 stands of the study area.*
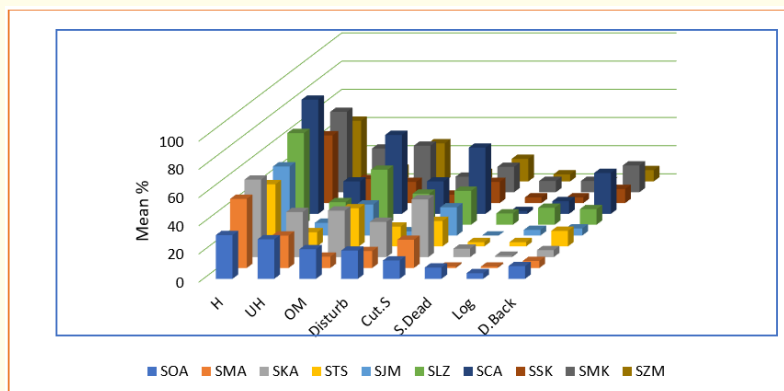

Figure 6: *A graphical presentation of physical conditions of juniper plants with mean values of 25 stands. H = Healthy; UH = Unhealthy; OM = Overmature; Cut. S = Cut stumps; S. Dead = Standing Dead; D. Back = Die-back. Note: S = Shaban; Obloon Area = SOA; Maghzi Area = SMA; Kasoona Area = SKA; Tore Shore = STS; Jang Meena = SJM; Loi Zawar = SLZ; Chamani Area = SCA; Shaikhan Kass = SSK; Maller Kottay = SMK; Zawar Maghzi = SZM.*

Soil analysis

Soil showed great variability not only between the sites but also among the stand of the same sites at present study. The type of soil sandy loam was predominated which represent the main part of soil sampled. In the total samples of soil across the study area, the sand sample showed about (45%), followed by silt (31%), clay (6%) while water holding capacity exhibited (18%) (Figure 7). In the sampling area organic content percentage observed rare, which range between (1.32 - 3.1%). Most of the stands were free from salinity and basic in reactions in the study area. The values of pH ranged from (7.65 - 8.0%) whereases electrical conductivity ranged between (0.3 - 1.0%) ds/cm which indicated suitable condition in all the sampling stand. All samples of the soils were invariably calcareous in nature, their lime content ranged from (12.02 - 35.67%) which stable in all stands comparatively (Figure 8). No correlation appears between soil variables and density, basal area and seedling density of *Juniperus excelsa* trees.
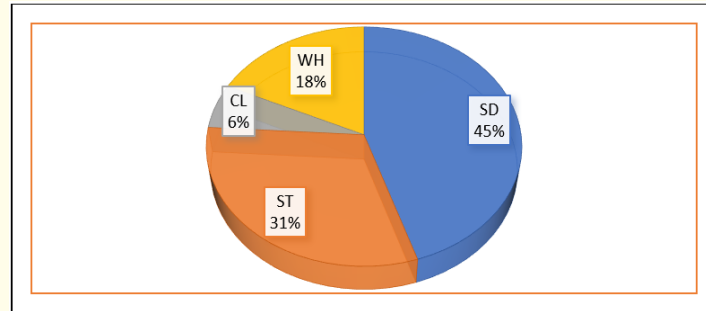
Figure 7: *Overall percentage values of soil physical characteristics (25 Stands) in the study area. SD = Sand; ST = Silt; CL = Clay; WH = water holding capacity.*
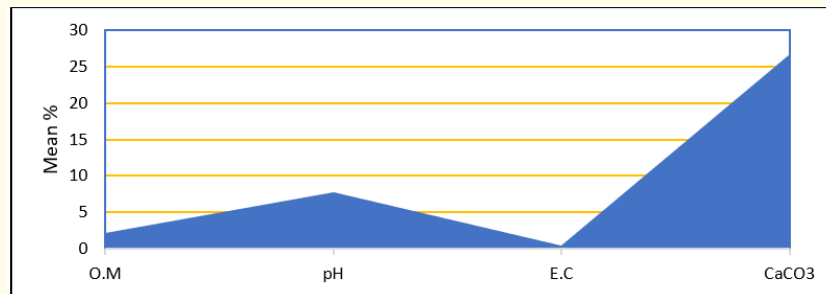
Figure 8: *Overall percentage values (mean of 25 Stands) of soil chemical characteristics of study area. O.M = organic matter; pH = Hydrogen concentration; E.C = Electrical conductivity; CaCO3 = Calcium Carbonate.*

Discussion

Juniperus excelsa is a dominated monospecific dry temperate tree species forest land in upper elevation of Ziarat, Herboi and Zarghun mountains in the province of Balochistan. Such forest is localised at altitude ranging from (200 - 300m) which makes pure, open and un-certified stands in the studied. Anthropogenic disturbance such as illegal cutting and over grazing have completely changed not only the vegetation composition but also the regeneration patterns of the area. Along the single dominated Juniper trees, *Fraxanus xanthoxyloides, Pistacia kunjuk* rarely exist. Such species were widely distributed in dry temperate areas and know eliminated from these forests [26]. Although, they are available very rare along the stream of water at Ziarat Juniper forest and Hazagangi national park, near Quetta [27]. Overall, (26) species of herbs, shrubs and grasses were recorded as associated flora at present study, whereas from the Ziarat Juniper forest (20) species were reported by Sarangzai., *et al* [28].

In the present study, the density of Juniper tree ranged from (26 - 269) ha^{-1} with a mean of (152 ± 63) individuals ha^{-1}. In the previous studied, the average density of Juniper trees at Ziarat (176 ± 77) ha^{-1} which ranged from (29 - 268) ha^{-1} reported by Sarangzai., *et al* [28]. *Pinus gerardiana* of Zhob district showed an average (321) ha^{-1} with a range of (15 - 658) trees ha^{-1} [16]. A sharp decline in the attributes of forest vegetation considered the level of Human and interference of livestock which was reported in Bagh district, Kashmir [29]. The overall basal area of current Juniper tract was recorded (58 ± 16) m^2 ha^{-1} than the previous studied forest of *Juniperus excelsa* (91) m^2 ha^{-1},

(41) m^2 ha^{-1} and strip of *Pinus gerardiana* (378) m^2 ha^{-1}. To explain this deference an earlier time estimate was based upon the complete Juniper tract but our mean (152) ha^{-1} refers to (25) random stands of Juniper rather than selective stands in the areas. Thus, this dry forest was not poor in density and basal area as compared to other forest. The huge variations from site to site in the data might be that trees density depends on different historical and environmental factors (Ahmed, 1984). Similarly, a large number of seedlings were found in the field area. These seedlings were present under the canopies or nearby parent trees. The seedlings are needed shade environment in the early stage of development otherwise if it exposed to soil surface, over grazing and low vegetation covers, these factors responsible for the lack of regenerations. The complete seedling in all the stands of the field area ranged mainly from (21 - 231) ha^{-1} and with mean of (96 ± 65) individuals ha^{-1}. The similar result for density and basal area of seedlings was reported by Sarangzai., *et al* [28]. The area of study mainly connected to anthropogenic disturbance, ancient agent and near to physiographic extant. Sarangzai., *et al*. [28] stated that the Juniper forest and its regeneration are incapable because of high value of anthropogenic is now in the condition of critical state, in the province of Balochistan.

Density and basal area were found great variability not only on elevations but also on various aspects might be due to anthropogenic and climate change. Juniper forest of Balochistan are unable to regenerate may be due to lack of natural regeneration, seed borer and hard seed coating according to Sheikh (1985). *Juniperus excelsa* is a living fossil in the area which deteriorating and thinning out very rapidly reported by Beg [30]. Size structure of the population provides an estimation of their regeneration process and their conservation status. In the current study, a huge number of young trees and seedlings of various size classes recorded which indicated that the regeneration is quite best, despite high pressure for fuel wood collections, selective cutting for timber, collection of Juniper berries and extensive grazing. Due to continuous disturbances in the area, the size class structure in the present Juniper stands is normal and sufficient number of individuals in small size classes are available. Thus, combined data display a balanced size class structure. Gaps were present in the size class structure which representing the cutting rather than the lack of regeneration. Several stands were regulated or well managed indicated the natural regeneration will be increased. However, gaps in the start, showed the grazing of young seedlings if present in the middle displayed the tree fall by cutting or storm reported by Ahmed., *et al* [31].

Sarangzai., *et al.* [28] also calculated the densities of healthy, unhealthy, disturbance and over mature Juniper individuals on the Juniper tract in Ziarat, Balochistan. Higher densities of healthy (30 - 45%) and over mature tress (18 - 32%) were reported by these workers. In the current study, healthy plants about (39%), over mature of Juniper trees found (18%) in a population. The unhealthy individuals (14%), disturbed (9%), cut stumps (10%) and die-back (4.1%). A large number of male plants (51%), female (32%) and bi-sexual (17%) plants were recorded in the study area. Sarangzai., *et al.* [28] also reported male predominance in Ziarat Juniper tract. The older populations of Juniperus communis on dry poor nutrient sites, predominated male individuals while as in young populations female individuals predominated reported by Ward [32], Falinski [33].

Texture of soil has huge influence upon soil fertility, water content, soil temperature, water holding capacity and soil erosion. The analysis soil of *Juniperus excelsa* explained here indicated that the sandy loam was the predominated soil. The main soil part which was analysed represent the sand fraction about (45%) of the total (25) stands. The findings were supported the results of Sarangzai., *et al.* [28], Kakar., *et al* [16]. Due to low organic matters contents and coarse textured nature therefore all the stands showed low to medium water holding capacity apparently. The analysed soil explain that the soils were well drained. Similar result from the soil of Hazar Gangi national park were reported by Qadir and Ahmed [14], Majeed [11] and also the same result from the soil of Ziarat reported by Sarangzai., *et al* [28]. In the study area the per centage of organic matter is low generally. This is due to erosion of the upper horizon of soil or it may be with the conclusion of humus. The concluded soils are basic in reaction, less pH with free from salinity and it might be due to the presence of resins. Due to the accumulation of salts on the upper surface therefore the conductivity in all stands were stable mainly and might be because of water evaporation. A characteristic feature of arid zone soil is the accumulation of calcium carbonate. Soil sample showed low to moderate calcareous nature in the current study. No correlation was recorded between soil texture which indicating that tree and

seedling density is greatly depend upon the soil containing sand, clay and calcium carbonate because of human disturbance, climate change and animal grazing particularly drought conditions in the past few years.

Conclusion

In short, *Juniperus excelas* is an economically and ecologically valuable species in the world. Our data has indicated that the present condition and natural regeneration process of *J. excelsa* has sufficient recruitment yet. Therefore, these forests of Juniper have degraded extensively that can be saved if urgent steps are taken for management and conservation.

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