PRESENT STATUS AND SIZE CLASS STRUCTURE OF SOME CONIFER DOMINATING FORESTS FROM MOIST TEMPERATE AREA OF WESTERN HIMALAYAN AND HINDUKUSH REGION OF PAKISTAN

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Abstract

Size class structure of conifer dominating forests of moist temperate areas is presented in this paper. On different environmental gradients (elevation, slope and aspect) sampling were carried out at 41 stands by point centered quarter method. In moist temperate areas, conifers are dominant as compare to angiospermic trees. Five conifers and seven angiospermic trees were recorded during the study. Among conifers *Pinus wallichiana* occupied highest frequency found in 35 stands while *Abies pindrow* occurred in 27 stands with high importance value and density. *Cedrus deodara* is well tolerant in different climatic conditions, recorded from 22 sampling sites. *Taxus fuana* and *Picea smithiana* attained low frequency and density, recorded from 6 and 5 stands respectively. Angiospermic species associated with conifers attained very low density. *Quercus incana, Quercus ilex, Pyrus pashia, Albizia chinensis, Juglans regia, Populus pamirica* and *Populus alba* occurred in few sampled forests. Most of the forests showed uneven size class structure but some forests showed inverse J shaped size class distribution which showed ideal regeneration potential. Most of the forests were under threat due to high degree of anthropogenic disturbance i.e. illegal cutting and over grazing.

Introduction

In the studies on population dynamics of tree species the density size class structure is often examined. Density size class structure has been particularly widely applied in forest ecology and phytosociology (Curtis and McIntosh, 1951). According to Kelly and Larson (1997) the principal problem encountered when studying the population dynamics of a forest community is the enormous length of time required to follow individuals from germination to death. Instead, present day stem densities structure is used to infer past fluctuations in population size and to make predictions of future trends. The life history pattern of an individual tree, or the structure of the population, can be conceived as comprising a series of stages (e.g. seedling, saplings, poles, mature trees etc.). Saxena and Singh (1984) suggested that population structure of a species in a forest can convey its regeneration behavior. Population structure, characterized by the presence of a sufficient population of seedlings, saplings and young trees, indicate a successful regeneration of forest species. Harper and White (1974), and Harper (1977) suggested that size may be a better predictor of reproductive output than age and that balanced or stable size distributions in higher plants may be analogous to balance or stable age distributions in higher plants. Natural disturbance plays a critical role in mediating old-growth forest dynamics and disturbance vary in type, scale, and effect on stand structure (Pickett and White, 1985, Pickett *et al.,* 1989). The theory of community and ecosystem dynamics has benefited greatly from understanding of the role of disturbance and in particular, the concept of gap or patch dynamics. Localized disturbance occurs occasionally at different points in a landscape, resulting in patches that are in different stages of response to disturbance (Pickett and White 1985). Within any forest landscape, the relative proportion of the various stages of stand structural and / or stand successional development depends to a large extent on the periodicity, magnitude and spatial and temporal stochasticity of any particular disturbance event. Forests dominated by relatively major disturbances are often viewed as a mosaic of relatively discrete seral or development patches of varying size structure. Non-equilibrium patch dynamics have become the dominant ecological paradigm by which to understand the relationship between forest and stand-level structure and disturbance (Pickett and White 1985; Wu and Loucks 1995). Spatial distribution of disturbance is determined by factors that influence the size and location of disturbance events. If trees at the gap margin are more likely to die than random canopy trees for instance, canopy gaps would expand (Worrall *et al.,* 2005).

Population dynamics and size class structure of mountainous forests of Pakistan were investigated by different researchers. Ahmed (1988) described the population structure of five tree species in Quetta. Ahmed *et al.,* (1990a, b) described population structure and dynamics of *Juniperus excelsa* in Baluchistan and in Rodhmallazi forest of Baluchistan, Pakistan respectively. They described population dynamics of the forest by evaluating density, basal area, age and growth rate of *Juniperus excelsa*. Similarly Ahmed *et al.,* (1991) described vegetation structure and dynamics of *Pinus gerardiana* forests in Baluchistan. Wahab *et al*. (2008) investigated phytosociology, structure, age and growth rate studies in Dangam District of Afghanistan. Ahmed *et al.,* (2009) presented vegetation structure of *Olea ferruginea* forests of lower Dir district of Pakistan. Ahmed *et al.,* (2010) describe the population structure and dynamics of *Cedrus deodara* dominating forests in different climatic zones of Himalayan and Hindukush regions of Pakistan. Khan (2011) describes the vegetation structure and dynamics of Chitral district, Pakistan while Wahab (2011) evaluated the vegetation structure and dynamics of District Dir, Pakistan.

Current investigation deals with the population structure of moist temperate area of Himalayan and Hindukush region of Pakistan. The size structure of the tree species was evaluated using diameter size frequency distribution.

Materials and Methods

Forty-one different sites, dominated by conifers were selected in the range of moist temperate area for sampling. Vegetation was sampled by Point Centered Quarter method (Cottom & Curtis, 1956). Phytosociological attributes and absolute values (density ha^{-1} of species and basal area of species m^2 ha^{-1}) were calculated following the methods described by Mueller-Dombois & Ellenberg (1974) and Ahmed & Shaukat (2012)**.** Diameter at breast height (dbh) of trees in stands was recorded. The dbh was divided into 10cm dbh size classes and size structure of conifer and broad leaf trees was presented graphically for each stand. Size class structure was studied for

(a) Forest stand as a whole (irrespective of species identity).

(b) For the dominant conifer species in the stands including *Pinus wallichiana*, *Abies pindrow*, *Cedrus deodara* and *Picea smithiana* were investigated following the method of Ahmed (1984).

Size classes: The diameter values (dbh) were classified into 16 categories as described below:
(1) = 10 – 20 cm diameter at breast height (dbh), (2) = 20.1 – 30 cm, (3) = 30.1 – 40 cm,
(4) = 40.1 – 50 cm, (5) = 50.1 – 60 cm, (6) = 60.1 – 70 cm, (7) = 70.1 – 80 cm, (8) = 80.1 – 90 cm, (9) = 90.1 – 100 cm, (10) = 100.1 – 110 cm, (11) = 110.1 – 120 cm, (12) = 120.1 – 130 cm, (13) = 130.1 – 140 cm, (14) = 140.1 – 150 cm, (15) = 150.1 – 160 cm and size class (16) = 160.1 – 170 cm.

For the purpose of description ("Results section") the adjacent classes may be combined as small, medium, etc in the form of six classes, as follows:

1. Small size class (10 to 30 cm dbh)
2. Medium size class (30.1 to 60 cm dbh)
3. Large size class (60.1 to 90 cm dbh)
4. Extra large size class (90.1 to 120 cm dbh)
5. Largest size class (120.1 to 150 cm dbh)
6. Over mature size class (120.1 to 150 cm dbh)

Results

Main locations (districts), close to the sampling sites presented in Fig. 1 while Density size class structure of stand is presented in Fig. 2, which shows the distribution of tree species in different size classes of stands. Main locations, sampling sites, elevation, slope, aspect and density ha^{-1} of each forest (site) are presented in Table 1.

Stand No. 1 Kumrat: This forest was dominated by *Pinus wallichiana* and *Cedrus deodara* with 245 and 110 trees ha^{-1} density respectively. *Pinus wallichiana* individuals were distributed in small size classes with 38% density and also in medium size classes. Large size classes are occupied by only 13% of the total population. Extra large size classes are occupied by 7% individuals of the total population and largest size classes occupied by only 4% of the total population. As a whole *Pinus wallichiana* occupied 61% of the total stands density. *Pinus wallichiana* seems to be regenerating satisfactorily in Kumrat forest. The structure shows many gaps or extremely low number of trees in large size classes.

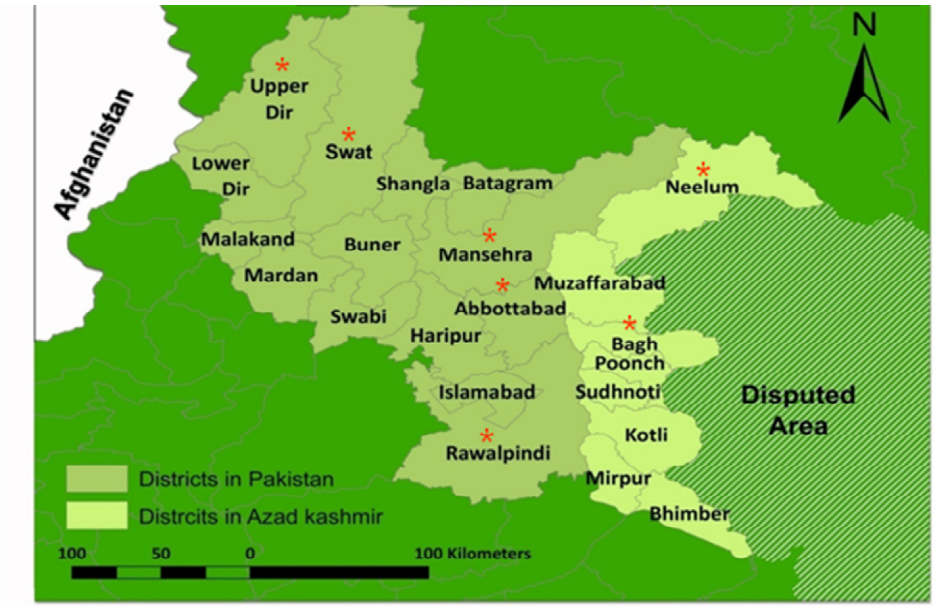
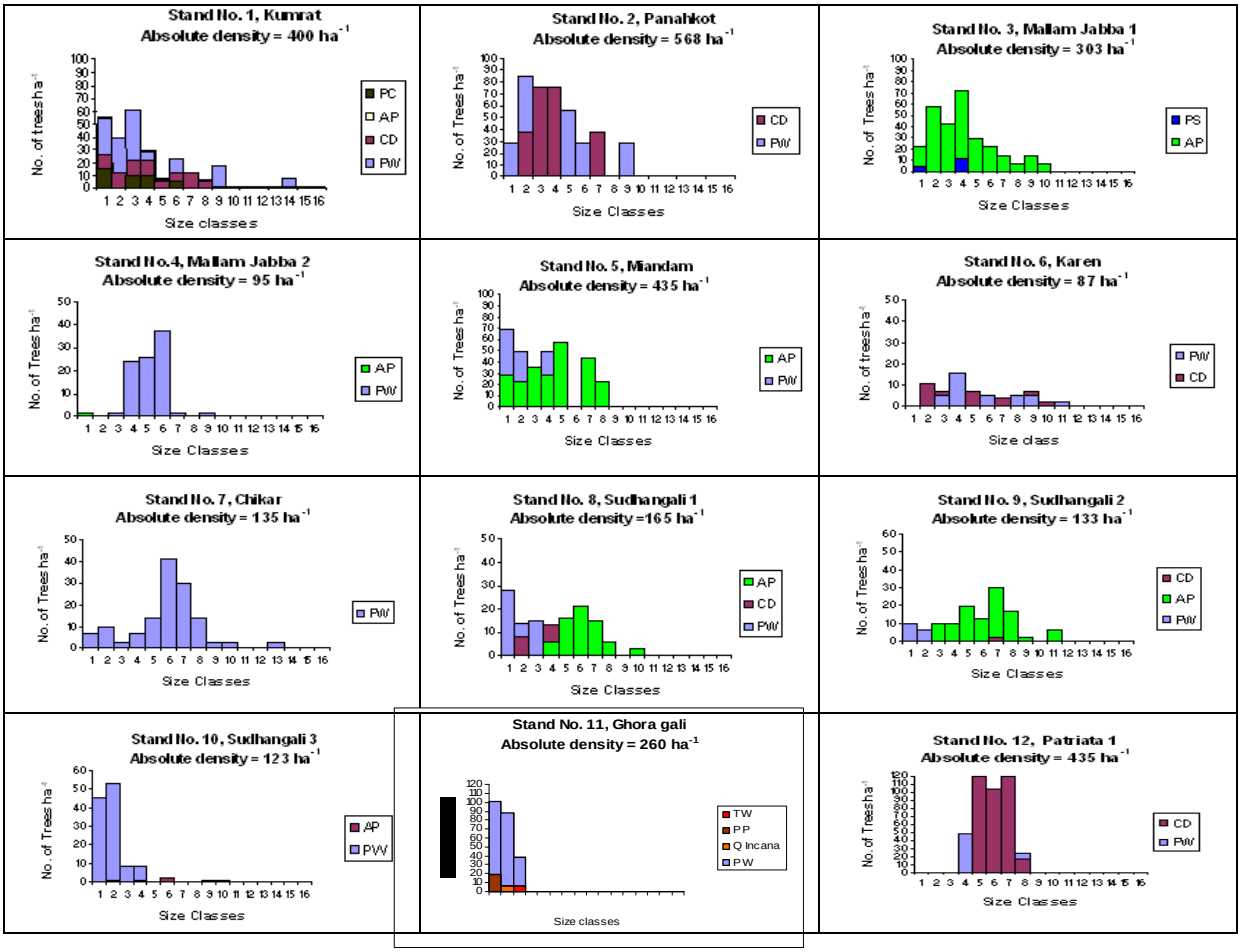
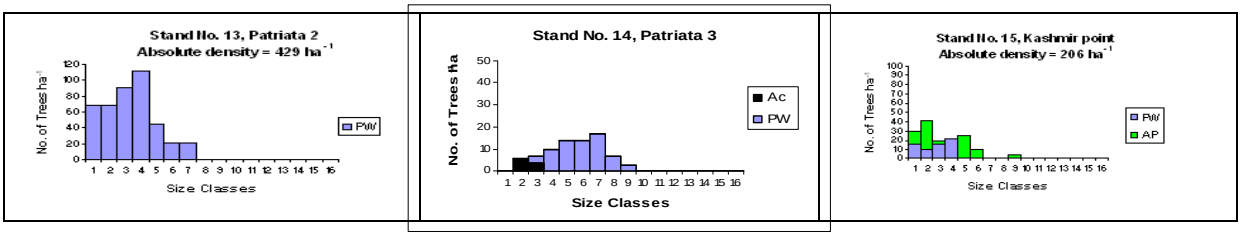
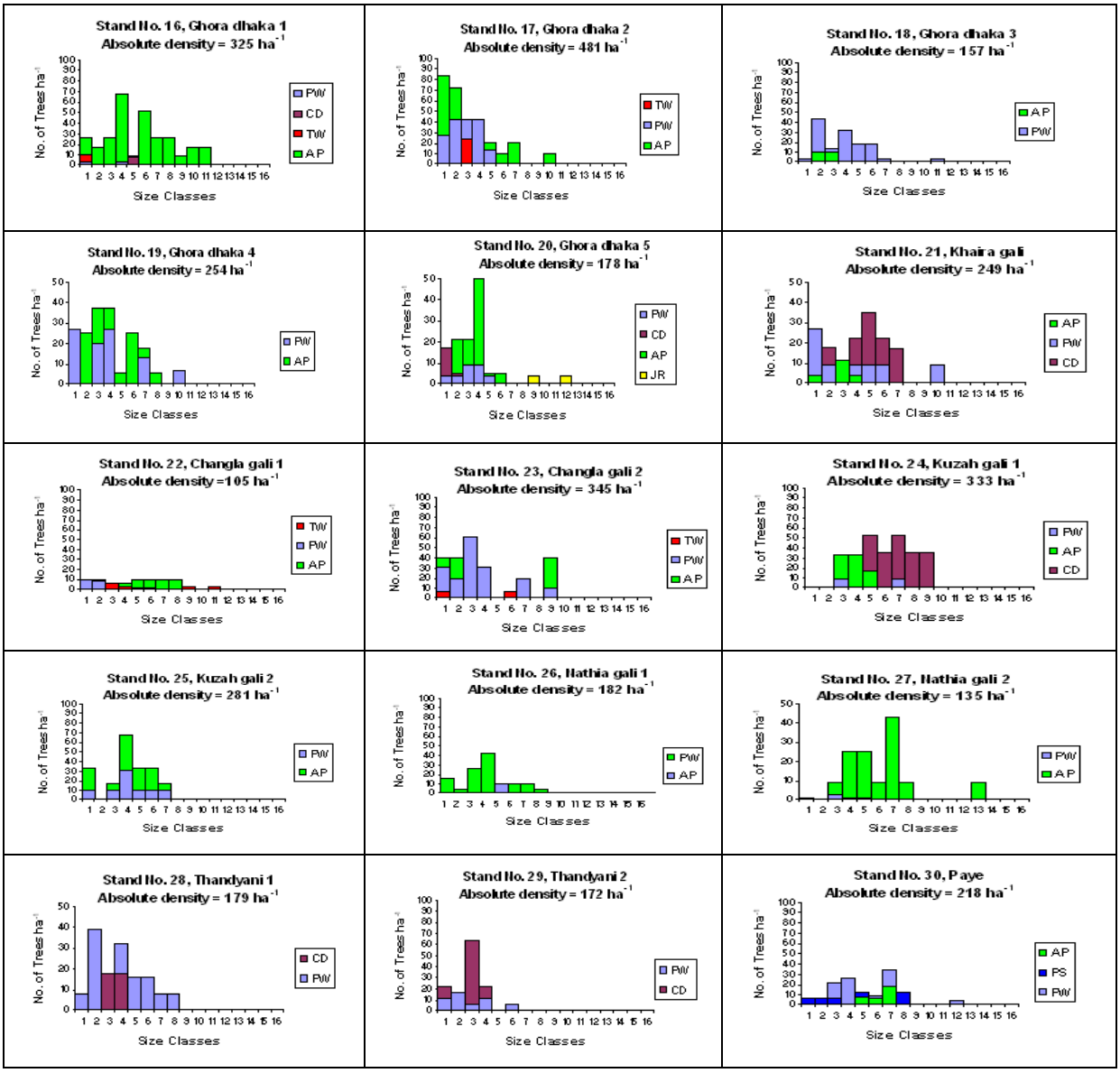
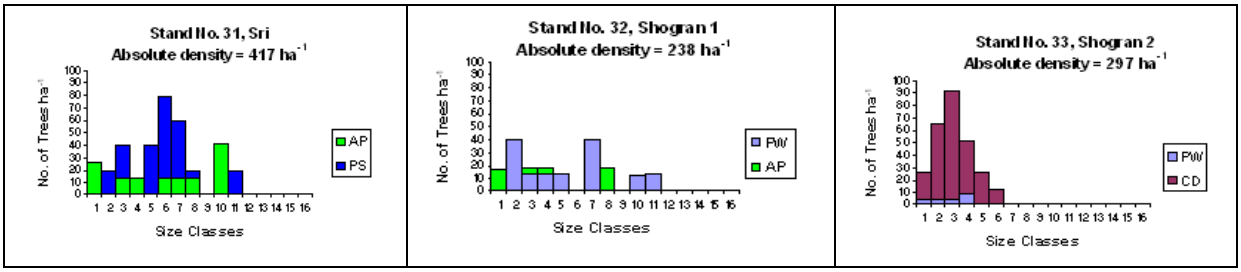


Fig.1. Study area map. *showing the district where sampling was conducted (Siddiqui *et al.*, 2013b).




Stand No. 13, Patriata 2
Absolute density = 429 ha-1
No. of Trees ha-1
Size Classes
PW
Stand No. 14, Patriata 3
No. of Trees ha
Size Classes
Ac
PW
Stand No. 15, Kashmir point
Absolute density = 206 ha-1
No. of Trees ha-1
Size Classes
PW
AP


Stand No. 16, Ghora dhaka 1
Absolute density = 325 ha-1
PW
CD
TW
AP
Stand No. 17, Ghora dhaka 2
Absolute density = 481 ha-1
TW
PW
AP
Stand No. 18, Ghora dhaka 3
Absolute density = 157 ha-1
AP
PW
Stand No. 19, Ghora dhaka 4
Absolute density = 254 ha-1
PW
AP
Stand No. 20, Ghora dhaka 5
Absolute density = 178 ha-1
PW
CD
AP
JR
Stand No. 21, Khaira gali
Absolute density = 249 ha-1
AP
PW
CD
Stand No. 22, Changla gali 1
Absolute density =105 ha-1
TW
PW
AP
Stand No. 23, Changla gali 2
Absolute density = 345 ha-1
TW
PW
AP
Stand No. 24, Kuzah gali 1
Absolute density = 333 ha-1
PW
AP
CD
Stand No. 25, Kuzah gali 2
Absolute density = 281 ha-1
PW
AP
Stand No. 26, Nathia gali 1
Absolute density = 182 ha-1
PW
AP
Stand No. 27, Nathia gali 2
Absolute density = 135 ha-1
PW
AP
Stand No. 28, Thandyani 1
Absolute density = 179 ha-1
CD
PW
Stand No. 29, Thandyani 2
Absolute density = 172 ha-1
PW
CD
Stand No. 30, Paye
Absolute density = 218 ha-1
AP
PS
PW
No. of Trees ha-1
Size Classes


Stand No. 31, Sri
Absolute density = 417 ha-1
AP
PS
Stand No. 32, Shogran 1
Absolute density = 238 ha-1
PW
AP
Stand No. 33, Shogran 2
Absolute density = 297 ha-1
PW
CD
No. of Trees ha-1
Size Classes

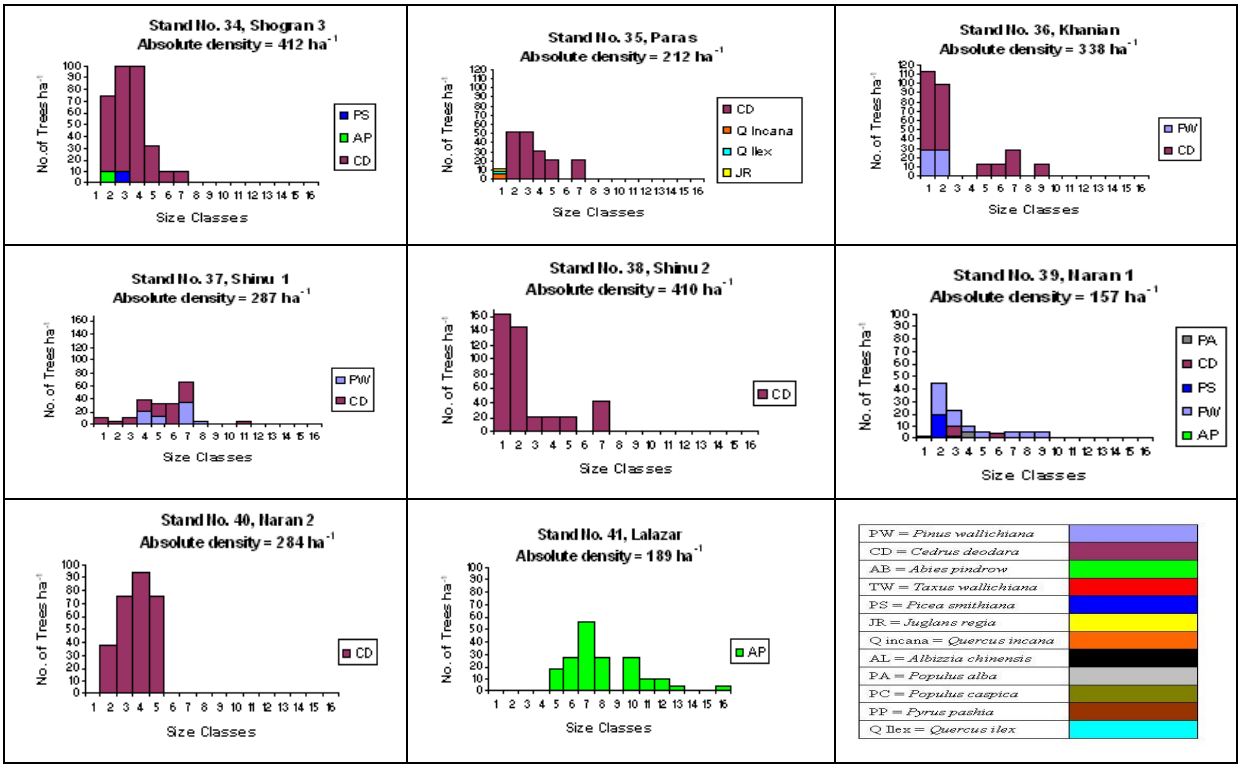


Figure 2 Size frequency distribution of tree species from 41 stands of study areas. Numbers of trees are per hector basis. Tree diameter distribution, grouped by density. Stem > 10 cm diameter breast height (dbh) are included. Each tree species are differentiated by different colors.

Co-dominant species *Cedrus deodara* attain small size classes with 34% of the individual, while medium size classes occupied by 43% of the trees. *Cedrus deodara* occupied 28% of the total stand density. No tree more than 90 cm dbh was recorded from this area presumably due to cutting of larger trees. *Abies pindrow* was third conifer species found in Kumrat forest with very low density i.e. 1.25 % of the total stand density, found only in small and medium size classes. *Populus caspica* (angiospermic tree) have flat structure from lower to medium size classes. It occupied 10% of the total stand density. The overall shape of the graph is positively skewed.

Stand No. 2 PanaKot: *Pinus wallichiana* was dominant species in PanaKot with 340 trees ha^{-1}. It occupied 60% of the total stand density. Its 33% individuals were distributed in small size classes and 50% in medium size classes. Large and largest size classes were occupied by 9% individuals each of the total population. No trees found in over mature size classes. Co-dominant species *Cedrus deodara* occupied 40% of the total stand density. It attain small size classes with 17% of the individuals, while medium size classes were occupied by 66% of the trees and large size classes occupied only 17% of the total population. No tree more than 100 cm dbh was recorded from this area. Small and medium size classes have more trees.

Stand No. 3 Malam Jabba 1: *Abies pindrow* was dominant species in Malam Jabba 1with 288 trees ha^{-1}. It occupied 90% of the total stand density. Its 26% individuals were distributed in small size classes, 48% in medium size classes, 14% occupied in large size classes and 7% in largest size classes of the total population. No trees were found in over mature size classes. *Picea smithiana* was also associated with *Abies pindrow* in Malam Jabba 1 with very low density which was only 15 trees ha^{-1}. It occupied 10% of the total stand density. It attained small size classes with 27% of the individual, while medium size classes occupied by 73% of the trees. No tree more than 110 cm dbh was recorded in this area.

Stand No. 4 Malam Jabba 2: *Pinus wallichiana* was dominant species in Malam Jabba 2 with the density of 93 trees ha^{-1}. It occupied 98% of the total stand density. A few trees found in small size classes and over mature size classes (120.1 to 150 cm dbh). But medium size classes occupied 56%, large size classes 42% and 2% in largest size classes of the total population. *Abies pindrow* was also associated with *Pinus wallichiana* in Malam Jabba 2 with very low density which was only 2 trees ha^{-1}. It occupied only 2% of the total stand density. It was found only in small size classes. The distribution of size class is positively skewed for *Abies* pindrow. *Pinus wallichiana* trees are totally absent in small and largest size classes.

Table 1 Site characteristics and density per hectare of tree species in forty one stands of moist temperate areas of Himalayan and Hindukush range of Pakistan (modified Siddiqui *et al.*, 2013a).

Main Location, Sites and Stand No.		Species Name	Elevation (m)	Slope (°)	Aspect	Density ha^{-1}
1- Dir upper (district), Malakand Division						
1	Kumrat	*Pinus wallichiana*	2400	R. Top	R. Top	245
		Cedrus deodara				110
		Populus pamirica				40
		Abies pindrow				5
2	Panahkot	*Pinus wallichiana*	2200	40	W	340
		Cedrus deodara				228
2- Swat (District), Malakand Division						
3	Malam Jabba 1	*Abies pindrow*	2600	34	W	288
		Picea smithiana				15
4	Malam Jabba 2	*Pinus wallichiana*	2350	30	N W	93
		Abies pindrow				2
5	Miandam	*Abies pindrow*	2600	49	N	239
		Pinus wallichiana				196
3- Nellam (district), Azad Kashmir						
6	Keran	*Cedrus deodara*	1960	30	N E	52
		Pinus wallichiana				35
4- Bagh (district), Azad Kashmir						
7	Chikar	*Pinus wallichiana*	1930	28	N W	135
8	Suddhan Gali	*Abies pindrow*	2450	22	E	70
		Pinus wallichiana				74
		Cedrus deodara				21
9	Suddhan Gali 2	*Abies pindrow*	2500	32	N	110
		Pinus wallichiana				20
		Cedrus deodara				3
10	Suddhan Gali 3	*Pinus wallichiana*	2420	38	West	117
		Abies pindrow				6
5- Murree (district), Rawalpindi Division						
11	Ghora Gali	*Pinus wallichiana*	2100	29	N	227
		Pyrus pashia				19
		Taxus fuana				7
		Quercus incana				7
12	Patriata Top 1	*Cedrus deodara*	2300	40	S E	362
		Pinus wallichiana				73
13	Patriata Top 2	*Pinus wallichiana*	2300	25	S W	429
14	Patriata Top 3	*Pinus wallichiana*	2000	39	S	72
		Albizia chinensis				10
15	Kashmir Point	*Abies pindrow*	2500	39	S	142
		Pinus wallichiana				65
		Juglans regia				18
		Cedrus deodara				12
6- Abbot Abad (district), Hazara division						
16	Ghora Dhaka 1	*Abies pindrow*	2500	36	N E	293
		Taxus fuana				16
		Pinus wallichiana				8
		Cedrus deodara				8
17	Ghora Dhaka 2	*Abies pindrow*	2500	32	S E	289
		Pinus wallichiana				168
		Taxus fuana				24
18	Ghora Dhaka 3	*Pinus wallichiana*	2800	40	S W	137
		Abies pindrow				20
19	Ghora Dhaka 4	*Abies pindrow*	2800	40	W	160

		Pinus wallichiana				94
		Taxus fuana				13
20	Ghora Dhaka 5	*Abies pindrow*	2600	37	S W	112
		Pinus wallichiana				31
		Cedrus deodara				22
		Juglans regia				13
21	Khera Gali	*Cedrus deodara*	2730	42	S E	379
		Pinus wallichiana				159
		Abies pindrow				68
22	Changla Gali 1	*Abies pindrow*	2650	47	W	60
		Pinus wallichiana				26
		Taxus fuana				16
		Juglans regia				3
23	Changla Gali 2	*Pinus wallichiana*	2670	35	S	173
		Abies pindrow				158
		Taxus fuana				14
24	Kuzah Gali 1	*Cedrus deodara*	2560	R. Top	R. Top	233
		Abies pindrow				83
		Pinus wallichiana				17
25	Kuzah Gali 2	*Abies pindrow*	2560	28	S E	200
		Pinus wallichiana				83
		Cedrus deodara				50
26	Nathia Gali 1	*Pinus wallichiana*	2640	35	S	116
		Abies pindrow				66
27	Nathia Gali 2	*Abies pindrow*	2630	33	N W	128
		Pinus wallichiana				7
28	Thandyani 1	*Pinus wallichiana*	2320	31	S	143
		Cedrus deodara				36
29	Thandyani 2	*Cedrus deodara*	2300	38	S	120
		Pinus wallichiana				52
7- Mansehra (district), Kaghan valley						
30	Paye, Shogran	*Pinus wallichiana*	3100	38	S	125
		Picea smithiana				60
		Abies pindrow				33
31	Sri, Shogran	*Picea smithiana*	2900	39	N	279
		Abies pindrow				138
32	Shogran 1	*Pinus wallichiana*	2400	27	S W	149
		Abies pindrow				89
33	Shogran 2	*Cedrus deodara*	2400	23	S	274
		Pinus wallichiana				23
		Abies pindrow				23
34	Shogran 3	*Cedrus deodara*	2500	33	S	392
		Picea smithiana				10
		Abies pindrow				10
35	Paras	*Cedrus deodara*	1600	20	N E	176
		Juglans regia				19
		Pinus wallichiana				9
		Quercus ilex				9
		Quercus incana				9
36	Khanian	*Cedrus deodara*	2000	35	E	282
		Pinus wallichiana				56
37	Shinu 1	*Cedrus deodara*	1900	39	N W	208
		Pinus wallichiana				79
38	Shinu 2	*Cedrus deodara*	1650	43	W	410
39	Naran valley 1	*Pinus wallichiana*	2500	R. Top	N W	102
		Picea smithiana				20
		Cedrus deodara				20
		Populus alba				10

		Abies pindrow				5
40	Naran valley 2	*Cedrus deodara*	2500	R. Top	N W	284
41	Lalazar, Naran	*Abies pindrow*	3000	45	N W	189

Key to abbreviations: R. Top = Ridge top, E = East, W = West, N = North, S = South,
Species with author name: *Pinus wallichiana* A.B.Jackson, *Abies pindrow* Royle, *Cedrus deodara* (Roxb.) G. Donf., *Picea smithiana* (Wall.) Boiss., *Taxus fuana* Nan Li & R.R. Mill, *Juglans regia* L. *Albizia chinensis* (Osbeck) Merrill. *Quercus incana* Roxb, *Quercus ilex* Griff., Itin., *Pyrus pashia* Ham ex D. Don, *Populus pamirica* Komarov *and Populus alba* L.

Stand No. 5 Miandam: Like Malam Jabba 1 this site was also dominated by *Abies pindrow* with lower density (239 trees ha^{-1}). It occupied 55% of the total stand density. Its 21% individuals were distributed in small size classes and 51% in medium size classes. Large size classes are occupied by only 28% of the total population. No trees were found in other size classes. Co-dominant species *Pinus wallichiana* attained 45% of the total stand density. It attains small size classes with 60% of the individual, while medium size classes (30.1 to 60 cm dbh) were occupied by 40% of the trees. Other classes are absent in case of *Pinus wallichiana*. No tree more than 90 cm dbh was recorded in this area. *Pinus wallichiana* and *Abies pindrow* attain more number in small size classes. The overall distribution is positively skewed.

Stand No. 6 Karen: *Cedrus deodara* with 52 trees ha^{-1} density was dominated in this forest. Twenty one percent of the *Cedrus deodara* individuals were distributed in small and 35% in medium size classes. Large size classes (60.1 to 90 cm dbh) are occupied by only 19% of the total population. Extra large size classes attain 17% individuals. Largest and over mature size classes were absent in this forest. It occupied 60% of the total stand density. *Pinus wallichiana* was co-dominant with 35 trees ha^{-1}. Its 60% trees occupied in medium, 29% in large and 20% in extra large size classes. *Pinus wallichiana* were absent in small, largest and over mature size classes. The structure of forest is almost flat which shows minimum number of individuals in all size classes. Shape of the distribution is more or less symmetrical.

Stand No. 7 Chikar: This was a monospecific forest, dominated by *Pinus wallichiana*. Its 13% individuals were distributed in small, 18% in medium, 63% in large and 4% in extra large size classes. Largest size classes (120.1 to 150 cm dbh) occupied by only 2% trees of the total population. Some gaps were found in extra large and mature size classes. Smaller number of trees found in small and medium size classes.

Stand No. 8 Sudhan Gali 1: This forest was dominated by *Pinus wallichiana* with 74 individuals ha^{-1}. Distribution of *Pinus wallichiana* in size class structure is as follows: 57% in small size classes, 41% in medium size classes and 2% in large size classes. Extra large, largest and over mature size classes of *Pinus wallichiana* were absent in this forest. It occupied 45% of the total stand density. Co-dominant species *Abies pindrow* attains 31% in medium size classes, 60% in large size classes and only 4% in extra large size classes. Small and over mature size classes were absent in case of *Abies pindrow*. It attains 42% of total stand density. *Cedrus deodara* was also associated in this forest with low density (13%), found only in small and medium size classes with 38% and 62% trees ha^{-1} respectively. It occupied only 13% of the total stand density. The structure shows many gaps or extremely low number of trees in extra large and mature size classes. Shape of graph is mostly irregular but somewhat positively skewed. *Pinus wallichiana* trees showed inverse J shape distribution.

Stand No. 9 Sudhan Gali 2: This forest was dominated by *Abies pindrow* which comprised of 83% of the total stand density. Its 36% individuals were distributed in medium size classes, large size classes are occupied by 55% of the total population and extra large size classes (90.1 to 120 cm dbh) occupied only by 9% of the total population. *Pinus wallichiana* was associated with *Abies pindrow* and occupies 15% of the total stand density. Interestingly 85% of the *Pinus wallichiana* individuals were distributed in small size classes and only 15% individuals were recorded in medium size classes. No trees of *Pinus wallichiana* were recorded in large, extra large and mature size classes. *Cedrus deodara* was also sub-associated with *Abies pindrow* and *Pinus wallichiana* but with very low density i.e. 2% of the totals stand density. It was found only in large size classes. The structure shows many gaps or extremely low number of trees in extra large and mature size classes (in case of *Pinus wallichiana* and *Cedrus deodara*). Small size classes for *Abies pindrow* also have no trees. Shape of the graph is almost uneven.

Stand No. 10 Sudhan Gali 3: This stand was predominated by *Pinus wallichiana* with 95 % of the total stand density. Its occupied 117 trees ha^{-1}. Its 84% individuals were distributed in small and 16% in medium size classes. No plant was recorded in large, extra large and over mature size classes. *Abies pindrow* also associated

with this forest with low density (5%), found in small, medium, large and extra large size classes. The structure shows many gaps or extremely low number of trees in large size classes (in case of *Pinus wallichiana*). Though *Abies pindrow* was found in all size classes but with extremely low in density.

Stand No. 11 Ghora Gali, Murree hills: This forest was dominated by *Pinus wallichiana* having 87% of total stand density. Its 83% trees were distributed in small size classes and 17% trees were recorded in medium size classes. No trees were found in other size classes. Total stand density of Ghora Gali is 260 trees ha^{-1}. *Pyrus pashia* and *Quercus incana* (angiospermic tree) found only in small size class, having very low stand density i.e. 7% and 3% respectively. *Taxus fuana* was also occupied very low 3% density found only in medium size class. The structure shows that all the species found in small and medium size classes. Large number of individuals was recorded in small size classes.

Stand No. 12 Patriata 1, Murree hills: *Cedrus deodara* attained 83% of total stand density. It's occupied 33% in medium size classes and 67% in large size classes of the total population. *Cedrus deodara* was absent in the remaining size classes. *Pinus wallichiana* was associated with *Cedrus deodara* in Patriata forest with very low 17% stand density. *Pinus wallichiana* occupied 66% density in medium size classes and 34% in large classes. Both species were found only in medium and large size classes. Gaps were evident in small size class.

Stand No. 13 Patriata 2: Patriata 2 is monospecific *Pinus wallichiana* forest, attained 429 trees ha^{-1}. Its 32% individuals occupied in small size classes, 58% in medium size classes and only 10% in large size classes of the total population. Though medium size classes have high density as compare to small size classes. No individual was found in extra large, largest and over mature size classes.

Stand No. 14 Patriata 3: The structure of Patriata forest showed very low density i.e. 82 trees per hectare. Dominant species (*Pinus wallichiana*) having 88% of total stand density. *Pinus wallichiana* individuals were distributed in medium size classes with 43%, 53% in large size classes and only 4% in extra large size classes while *Pinus wallichiana* were absent in small, largest and over mature size classes. *Albizia chinensis* (angiospermic tree) was found only in small and medium size classes with 12% very low density.

Stand No. 15 Kashmir point, Murree: The structure of Kashmir point forest showed moderate (237 trees ha^{-1}) density. This forest was dominated by *Abies pindrow* occupied 60% of total stand density. Its 50% individuals were distributed in small size classes, 39% in medium size classes, 7% in large size classes and only 3% in extra large size classes. *Pinus wallichiana* was co-dominant species attained 27% of the total stand density. It occupied 42% in small size classes and 58% in medium size classes. No tree was present in other size classes. Overall density of *P. wallichiana* was 65 trees ha^{-1}. *Cedrus deodara* was associated conifer species found in this stand, with 5% of total stand density found only in small size class. *Juglans regia* was angiospermic species having 8% of total stand density, found only in large size class.

Stand No. 16 Ghora Dhaka 1: This forest was dominated by *Abies pindrow* with 293 trees ha^{-1} out of 325 trees ha^{-1} total stand density. Its occupied 90% of total stand density. *Abies pindrow* occupied 15% individual in small size classes, 35% in medium size classes, 36% in large size classes and 14% in extra large size classes of total population. *Pinus wallichiana, Taxus fuana and Cedrus deodara* were associated species of this forest. *Taxus fuana* occupied 5% of total stand density. It 69% trees were distributed in small and 31% in medium size classes. *Pinus wallichiana* and *Cedrus deodara* occupied 2.5% each of total stand density. *Pinus wallichiana* was occupied in small and medium size classes with 50% trees ha^{-1} density each in both size classes. *Cedrus deodara* was found only in medium size class. Shape of graph is more or less symmetrical.

Stand No. 17 Ghora Dhaka 2: Density size structure of this stand is showing distribution of three conifer species in different size classes. This forest was dominated by *Abies pindrow* with 289 trees ha^{-1}. *Abies pindrow* occupied 60% of total stand density. It occupied 54% individual in small, 32% in medium, 11% in large and only 3% individuals in extra large size classes of total population. *Pinus wallichiana* was co-dominant species in Ghora Dhaka forest, occupied 35% of total stand density. Small size classes occupied 42% density and 58% density in medium size classes of the total population. *Taxus fuana* occupied 5% of total stand density found only in medium size classes. Shape of graph is more or less negative exponential (inverse J).

Stand No. 18 Ghora Dhaka 3: This stand was dominated by *Pinus wallichiana* with 137 trees ha^{-1}. *Pinus wallichiana* occupied 87% of total stand density. It's occupied 34% individual in small, 47% in medium, 16% in large and only 3% individuals in extra large size classes of total population. *Abies pindrow* was associated species in this forest occupied 13% of total stand density. It is found in small and medium size classes with 50% density each. Several gaps were observed in larger size classes but smaller size classes occupied by many

individuals. The shape of graph may be considered as positively skewed. Larger size classes have minimum or no trees.

Stand No. 19 Ghora Dhaka 4: At Ghora Dhaka 4 *Abies pindrow* was dominated with 160 trees ha^{-1}. This species occupied 60% of total stand density. It has 19% individuals in small, 50% in medium and 31% in large size classes of the total population. *Pinus wallichiana* was co-dominant species in this forest, occupied 35% of total stand density. Small size classes occupied 29% density, medium size classes contained 50%, large size classes showed 14% while extra large size classes occupied 7% density of total population. *Taxus fuana* was third conifer species found in this forest, with 5% density of total population. It is recorded only in medium size class. Overall the graph shows positively skewed distribution.

Stand No. 20 Ghora Dhaka 5: This forest was also dominated by *Abies pindrow* with 112 trees ha^{-1}. It's occupied 64% of total stand density. It attained 27% individual in small, 68% in medium and only 4% in large size classes of total population. *Pinus wallichiana, Cedrus deodara and Juglans regia* were associated species in this forest. *Pinus wallichiana* occupied 17% of total stand density. Small size classes attained 27% density and medium size classes based on 73% density of total population. *Cedrus deodara* showed 12% of total stand density, found only in small size classes. *Juglans regia* have 7% of total stand density. It 33% trees were distributed in small, 33% in extra large and 33% in largest size classes. *Juglans regia* does not seem to be reproducing satisfactorily. Again like the stand No. 19 the shape of the graph is positively skewed.

Stand No. 21 Khaira Gali: *Cedrus deodara* was in leading dominant position with 149 trees ha^{-1} in this area with 60% of the total stand density. Its 27% individuals distributed in small, 46% in medium and 27% in large size classes. *Pinus wallichiana* was co-dominant species in this forest with 81 trees ha^{-1} density. It occupied 33% of total stand density. Forty four %, 33%, 11% and 12% individuals of this species were distributed in small, medium, large and extra large size classes of structure respectively. *Abies pindrow* was also associated with above mentioned species , showed only 7% of total stand density and 19 trees ha^{-1}. It was found only in small and medium size classes with 21% and 79% density respectively. Maximum 110 cm dbh trees were recorded in this forest. No tree species was found between 80 to 100cm and after 110cm dbh. *Abies pindrow* and *Pinus wallichiana* seem to be reproducing well as evidenced by their densities in the smaller size classes. The overall graph is positively skewed.

Stand No. 22 Changla Gali 1: Changla Gali 1 was dominated by *Abies pindrow* with 60 trees ha^{-1}. It occupied 57% of total stand density. Its 30% individuals were located in small size classes, 25% in medium size classes and 45% in large size classes. *P. wallichiana* was co-dominant species in this forest with 26 trees ha^{-1} density. It contained 25% of total stand density, small size class occupied 69%, medium size classes occupied 23% and only 8% trees were distributed in large size classes. *Taxus fuana* was associated species, occupied only 18% of total stand density and 16 trees ha^{-1}. It was found only in medium and extra large size classes with 56% and 44% density respectively. Maximum 120 cm dbh trees were recorded in this forest. The structure was almost flat, due to less number of trees in all size classes. Overall the graph shows rectangular (equi-distribution).

Stand No. 23 Changla Gali 2: *Pinus wallichiana* was dominated with 173 trees ha^{-1} in this forest. It contained 50% of total stand density. It's 29% individual were distributed in small, 53% in medium, 12% in large and 6% in extra large size classes. *Abies pindrow* was co-dominant species with 158 trees ha^{-1}. It had 46% of total stand density. Small size classes showed 51%, medium size classes had 25% and only 24% individuals were in large size classes. *Taxus fuana* was associated with above mentioned species and occupied only 4% of total stand density with 14 trees ha^{-1}. It was found only in small and large size classes with 50% density in both classes. No trees of any species were found in 50-60 cm, 80-90 cm and after 100 cm dbh. Small and medium size classes had average number of trees. Maximum 100 cm dbh tree was recorded in this forest.

Stand No. 24 Kuzah Gali 1: In this forest *Cedrus deodara* was showing 233 trees ha^{-1}. It's occupied 70% of total stand density. It's 30% individual were recorded from medium size classes, 54% in large size classes and 16% in extra large size classes. *Abies pindrow* was co-dominant species in this forest with 83 trees ha^{-1}. *Abies pindrow* occupied 25% of total stand density and found only in medium size classes. *Pinus wallichiana* was associated species this forest and occupied only 5% of total stand density and 17 trees ha^{-1} density. It is represented only in medium and large size classes with 50% density in both size classes. No tree was recorded in small and over mature size classes. This makes the forest unstable and static. Maximum trees of 100 cm diameter at breast height were recorded from this location.

Stand No. 25 Kuzah Gali 2: *Abies pindrow* was distributed as a dominant species in this location with 200 trees ha^{-1}. It's occupied 60% of total stand density. It occupied 17% individuals in small, 58% in medium and

25% in large size classes of total population. *Pinus wallichiana* was co-dominant species in Kuzah Gali forest with 83 trees ha^{-1}. This species occupied 25% of total stand density. It occupied 12% individuals in small, 63% individuals in medium and 25% trees in large size classes. *Cedrus deodara* was associated with *Abies* and *Pinus* in this stand; it occupied 15% density of total population. It is recorded from small and medium size classes with 30% and 70% respectively. No tree was recorded in extra large and over mature size classes. Maximum trees of 100 cm diameter at breast height were recorded from this forest. The overall shape of graph is positively skewed.

Stand No. 26 Lalazar 1, Nathia Gali: This sampling site was dominated by *Pinus wallichiana* with 116 trees ha^{-1}. It occupied 64% of total stand density. Its 18% individual occurred in small, 59% in medium and 23% in large size classes. *Abies pindrow* was co-dominant species in Lalazar forest with 66 trees ha^{-1}. It occupied 36% of total stand density with 83% individuals in medium and 17% individuals in large size classes. No tree was recorded in extra large and over mature size classes. Small and medium size classes have minimum number of trees. Up to 90 cm dbh trees were recorded in this forest.*****

Stand No. 27 Lalazar 2: Due to change of aspect and elevation the dominant species was *Abies pindrow* instead of *Pinus wallichiana* as in Lalazar 1. *Abies pindrow* was dominant species with 128 trees ha^{-1}. It occupied 95% of total stand density. It showed 46% individual in medium, 48% in large and only 6% in over mature size classes. *Pinus wallichiana* was associated species in Lalazar 2 forest with 7 trees ha^{-1}. This species was recorded only in small and medium size classes with 29% and 71% density respectively. No tree of *Pinus wallichiana* was found more than 60 cm dbh in this forest. *Abies pindrow* was also absent in small and extra large size classes. Largest tree from this location was 90 cm dbh. The shape of the graph is irregularly symmetrical with gaps.

Stand No. 28 Thandyani 1: *Pinus wallichiana* attained a dominant position in this study area with 143 trees ha^{-1}. It occupied 80% of total stand density with 33% individual in small, 45% in medium and 22% in large size classes of total population. *Cedrus deodara was* co-dominant species with 36 trees ha^{-1} density, only found in medium size classes. No tree of this species was recorded in other size classes. Highest 90 cm dbh trees were recorded from this stand.

Stand No. 29 Thandyani 2: Due to change of aspect *Cedrus deodara* became a dominant species instead of *Pinus wallichiana* as in Thandyani 1. This species attained 120 trees ha^{-1} density and captured 70% of total stand density. It's 28% individuals were distributed in small and 72% in medium size classes. *Pinus wallichiana* was co-dominant species at this aspect with 52 trees ha^{-1}. It was recorded in small, medium and large size classes with 56%, 35% and 9% density of total population respectively. Both species were absent in last three size classes. Maximum 70 cm dbh trees were recorded from this locality.

Stand No. 30 Paye, Kaghan valley: This forest was dominated by *Pinus wallichiana* with 125 trees ha^{-1} showing 57% of total stand density. It occupied 4% individual in small, 50% in medium, 42% in large and only 4% individuals were recorded in largest size classes. *Picea smithiana* was co-dominant species in Paye forest with 60 trees ha^{-1}. It occupied 28% of total stand density. It was recorded in small size classes with 23% density, 33% in medium size classes and 44% density in large size classes. *Abies pindrow* was associated with this forest, occupied only 15% of total stand density and 33 trees ha^{-1}. It found only in medium and large size classes with 24% and 76% density in both size classes respectively. The structure was almost flat and shows many gaps.

Stand No. 31 Sri, Kaghan valley: *Picea smithiana* was considered as a dominant species in this site with 279 trees ha^{-1}, occupied 67% of total stand density. It's 7% individuals were recorded in small, 29% in medium, 57% in large and only 7% individuals were recorded in over mature size classes. *Abies pindrow* was co-dominant species in this Forest with 138 trees ha^{-1}. It occupied 33% of total stand density. *Abies pindrow* recorded in small size classes with 20% density, 21% in medium size classes, 30% density in large size classes and 29% individual in largest size classes.

Stand No. 32 Shogran 1, Kaghan valley: *Pinus wallichiana* attained 149 trees ha^{-1} while *Abies pindrow* represented by 89 trees ha^{-1}. Both occupied 63% and 37% of total stand density respectively. *Pinus wallichiana* attained 27% individuals in small, 28% in medium, 27% in large and only 18% individuals were recorded in largest size classes. *Abies pindrow* was co-dominant species found in small, medium and large size classes with 39%, 40% and 21% density respectively. The structure was almost flat and shows many gaps.

Stand No. 33 Shogran 2: This forest was dominated by *Cedrus deodara* with 274 individual ha^{-1} density, attained 86% of total stand density. It contained 33% individual in small size classes, 62% in medium size

classes and only 5% individuals in large size classes. *Abies pindrow* and *Pinus wallichiana* was associated species with *Cedrus deodara* in Shogran forest, occupied 7% of total stand density each. *Abies* pindrow found only in small size classes where as *Pinus wallichiana* occupied 43% in small size classes and 57% in medium size classes. Not more than 70cm dbh trees were recorded in this forest.

Stand No. 34 Shogran 3: Size class structure of Shogran 3 represented by three conifer species *i.e. Cedrus deodara* with 392 trees ha^{-1}, *Abies pindrow* and *Picea smithiana* attained 10 trees ha^{-1}. *Cedrus deodara* occupied 95% of total stand density while *Abies pindrow* and *Picea smithiana* attained 2.5% each. Nineteen percent individuals were distributed in small, 76% in medium and 5% in large size classes. *Abies pindrow* and *Picea smithiana* were recorded only in small and medium size classes respectively. Highest number (76%) of *Cedrus deodara* were recorded from medium size class while lesser number of individual distributed in small size class.

Stand No. 35 Paras, Kaghan valley: Five tree species were associated in this forest with different density *i.e. Cedrus deodara* with 176 trees ha^{-1}, *Juglans regia* 19 trees ha^{-1} and *Pinus wallichiana*, *Quercus ilex* and *Quercus incana*, occupied 9 trees ha^{-1} respectively. *Cedrus deodara* occupied 79% of total stand density and its 30% individuals distributed in small, 59% in medium and 11% in large size classes. *Juglans regia* occupied 9% of total stand density, found only in small size classes. Three other species *i.e. Pinus wallichiana, Quercus ilex* and *Quercus incana*, occupied 4% of total stand density each. *Pinus wallichiana* and *Quercus incana* found in medium size classes whereas *Quercus ilex* found in small size classes. Maximum 80 cm dbh trees were present in this forest. No trees were found in larger size classes.

Stand No. 36 Khanian, Kaghan valley: This steep sloped site occupied by *Cedrus deodara* and *Pinus wallichiana* with 282 trees ha^{-1} and 56 trees ha-1 respectively. Both species attained 83% and 17% density of the total stand density. *Cedrus deodara* occupied 75% individual in small, 5% in medium, 15% in large and 5% in largest size classes of total population. *Pinus wallichiana* was associated species in Khanian forest, occupied only in small size classes. Many gaps were present and no tree was found in larger size lasses. Both species were found in small size class with high density.

Stand No. 37 Shinu 1: This forest was also dominated by *Cedrus deodara* with 208 trees ha^{-1} and 72% of total stand density. It's 9% individuals occupied in small, 40% in medium, 50% in large and only 1% in extra large size classes. *Pinus wallichiana* was co-dominant species found only in medium and large size classes with 43% and 57% density respectively. It attained 28% of total stand density with 79 trees ha^{-1}.

Stand No. 38 Shinu 2: Monospecific *Cedrus deodara* forest attained 410 trees ha^{-1}. It's 75% individuals distributed in small, 15% in medium and 10% in large size classes. No tree larger than 80 cm dbh tree was recorded from this forest. The shape of the graph is almost inverse J distribution.

Stand No. 39 Naran 1: Naran 1 forest was dominated by *Pinus wallichiana* with 102 trees ha^{-1} and 65% of total stand density. It occupied 44% individuals were distributed in small size classes, 39% in medium size classes, 12% in large size classes and only 5% individuals were recorded in over mature size classes. *Cedrus deodara* and *Picea smithiana* was co-dominant species with *Pinus wallichiana* occupied 13% of total stand density (20 trees ha^{-1}). *Cedrus deodara* was found in medium and large size classes with 50% density each. *Picea smithiana* was found only in small size classes. *Populus alba* and *Abies pindrow were* associated species in this forest. *Populus alba* occupied 6% of total stand density, found only in medium size classes while *Abies pindrow* attained only 3% density of total stand density and found in small size classes. Maximum number of *Pinus wallichiana* trees were found in small size class with gradual decrease in larger size classes, forming negative exponential (inverse-J) distribution.

Stand No. 40 Naran river belt 2: Naran River belt 2 was distributed by monospecific cedrus forest which occupied 284 trees ha^{-1} and it was recorded only in small and medium size classes with 13% and 87% density respectively. No trees were found in other size classes. Individual large than 60 cm dbh were not recorded in this forest. The shape of the graph is positively skewed.

Stand No. 41 Lalazar, Naran: Monospecific *Abies pindrow* forest showed 189 trees ha^{-1} and its 10% individuals recorded in medium, 59% in large, 20% in extra large, 8% in largest and only 3% individuals were recorded in over mature size classes. No tree more than 50 cm dbh was recorded from this forest. Seedlings and saplings were also absent in this forest. However one tree with 170 cm dbh was recorded from this location, indicating the sign of illegal cutting.

Disturbances in these forests like cut stumps, log stumps and the sign of legal or illegal cutting are seen in this location.

Discussion

Forests of any country are of great economic value as well as ecological significance. According to Amjad *et al.,* (1996) Pakistan has insufficient forest resources. There is hardly 4.28 million hectares or 4.9 percent of total area under forest / tree cover. Out of it the productive forests are less than 2%. Baig *et al.,* (2008) stated that in Pakistan, forests and planted trees occupied an area of about 4.2 million ha which is equivalent to 4.8 percent of the total land area. In Pakistan, the total area under forest is decreasing rapidly and currently it is estimated as 3 percent / year.

The present study focuses on the population structure and status of conifer dominating forests of moist temperate areas of Himalayan and Hindukush region of Pakistan. Particular attention is given to size structure of trees and disturbance history so as to determine how stand structure and its development are influenced by the type, scale and frequency of natural disturbance. Goff and Zedler (1968) examined both stands and species structural relationships on a regional scale, in the Western Great Lakes area of Wisconsin.

Size class structure may give useful insight into the present and future trends of the species or forest as a whole. For example, an ideal "climax" species should be well represented in all size classes, indicating that the species is reproducing and replacing itself at a site. On the other hand, a species that is present in only the largest size classes may gradually be lost from a population or forest as the large, old individuals die (McCune and Grace 2002). Size-structured populations are sometimes incorporated into community analysis by treating each size class as a separate species in the analysis. This has desirable effect of incorporating information that may better integrate life history patterns into an analysis of community patterns.

Size class structure of the study area showed that stands are composed of mosaics of mixed size classes. Tree species in some stands showed better representation in small size classes (10 to 30 cm dbh) with a gradual decline in higher size classes and forming complete or partial inverse J-shaped distribution in nine stands (22%). In these stands large number of conifer seedlings and saplings were recorded, indicating a balanced population structure of the forests. Such distribution patterns of the forest from mountainous areas of Pakistan have been noted by some workers. Ahmed *et al.,* (2006) reported 336 stem ha^{-1} density for *Cedrus deodara* from Matiltan glaciers and the individuals were mainly distributed in 10 to 30 cm dbh size classes with a gradual decline in larger size classes while 140 individuals of *Pinus wallichiana* were mostly distributed in small size classes with gradual decline in higher size classes from the forests of Lower Topa and Jhika Gali (Murree), forming an inverse J-shaped distribution, depicting ideal regeneration pattern. Ahmed *et al.,* (2006) further examined the size frequency distribution in different climatic zones, for example, in sub-alpine zone, size class structure of *Pinus wallichiana* showed that a high number of individuals were concentrated in small size classes with gradual decrease in large size classes, Likewise, in the sub-alpine-dry-temperate ecotonal zone, 170 individuals ha^{-1} of *Pinus wallichiana* were distributed in 10 to 40 cm dbh size classes with a considerable decrease in larger size classes, indicating a better regeneration pattern and maintenance of a stable distribution. Such forest structure represents frequent reproduction (Knight, 1975).

Many workers from overseas also found inverse J-shaped distribution of forest species, such results provide comparison with our study *i.e.* McCarthy (2001); McCarthy and Weetman (2006).

Complete or partial inverse J- shape distribution of stands showed good regeneration pattern of some species in a stand but inverse- J shaped distribution did not mean that all species present in that stand are in stable condition. If J-shaped distribution occurred in a monospecific forest, this tells us the distribution pattern of individual species. Most of the individual stands did not show the ideal regeneration pattern and no inverse J-curve is formed. Seventy three percent forests of current study showed uneven structure while 17 % exhibited bell shaped structure. Ahmed and Naqvi (2005) recorded 12 % trees of *Picea smithiana* from 10 to 30 cm dbh size classes while 24% from 50 to 70 cm dbh size classes and 46% were distributed in 30 to 60 cm dbh size classes from the forests of Naltar valley, Gilgit, indicated great disturbance. In the present study, some individual stands showed flat size class structure (7 %) and did not depict any particular trend like Wahab *et al.,* (2008) observed flat density size class structure for *Picea smithiana* from the forest of Sheshan, Afghanistan. They were, therefore, unable to postulate any future trend, which was primarily due to extensive cutting and logging. However, absence of seedlings and low number of plants in small size classes indicated lack of recruitment in this area.

During field sampling large number of seedlings and saplings (<10 cm dbh) of conifer species (*Pinus wallichiana, Abies pindrow and Cedrus deodara*) were recorded while seedlings that were found in low numbers were those of *Picea smithiana* and *Taxus fuana*. Regeneration was observed in the vicinity of groups of parent trees or near young developing trees of the same species. Seedlings were recorded not only in canopy gaps along the tracks and open areas but also near parent's shade. This indicated that light may not be the only and major limiting factor for germination and establishment of conifer seedlings (Shaukat, 1973). The number

of seedlings may be large in dense and closed forests while the number may be small in relatively open forests. It appeared that the number of seedlings was also related to the thickness of the litter and the density of the understorey plants. Where the thickness of litter was high (e.g. Kumrat, Panakot, Sudhan Gali and Malam Jabba) seeds fail to penetrate through the layer of litter. Therefore, in such places the chances of seed germination and subsequent seedling growth are severely hampered. Similarly, Mirams (1950), Beveridge (1977), Halkett (1981) and Ahmed (1984) observed low numbers of *Kauri* seedlings in places where the understorey was dense or the litter layer was thick and harsh.

Among the conifers of the study area *Cedrus deodara* occupied highest average density ha^{-1}, next being *Abies pindrow*, then *Pinus wallichiana* and *Picea smithiana* and lastly *Taxus fuana*. These results indicated that frequency did not affect the species density of individual stands. Though *Pinus wallichiana* is widely distributed species in the study area, it could not attain the highest density while *Cedrus deodara* occurred in half of the sampled stands but attained highest density in a stand.

Gaps in size class structure: Gaps were evident in size class structure of many individual forests of study area. Gaps were evident in 83% individual forests of current study. The causes of gaps in size class structure of moist temperate area of Pakistan have never been studied by earlier workers. During field sampling it was also observed that many forests of the study area are in unstable condition because dead or logged trees specially conifers are not being replaced by almost equal number of seedlings or saplings. The possible causes of gaps in forest structure are observed by many workers. Gaps in size class structure may also result from tree fall by storm as reported by Hutchins (1981) and Palmer (1982) and also observed at Te Moehau little Barrier Island, Trounson Kauri Park and Omahutta by Ahmed (1984). Pickett and White (1985). Pickett *et al.,* (1989) emphasized that natural disturbance plays a critical role in mediating old-growth forest dynamics, and disturbances vary in type, scale, and affect on stand structure. If the trees are taken from the mature or over mature size classes, it can be managed easily. Worrall *et al.,* (2005) observed that the canopy gaps are not static but expand over time due to mortality of trees at the gap margin and coalescence of gaps.

Similar number of conifer individuals occurred in some stands but showed different size structure and gaps were also observed in many stands due to absence of individuals or species of the specific size classes. Gaps in size class structure were also observed in other conifer forests (*Cedrus deodara, Pinus wallichiana* and *Picea smithiana*) of Afghanistan by Wahab *et al*., (2008). Gaps in size class structure of the forests does not mean that particular size class is absent from the stand or is due to failure of regeneration of particular species. It is possible that due to sampling criteria some size classes could not be included in the sample (Ahmed, 1984; Ahmed *et al.*, 2011). However, possibly, it is not the major case in these forests, the gaps may be mainly due to selective cutting of trees. Out of 41 stands gaps were observed in small and large size classes in many stands with flat size class structure indicating no recruitment or cutting of small and large sized trees. Such type of unbalanced forests needs more attention from the protection and management viewpoint.

Among the conifer *Pinus wallichiana* exhibited negatively skewed regeneration pattern indicated by the large number of individuals were distributed in small and medium size classes. Marked structural heterogeneity was observed in many forests possibly due to environmental and nutritional differences among the sites. Conifers were found dominant over angiospermic species on all aspects. Most of the forests were highly disturbed by anthropogenic causes. *Picea smithiana* and *Taxus fuana* were seriously disturbed by the local people and in future they can become endangered or extinct from these forests. To prevent the rapidly declining trend of these species, it is necessary to recognize their status and educate the local people on understanding their unique ecological and economic values.

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