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Maturity dynamism of plant life in Tehsil Takht-e-Nasrati, District Karak, Pakistan

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Abstract

In the present investigation the Maturity Index of plant life in Tehsil Takht-e-Nasrati was determined during spring, summer and winter and 22 communities were reported from each season. The area is clearly divided into plain and hilly area. Throughout spring the maturity index was high 44.79 in phase 3 while low 41.02 in phase 2. All over summer the Maturity Index was high in phase 1 and low in phase 4 while the low number of species (16) and frequency (775) was found in phase 1 and 4 respectively. Furthermore, the Maturity index was high (41.59) in phase 4 and low (33.86) in phase 1 during winter while the low rate of species number (17.5) and frequency (705) was found in phase 4. Maturity Index is an important indicator for the maturity of communities in a specific area and season. This study pointed out that the climatic environment of region has privileged conscription of area and species frequency was changed with the change of season and altitude. It was concluded that ecologists build up methods for studying the degree of vegetation deviation because nowadays it is an instancy of nature.

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Introduction

The biological assessment is necessary for a sufficient characterization and different parameters of a plant community. These activities could be for store extraction, consumer utilization, progress of preservation or unpleasant of foreigner species etc. The vegetation in the areas does not a sign of a visibly growth species composition, but relatively a mixture of dominated by native plants of largely invasive weedy alien plant, and mixed native and non native plant. All over the world, natural habitats are being ruined. There is confirmation of pollution in the most distant area of the planet. Plant communities were disturbed with the increasing and spreading of consumer population. The conservation of the plant life is very necessary to maintain natural habitat for our pleasure and provide sound way to control pollution. Plant ecologists have sited rising stress on an efficient kind of vegetation (Lehsten and Kleyer, 2007). The study of plant life analyzed the correlation of plant communities to environmental changes such as consumers, soil, wind, temperature and pollution. A lot of work has been done in the field of ecology in the world but less work have been seen on the maturity index. Some phytosociological studies on plant communities of different areas in world have been conducted by different workers like (Hussain & Shah, 1989) that studied the phytosociology of vanishing sub tropical vegetation of Docut Hills in Swat. Hussain & Ilahi (1991) has carried out the ecology and vegetation of lesser Himalayas, Pakistan. Hussain *et al.,* (1992) deliberated the phytosociology of vanishing sub tropical vegetation of Docut Hills in Swat. Hussain *et al.,* (1993) calculated the phytosociology of the vanishing sub tropical dry deciduous forests in District Swabi, Pakistan. Hussain & Baz, (1996) carried out the phytosociology of some parts of Landikotal area, Khyber Agency, Pakistan. Behera and Roy, (2005) assessed the biological richness in different altitudinal zones in the Eastern Himalayas, Arunachal Pradesh, India. Khan and Shaukat, (2005) determined the standing phytomass of dominated communities in Karachi, Hussain & Durrani, (2007) determined the forage productivity of Kalat, Pakistan. Iqbal et al., (2008) surveyed the certain plant communities in urban Karachi. Sharma *et al.,* (2008) studied the Forest biomass and dynamics in a western Himalayan. Ahmad *et al.,* (2010) studied the plant community structure in Himalayan Plateaus. Shaheen *et al.,* (2011) carried out the structural diversity and vegetation dynamics on lesser Himalayan Subtropical Forests of Bagh District, Kashmir. Whereas, little work has been reported from present area on different aspects like Khan (2004 & 2007) study of the angiosperms of Tehsil Banda Daud Shah and Ethnobotany of Tehsil Karak, NWFP, Pakistan respectively. Khan *et al.,* (2011) arranged the floristic list of Tehsil Takht-e-Nasrati Pakistan and Khan el al., (2011) described the conservation and ecological characteristic of trees in Tehsil Karak, Pakistan. The present area considered those where the reliability of the ordinary situation and standard structure development has been directly or indirectly affected by consumer activities. Maturity Index is used as unique indicator of plant life in a specific area.

Material and methods

Research area

The Tehsil Takht-e- Nasrati is situated at 32.47° to 33.28° North and 70.30 ° to 71.30° East. The research area is bounded by Tehsil Karak on the North East, District Mianwali on the East, District Lakki Marwat on the South West and Tribal area Adjoining District Bannu on the West (Fig. 1). The total area of Tehsil is about 613.66 square Km. Majority of the area consists of rigged dry hills and rough field areas i.e. 323.97 square Km. Agriculture land is about 289.7 square Km. The major income source of the area is agriculture which is rain depended. Although the hills are dry residual exposes yet they contained precious minerals like coal, gypsum, uranium and gas etc. Takht-e-Nasrati is situated at 340 m above the sea level. The area is located in semi-arid climatic region, having hot summer and very cold winter. The rainfall is scanty

and uncertain. Winter rains are generally of long duration and of low intensity. Summer monsoon rains are torrential in heavy shore intensity. In the year 2001 - 2010, 121.6 mm of rainfall per 10 year was recorded on District level (Table 1). June and July are the hottest months, whereas December and January are the coldest months. In the year 2001 - 2010 the mean maximum temperature was 39.5 C °, in the month of the June, where as the mean minimum temperature was as low as 4.26 C °, in the month of January, recorded on District level (Table 1). The climate and weathers are also influenced by wind. In hottest months especially June swivel winds are developed on the plain area an afternoon due to local heating and convectional uprising. Sometimes strong, dry and hot winds with huge dust enter the area from different sides (Khan *et al.*, 2011).

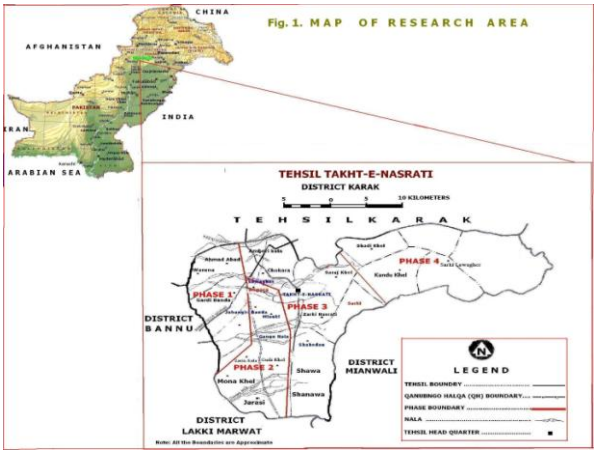

Fig. 1. Map of Tehsil Takht-e-Nasrati.

Collection and Identification of plants

Four distinct microhabitats such as Phase 1, Phase 2, Phase 3 and Phase 4 at altitude of 340-399 m, 400-499 m, 500-599 m and 600-700 m were described respectively based on physiognomic features. The study was conducted by frequent survey in winter, spring and summer during 2009 to 2010. Plants species were collected, preferably in duplicate or triplicate form. They were pressed, dried, preserved and mounted on herbarium sheets for identification. Plants were identified with the help of available literature and voucher specimens have been deposited in herbarium, Department of Botany, University of Peshawar, Khyber Pakhtunkhwa, Pakistan.

Vegetation examination

Based on species area curve, the suitable size of the quardrat for trees, shrubs and herbs were determined which were 10X10 m, 5X5 m and 1X1 m respectively. Combinations of systematic and random quadrats were used to give better results. Thus, at lower altitude and hills, quadrats were laid systematically and randomly respectively. The distances between the 2 adjacent stands were approximately 1.5 km.

Maturity index

Maturity index is an indicator of maturity of stand or community. A value more than 60% indicates maturity of the stand. It was measured using Pichi-Sermolli's (1948) method as follows:

$$DM = FASS/TNSS$$

$DM = Degree\ of\ Maturity$

$FASS = Frequency\ values\ of\ all\ species\ in\ a\ stand$

$TNSS = Total\ number\ of\ species\ in\ a\ stand$

Frequency

It is a percentage of sampling plots in which a given species occurs. The frequency was measured in each stand for each specimen through following formula.

$$F = NQS/TNQ$$

$F = Frequency$

$NQS = Number\ of\ quadrats\ in\ which\ species\ occur$

$TNQ = Total\ number\ of\ quadrats$

Results

In the present investigation, the Maturity Index of plant life was determined during spring, summer and winter in Tehsil Takht-e-Nasrati. The area is clearly divided into plain and hilly area which is again divided into 2 phases on the basis of altitude each one. In present effort, 4 communities were reported from phase 1 & 4 whereas 7 from phases 2 & 3 and than mean result were prepared of the area. Maturity Index

is an important indicator for the maturity of the communities in a specific area.

Spring season

Throughout spring the species number, frequency and maturity index was found in phase 1, 20.25, 872.5 and 43.1325, in phase 2, 20.43, 822.86 and 41.02, in phase 3, 17.71, 780 and 44.79 and in Phase 4, 19, 812.5 and 42.91 respectively. The highest number (20.43) of plant species and low maturity index was found in phase 2 while low species number and high maturity index was found in phase 3 (Table. 2).

Table. 1. Climatic data of Tehsil Takht-e-Nasrati for the year 2001-2010.

Months	Temperature (C°)		Humidity (%)		Rainfall (mm)	Soil Temperature (C°) Average	Wind speed (Km Per Hour)
	Max	Min	Max	Min			
January	19.18	4.26	75.80	35.24	27.43	7.03	2.9
February	21.69	7.29	77.39	42.23	37.72	9.14	3.2
March	28.20	12.06	75.38	35.23	37.17	13.89	3.5
April	34.74	17.94	66.12	29.42	36.54	19.02	5.2
May	38.32	22.33	59.66	30.73	31.6	21.87	5.4
June	39.50	25.9	59.96	32.89	74.24	25.78	5.5
July	38.44	25.76	73.33	38.76	121.6	26.77	5.2
August	36.66	25.29	75.68	42.61	108.3	26.37	4.1
September	35.47	21.95	77.21	39.29	61.58	23.49	3.7
October	32.33	16.79	71.55	35.51	15.13	20.09	3.5
November	26.71	10.01	71.56	36.66	5.80	14.10	3.2
December	21.93	5.67	75.20	35.90	15.38	8.96	3.1
Mean	31.1	16.27	71.57	36.21	47.71	18.04	4.04

Table. 2. Mean value of maturity Index in different seasons of Tehsil Takht-e-Nasrati.

	Phase 1			**Phase 2**			**Phase 3**			**Phase 4**		
Seasons	S N	T F	M I	S N	T F	M I	S N	T F	M I	S N	T F	M I
Spring	20.25	872.5	43.133	20.43	822.86	41.02	17.71	780	44.487	19	812.5	42.91
Summer	16	957.5	60.18	19.43	971.4	50.09	17.57	824.3	48.19	17	775	46.34
Winter	26.25	887.5	33.86	22.71	897.14	39.78	18.86	742.9	40.614	17.5	705	41.599
Mean	20.833	905.83	45.724	20.86	897.13	43.63	18.05	782.4	44.43	17.83	764.2	43.616

SN: Species Number; TF : Total Frequency; MI: Maturity Index

Summer season

During summer the species number (19.43) and total frequency value (971.4) was high in phase 2 while Maturity Index in Phase 1. The low species number (16) was found in Phase 1 but total frequency (775) and Maturity Index in Phase 4 (Table. 2).

Winter season

Fig. 2. Ground flora preferred by consumer in plain area.

Fig. 3. Trees are preferred by consumer in hilly area.

Fig. 4. Cutting of tree in Saraj Khel for fuel.

The plant species number was high (26.25) in Phase 1, frequency (897.143) in Phase 2 and Maturity Index (41.598) in Phase 4. The low rate of species number (17.5) and frequency (705) was found in Phase 4 while Maturity Index (33.859) in Phase 1 (Table. 2).

Fig. 5. Cutting of tree in Phase 2 for consumer food during winter.

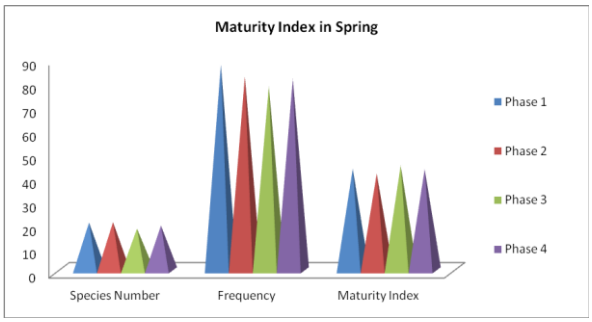

Fig. 6. Maturity Index decreased with increasing altitude in spring.

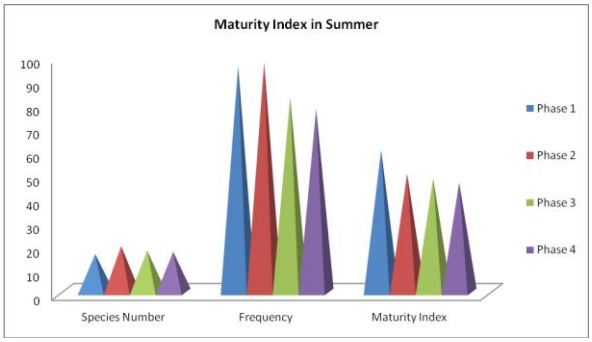

Fig. 7. Maturity Index decreased with increasing altitude in summer.

Discussion

Maturity Index helps us to get better understanding of plant life study and provides a clear image of the vegetation. Plant life communities in research area illustrated maturity index scores less than 50 except in

phase 1 in summer that indicates unbalance and immaturity within communities, seasons and phases due to lesser adaptation to the ecological conditions of area. It was noticed that in plain area the grazing pressure is high on ground flora, herbs and seedlings while in hilly area it is high on shrubs and trees that has created a massive stress (Fig. 3 & 4). The high concentration of consumer interference regularly disturbs the natural balance of plant life populations as a result preventing them to reach a climax phase of plant life maturity. Our result was similar with that of Saxena & Singh (1984) & Negi, (2009). This phenomenon is clear from the heavy grazing and tree cutting down in studies sites (Fig. 5 & 6). In the present study the maturity Index was high 60.18 and low 33.86 in Phase 1 during summer and winter respectively. The total frequency rate was high (971.4) in phase 2 during summer and low (705) in phase 4 during winter (Table. 2). The high maturity index in phase 1 shows that shrubs reached to their mature stage in the area. In plain most of area was surrounded by shrubs and trees for protection and food requirement for the consumer. Khan et al., (2011) is also agreed that the area is found under biotic pressure. The area is totally rain depended. Therefore, if a rain occurs, plain area become ready to cultivation, in case the grazing is avoided for few months. The grazing rate is very high in hilly area during summer owing to which plant cannot attain their climax stage. Therefore, the maturity index was seen below 50 in all phases. The pressure on the growing seedlings of plants occurs due to over and illegal grazing and cutting in the area because the limited grazing area and no energy facilities are available to consumers. The Oza, (2003) described the destruction of forests and Wildlife in the Kashmir Wilderness while Alam & Ali, (2010) prepared the red list of plant

From result it was noticed that maturity index was decreased with increase of altitude in both plain and hilly area during spring (Fig. 7). The maturity Index was decreased with increase of altitude during summer (Fig. 8). During winter the species numbers were decreased while maturity index was increased with increase of altitude (Fig. 9). The maturity index of plant community required for conservation and biodiversity purposes depends on type of the area. But anyway it is basic requirement for stable plant life measurement. Plants are collected in abundant as a medicinal, fuel and utilized by people for different purposes (Khan *et al.,* 2011). Plant cutting rate was high in hilly area, because plants are main source of income. Cutting rate was also high during summer as people used them as a fuel.

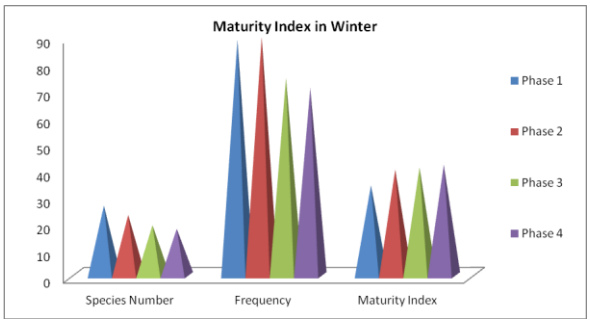

Fig. 8. Maturity Index increased with increasing altitude in winter.

In summer, species number and frequency was found high and maturity index was decreased in plain area while each and every one was decreased in hilly area with increase in altitude. In spring, with the increase of altitude, frequency and maturity were decreased and species number was increased in plain area while species number and maturity were decreased and frequency was increased in hilly area. From the result, it was noticed that in spring, maturity was increased with the decrease of species number and vise versa. Furthermore, less numbers and high frequency of species increase the maturity of plant life in research area.

Comparison in seasons, maturity was found high in summer due to less numbers of plant species and high frequency as compare to the other seasons. In winter the species number were high due to the presence of nonpalatable and cultivated plant in the area. So

consumers choose plant for food. In summer the cultivated plant and other natural species were unavailable in the area therefore, the palatability rate was high and only none palatable species are present in the area. People of the area are poor so they cut the species at the end of summer, for burning purposes in winter. In spring the rain percentage is more, therefore, the plant number is high but the frequency and Maturity Index was low.

Conclusion

The maturity index is necessary for perfect representation of quantitative and qualitative characteristics and used as an ideal way to study the plant life. It is used as a perfect way to study and helps skillfully in evaluating the biodiversity and conservation of intact habitat and plant life in specific area. This study pointed out that climatic environment of region has privileged conscription of area and frequency was changed with the change of seasons and altitude. Plant ecologists have commonly been conscious that vegetation shows a discrepancy over a broad variety of particular scales and area. Therefore, it is needed that we apply the maturity Index methods for studying the degree of plant life deviation.

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