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Assessment of Growing Stock of Matta Forest Subdivision of Swat Forest Division

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ABSTRACT
Evaluation of planting trees is very important for the present time and future for the scientific management of forests. This study was conducted with the same purpose in the Matta forest sub- division of Swat forest division KPK Pakistan. For this purpose, the technique used was random sampling with a sample intensity of 0.5%. Therefore, the total forest area of 17,501 hectares was studied by taking a sample of the 30 plots. Each plot of one hectare was used for collecting data on tree density, age, increment, diameter, form factor, and the size of the basal area of trees. Based on the information that has been collected, volume tables were prepared which suits the local conditions as the previous volume tables were not suited to the local conditions.

KEYWORDS: dependent variables, Growing stock, Independent variables, Sub tropical, Sub humid, Volume tables

1. INTRODUCTION

Growing stock, being indicator of forests products, is the most significant parameter of forest resource. Forests is the merely source of producing timber that is major component in any field of work. Forest inventories primarily aimed at assessing the growing stock and the traditional working plan prescription focused on obtaining sustained yield of timber from forests. Growing stock assessment has gained further importance in the present scenario because of the role forests play in climate change and in global carbon cycle. It is estimated that the world's forests store 283 Giga tones (Gt) of carbon in their biomass alone, and 638 Giga tones (Gt) of carbon in the ecosystem as a whole including dead wood, litter and soil up to 30 cm depth. Thus forests contain more carbon than entire atmosphere (Global Forest Resource Assessment 2005).

Forests are the most important renewable resource by virtue of its ecological and socio economic importance. It is the only source of providing timber and other construction wood, and contributes as a major component of the energy sources for cooking and heating in rural areas. Forests once existed in most parts of Pakistan, yet upon observation today, one would not see a vestige of them worthy of the name. The Himalayan ranges have been denuded completely of tree growth with only mere remnants of the original forest remaining where protection has been extended (Champion et al. 1965). Pakistan's forest resources are limited. Presently, about 5 % of the country's land is under forest cover. It is becoming difficult to meet the demands of the growing population for fuel wood, fodder, agricultural implements, and raw material required for wood based industries. More than 60 percent of the land in Pakistan is either already affected or likely to be affected by desertification. The suspended sediment load per km of drainage basin is one of the highest in the region. More than 11.2 m.ha land has already been affected by soil erosion, 4.2 m. ha have rendered unproductive by salinity, and another 2 m. ha have become unarable due to water logging. In spite of reclamation efforts, large areas remain plagued by these problems (Sheikh and Hafeez, 1997).

In 2010, the estimated total growing stock in the world's forest amounted to about 527 billion m3, this corresponds to an average of 131 m3 per hectares. The highest levels of growing stock per hectare were found in central Europe and some tropical areas. There was a small decline in total growing stock over the period 1990–2010, but it is unlikely that this change is significant in statistical terms (Global forest resources 2010).

The target forest area lies in swat Forest Division. Its climate is moist temperate with an average minimum temperature of 4.8°C in winter and 33.5°C in summer. The average annual rainfall is about 800 mm. The precipitation occurs mostly in spring and summer seasons with snowfall at the higher elevations (Mannan, 2002).

2. MATREIALS AND METHODS

The study was conducted in Matta Forest Sub division which has an area of 683 Km2 and population of 367000 according to 2009 data. Out of this total area 26084 hectares is having forest while the remaining area is divided into cultivated land and uncultivated area in different ratios. The density of population is 368 persons per square kilometer with a household size of 9 members per family

(Anonymous, 2000). The study area was divided into two different climatic zones (i.e., sub-tropical sub humid and sub-humid zones) on the basis of climatic data and altitudinal considerations. Sub humid sub-tropical zone covers Tehsile Matta, Kharerai, Sambat, Dureshkhela, Sakhra, Pirkalay Gurra and Chuprial, While some areas of Matta subdivision, Shawar ,Biha, Roringar, Mandal Dag and Lalko lies in moist temperate regions. The average minimum temperature at Matta in December is 4.8°C and mean maximum in July is 33.5°C at the same station. The average annual rainfall at Swat and Matta is 1500 mm and 800 mm respectively. Shawar, Biha, Mandal and Lalko valleys receive maximum precipitation in the form of snow during winter (Khan, 2008).

Random sampling techniques were used for data collection. Study area was divided into 3 blocks. From each block 3 x 10=30 plots were selected randomly on the basis of following characteristics.T1 = plot one, representing dense forest, T2= plot 2, representing moderate forest, T3 = plot 3, representing sparse forest area. For the assessment of growing stock the plot size 100 m into 100 m were taken. Regression Analysis technique was used to construct volume tables (Steel et al. 1997).

3. RESULTS AND DISCUSSION

The data was recorded from the representative sites comprising species composition, density, age, diameter, height and basal area of Matta forest sub division of swat forest division. After applying statistical analysis and calculations the results are presented and the volume tables of dominant tree species prepared are discussed as under. There are various types of species found in the study area such as Pinus wallichiana, Pinus roxburghii, Picea smithiana, Taxus baccata, Juglans regia, Quercus species etc but the result shows that the dominant species of the study area were Pinus wallichiana (kail) and Pinus roxburghii (Chir). The composition of Pinus wallichiana is (47.37%) while that of Pinus roxbughii is (49.70%) because these two are the dominant species of study area. To find out growing stock the data were collected from three different sites based upon density. The area was divided into dense forest, moderate and sparse forest. Randomly 30 plots were selected 10 plots from each forest area such as dense, moderate and sparse. The highest tree density was found that of Pinus roxburghii (11.83 trees/ha) while the lowest was that of Pinus wallichiana which was (10.7 trees/ha). The variation in both is due to certain reason such as less natural regeneration, low availability of water, less availability of other essential nutrients, low availability of space, structure and texture of soil, plant to plant distance.

The height of each tree was found by trigonometric principles. The height was arranged according to the diameter class and the lowest diameter class starts from 30-34 and goes up to 95 and we keep the class difference as 5. The average height of Pinus wallichiana as shown in table 1 is 29.80 m while that of Pinus roxburghii is 28.08 m as shown in table 2. So from the calculated data, it can be inferred that there is positive relationship between diameter and height because when the diameter increase the height also increases although when the tree reaches to rotation age, variations may occur. Increment of individual tree was found by dividing the length of tree core by 10 years. Increment was arranged according to the diameter class which starts from 30-34 having a class difference of 5 and goes up to 94. The average diameter of Pinus wallichiana was 53.76 cm at breast height point and the average height was 29.80 m while that of Pinus roxburghii was 52.45 cm and average height was 28.08 m.

For making volume table first of all we found height, form factor and basal area and on the basis of this data we prepare volume table. The volume of all individual tree was found with the help of formula (Height*Form Factor*Basal area). The maximum volume found that of diameter class 68 (cm) was 2.85 m3/ha and minimum of diameter class 39 (cm) which was 0.125 m3/ha of Pinus wallichiana, While that of Pinus roxburghii the maximum volume found was 1.680 m3/ha of diameter class 76 (cm) and minimum 0.068 m3/ha of diameter class 35 (cm). The poor or lower growth rate is due to certain reasons such as shortage of water supply due to low rain fall, nutrients deficiency, less availability of space for growth, soil quality etc (Moinuddin et al).

Table 1: Volume table of *Pinus wallichiana*

DBH class	M DBH (cm)	Mean DBH	D^2 (m)	Average height(m)	Form Factor	Volume m^3/tree	No. of existing	Total volume

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(cm)		(m)					trees/ha	m^3/ha
31	31.25	0.312	0.09	21.97	0.56	0.9436	0.1333	0.258
32	32.45	0.324	0.10	22.23	0.56	1.0295	0.1333	0.137
33	33.59	0.335	0.112	22.43	0.56	1.1130	0.1666	0.185
34	34.62	34.62	0.119	23	0.55	1.1907	0.1666	0.198
35	35.36	0.353	0.125	23.71	0.55	1.2805	0.1666	0.213
36	36.86	0.368	0.135	24.66	0.55	1.4472	0.1666	0.241
37	37.83	0.378	0.143	25.95	0.55	1.6042	0.2	0.320
38	38.8	0.388	0.150	24.05	0.54	1.5355	0.1333	0.204
39	39.77	0.397	0.158	25.65	0.54	1.7206	0.1333	0.229
40	40.74	0.407	0.165	25.96	0.54	1.8273	0.2333	0.426
41	41.71	0.417	0.173	26.32	0.53	1.9060	0.1	0.190
42	42.88	0.428	0.183	26.34	0.53	2.0160	0.2666	0.537
43	43.65	0.436	0.190	26.47	0.53	2.0993	0.1666	0.349
44	44.61	0.446	0.199	26.95	0.53	2.2322	0.0666	0.148
45	45.59	0.455	0.207	24.86	0.53	2.1508	0.1666	0.358
46	46.57	0.465	0.216	27.53	0.52	2.4384	0.1	0.243
47	47.54	0.475	0.226	27.78	0.52	2.5641	0.2333	0.598
48	48.5	0.485	0.235	28.5	0.52	2.7379	0.2333	0.638
49	49.48	0.494	0.244	29.53	0.52	2.9526	0.2666	0.787
50	50.45	0.504	0.254	30.53	0.51	3.1124	0.3333	1.037
51	51.42	0.514	0.264	28.62	0.51	3.0310	0.5666	1.717
52	52.39	0.523	0.274	29.86	0.5	3.2184	0.1	0.321
53	53.36	0.533	0.284	29.44	0.5	3.2917	0.266	0.877
54	54.3	0.543	0.294	27.9	0.5	3.2304	0.166	0.538
55	55.31	0.553	0.305	28.81	0.49	3.3918	0.266	0.904
56	56.27	0.562	0.316	30.64	0.49	3.7336	0.2333	0.871
57	57.24	0.572	0.327	30.73	0.48	3.7957	0.5	1.897
58	58.2	0.582	0.338	30.61	0.48	3.9087	0.4666	1.824
59	59.18	0.591	0.350	29.52	0.47	3.8163	0.3666	1.399
60	60.15	0.601	0.361	28.52	0.47	3.8089	0.2333	0.888
61	61.01	0.610	0.372	29.52	0.46	3.9697	0.5	1.984
62	62.01	0.620	0.384	31.54	0.45	4.2863	0.1333	0.571
63	63.03	0.630	0.397	32.13	0.45	4.5113	0.1	0.451
64	64.01	0.640	0.409	28.8	0.45	4.1705	0.3666	1.529
65	65.03	0.650	0.422	29.62	0.45	4.4270	0.2666	1.180
66	66.94	0.669	0.448	30.92	0.45	4.8968	0.2333	1.142
67	67.9	0.679	0.461	30.8	0.45	5.0187	0.3	1.505
68	68.88	0.688	0.474	32.24	0.42	5.0456	0.5666	2.859
69	69.84	0.698	0.487	32.65	0.42	5.2532	0.2333	1.225
70	70.8	0.708	0.501	33.77	0.42	5.5838	0.2333	1.302
71	71.75	0.717	0.514	34.43	0.41	5.7076	0.2	1.141
72	72.71	0.727	0.528	34.85	0.41	5.9328	0.0666	0.395
73	73.7	0.737	0.543	33.9	0.4	5.7847	0.1	0.578
74	74.7	0.747	0.558	33.76	0.39	5.7702	0.2	1.154
76	76.64	0.766	0.587	35.21	0.38	6.1723	0.1333	0.822
78	78.58	0.785	0.617	35.32	0.38	6.5090	0.1333	0.867

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80	80.52	0.805	0.648	37.15	0.37	6.9993	0.1333	0.933
81	81.49	0.814	0.66	34.16	0.37	6.5920	0.1	0.659
82	82.46	0.824	0.677	37.38	0.36	7.1865	0.0666	0.479
83	83.4	0.834	0.695	42	0.35	8.0304	0.0333	0.267

Table 2: Volume table of *Pinus roxburghii*

DBH class (cm)	M DBH (cm)	Mean DBH (m)	D^2 (m)	Average height(m)	Form Factor	Volume m^3/tree	No. of existing trees/ha	Total volume m^3/ha
30	30.09	0.300	0.09	18.25	0.39	0.506	0.4	0.202
31	31.05	0.310	0.09	17.61	0.38	0.505	0.3	0.152
32	34.59	0.345	0.119	18.01	0.38	0.643	0.3	0.192
34	34.67	0.346	0.120	18.15	0.38	0.651	0.333	0.217
35	35.89	0.358	0.128	18.42	0.37	0.689	0.1	0.068
36	36.83	0.368	0.135	18.16	0.37	0.715	0.2	0.143
37	37.85	0.378	0.143	19.45	0.37	0.809	0.4	0.323
38	38.12	0.381	0.145	20.02	0.36	0.822	0.2	0.164
40	40.74	0.407	0.165	21.87	0.36	1.026	0.133	0.136
41	41.71	0.417	0.173	22.77	0.36	1.120	0.133	0.149
42	42.67	0.426	0.182	24.47	0.36	1.259	0.133	0.167
43	43.63	0.436	0.190	23.27	0.35	1.217	0.133	0.162
44	44.6	0.446	0.198	24.23	0.35	1.325	0.1	0.132
46	46.57	0.465	0.216	22.9	0.35	1.365	0.1	0.136
48	48.51	0.485	0.235	24.37	0.35	1.576	0.133	0.2101
49	49.46	0.494	0.244	22.32	0.34	1.458	0.166	0.2430
50	50.45	0.504	0.254	24.75	0.34	1.682	0.233	0.3925
51	51.42	0.514	0.264	26.26	0.34	1.854	0.2	0.3708
52	52.39	0.523	0.274	28.78	0.34	2.109	0.1667	0.3515
54	54.34	0.543	0.295	30.1	0.34	2.373	0.2	0.4746
55	55.3	0.55	0.305	30.47	0.34	2.488	0.233	0.5805
56	56.27	0.562	0.316	28.28	0.34	2.391	0.167	0.3985
57	57.24	0.572	0.327	31.85	0.34	2.786	0.2	0.5573
58	58.21	0.582	0.338	32.11	0.33	2.819	0.233	0.6579
59	59.2	0.592	0.350	33.2	0.33	3.015	0.267	0.8041
60	60.61	0.606	0.367	34.81	0.33	3.314	0.3	0.994
61	61.12	0.611	0.373	31.75	0.33	3.074	0.2333	0.7172
64	64.03	0.640	0.409	33.06	0.31	3.300	0.167	0.5500
66	66.94	0.669	0.448	34.7	0.31	3.785	0.233	0.8833
67	67.9	0.67	0.461	33.98	0.3	3.691	0.2333	0.8612
68	68.88	0.688	0.474	35.01	0.3	3.913	0.3	1.1741
69	69.85	0.698	0.487	33.56	0.3	3.858	0.167	0.6430
70	70.81	0.708	0.501	32.54	0.3	3.844	0.3667	1.4095
71	71.78	0.717	0.515	33.09	0.3	4.017	0.233	0.9373
72	72.74	0.727	0.529	36.5	0.29	4.398	0.1333	0.5864
73	73.7	0.73	0.543	34.5	0.29	4.268	0.1333	0.5690
74	74.71	0.747	0.558	36.71	0.29	4.666	0.2	0.9333

75	75.66	0.756	0.572	36.36	0.29	4.740	0.1	0.4740
76	76.61	0.766	0.586	35.5	0.28	4.581	0.367	1.6800
77	77.6	0.77	0.602	34.38	0.28	4.552	0.1667	0.7587
78	78.56	0.785	0.617	34.47	0.28	4.678	0.2667	1.2475
79	79.51	0.795	0.632	33.5	0.27	4.490	0.3333	1.4969
80	80.5	0.805	0.648	35.1	0.27	4.823	0.4	1.9293
81	81.45	0.814	0.663	35.48	0.27	4.991	0.13333	0.6655
82	82.41	0.824	0.679	35.85	0.27	5.163	0.2	1.0326
83	83.35	0.833	0.694	35.1	0.27	5.170	0.1333	0.6894
84	84.42	0.844	0.712	35.31	0.26	5.138	0.2667	1.3703
86	86.34	0.863	0.745	37.2	0.26	5.662	0.3	1.6988
87	87.3	0.873	0.762	38.64	0.26	6.013	0.233	1.4031
88	88.28	0.882	0.779	38.02	0.26	6.050	0.133	0.8067
89	89.25	0.892	0.796	35.27	0.25	5.516	0.233	1.2871
90	90.21	0.902	0.813	34.32	0.25	5.483	0.233	1.2795

4. CONCLUSIONS

The results of the study showed that the study area had once very dense vegetation but presently, the vegetation is very poor and sparse. There are not much mature trees. The left trees present are mostly immature. The reason for this is the different disturbing factors.i.e. Animals grazing and other human related disturbing factors. Last but not the least Poor management is also a main reason for the poor vegetation. Due to these reasons, the regeneration in the area is also negligible. There is a need of more plantation campaigns and awareness among people to save and improve the vegetation in the area.

5. REFERENCES

1. Al-Amin, M. Alamgir, M and Bhuiyan, M.A.R. Structural composition based on diameter and height class distribution of a deforested area of Chittagong Bangladesh, Journal of Applied Sci 5(2) (2005) 227-231.
2. Addo-Fordjour, A.S., A. Obeng, K. Anning and M. G. Addo. 2009. Floristic composition, structure and natural regeneration in a moist semi-deciduous forest following anthropogenic disturbances and plant invasion. Int. J. of Biodive Cons., 1(2): 21-37.
3. Akhavan, R., G. Z. Amiri and M. Zobeiri. 2010. Spatial variability of forest growing stock using geostatistics. Caspian J. Env. Sci., 8 (1): 43-53.
4. Cabaravdic, A., D. R. Pelz, G. Chirici, C. Kutzer, E. Catic and H. Delic 2011. Weighted functions in the k-NN estimates of growing stock in high forest, Works of the Faculty of Forestry, University of Sarajevo. 2: p. 15 - 29.
5. Corona, P., L. Fattorini and S. Franceschi. 2009. Estimating the volume of forest growing stock using auxiliary information derived from relascope or ocular assessments. J. F. Eco. Mgt., 257(10): 2108-2114.
6. FAO. 2010. Global forest resources assessment, Food and Agriculture
7. Khan, M. I. 2008. Land covers assessment through GIS and RS in Swat.
8. Packalen, P., A. Suvanto and M. Maltamo. 2009. A Two Stage Method to Estimate Species-specific Growing Stock. Photogramm. Engg. R. S., 75 (12) 1451–1460.
9. Moinuddin A., M. wahab, N. Khan, M. F. Siddiqui, M. U. Khan and S.T. Husain.2009. Age and growth rates of some gymnosperms of pakistan: a dendrochronological approach. Pak. J. Bot., 41(2): 849-860.
10. Sheikh, M. I. and S. M. Hafeez. 1997. Forest and Forestry in Pakistan. A-One Publisher Urdu Bazar Lahore, Pakistan: p. 151-160.
11. Sulinski, J. 2007. The tree-stand height and age based method for calculation of annual biomass production in a forest community. Acta Agraria et SilvestriaSeries Silvestris. 45: 89-119.
12. Swati, M.K. and M. A. Cheema.1991. Outturn volume of chir pine in Guzara forests of district Mansehra. Pakistan Journal of Forestry. 41(2): 94-101.
13. Vuckovic, M. and M. Ratknic. 1998. Forest tree increment and ecological monitoring Proceedings of an international jubilee conference marking the 70th anniversary of the Forest Research Institute, Sofia, Bulgaria, 6-7 October 1998 Volume-1:50-56