Study of tree diversity using GBH as an Ecological parameter: A case study of Mandvi forest Range, Kachchh District, Gujarat State, India

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Abstract: *Biodiversity is an umbrella term use for all living organism on this planet. India is rich in biodiversity and is one of the mega diversity centres in the world. In today's era, due to urbanization and industrialization, the need of land, wood and other natural resources increasing very high which result into declining of biodiversity and nature. We are losing nature day by day. For the purpose of conservation of it, We need the documentation and data with various parameters which can be help us for better conservation action plans. GBH is one of the ecological parameters to find out the future scenario of the forest. In present study GBH of 8106 trees were recorded and classified in to various GBH classes and documented well.*

Key word: *GBH, Tree, Mandvi forest.*

1. INTRODUCTION:

The term Forest is define as a large area covered chiefly with trees & undergrowth and dominated by trees. The term 'biodiversity' was coined by Walter G. Rosen in 1985 as a catchy replacement for 'biological diversity' (Sarkar 2002). Biodiversity is defined as "the full range of life in all its forms." This includes the habitats in which life occurs, the ways that species and habitats interact with each other, and the physical environment and the processes necessary for those interactions. (Norse et al. 1986; Wilson 1988; Heywood & Baste 1995; Washington Biodiversity Council 2007).). Globally, there are about ~8.7 million (61.3 million SE) eukaryotic species, of which, 2.2 million (60.18 million SE) are dwelling in the ocean depths (Mora et al. 2011). However, scientists have estimated that the number of species of plants and animals on earth could vary from 1.5 to 20 billion. Thus the majority of species are yet to be discovered.

India is the seventh largest country in the world and Asia's second largest nation with an area of 3,287,263 square km. Indian subcontinent hosts many number of endemic plant species and it goes up to 33% (Thapar 1997). India hosts 6.0% of all flowering plant species. Surveys conducted so far in India have inventoried over 45,500 species of plants and over 91,000 species of animal's accounts around 7-8% of the World's recorded species (MoEF 2008). The angiosperm flora of Gujarat is mostly varied in extent and composition. There are 2198 species of higher plants belonging to 902 genera and 155 families which represent 12.91% of the total flora of country.

On the beginning of 21st century, as we are losing diversity and the delicate balance of ecosystem, the need to initiate conservation plans is greater than ever before. Living component of earth is exposed to great danger due to two reasons 1) Growth of human population and 2) accelerating deterioration of the environment. The decline in the number of several species of plants and animal began with human civilization. Many valuable plant species become extinct without documented. Due to frequent loss of plant species, a recorded flora's GBH is altered a lot which need constant monitoring.

Girth is a measurement of the distance around the trunk of a tree measured perpendicular to the axis of the trunk. The base of the tree is measured for both height and girth as being the elevation at which the pith of the tree intersects the ground surface beneath, or where the acorn sprouted. Tree girth is one of the parameters commonly measured as part of various champion tree programs and documentation efforts. GBH is the biological parameter used to predict the future scenario of forest of individual species. GBH is also helps in the calculation of carbon stalk produced by trees. GBH is the parameter which gives current status of the forest range whether it is mature or immature. It also helps to conserve the endemic plants. GBH is used estimating the amount of timber volume in a single tree or stand of trees utilizing the allometric correlation between stem diameter, tree height and timber volume (Mackie, 2006). It can also be used in the estimation of the age of veteran trees given that diameter increment is the only, "constant non-reversible feature of tree growth" (White, 1998).

2. STUDY AREA:

Mandvi is located in the Kachchh district which is located between at western part of Gujarat state. It located between 22.81 N and 69.36 E. Mandvi was developed by Rao of Kachchh state, Khengarji in 1580. It is about 56 km south of regional capital of Bhuj and 446 km from major Gujarat Mega city of Ahmadabad.

The maximum and minimum temperatures recorded in the area are 2 C in the winter and 4C to 45C in summer. June to September is monsoon period. The Average annual rainfall is approximately 14 inches.

3. METHADOLOGY:

Several study trips were arranged during the research period between October 2016 and February 2017, to record the GBH data. All the plants above 10 cm GBH (girth at breast height) were considered as samplings. Total 165 sample plots, each of 50 X 50 mt. sq. Size were laid down in different forest areas for enumeration of tree species. GBH of 8106 trees were measured. For representing the population structure of trees the following arbitrary GBH classes were established: A) 0 to 20; B) 21 to 40; C) 41 to 60; D) 61 to 80; E) 81 to 100; F) 101 to 120; G) 121 to 140; H) 141 to 160; I) 161 to 200**;** J) 181 to 200; K) 201 to 220; L) 221 to 240; M) 241 and above it. The total number of individual belonging to individual girth class was calculated for each tree species in all forest areas. All recorded trees were identified to species level with the help of regional floras.

4. OBSERVATION:

4.1 GBH (Girth at Breast Height) study of tree species.

GBH of 8106 trees, growing in 165 sample plots, was measured to observe future scenario of the forest. Out of 8106 trees, 3370 trees shows GBH ranging between 21 and 40 cm while only 6 trees shows more than 180 cm. out of the total 8106 trees, 3116 trees shows GBH ranging between 0 and 20 cm constituting 38.44% of the total trees. Out of 8106 trees, 4984 trees show GBH ranging between 21 and 180 cm consisting 61.49%. Out of 8106 trees, 6 trees show GBH more than 180 cm and this constitutes 0.074% of the total tree composition.

Table: 1 Number of trees under various GBH ranges

GBH range	Number of trees	Percentage
0 to 20 cm	3116	38.44
21 to 160 cm	4974	61.36
161 onwards	16	0.2

GBH range of 8106 trees is shown in table: 2

Table 2 Showing GBH ranging of tree

Sr. no	Species name	1	2	3	4	5	6	7	8	9	10	11	12	13	14
		A	B	C	D	E	F	G	H	I	J	K	L	M	TOTAL
1	*Acacia catechu* Willd.	1242	1543	417	135	33	2	0	2	0	0	0	0	0	**3374**
2	*Balanites aegyptiaca*(L.) Delile	692	376	140	20	2	0	0	0	0	0	0	0	0	**1230**
3	*Acacia nilotica* (L.) Del.	235	412	115	50	25	1	1	3	6	0	0	0	0	**848**
4	*Acacia senegal* (L.) Willd	262	180	57	56	14	8	1	1	0	0	0	0	0	**579**
5	*Acacia leucophloea* (Roxb.)Willd.	239	253	50	5	4	0	0	0	0	0	0	0	0	**551**
6	*Azadirachta indica* A. Juss.	194	260	32	7	1	0	0	0	0	0	0	0	0	**494**
7	*Prosopsis cineraria* (L.) Druce	145	213	70	24	9	1	3	0	0	0	0	0	0	**465**
8	*Butea monosperma* (Lam.)	1	12	22	23	22	9	10	2	2	1	1	0	0	**105**
9	*Delonix regia (Boj.)* Raf	8	42	22	10	8	0	1	0	0	0	0	0	0	**91**
10	*Cordia myxa* L.	32	12	6	0	7	14	9	0	0	0	0	0	0	**80**
11	*Bombax ceiba* L.	1	3	13	15	10	16	9	4	1	1	0	0	0	**73**
12	*Phyllantghus emblica* L.	23	17	14	13	2	0	1	0	0	0	0	0	0	**70**
13	*Crateva nurvala* Buch.-Ham	12	14	12	0	0	0	0	0	0	0	0	0	0	**38**
14	*Alinthus excelsa* Roxb.	4	13	2	2	2	0	0	0	0	0	0	0	0	**23**
15	*Bauhinia racemosa* Lam.	11	4	2	0	0	0	0	0	0	0	0	0	0	**17**
16	*Pethecellobium dulce (Roxb.) Benth.*	3	5	3	1	0	0	0	0	0	0	0	0	0	**12**
17	*Moringa oleifera* Lam.	0	1	0	2	2	2	3	0	0	0	0	0	0	**10**
18	*Ficus bengalensis* L.	0	1	1	0	0	1	1	2	1	0	0	1	2	**10**
19	*Ficus religiosa L.*	1	3	3	2	1	0	0	0	0	0	0	0	0	**10**
20	*Dalbergia sissoo* Roxb.	6	1	2	0	0	0	0	0	0	0	0	0	0	**9**
21	*Parkinsonia aculeate* L.	4	4	0	0	0	0	0	0	0	0	0	0	0	**8**
22	*Thespesia populnea* (L.) Sol. Ex correa	0	0	1	1	2	0	0	0	0	0	0	0	0	**4**
23	*Aegle marmelos* (L.) Correa	1	1	1	0	0	0	0	0	0	0	0	0	0	**3**
24	*Lannaea coromandelica* (Houtt.) Merr.	0	0	0	0	0	1	0	0	0	0	0	0	0	**1**
25	*sterculia urens* Roxb.	0	0	0	0	0	0	1	0	0	0	0	0	0	**1**
26	**TOTAL**	**3116**	**3370**	**985**	**366**	**144**	**55**	**40**	**14**	**10**	**2**	**1**	**1**	**2**	**8106**

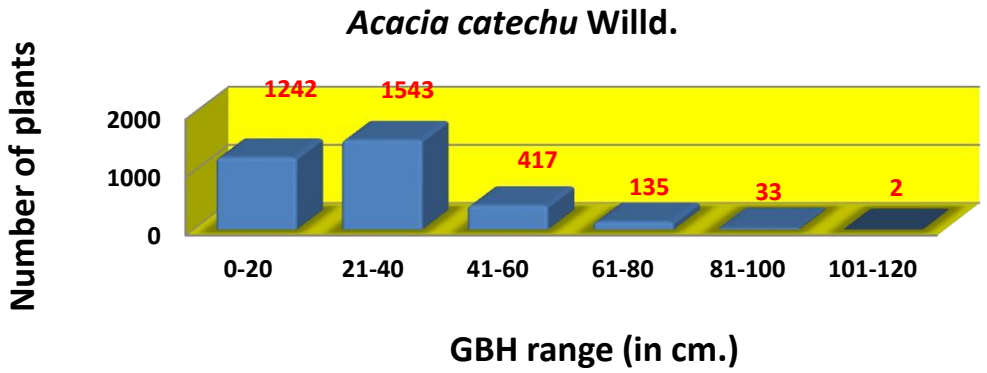
A = 0-20 (3116)
B = 21-40 (3370)
C = 41-60 (985)
D = 61-80 (366)
E = 81-100 (144)
F = 101-120 (55)
G = 121-140 (40)
H = 141-160 (14)
I = 161-180(10)
J = 181-200 (02)
K = 201-220 (01)
L = 221-240(01)
M = 241&Above(02)

4.2 Acacia catechu Willd.

Local name: Khair
Family: Mimosaceae

Out of 8106 trees enumerated from 165 sample plots of Mandvi Range, 3374 trees belong to *Acacia* which constitute 41.62% of the total tree population. *Acacia* trees are dominated in all the area of Mandvi range and are found everywhere in the forest.

Chart: 1



4.1.1 GBH:

Out of 8106 trees, 1543 trees show maximum GBH and fall in 21 – 40 cm.1242 trees shows the GBH between 0 – 20 cm and trees with GBH range 41 – 60 cm, 61 – 80 cm and 81 – 100 cm are also good in number. Maximum population of *Acacia* trees in the forest indicates that environmental conditions are favourable for the growth of *Acacia* plants species.

4.2. Balanites aegyptiaca (L.) Delile

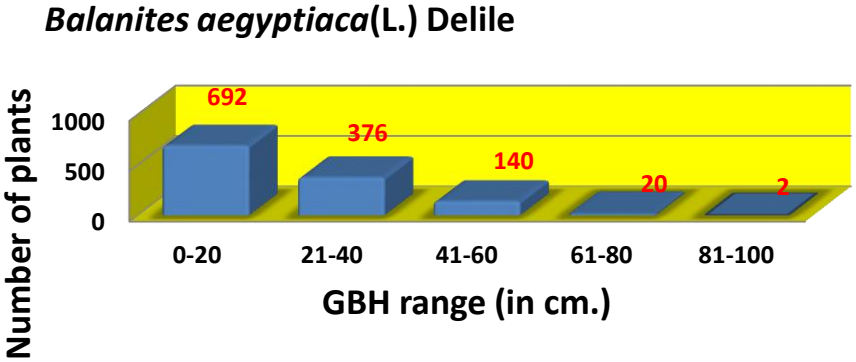
Local name: Hingoriyo
Family: Balanitaceae

Out of 8106 trees enumerated from 165 sample plots, the *Balanites* with 1230 individuals constitute 15.17%. It is second largest species followed by *Balanites.*

4.2.1 GBH:

The number of trees showing minimum girth ranges between 0 – 20 cm is 692 while those showing maximum girth classes ranging between 80 – 100 cm are only 2 in the total 165 sample plots studied so far. More number of trees i.e. 692 and 376 are recorded in the range having 0 – 20 cm and 21 – 40 cm girth classes respectively. Out of the total 1230 trees of *Balanites,* only 22 trees show girth class above 60 cm.

Chart:2



4.3. *Acacia nilotica* (L.) Del.

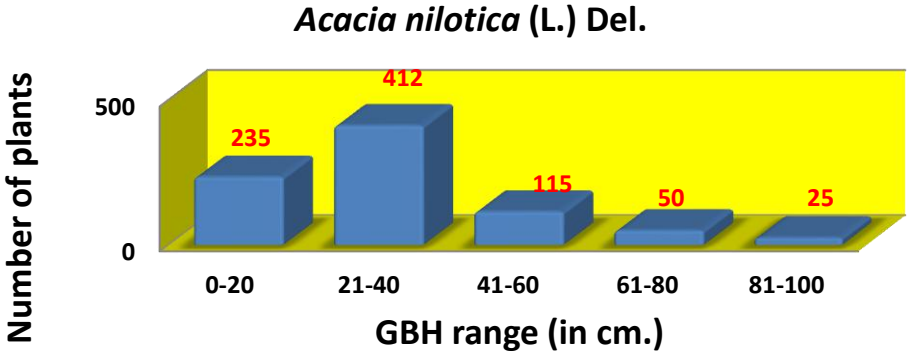
Local name: Desi baval
Family: Mimosaceae

The total trees of *Acacia nilotica* reported in 165 sample plots are 848 which constitute 10.46% of the total trees of different species enumerated for study

4.3.1 GBH:

The tree showing the GBH between 101 – 120 cm, 121 – 140 cm, 141 – 160 cm and 161 – 180 cm are fewer in number i.e. 1, 1, 3 and 6 respectively. Maximum trees i.e.412 are recorded in the class having 21 – 40 cm. GBH. Trees with the GBH range 0 – 20 cm and 40 – 60 cm are also good in number.

Chart: 3



4.4. *Acacia senegal* (L.) Willd

Local name: Izrayal baval

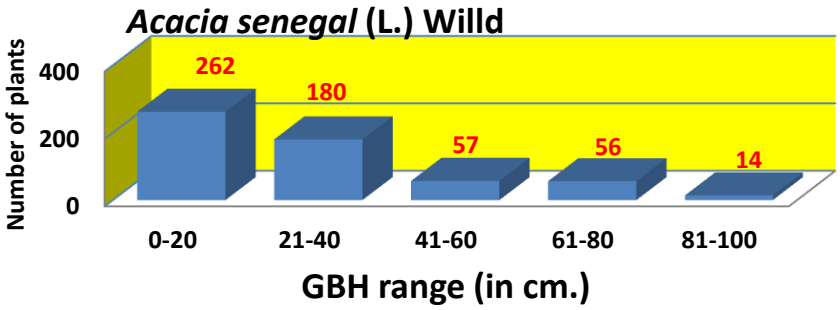
Family: Mimosaceae

79 trees of *Acacia senegal* are recorded in the 165 sample plots and it constitutes 7.14% of total trees belonging to different tree species.

4.4.1 GBH:-

Out of 579 trees, 262 trees fall under the GBH range of 0 – 20 cm. 180 trees show GBH range between 21 – 40 cm. Trees having GBH range between 21 – 40 cm and 41 – 60 cm are also quite good number. Only 24 trees show GBH range above 60 cm, indicating that over mature trees are less in number. This clearly indicates that very young trees are present and over mature trees are very less in number in forest area.

Chart: 4



4.5. *Acacia leucophloea* (Roxb.)Willd.

Local name: Haramo Baval (Desi Khair)

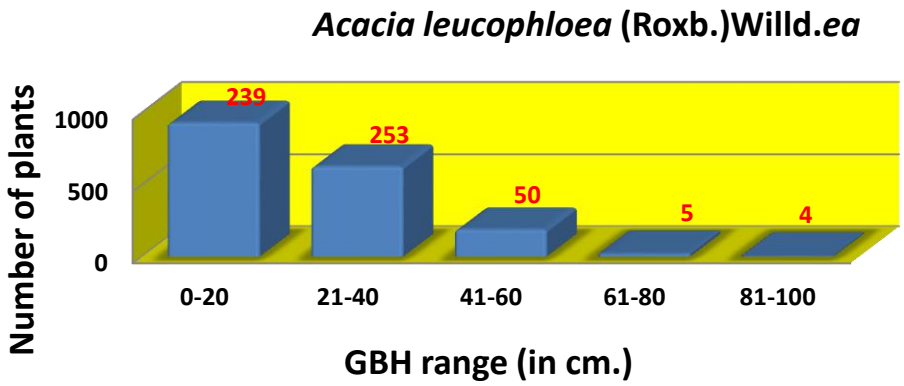
Family: Mimosaceae

Total 551 trees are enumerated in 165 sample plots, which constitute 6.8% of the total tree species.

4.5.1 GBH:-

Out of 551, 253 trees fall under the GBH range between 21 –40 cm. Only 9 trees show GBH above 60 cm. 50 trees reveal GBH range between 41 – 60 cm respectively. Trees with GBH range 0 – 20 cm are also quite good in number.

Chart: 5



4.6. *Azadirachta indica* A. Juss.

Local name: Limdo

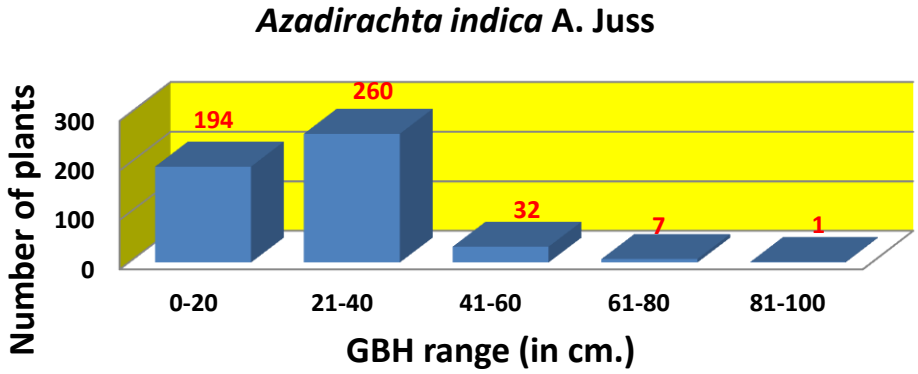
Family: Meliaceae

494 trees of *Azadirachta indica* are recorded in the 165 sample plots, which constitute 6.1% the total tree belonging to different species.

4.6.1 GBH:-

The number of trees showing the GBH range above 60 cm only 8 trees respectively. Maximum trees i.e. 260 are recorded in the class having 21 – 40 cm GBH. Trees with the GBH range 0 – 20 cm are in good number. This clearly indicates that very immature trees are present in forest area.

Chart: 6



5. RESULTS AND DISCUSSION:

GBH of 8106 trees, growing in 165 sample plots is measured to observe future scenario of the forest. Out of 8106 trees, 3370 trees shows class A (0-20) which is followed by 3116 trees class B (21-40), 985 trees shows class C (41-60) and 366 trees shows (61-80). Less number of trees shows class H, I, J, K, L, M (Less than 15 trees). The it clearly indicate that maximum trees fall under GBH ranging between 21 cm to 40 cm and very less numbers of trees fall under higher GBH range which is 180 cm. *Acacia catechu* has maximum numbers of trees (3374), followed by *Balanites egyptiaca* (1230), *Acacia nilotica* (848), *Acacia Senegal* (579), *Acacia leucophloea* (551) and *Azhadirecta indica* (494). Out of six species 4 species are belonging to genus Acacia which clearly indicate that Mandvi forest range is suitable for the growth of Acacia species. It clearly indicates that the forest is neither young nor mature, but comes between the two categories i.e. immature forest. In future the forest become rich in terms of biodiversity if it is not affected by activities like cutting of plant for timber, encroaching or deforestation of plants.

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