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Research Article

INVASION OF *PROSOPIS CHILENSIS* (MOLINA) STUNTZ AND ITS STATUS COMPARED WITH OTHER DOMINANT TREE SPECIES OF 'THOL LAKE WILDLIFE SANCTUARY', NORTH GUJARAT

***Vyas D.N. and Dabgar Y.B.**
R.R. Mehta College of Science & C. L. Parikh College of Commerce, Palanpur (N. Gujrat)
**Author for Correspondence*

ABSTRACT
Study of status of Prosopis chilensis (Molina) Stuntz in comparison of other dominant tree species in a protected area of 'Thol Lake wildlife Sanctuary' was of concern. Presently the species was found to be second most dominant tree species of the study area after Acacia nilotica (L.) Del. subsp. indica. An attempt have been made in the present study to evaluate the status of the species in respect of its estimated dominance in nearer future by comparing ratio of its trees, recruitment and regeneration with that of the other dominant tree species of the study area. Furthermore number of premature trees of lower GBH classes of the species was also compared with those of other dominant tree species. With the result of these comparisons Prosopis chilensis (Molina) Stuntz was found to have potential of being the most dominant tree species in upcoming days.

Key Words: *Prosopis Chilensis, Thol, North Gujarat*

INTRODUCTION
Prosopis chilensis (Molina) Stuntz is an invasive tree species, which is rapidly spreading in Western India. The species is highly adopted to survive almost in any condition. Pods of the tree are preferred fodder of livestock. Thus, easy and fast seed dispersal has been resulted in rapid spread of the species. It has been proved after several researchers that the species is so dominant that it does not allow many native plant species to grow underneath it. Area under present study 'Thol Lake Wildlife Sanctuary' is also not exempted of invasion of *Prosopis chilensis* (Molina) Stuntz. At the first observation the tree species was seemed to be dominant in the area along with *Acacia nilotica* (L.) Del. subsp. *indica*. Thus the objective to identify status of *Prosopis chilensis* (Molina) Stuntz in comparison of other dominant tree species of the study area was of concern. With the accurate knowledge of current status in respect of its establishment within the sanctuary, a proper and sustainable management plan for the species could be worked out to improve the habitat here.

Study Area
Gujarat is unique in considering its wealth of natural and man-made water bodies/wetlands. Four such inland wetlands in the state have been established and designated as sanctuaries primarily for waterfowl. These are Nal sarovar, Khijadia, Porbandar and Thol (Singh, 1998). Though, the selected study area Thol is encompassing irrigation tank, is legally named 'Thol lake Wildlife Sanctuary' as per the notification. It is in fact one of the sanctuaries of the state considering that waterfowl constitute dominant form of the wildlife to be protected. The sanctuary is popularly known as 'Thol Bird Sanctuary' (TBS).

The area falls under Mehsana district of North Gujarat region, which is a semi-arid zone and mostly composes dry deciduous vegetation. In physiognomic manner forests of the district are scrub type where vegetation is open i.e. trees and shrubs are widely spaced. The vegetation on the whole consists of co-dominant by thorny shrubs and trees capable of resisting drought. Such vegetation falls under Bio-geographic zone – IV. The area under present study also falls under the same conditions and categories naturally. In addition to that it is a protected area which is considered as wetland. The vegetation found here mainly was of scrub type with mixed flora of aquatic and marshy plants. TBS comprise a total area of 699 ha. with 5.62 km. long periphery. It experiences three distinct seasons, winter, summer and monsoon. Temperature ranges here from as low as 8^{o}C in winter to as high as 43^{o}C in summer. Average

annual rainfall is 600 mm, ranging from 100 mm to 800 mm. The study area is also facing anthropogenic pressures viz. agriculture, grazing, industrialization, oil drilling and tourism

MATERIALS AND METHODS

Intensive field visits of the study area were organized under present research. For the purpose of data collection, standard quantitative assessment technique like belt transects method (Muller-Dombois and Ellenberg, 1974; Kershaw, 1973) was used. Because the study area holds a water body with variation in water covered area during different seasons of the year, the survey was started from the peripheral region. Meanwhile when and where (mostly in summer) the water lodged areas dried up, were also surveyed. Thus, entire sanctuary was covered to quantify ecological characters. Depending on the width of peripheral region a 100 mt. wide belt was recognized and studied using circular plots of 10 mt. radius each were plotted at every 50 mt. intervals randomly within the belt area for the study of tree species. Same sized plots were plotted within rest of the sanctuary area also, where water was not present. In the circular plots of 10 mt. radius tree species were recorded along with their total number, height, Girth at Breast Height (GBH), cutting, lopping, recruitments and regenerations. All the tree species with GBH less than 10 cm. were considered as recruitments. Values of relative frequency, relative density and relative dominance of the tree species were added together to determine Important Value Index (IVI).

RESULTS AND DISCUSSION

In the smaller area of the TBS in comparison of other sanctuaries and forest reserve areas of North Gujarat, a good number of tree species were identified. A total of 36 tree species were documented during present study. Out of which, 30 were falling within the plotted area.

Amongst all the tree species falling within plotted area ***Acacia nilotica* (L.) Del. subsp. *indica*** was found to be most dominant trees species with 946 individual trees out of a total of 3198 comprising 29.58% of the total which was followed by ***Prosopis chilensis* (Molina) Stuntz** with 878 individual trees comprising 27.45% of the total, ***Acacia leucophloea* (Roxb) willd.,** 658 individual trees comprising 20.58% of the total, ***Prosopis cineraria* (L.) Druce** with 139 individual trees comprising 4.35% of the total and ***Salvadora persica* L.** with 89 individual trees comprising 2.78% of the total. Total of individual trees of these five dominant species was 2,710 comprising 84.74% of the total, while total of individual trees of all the rest of the tree species was just 488 comprising 15.26% of the total (figure 1).

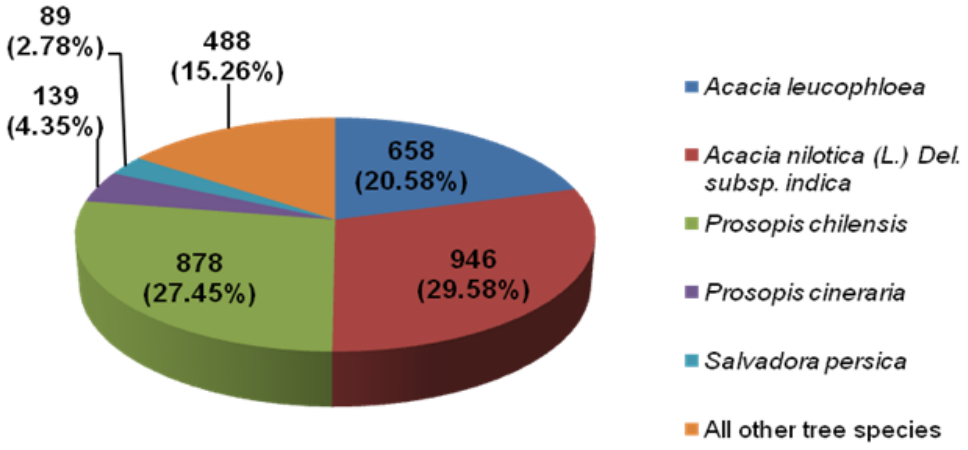

Figure 1: Contribution of dominant tree species

Important Value Index (IVI) of these species also showed the same dominance sequence. Unsurprisingly IVI of ***Acacia nilotica* (L.) Del. subsp. *indica*** was 135.89. It was followed by ***Prosopis chilensis***

(Molina) Stuntz with IVI 128.42, ***Acacia leucophloea* (Roxb) willd.** with IVI 109.97, ***Prosopis cineraria* (L.) Druce** with IVI 55.38 and ***Salvadora persica* L.** with IVI 54.47 (table 1).

Table 1: Dominant tree species and their IVI

Sr. No.	Tree species	No. of Individual	Relative frequency	Relative density	Relative dominance	IVI
1	*Acacia nilotica* (L.) Del. subsp. *indica*	946	17.65	114.22	4.02	135.89
2	*Prosopis chilensis* (Molina) Stuntz	878	16.99	109.99	1.44	128.42
3	*Acacia leucophloea* (Roxb) Willd.	658	14.49	93.77	1.71	109.97
4	*Prosopis cineraria* (L.) Druce	139	6.97	45.12	3.22	55.31
5	*Salvadora persica* L.	89	6.75	43.71	4.00	54.47

Recruitment and regeneration of dominant tree species were also documented during present study. ***Acacia nilotica* (L.) Del. subsp. *indica***, the most dominant tree species was holding a total of 946 individual trees along with 217 recruitments and 416 regenerations within the total plotted area. The ratio of these three categories was found to be 1 : 0.22 : 0.36. In the same approach second most dominant tree species ***Prosopis chilensis* (Molina) Stuntz** was holding a total of 878 individual trees along with 672 recruitments and 1145 regenerations. The ratio of them was found to be 1 : 0.76 : 1.30. It is considered necessary to mention here that the total number of individual trees of *Acacia nilotica* (L.) Del. subsp. *indica* is higher than that of the *Prosopis chilensis* (Molina) Stuntz but the ratio of tree to recruitment to regeneration of *Prosopis chilensis* (Molina) Stuntz was moderately higher than that of *Acacia nilotica* (L.) Del. subsp. *indica.*

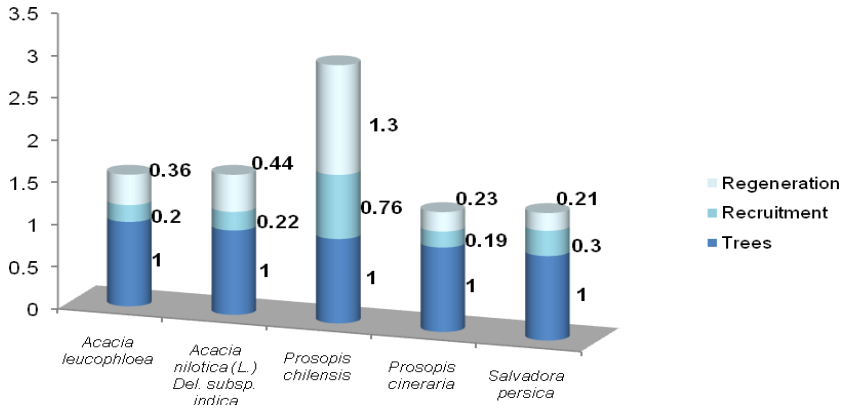

Figure 2: Ratio of dominant tree species, their recruitment and regeneration

The third dominant tree species ***Acacia leucophloea* (Roxb) willd.** was holding a total of 658 individual trees along with 133 recruitments and 239 regenerations within the total plotted area. The ratio of the three categories of the species was found to be 1 : 0.2 :0.36. The fourth dominant tree species ***Prosopis cineraria* (L.) Druce** was holding a total of 139 individual trees along with 26 recruitments and 32 regenerations within the total plotted area. The ratio of the three categories of the species was found to be

1: 0.19: 0.23. The fifth dominant tree species ***Salvadora persica* L.** was holding a total of 89 individual trees along with 27 recruitments and 19 regenerations within the total plotted area. The ratio of the three categories of the species was found to be 1: 0.3: 0.21 (figure 2).

(In the pictures showing recruitment and regeneration of Prosopis chilensis (Molina) Stuntz within the study area)

In addition to that Girth at Breast Height (GBH) of all the dominant trees falling inside plotted area was also measured. Trees measured for their GBH were scrutinized in GBH classes viz. 11-30 cm, 31-50 cm, 51-70 cm……211-230 cm and 231 cm & above *(table 3)*.

Table 3: Number of dominant trees in different GBH classes

Sr. No.	**Tree species**	**GBH classes (cm)**								
		11-30	**31-50**	**51-70**	**71-90**	**91-110**	**111-130**	**131-150**	**151-170**	**171 & above**
1	*Acacia nilotica* (L.) Del. subsp. *indica*	41	132	219	428	62	24	16	19	5
2	*Prosopis chilensis* (Molina) Stuntz	211	391	122	103	31	17	2	1	0
3	*Acacia leucophloea* (Roxb) Willd.	154	364	67	35	27	4	1	3	3
4	*Prosopis cineraria* (L.) Druce	7	21	71	18	14	3	2	3	0
5	*Salvadora persica* L.	5	13	17	38	9	2	1	0	4
Total		**418**	**921**	**496**	**622**	**143**	**50**	**22**	**26**	**12**

Trees reaching GBH class 51-70 cm higher than that were considered to be mature in respect of their establishment in the sanctuary.

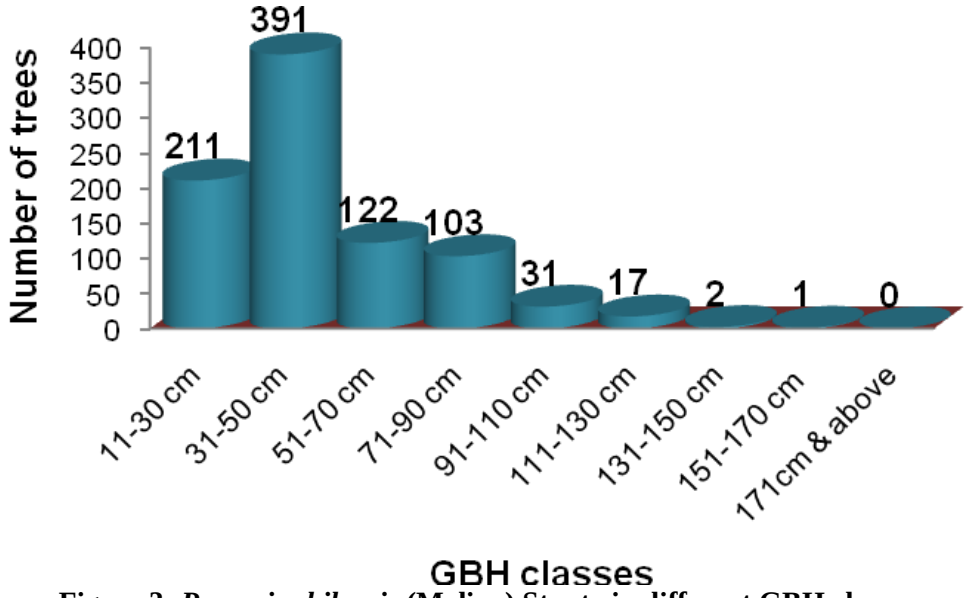

Figure 3: *Prosopis chilensis* (Molina) Stuntz in different GBH classes

In the same concern there were 773 mature trees of ***Acacia nilotica* (L.) Del. subsp. *indica*** followed by 276 mature trees of ***Prosopis chilensis* (Molina) Stuntz**, 140 mature trees of ***Acacia leucophloea* (Roxb) willd.**, 111 mature trees of ***Prosopis cineraria* (L.) Druce** and 71 mature trees of ***Salvadora persica* L.** within the plotted area. Compared to all other dominant tree species, *Prosopis chilensis* (Molina) Stuntz was the only species which was holding maximum individuals 211 and 391in the lower GBH classes of 11-30 cm and 31-50 cm than 51-70 cm. respectively (figure 3).

Conclusion

Though in the concern of population and IVI values ***Acacia nilotica* (L.) Del. subsp. *indica*** was found to be the most dominant species followed by ***Prosopis chilensis* (Molina) Stuntz**, it was concluded that *Prosopis chilensis* (Molina) Stuntz was having more potential to be the most dominant tree species of the study area in nearer future. In other words population of this species is in developing stage towards maturation in future. In this apprehension it may be configured that *Prosopis chilensis* (Molina) Stuntz will be a most dominant tree species in upcoming years by overtaking *Acacia nilotica* (L.) Del. subsp. *indica*. These was for the reasons **1)** Along with holding second most dominant position in the study area *Prosopis chilensis* (Molina) Stuntz was found to be with highest recruitments and regenerations, which may result in mature trees in nearer future. **2)** In the concern of GBH classes *Prosopis chilensis* (Molina) Stuntz was also holding second largest group of mature trees but it was holding the largest groups of premature trees which were supposed to be mature in upcoming days. **3)** Continues grazing pressure endangering native species and allowing rapid seed dispersal of *Prosopis chilensis* (Molina) Stuntz within the sanctuary area.

It has been indicated by several researchers that invasion of *Prosopis chilensis* (Molina) Stuntz is not a welcome knock for many native plant species. Hence removal of *Prosopis chilensis* (Molina) Stuntz. has become first need of the sanctuary. Sudden removal of this species will open up the area, which may not be liken by bird community especially waterfowl. This may result in rapid decrease in number of birds in the sanctuary. As a solution of the issue intensive plantation of native tree species like *Azadirechta indica* A. Juss, *Acacia leacophloea* (Roxb) willd., *Acacia nilotica* (L.) Del. subsp. *indica* and *Prosopis cineraria* (L.) Druce would be done first. When these species cross their recruitment stage and are ready to become mature trees, removal of *Prosopis chilensis* (Molina) Stuntz. along with their roots can be done. Removal of their roots is necessary to avoid regeneration. In addition to that plantation mentioned above could be done in sparse areas in regards of tree layer. This will sustainably improve the habitat for long terms.

However removal of *Prosopis chilensis* (Molina) Stuntz. is needed, burning of these trees for the purpose of making coal should be strictly prohibited to avoid soil degradation and destruction to many other adjacent species . Activity of grazing must be stopped at immediate action to control further invasion of the species.

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