15.0 Status Survey of Threatened Plants in Kachchh Desert, Gujarat

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Introduction

Kachchh, the second largest district in India forms major portion of a biogeographic province within Indian Desert (Rodgers *et al.* 2000). This dry land is endowed with varied micro-habitats and an array of xerophytic vegetation adding uniqueness to the biodiversity of the Gujarat state and India. This district (45,652 km^2; 22^o 41' 11" to 24^{o}41' 47" N and 68^o 9' 46" to 71^o 54' 47" E), located in the westernmost part of Gujarat state, covers about 73% of the total arid region in the state. It experiences extreme climatic conditions from very hot in summer (mean maximum temperature 39 – 45^{0}C) and cold (mean minimum 2^{0}C) in winter. Droughts are frequent with normal rains once in two to three years, which averages to 326mm in 13 rainy days. These climatic conditions have resulted in unique habitats which vary from tropical thorn forest to extensive grasslands, mangroves, mud flats along the coast, seasonal wetlands and the most unique *Rann* (saline desert) interspersed with elevated land masses, called 'Beyts'. These habitats support several species of plants many of them are highly threatened.

As per the classification by Champion & Seth (1968), as many as 14 different sub-types or categories of vegetation can be seen in the area. Approximately 768 plant species have been recorded from this region so far, which constitutes about 18% flora of the state (Shah 1978). However, being a typical desert, the region is marked by sparse vegetation cover and low biomass productivity. According to Nayar & Sastry (1988, 1990) as many as 48 species of vascular plants, typical of Indian Deserts are found in the Kachchh region, which fall in one or other category of Red Data Book (RDB). Major causes of their depletion are ever increasing anthropogenic pressures, changes in land use practices and resultant alteration of natural habitats. Therefore, it becomes imperative to identify and locate populations of rare and threatened taxa in different biogeographic zones and evolve strategies for their conservation. In this paper we present the findings of a short status survey of selected RDB plants in the Kachchh deserts of Gujarat and discuss the conservation strategies.

Present Survey

Nineteen plant species categorized as 'Threatened' by the World Conservation Monitoring Centre (1994) and also listed under various threat categories in the RDB of Indian Plants (Nayar & Sastry 1988, 1990) were surveyed in the Kachchh region of Gujarat during 1998 to 2001. The localities from where these plants had been reported in the literature were revisited and known habitats were sampled for their populations. The survey was done using belt transects and circular plots (Mueller-Dombois & Ellenberg 1967, Kershaw 1973). The belt transects (1- 5 km x 6 m wide) were walked across the sampling patches along a fixed direction starting from a random point within the patch. The number of line transects depend upon the size of the patch. Along these transects the targeted species were searched. Whenever a threatened species was encountered, plant specific circular plots of varying radii (1m for herbs and 3m for shrubs and climbers) were laid to enumerate the number of individuals. In addition, site specific intensive search was made using belt transects (herb 10 x 2m and shrubs 25 x 4m) in six different directions leaving the line of movement to document the abundance of the target species.

Information on the type of habitat and perceived threats were recorded based on subjective rating (low, medium and high). The major threats identified were: Habitat degradation (grazing and soil erosion), Habitat loss (industrial and urban development, mining, agriculture expansion, encroachment), Natural factors (pest attack, low propagation) and Exploitation (extraction and cutting). Threat status were assigned (based on status within survey area) to all these species within the study area by grouping them into highly threatened (HT), moderately threatened (MT) and less threatened (LT) categories. This was done based on the number of individuals, number of habitats and locations they were found. The species with <500 individuals, present in <3 habitats and <10 locations were categorized as HT; species with 500-1500 individuals, recorded from 3-6 habitats and 10-20 locations were categorized as MT species; species with >1500 individuals, found in >6 habitats and >20 locations were classed as LT species. The total length of transects sampled in various habitats were: Wetland - 11kms, Open scrub - 40kms, Forest - 34kms, Grassland - 19kms, Borders of agricultural fields - 18kms and coastal areas - 23kms. This exercise was attempted to prioritize the species which need immediate conservation action. Sighting locations were plotted on a base map to identify the threatened botanical hotspots for *in-situ* conservation.

Results and Discussion

Abundance and distribution: The 19 species surveyed include eight herbs, six shrubs and five herbaceous climbers. Among these, *Carollocarpus conocarpus* and *Ammania desertorum* had very low numbers *i.e.* seven (3 locations) and 16 individuals (two locations) respectively and had highly restricted distribution. *Commiphora wightii* and *Helichrysum cutchicum* showed wider distribution (75 and 40 locations respectively) and had 9774 and 6586 individuals respectively (Table 1).

Table 1 : Abundance, Distribution and Local Threat Status (LTS) of Threatened Plants in Kachchh Desert

Habit: H = Herb, S = Shrub, C = Climber, HC = Herbaceous Climber
LTS: HT-Highly Threatened, MT–Moderately Threatened, LT–Less Threatened

S. N	Species	Habit	Total Abundance	# Talukas (Locations)	No. of Habitats	LTS
1	*Ammania desertorum* Blat. & Hallb.	H	16	2 (2)	1	HT
2	*Campylanthus ramosissimus* Wight	S	3240	4 (11)	4	MT
3	*Citrullus colocynthis* (L.) Schrad.	HC	1980	6 (21)	7	LT
4	*Commiphora wightii* (Arn.) Bhandari	S	9774	8 (75)	13	LT
5	*Convolvulus stocksii* Boiss.	HC	2184	5 (19)	7	LT
6	*Corallocarpus conocarpus* (Dalz. & Gibs.) Hook. f. *ex* Clarke	C	7	2 (3)	2	HT
7	*Dactyliandra welwistschii* Hk.f.	C	38	1 (4)	1	HT
8	*Dipcadi erythraeum* Webb. & Berth.	H	1555	3 (13)	7	MT
9	*Ephedra foliata* Boiss.	S	1109	4 (21)	10	MT
10	*Helichrysum cutchicum* (Clarke) Rao	H	6586	7 (40)	9	LT
11	*Heliotropium bacciferum* var. *suberosum* (Clarke) Bhandari	S	2740	5 (14)	8	MT
12	*Heliotropium rariflorum* Stocks.	*S*	*2261*	*6 (34)*	*9*	*LT*
13	*Indigofera coerulea* var. *monosperma* (Sant) Sant.	S	1887	3 (12)	8	MT
14	*Ipomoea kotschyana* Hochst. *ex* Choisy	HC	1777	4 (16)	6	MT
15	*Limonium stocksii* (Boiss.) O. Kuntze	H	405	2 (2)	1	HT
16	*Pavonia ceratocarpa* Dalz.*ex* Mast.	H	124	5 (10)	5	HT
17	*Sida tiagii* Bhandari	H	3218	5 (23)	8	LT
18	*Schweinfurthia papilionacea* (Burm. f.) Boiss.	S	136	1 (1)	1	HT
19	*Tribulus rajasthanensis* Bhandari & Sharma	H	1071	4 (16)	8	MT

Habitat Specific Distribution: These species occupied six major habitat types, of which open scrub harboured highest number (eight) of species. These species had higher abundance in this habitat (35-100% of the total population). The second highest number of species (four) was recorded from grasslands (51-82%) and three in forested (41-65%)

habitats (Figure 1). *Ammania desertorum*, *Dactyliandra welwitschii*, *Limonium stocksii* and *Schweinfurthia papilionacea* were restricted to single habitat *viz*. wetlands, agricultural and fallow lands, coastal dunes and open scrub respectively. *Heliotropium bacciferum* var. *suberosum* (90%) also showed more affinity to the coastal habitats. Low abundance of some species could be inherent and for others it may be failure of regeneration. Water availability during and after germination in desert region is uncertain, which leads to high stress and mortality of annual plants (Le Houwrou 1984, and Van Rooyen *et al.* 1991). Singh (1998) noticed low propagation of even perennials due to frequent drought and high grazing pressure in the semi-arid area of Saurashtra. It is true for arid Kachchh which experienced 14 spells of drought within 23 years *i.e.* 1972 – 1994 (Anonymous 1996).

Commiphora wightii was recorded at 75 locations, eight areas (Talukas) and mostly occupied open scrub (57%) and forest (40%) on undulating terrain (Figure 1). This being a hardy species is reported to occur on undulating terrain, loamy and gravelly soil, with shallow depth, pebbly substratum low grazing area with open canopy favoring high density (Dixit & Rao 2000).

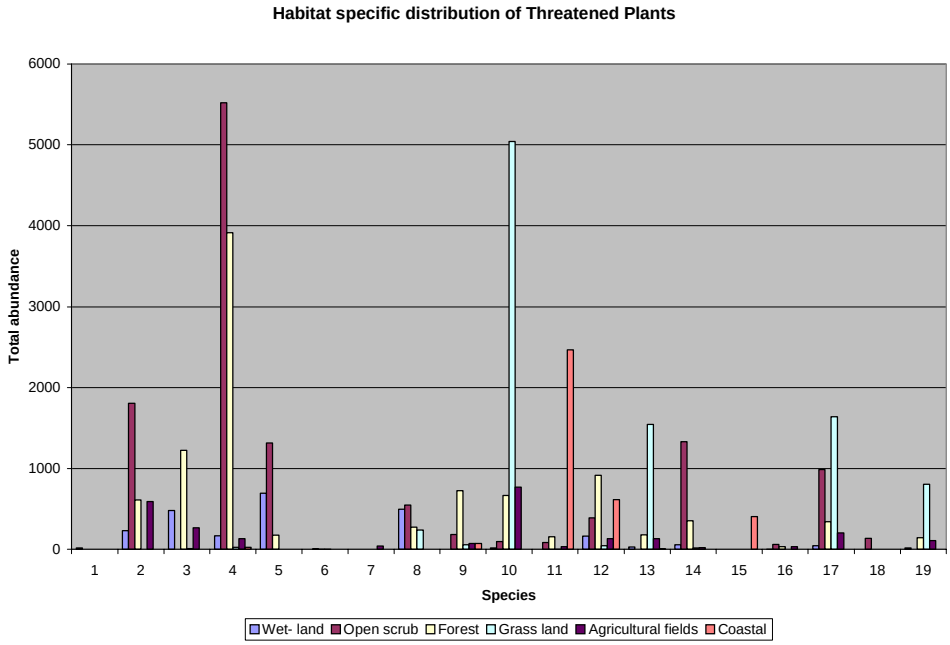

Figure 1. Habitat specific distribution of Threatened Plants. Species numbers are in the same sequence as given in Table 1.

Local Conservation Status: Based on abundance and distribution, six species *viz*. *A. desertorum*, *C. conocarpus*, *D. welwitschii*, *L. stocksii*, *Pavonia ceratocarpa* and *S. papilionacea* were found to be HT as these had low number (<500 individuals), present in <three sites and < three habitats. Seven species *viz*., *Campylanthus ramosissimus*, *Dipcadi erythraeum*, *Ephedra foliata*, *Heliotropium bacciferum* var. *suberosum*, *Indigofera caerulea* var. *monosperma*, *Ipomoea kotschyana* and *Tribulis rajasthanensis* were moderately threatened. Six species *viz*., *Citrullus colocynthis*, *Commiphora wightii*, *Convolvulus stocksii*, *Helichrysum cutchicum*, *Heliotropium rariflorum* and *Sida tiagii* were found to be less threatened (Table 1 & Figure 1).

Threats

Quantification of threats of annual plants is difficult when compared to perennials because of their smaller size and short life span. It is further complicated if it has restricted distribution and low abundance. The subjective rating of threats based on the field observation showed that except *C. wightii*, all other species faced major threat in the form of

habitat degradation due to excessive livestock grazing (Table 2). A recent study on grasslands of Kachchh estimated that out of nine Talukas, four were with very high and three with high intensity of grazing pressure (Anonymous 2004), which also induced erosion of top soil. It has been estimated that soil erosion in Kachchh ranges between 25-50% in different Talukas (Anonymous 1994).

Habitat loss is the second major threat to affect several species. This includes mining and industrial development. Nine species were under the threat of natural factors, of which *C. colocynthis* and *I. caerulea* faced lack of regeneration. However, survey of these species after rainy season would give a true picture. Rest of the seven species were affected by termite attack (Table 2). Among the assessed 19 species, 13 species are reported to be medicinally important in Kachchh (Silori *et al.* 2005). Of these, *C. colocynthis*, *D. welwistschii*, *E. foliata* and *S. papilionacea* are used at low level, while *C. wightii* is heavily exploited for local medicine. It has been reported that a mature *C. wightii* (Guggal), can produce 250-500 gm of gum (Atal *et al.* 1975) and an estimated 300-400 tones of Guggal has been sold in Bhuj every year. However, this plant was found to be widely distributed in Kachchh. Crude methods of gum extraction from younger plants (Joshi *et al.* 2004) is likely to affect its abundance in future.

Table 2 : Evaluation of Threats faced by Threatened Plants

S. N	Species	Habit	Total Abundance	# Talukas (Locations)	No. of Habitats	LTS
1	*Ammania desertorum* Blat. & Hallb.	H	16	2 (2)	1	HT
2	*Campylanthus ramosissimus* Wight	S	3240	4 (11)	4	MT
3	*Citrullus colocynthis* (L.) Schrad.	HC	1980	6 (21)	7	LT
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Threatened Botanical Hotspots: Nineteen threatened species were recorded from 337 locations covering all the nine Talukas of Kachchh district. Threatened Botanical Hotspots were identified by plotting all the 125 locations of only highly and moderately threatened species. Both HT and MT species were present in all the Talukas, except in Anjar. Among the talukas, Bhuj showed presence of 11 species at a maximum of 41 locations, which formed 32.80% of the total locations, followed by Abdasa (six species at 26 locations, forming 21%). Grouping of locations based on their distribution resulted in two threatened botanical hotspots. Of these, one hotspot is located in Abdasa taluka at the south western part. This hotspot identified as Naliya Biodiversity Reserve (NBR), is predominantly a grassland habitat, locally known as Naliya grassland. The second hotspot is located at southern part covering the area at the tri-junction of Bhuj, Mandvi and Mundra talukas, which includes the forested areas of Megpar and Dhunai villages in Mandvi, Kera and Dahisara villages of Bhuj, and Dahisara Reserved Forests (Figure 2 & Plate 15). This has been identified as Kachchh Threatened Plant Reserve (KTPR), which included 30 (46.88%) of the total 64 locations of the three talukas. Further, this area is predominantly with hilly terrain dominated by *Acacia senegal* and *A. nilotica* thorn forest interspersed with *Euphorbia cadusifolia* and *Grewia tenex* open scrub.

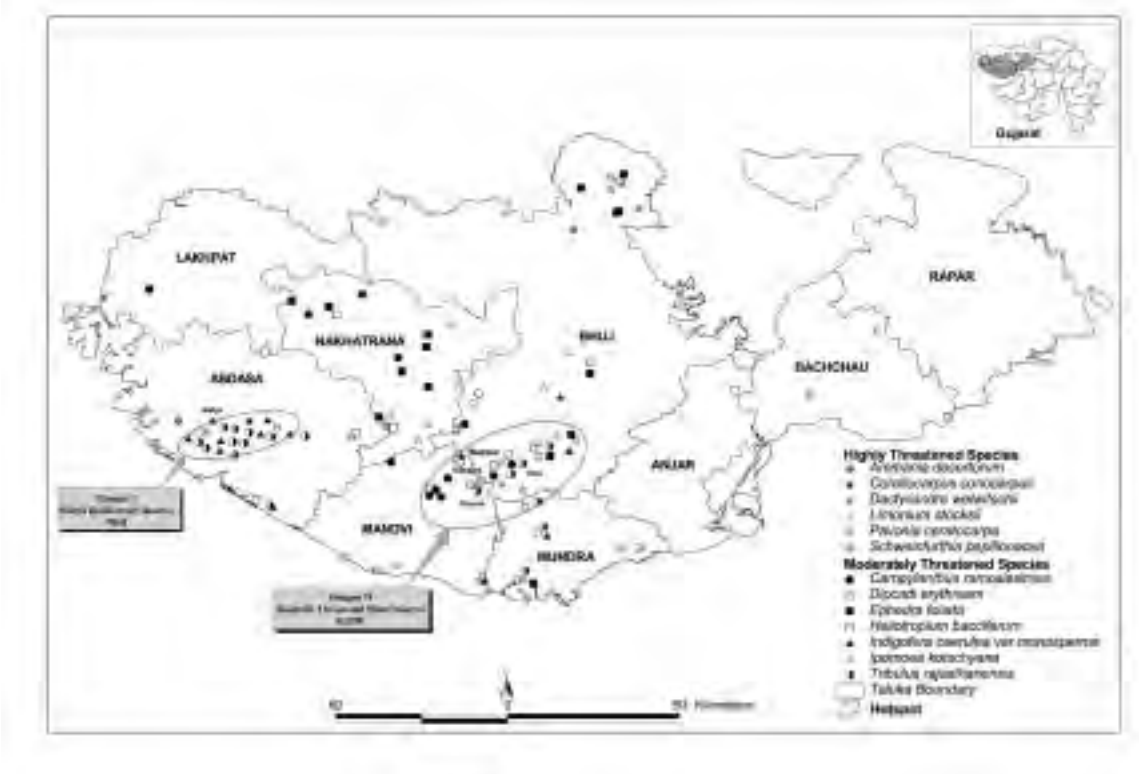

Figure 2. Distribution of Threatened Plants in Arid Kachchh, Gujarat

Conservation Strategies :

(i) Since majority of the threatened species are annuals and more susceptible to uncertain arid climate and prolonged drought, it would be necessary to carry out an intensive survey of these species following good monsoon which will give true picture of the distribution, abundance and regeneration status of these species.

(ii) The intensive survey of HT and MT species would be needed so as to identify more sites and initiate *in- situ* conservation measures.

(iii) The Naliya Biodiversity Reserve (NBR) encompasses the Naliya grassland covering roughly 100km^2 of almost continuous grassland with few shrubs (Savannah). This area needs to be brought under Protected Area Network, considering that this ecosystem itself is endangered and it is home of ten threatened animal species in addition to eight threatened plant species.

includes the environs of Megpar and Dhunai villages in Mandvi and Dahisara village of Bhuj, which includes Dahisara Reserved Forests that needs to be immediately brought under strict protection from wood cutting, livestock grazing, quarry lease (small scale mining), the major threats of the area. This can possibly be notified as a Kachchh Threatened Plant Reserve as it harbours overall nine threatened plants.

(v) Considering the rarity of these species, steps should be taken immediately to grow or propagate both the HT and MT species in botanical gardens so as to conserve them as part of *ex situ* conservation plan. In addition, propagation techniques for the species which are under heavy exploitation for enthno-medicine should be developed and the possibilities of cultivating them must also be encouraged so as to reduce the pressure on the wild population.

Plate 15
Threatened Plants of Kachchh, Gujarat

1. *Heliotropium bacciferum*
2. *Sida tiagii*
3. *Helichrysum cutchicum*
4. *Ephedra foliata*
5. *Commiphora wightii*

(vi) Awareness on the rarity and the conservation significance of the different species should be created among the locals especially the native healers involved in using these plants in Traditional Health Care System for healing various types of diseases.

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