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Distribution and Some ecological observation on Threatened plants of Western Kachchh, Gujarat

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Abstract: **The present investigation deals with some ecological observation of threatened plants with special reference to its distribution in the western Kachchh region of Gujarat. A total of 19 plant species have been reported which are categorized as threatened. Among them, one species (*Talinum portulacifolium.*) was first time recorded from wild and two threatened species *i.e*. *Limonium stocksii* and *Corallocarpus conocarpus* were first time recorded from the study area. It was also observed that mixed thorn forest habitat is a conservation significant habitat of the study area which supports maximum species which falls under the threatened category. The western part of the district is mineral rich lead to various mining activities *i.e.* large scale land denudation observed as the major threats to species population by habitat fragmentation and degradation.**

Keywords: **Threatened plants, distribution, western Kachchh, conservation.**

1. INTRODUCTION

Present day ecologists have an important task to understand the rarity of species. Regarding to the geographical distribution of such species is restricted to certain habitats; while the other relative belongs to same genus have widespread distribution have fascinated ecologists and evolutionary biologists. While on the other hand many conservation biologist warn that in coming 20 to 30 years, 25 % of the all species could be extinct (Singh, 2002), Which is induced by the incredible increase in human population with subsequent urbanization has resulted in over exploitation of natural resources, fragmentation of the habitat and rapid decrease in natural flora (Davis *et al.*, 1994, Heywood, 1995; Western, 2001and Watling & Donnelly, 2007). Such anthropogenic activities leads to the rapid extinction of plants species and Hilton-Taylor (2000), stated that the present rate of plant species extinction is one species per day which is considered as 1000-10000 fold more than the nature. Based on the same, it is predicted that 60,000 to 100,000 plants species will be disappear in next 50 years (Bramwell, 2002).

Habitat fragmentations identify as the major culprits to loss the wealth of floral diversity i.e. important species found in small patch. Such small patches of particular habitat are most vulnerable to the deterioration and various studies deals with the habitat modeling were also supports the same which impacted by demographic, environmental and genetic haphazardness (Zietsman *et al.*, 2008). Statistic (demographic) haphazardness is threats to only small population size while environmental impact is found as the most threatening factor to fragmented population from extinction (Matthies *et al.*, 2004). Thus, individual's population and meta population need to carry under the conservation efforts as the identifying those rare (Shaw *et al.*, 1997). Tenth of total recorded angiosperms of globe are facing one or other form of extinction threats and among those total 1500 species found in the India which as listed as threatened (Daniels and Jayanthi, 1996).

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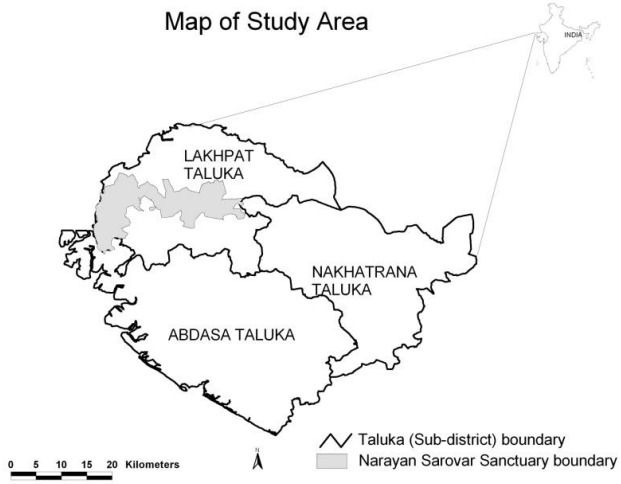
The study was very least explored to document the status of threatened plant. Thus in the present study an attempt were made to know the ecological status, distribution and threats with possible management and conservation options for threatened plants of the western Kachchh region.

2. MATERIALS AMD METHODS

Study area:

Due to its unique ecological setting and geographical situation, Kachchh is classified as biotic province "3A" -Kachchh desert of bio-geographic zone the Indian desert (Rodgers and Panwar, 1988). According to Champion and Seth (1968), a total of ten forest types are represented in and around the Narayan Sarovar Sanctuary (NSS). The study area covering over 5000 km2 area in western Kachchh region encompasses parts of Lakhpat, Abdasa and Nakhtrana talukas of Kachchh of Gujarat state. The average rainfall of western Kachchh is 350 mm per annum and most of the rainy days occur during July to September (South West Monsoon). The minimum and maximum temperature recorded is 2º C (winter) and 44º C (summer), respectively (GMDC, 2009b). As mentioned above, in western Kachchh low precipitation and poor condition of soil, exclude perennial plants species except some xerophytes and the tree species cover is comparatively less than shrubs.



Methods:

Plants under the different categories describe by the Walter and Gillett (1998), Nayar and Sastry (1988), GES, MSU and GUIDE (2002) and UNEP-WCMC (2011) with data base were considered for the existing threatened plants in study areas. A transect method were used to collect the information on the number of individuals of respected threatened plants. Hence, the quantitative assessment of the RET plant was according Misra, 1968 and Mueller-Dombois & Ellenbeg, 1974. In addition on the basis of published and unpublished literature and verbal communication with locals as used as the references to search the site-specific RET plants. At the occurrence of the each species, a circular plot of 10 m radius was laid to document the associated species. Within each sample plot the details on various ecological characteristics *i.e.* numbers of individuals of threatened species with associated species, their regeneration, threats faced by them and micro habitat with few environmental parameters (such as substratum, soil type *etc*.) were also recorded. Density and diversity of each RET plant with their preferred habitats and ecological details were also considered **(**Misra, 1968 and Mueller-Dombois & Ellenbeg, 1974).

3. RESULTS AND DISCUSSION

Results of present study were given on the species specific ecology and their distribution, which will be more helpful to suggest and design their conservation and management strategies. A total of 20 plant species recorded from the study area, which is categorized as "threatened" by Walter and Gillett (1998) and under various threats categories by Nayar and Sastry (1988) in Red Data Book of Indian plants. As discussed above total 19 RET plants recorded so far from the Kachchh district (Nayar and Sastry, 1988; Walter and Gillett, 1998; GES, MSU and GUIDE, 2003; Joshua *et al.*, 2008; and UNEP-WCMC, 2011) and during the present total 20 RET species were recorded in which one species (*Talinum portulacifolium.*) was first time recorded from the study area and Two RET species such as *Limonium stocksii* and *Corallocarpus conocarpus* were first time recorded from the study area (GES, MSU and GUIDE, 2002). *Commiphora stocksiana* is first time reported from India (Patel et. al, 2013 & Patel et. al. 2015). *Limonium stocksii*, *Dipcadi erythraeum*, *Talinum portulacifolium*, *Indigofera caerulea* var. *monosperma* and *Ipomoea kotschyana* were recorded only two or three times during the field inventory with very least number of individuals *i.e.* 10, 5, 2, 8 and 10, respectively. *Commiphora wightii*, *Helicrysum cutchicum*, *Convolvulus stockii and Heliotropium rariflorum* had wide distribution with 464, 785, 133 and 185 numbers of individuals. Various ecological and distribution details on the various species as given follow:

1. *Ammannia desertorum* Blatt. & Hallb:

A. desertorum is an annual herb belongs to Lythraceae family. It grows on the wet ground made by fresh water with loamy-clay soil. *Cynodon dactylon, Ammania baccifera, Polygonum plebeium var. indica*, *Phyla nudiflora* and *Physalis longifolia* are the major associated species which found in the vicinity of it. During the threatened plants inventory, as the species prefer the wet ground, found that species occur in the wetland habitats which may natural or man-made. Species also found near the road side which are filled by water during the monsoon. A total 13 number of individuals were recorded from the six transects. Species specific threats are habitat loss due to enhancement of the pond or wetland by digging is the major human induced threats while drought is considering as natural phenomena to the survival of it.

2. *Campylanthus pungens* O. Schwartz:

C. pungens is an under shrub belonging to Scrophulariaceae family. It grows on the gentle undulating terrain with gentle slope and eroded sand stone. The soil types which mostly prefer, is sandy and sometimes also found in gravelly substratum with silt loam soil with shallow depth. Few previous studies also reported that species occur on the sand stone (Sabnis and Rao, 1983) and lime stone deposited areas (Nayar and Sastry, 1988) and so during the field work, sometimes white flower observed due to the chemical composition of the substratum**.** While sand stone and lime stone are important minerals of the study area, Hence species faces the threats of extinction due to mining activities for such minerals (Joshua *et al.*, 2008). Apart from this, termite attack was also found as natural threats. *Acacia senegal*, *Commiphora wightii*, *Prosopis cineraria*, *Zizyphus nummularia*, *Grewia tenex* and *Dicoma tomentosa* are the major associated species. Habitat based assessment shows that, 40.44 % occur in the mixed thorn forest followed by the *Prosopis* forest with 30.33 %. It is also found in the *Acacia* forest, sparse grassland and *Euphorbia-Salvadora* forest with few individuals.

3. *Citrullus colocynthis* (L.) Soland:

C. colocynthis is perennial prostate trailing species belongs to Cucurbitaceae family. It generally grows in the sandy soil and such soil generally found in the dried streams and river bad and also found in the agriculture land *i.e.* it prefer the flat to gentle undulated terrain with shallow to deep soil. Other species of Cucurbitaceae family such as *Cucumis callous* and *C. prophetarum* are generally found in the close vicinity. Bhadari *et. al.* (1996) reported this species form the sand dunes and sandy ground of Rajasthan and such habitat heterogeneity leads to the difference in population size. GES *et al.* 2002 recorded this species throughout the Gujarat and Shah (1978) also found in large or small patches as weed in wasteland and fallow agriculture land. Maximum occurrence of this species is from agriculture and mixed thorn forest (35.29 %) followed by *Euphorbia-Salvadora* forest (23.52%). As sand generally use in the construction work, overexploitation of such mineral leads to the habitat loss and seeds also important for oil yielding which used for medicinal purpose.

4. *Commiphora stocksiana* Engl:

C. stocksiana is an important medicinal plants locally known as" Mitha Gugal" in Kachchh district. This species has very limited distribution in district as well as country. The species first time reported by stocks in 1847 from Baluchistan in Pakistan. Later few more worker also confirm its distribution from the type locality only. Recently Patel et. al. [] reported this species from the Lakhapat taluka in Kachchh district. This is the only single wild locality of this species in India, however the Baluchistan is adjoining part to the Indian border and no any other locality has been reported. Hence this is will be endemic and critically endangered species.

C. stocksiana is a balsamiferous small tree or shrub in hilly and moderately undulating terrain. It tree is prefer to grows in substratum of rocks or boulders and in sandy soil (Enright et. al, 2005). The species is generally found in the tropical thorn forest especially in the area of mixed thorn forests. The species is generally distributed in calcareous rocks and dry river beds of coastal regions. The tree species like *Acacia senegal*, *Euphorbia caducifolia*, *Grewia spp*. and *Salvadora spp.* are the associated species for it.

Due to the presence and extraction of oleo-gum-resin having important medicinal properties, this species facing the threats of over-exploitation as well as habitat loss, alteration and fragmentation (Patel et. al. 2015).

5. *Commiphora wightii* (Arn.) Bhandari:

C. wightii is a highly medicinal important plant of the arid and semi arid Indian subcontinent has wide distribution among Gujarat (GES *et al.*, 2002; Parmar, 2003). This plant found in the various diverse micro-habitats *i.e.* from gentle to moderately undulating terrain of river of stream bank with soil, pebbly, gravelly and rocky substratum with composition

of loamy and sandy soil. In India, it is found on the hilly and coastal sandy tract of arid region, where the rainfall and temperature ranging from 225-500 and 0-48°C, respectively (Hocking, 1993). Rocky hillocks with gravelly soil (Sabnis and Rao, 1983) and open dry hills and piedmonts (Bhandari, *et al.*, 1996) are also identified as their habitat. In the supports of above statement, during field work found that the regeneration only occurs in the crevices of rocks where sandy loamy soil quickly watered with rain. Dixit and Rao (2000) stated that as the hardy nature of the species; occur on the undulating terrain, loamy and gravelly soil with shallow depth, pebbly substratum and low grazing area with open canopy favoring high density.

During the field inventory, found that mixed thorn forest recorded with maximum 38.57 % of total followed by the *Acacia* forest (21.12%) and *Euphorbia-Salvadora* forest (20.47%). Remaining four habitat have very least occurrence (<5%). Heavy mounting pressure on by over tapping with un-scientific method for oleo-resin (guggul gum) is found as the major threat to the loss of its population. Apart from this, habitat destruction, seed viability and germination also found as threats to its survival (Parmar, 2003).

6. *Convolvulus stockii* Boiss*:*

C. stockii is an herb of Convolvulaceae family was encountered with total 133 individuals from different five habitats. *Aristida spp*. has grater association with this species. Occurrence of this species is more site specific *i.e.* hilly undulating terrain with gentle slope and pebbly substratum with dense or sparse cover of grass (*Aristida spp.*). it grows on the loamy soil with shallow to moderate depth and such observation was also made by earlier researches (Sabnis and Rao, 1983; Bhandari *et al.*, 1996). More than 70% of the total individuals occur from mixed thorn forest while remaining all have very least representation of it. As pebble and gravel are going to be use in the linear developments, mining of it leads to the destruction of habitat which is found as the major threats to its existence.

***7. Corallocarpus conocarpus* (D. & G.) Cl:**

C. conocarpus is a climber belongs to the Cucurbitaceae family. Previously this species was recorded from Mandavi taluka and so far not been reported from western Kachchh (GES *et al.*, 2002). This species has been reported from total four habitats with total 36 individuals and agriculture (hedge) have been reported with maximum number of individuals (n=15). This species have been reported under from gentle to flat terrain with loamy clay soil with very few amount of boulders. *Zizyphus nummularia*, *Euphorbia caducifolia* and *Capparis decidua* are the most used host species for this climber. Maximum number of individuals was recorded on the *Zizyphus nummularia* from agriculture hedge near Vayor village of Abdasa taluka. Thus, Agriculture represents the 41.66 % of occurrence followed by *Euphorbia-Salvadora* forest while dense grassland and mixed thorn forest supports 16.70% and 8.33 %, respectively. Agricultural encroachment was found as the major threats and mining based industrial develop was identified as subsidiary threats to its existence by habitat loss.

8. *Dactyliandra welwitschii* Hk. F:

D. welwitschii is a climber of Cucurbitaceae family which has wide habitat distribution *i.e.* recorded from six habitats with total 65 individuals. Substratum of sandy loam soil with shallow to moderate depth of gently undulating terrain with flat to gentle slope is found the habitat characteristics for this species. Mixed thorn forest supports the 23.08% of total occurrence while *Acacia* forest, sparse grassland, *Euphorbia-Salvadora* forest and agriculture habitats have even distribution ranging from 15% to 18 %. Host species are *Zizyphus nummularia, Capparis decidua*, *Euphorbia caducifolia, Salvadora oleoides* and *Prosopis juliflora* also found. As above mention host species have been found on the agriculture hedge, previously same observation was made by (Hook, 1871 and Bhandari, 1996). Loss of host species by illicit cutting for charcoal making is found as major threat.

9. *Dipcadi erythraeum* Webb. & Berth:

This is an herb with pseudo-bulb belongs to Liliaceae family. This species has been reported from only one habitat among total studied with only five individuals from two location of *Acacia* forest habitat. This species mainly found in the gentle to moderate undulating terrain with pebbles and boulders as substratum with loamy sand soil with shallow depth. Once it was also reported from rocky hills which sandy soil. *Aristida spp*., *Cymbopogon spp*. and *Indigofera cordifolia* are the associated species. Along with associated species, this one grows generally after immediate rain and this observation had been also noted by Joshi (2002) and Cooke (1958). Thus, pattern and periodicity of rainfall is affecting the growth. Apart from this natural phenomenon and over grazing were also found as a threats.

10. *Ephedra foliata* Boiss. & Kotschy ex Boiss:

E. foliata is a straggling shrub belongs to Gnetaceae Family of Gymnosperm and it only Gymnosperm species found as wild in Gujarat. This species was mostly encountered from the bottom of hills to moderately undulating terrain with has gentle to moderate (in case of river bank) slope and soft layer of soil which consist of sandy loam type of soil with moderate depth. *Salvadora oleoides*, *Acacia senegal*, and *Euphorbia caducifolia* were found as the key host species. Among the total occurrence of species, 41.93 % were recorded from mixed thorn forest followed by *Euphorbia-Salvadora* forest (30.64%) and *Acacia* forest (19.35%). Previously, Bole and Pathak (1988) recorded this species from sandy, gravelly or even rocky area and also from agriculture area. An observation was made that grazing animal like camel feed on it and agriculture expansion by converting of undulating terrain to flat; are the major cause to loss of its population.

11. *Helicrysum cutchicum* (C.B.CI.) Rolla Rao et Des:

It is an endemic herb, has restricted distribution to Kachchh and some portion of Saurashtra (GES *et al.*, 2002 & Rao and Deshpande, 1968). This species have been found as well adapted to the arid or semi arid climatic condition and so during field work found from all studied eight habitats. On the flat and gentle undulating terrain with gentle slope and clay and sandy soil is the topographic characters of its presence. Nayar and Sastry (1988) were reported from slope of rocky hillocks, Kothari (1987) observe this species among grass on slope of rocky hillocks and dry riverbed. While Joshi (2002) stated that it is commonly found in the grasslands of Kachchh. Among total recorded 785 individuals, 32.87 % recorded from sparse grassland followed by *Acacia* forest, mixed thorn forest and *Prosopis* forest with 18.85%, 16.30% and 14.77%, respectively. Thus the previous observation on the occurrence and also the present investigation, found that the sparse grassland is the potential habitat for it but the over grazing is found as the major threat while *Prosopis* forest also supports quite good number of individual, thus the invasion may also have negative impact on its population.

12. *Heliotropium bacciferum* Forsk. var. *suberosum* (Clarke) Bhandari:

This is herbaceous species of Boraginaceae family which have restricted distribution among Kachchh, Saurashtra and North-East Rajasthan in India **(**GES, *et al.*, 2002 & Watler and Gillett 1998). This species mainly found on the sandy soil and sometime little amount of loamy soil. It grows on the flat to gentle undulating terrain with moderate soil depth. Areas in the close vicinity of coastal region (Joshua *et al.*, 2008) and fallow agriculture land have been found as the good location for its presence. Among the total recorded, 55.40 % were reported from agriculture followed by mixed thorn forest and remaining three habitats have less than 10% representation. Habitat loss is found as the threats to its existence.

13. *Heliotropium rariflorum* Stocks:

This is also an herb of Boraginaceae family which has moderate affinity to the saline soil or coastal area (GES *et al.*, 2002). This species had been recorded from the wide range of topographic condition *i.e.* observed on the flat area and gentle to moderate slope with shallow depth of sandy soil. Above mention topographic condition occupying the vast area of study area and thus this species has also the wide spread among studied habitats *i.e.* among the total studied eight, seven habitats represent its presence. A total 185 individuals have been recorded in which 32.97 % recorded from mixed thorn forest followed by sparse grassland with 28.11 %. Agriculture and *Acacia* forest have moderate presence with 16.75% and 10.27% of total recorded. While *Euphorbia-Salvadora* forest, *Prosopis* forest and wetland represent less than 10% of its total occurrence. Invasion of *Prosopis juliflora* and over grazing have been reported as threats.

14. *Indigofera caerulea* Roxb. var. *monosperma* (Sant.) Sant:

This species have been found as the bushy shrub or under shrub belongs to Fabaceae family. During the field work, found this species from only three locations with very few numbers of individuals. The topography of those locations was flat terrain with hard soil layer and soil type was sandy and clay which had quite good soil depth. Under such topography, this species had been reported from mainly three habitats such as sparse grassland, *Acacia* forest and *Euphorbia-Salvadora* forest with 62.50%, 25 % and 12.50% of representation of total recorded population. Previously it was reported from sandy coastal area of Saurashtra and hard to gravelly soil of arid regions of Kachchh (Sabnis and Rao (1983); Nayar and Sastry, 1988). As the species have the good representation in sparse grassland and such habitat facing the threats of over grazing, species also concerning same threats.

15. *Ipomoea kotschyana* Hoc. ex Choisey:

A prostate herb belongs to Convolvulaceae family. This species had been reported from only one location with 10 individuals only. This species had found near the dumpling site of lignite mining and the soil was the run down from the

dump and thus that soil in mixed form of clay and sandy. That location represents the sparse grassland habitat. Joshi (2002) reported this species from flat terrain with sparse or dense grass cover while Sabnis and Rao (1988) stated that this is found in the sandy and hardy gravelly soil and also from fallow agriculture land (Raole, 1993). Rapid change in the land use pattern found as the major threat.

16. *Limonium stocksii* (Boiss.) O. Ktze:

L. stockii is a suffrutescent herb of Plumbaginaceae family. This is the plants have been reported from the two location of mixed thorn forest habitat with total 10 individuals. As this species is an indicator of saline condition (GES, *et al.*, 2002) found in the vicinity of the coastal belt and also reported from Saurashtra coast (GES, MSU and GUIDE, 2002). This species occur on the lime stone deposited areas where the terrain is flat and top layer is hard made of limestone. *Urochondra setulosa* and *Pluchea* spp. have close association with this species. During the field observation, *Campylanthus pungens* had been also found in the vicinity of it. in regards of its population decrease; observation had been made heavy wind velocity and other factors has negative impact on pollination hence during the field work species found in flowering stage but never find in the fruiting stage. Apart from this natural phenomenon, as lime stone is an important mineral for cement industries, mining of it also leads to loss of habitat.

17. *Pavonia ceratocarpa* Mast:

P. ceratocarpa is a perennial herb and sometimes like as under shrub belongs to the Malvaceae family. This species had been observed in the two habitat types with total 11 numbers of individuals. *Capparis decidua*, *Indigofera cordifolia* and *Cymbopogon spp*. are the associated species. Gentle to moderately undulating terrain with sandy loam soil and gravelly substratum with shallow depth is the topography characteristics. Generally it prefer the moist area *i.e.* found in the beneath of bushy shrub species. Mixed thorn forest represents the 63.64 % of its total while remaining was recorded from *Prosopis* forest. Previously it was reported from hillocks with hard gravelly soil during monsoon (Sabnis and Rao, 1983; Joshi, 2002 & GES *et al*., 2002). Agriculture encroachment was found as the threat.

18. Sida tiagii Bhandari:

S. tiagii is an herbaceous under shrub belongs to Malvaceae family, had been located from the total six habitats with 71 individuals. This species prefer the flat terrain with hardy soil substratum which consists of sandy soil and little amount of clayey soil and the depth of soil is quite more. On the above mentioned topography, species has the maximum occurrence from mixed thorn forest with 43.66% of total followed by *Euphorbia-Salvadora* association with 36.62%. Remaining four habitats *viz*. *Acacia* forest (4.22%), agriculture (1.40%), dense grassland (8.45%) and *Prosopis* forest (5.63%) represent the quite low population. Earlier it was noted that this species grow on the open sandy ground (Bhandari, 1996). During the course of field work, found that species has been declining due to the associated activities of deforestation for fire wood collection and sand stone mining.

19. *Talinum portulacifolium* (Forsk.) Aschers. & Schweinf:

This is the fleshy hanging shrublet belongs to Portulacaceae family, is first time recorded from the study area, while previously reported from the botanical garden of M. S. University, Baroda (GES, et al., 2002). Only single time encountered with only two individuals from the study area. This species found on the rocky area with steep slope and crevice-based soil substratum. The substratum was mainly consisting of lime stone and sandy soil. This species encountered only from the mixed thorn forest and thus it is difficult to say about its habitat preference or about its population in the study area. Thus it is an important species which is occur in wild, to pay special attention to its conservation and regeneration in natural habitat.

20. *Tribulus rajasthanensis* Bhandari et Sharma:

T. rajasthanensis is a prostate herb belongs to the Zygophyllaceae family, reported from the total five habitats of study area. A general topographic characteristic of the habitats was flat terrain to rocky plateau of sand stone with sandy and clayey soil with moderate soil depth, which is also previously reported by Bhandari (1996). Habitat wise population shows that species prefer flat terrain with sandy soil with little amount of clay means agriculture area reported with 40 % of total followed by *Prosopis* forest with 30%, while remaining three habitats represents less than 10 individuals. Industrial development reported as severe threat found as major threats due to maximum agriculture lands are going to convert into industrial development.

4. CONSERVATION RECOMMENDATIONS

Present study deals with the species specific observation and distribution of threatened plants of western Kachchh region *i.e.* topographical situation of each habitat and composition of associated species are two important characteristics for distribution of each species. As discussed, the depletion of water table and erosion of soil with deficiency in soil nutrients also leads to decline the population size of such species and its further decline the habitat. Water and grazing have the positive co-relation which also leads to significant impact on threatened plants (McIntyre and Lavorel, 1994). Habitat wise and over all ecological distribution of threatened plants species reveals that *Commiphora wightii*, *Helicrysum cutchicum* and *Heliotropium rariflorum* are the most abundant and wide distribution species with significance population size in study area. While *Dipcadi erythraeum* and *Indigofera caerulea* var. *monosperma* and *Talinum portulacifolium* are very rare species and distributed with very few localities in study areas.

Habitat wise distributions of such threatened plants suggest that, mixed thorn forest habitat was most conservation significant habitat which supports 15 threatened plants among 19. *Acacia* forest and *Euphorbia-Salvadora* forest also supports more 60% of total recorded threatened plants from study area. Apart from this, these three habitats and sparse grassland also support the good population of recorded threatened plants. *Prosopis* forest also supports the more than 50% of total recorded threatened plants and thus it is observed that Invasion of *Prosopis juliflora* in other forest area is still going and they are facing the problem of extinction. Wetland habitat supports only three threatened species with only 25 individuals but it is the only habitat for *Ammania desertorum* and thus it has high conservation significant. Including this *Dipacdi erythraeum, Ipomoea kotschyana, Limonium stockii* and *Talinum portulacifolium* have been also occur in the single habitat, which suggest conservation of their respected habitat for the survival of them.

Among this total 19 species, 12 species recorded as medicinally important **(**Silori *et al.*, 2004; Joshi, 2002; Patel *et al.*, 2010; GUIDE 2009) and among that *Commiphora wightii* is the heavily exploiting for local medicinal purpose while remaining 11 species have been use occasionally. Mature *C. wightii* can produce 250-500 gm gum (Atal *et al.*, 1975) and estimated production of guggal gum from Kachchh district is 300-400 ton per year, but as discussed above un-scientific method of collection from younger plants (Parmar, 2003 and Joshi *et al.*, 2004) is major threats to its population. National and State Medicinal Plants Board have been carried the *C. wightii* under species for harvesting for commercial purpose by considering their high medicinal value, sponsored various efforts on the *in-situ* and *ex-situ* conservation and management.

During the survey, certain area have been identify as the potential site for the conservation of threatened plants in Natural habitat are the surrounding areas of *Akri*, *Khanot, Fulra, Maldo, Mudhavay*, and *Siyot* (in the revenue boundaries) are potential with good population size and have been carried under species conservation to conserve the natural and unique habitats.

Apart from this all area fall under and in close vicinity Narayan Sarovar Wildlife Sanctuary (NSS) supports the 14 species of threatened (Pardeshi *et al.*, 2010). Including this protected forest area, various RFs (Reserve Forest) like Ratipar, Gugariyani, Chakrai, Mindhiyari, Kaniyari, Maniyara and Khirsara with their adjoining area are also supporting the good population of threatened plants and need to conduct species specific survey. Among these all protected areas, various microhabitats of certain threatened plants should be protected by green fencing of thorny indigenous species like *Euphorbia caducifolia* and *Balanites aegyptica*.

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