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Habitat alteration and floristic changes in and around Harni pond Baroda, India

MONA DAVE & N.S.R. KRISHNAYYA*

Ecology Lab., Department of Botany, Faculty of Science, M. S. University Vadodara – 390 002, Gujarat, India

Abstract: Fragmentation of habitat is one of the major reasons for altering the vegetal cover across different scales. The present study aims to focus on the changes occurred in the overall vegetal cover and floristic composition in and around Harni pond at Baroda due to the impact of anthropogenic pressure over the past 45 years. It documents the existing vegetal cover and compares the shifts in the density and diversity of plant species documented earlier. Vegetal cover in and around the pond was monitored for a period of 2 years (2000-2002). The plants documented were compared with that of a previous study carried out in 1957. The earlier study documented a total of 158 angiosperms of 48 families. In the present study, out of these 158 initially documented species, a total of 113 species belonging to 46 families were relocated and a new documentation of 28 angiosperms belonging to 15 families was made from the study area. A good number of plants with lesser density have undergone local extinction and the population of commonly occurring plants has shown a reduction. Notable reason behind the diversity decline is the high reduction in seed bank of pond area. Few species with larger densities disappeared. The disappearance was more in species with low density. Some species maintained similar numbers irrespective of habitat variation. Results are discussed in the light of habitat alteration and vegetal cover variation.

Resumen: La fragmentación del hábitat es una de las principales razones de la alteración de la cubierta vegetal a través de diferentes escalas. El presente estudio se enfoca en los cambios ocurridos en la composición florística general de la cubierta vegetal en y alrededor del estanque Harni en Baroda debidos al impacto de la presión antropogénica en los últimos 45 años. Se documenta la cubierta vegetal existente y se comparan los cambios en la densidad y diversidad de especies de plantas documentadas previamente. La cubierta vegetal en y alrededor del estanque fue monitoreada durante un periodo de 2 años (2000-2002). Las plantas documentadas fueron comparadas con las de un estudio previo realizado en 1957. El estudio anterior documentó un total de 158 angiospermas en 48 familias. En el presente estudio, de ese total de 158 especies documentadas inicialmente, 113 especies en total pertenecientes a 46 familias fueron localizadas de nuevo; además, se documentaron por primera vez para el área de estudio 28 angiospermas pertenecientes a 15 familias. Un buen número de plantas con densidades bajas se han extinguido localmente y las poblaciones de plantas comunes mostraron reducciones. Una razón notable del decremento en la diversidad es la gran reducción en el banco de semillas en el área del estanque. Pocas especies con densidades grandes desaparecieron. La desaparición fue más común en especies con bajas densidades. Algunas especies mantuvieron números similares independientemente de la variación del hábitat. Los resultados se discuten a la luz de la alteración del hábitat y la variación de la cubierta vegetal.

Resumo: A fragmentação do habitat é uma das principais razões para a alteração do coberto vegetal ao longo de diferentes escalas. O estudo actual tem por objectivo focar as mudanças ocorridas na composição da cobertura florística global no e ao redor do lago Harni em Baroda devido ao impacte das pressões antropogénicas ao longo dos últimos 45 anos. Ele documenta a cobertura vegetal existente e

**Corresponding Author*

compara as mudanças na densidade e diversidade das espécies vegetais documentadas anteriormente. A cobertura vegetal no e à volta do lago foi monitorizada por um período de 2 anos (2000 – 2002). As plantas documentadas foram comparadas com as do estudo anterior levado a efeito em 1957. O primeiro estudo tinha identificado um total de 158 angiospérmicas de 48 famílias. No estudo actual destas 158 espécies inicialmente inventariadas, um total de 113 espécies pertencendo a 15 famílias foram identificadas na presente área de estudo. Um bom número de plantas com menor densidade sofreram uma extinção local e a população das plantas ocorrendo comummente mostram uma redução. Uma razão forte por detrás deste declínio da diversidade é a elevada redução do banco seminal na área do lago. Poucas espécies com grandes densidades desapareceram. O desaparecimento foi mais elevado nas espécies com menor densidade. Algumas espécies mantiveram números similares irrespectivamente das variações do habitat. Os resultados são discutidos à luz das alterações do habitat e das variações do coberto vegetal.

Key words: Habitat alteration, anthropogenic pressure, fragmentation, pond ecosystem, diversity decline.

Introduction

Species diversity varies greatly through space and time (Robin & David 2001). Disturbance is widely believed to be one of the main factors influencing variation in species diversity (Noss 1996). Disturbance is a discrete event that abruptly destroys or displaces individuals, by directly or indirectly changing the availability of substrate and/or other resources and creates an opportunity for new individuals to become established (Robin & David 2001). Each landscape element is subjected to specific disturbances by management such as cultivation, trampling and mowing as well as abandonment (Kitazawa & Ohsawa 2002). Various habitats can be regarded as spatially and temporally dynamic patches of vegetation being subjected to diverse human interference (Bhuju & Ohsawa 2001). At a landscape level, disturbance leads to environmental heterogeneity and/or patchiness of habitats, and promotes species packing in an area. That human activities can decimate or impoverish local and regional biota is indisputable (Cane & Tepedino 2001). Humans have altered ecosystems to varying degrees and the resulting array of natural, semi-natural and human made ecosystems within a landscape can be conceived as constituting both a readily measurable gradient of land use and a more complex gradient of anthropogenic effects. Change is a universal attribute of earthly environments and is immutably intertwined with processes responsible for the origin and evolution of life on this planet (Risser 1987). Present levels of anthropogenic activities are rapidly altering natural habitat giving almost no time to local biota to develop adaptations. This results in irreversible variation in existing vegetal cover. A number of studies have sought to consider the relationship between species distributions and habitat fragments (Opdam *et al.* 1985; Hinsley *et al.* 1996; Skidmore *et al.* 1996 & Fitzgibbon 1997). The present study aims to focus on the changes that occurred in the overall floristic composition growing in and around Harni pond at Baroda due to the impact of anthropogenic pressure over the past 45 years. It documents the existing vegetal cover and compares the shifts in the density and diversity of plant species documented by Phatak & Satakopan (1957).

Materials and methods

The work of Phatak & Satakopan (1957) was taken as a base line data for the present study. In the past half a century, the area has undergone changes pertaining to urbanization and other anthropogenic activities, affecting the vegetation growing in and around the pond area. The work has been carried out at Harni pond, situated north east of Baroda district, Gujarat state (21-23° north latitude and 73-74° east longitude, Alt. – 35.75 m). The pond is perennial and the water level recedes considerably during summer. The bed is composed of clay and silica. Initially, the pond area com-

prised of ~19 hectares, which is now reduced to ~14 hectares (Fig. 1). The main reason behind the reduction of the area was due to siltation, encroachment, etc. Every year, the dried soil beds of ponds in summer are continuously excavated for the brick preparation leaving a large area exposed and devoid of vegetation. In monsoon, the allocation of water in the pond area becomes uneven. Major portion of rainwater gets accumulated in the newly excavated areas of the pond with minimum population of hydrophytes. The hydrophyte population is now seen restricted to small fragmented ditches scattered in the entire area of pond (Fig. 1).

Vegetal cover in and around the pond was monitored for two years (2000 – 2002). Fortnightly field visits were made to monitor two consecutive cycles of herbaceous vegetation. Plants collected were brought to the laboratory and were identified with the help of The Flora of the Presidency of Bombay (Cooke 1908) and The Flora of Gujarat State (Shah 1978). They were also compared with the herbarium collections of Phatak & Satakopan (1957). The list of plants made was compared with that of Phatak & Satakopan (1957) to find out any kind of variations in floristic composition due to habitat alterations. The density status of the plants was evaluated through visual observations to have commonality with the previous study.

Result and discussion

The earlier study (Phatak & Satakopan 1957) documented a total of 158 angiosperms belonging to 48 families. In the present study, out of these 158 initially documented plants, a total of 113 species belonging to 46 families were relocated and new documentation of 28 angiosperms belonging to 15 families were made from the study area.

Table 1 contains the list and the density status of plants documented both in 1957 & 2002. Table 2 contains the list and density status of new documented plants in 2000 – 2002. Fig. 2 gives the comparative account of the variation in the local densities of located plants compared to the earlier documented plants.

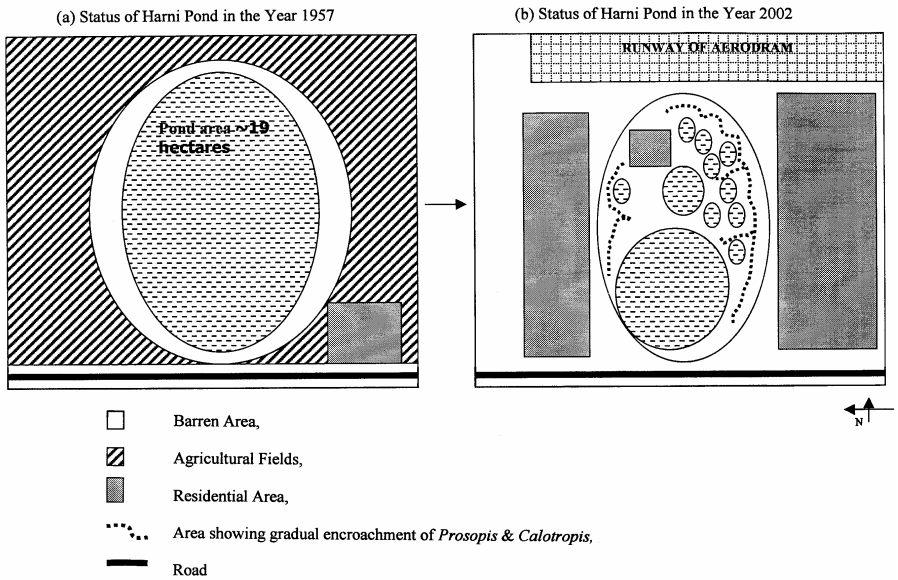

Fig. 1. Status of Harni Pond in 1957 and 2002; (a) The picture evidencing the pond status in 1957. The unremitting pond area surrounded by agricultural field and a small residential area is cornered to the right of the pond. (b) Presently (2002), the entire pond of ~19 hectares in 1957 is now reduced to ~14 hectares and fragmented into small ditches of water. The surrounding agricultural coverage is rehabilitated into residential area. The figure also demonstrate gradual encroachment of scrub vegetation inside the pond area.

Table 1. List and the density status of plants documented in 1957 & 2000 – 2002; (A = Rare, B = Not Common, C = Common, X = Locally extinct) (+) Plants showing increase in density, (*) plants showing decrease in density, (●) plants showing constant density, (**) plants locally extinct.

Plant Name and Family	Density status 1957	2000 – 02
Menispermaceae		
+ *Cocculus villosus* DC.	A	C
** *Tinospora cordifolia* Miers	A	X
Nymphaeaceae		
● *Nelumbium speciosum* Willd.	B	B
● *Nymphaea nouchali* Burm.	C	C
● *Nymphaea stellata* Willd.	A	A
Papaveraceae		
+ *Argemone mexicana* L.	B	C
Violaceae		
* *Ionidium suffruticosum* Ging.	B	A
Polygalaceae		
* *Polygala erioptera* DC.	A	B
Caryophyllaceae		
** *Polycarpon indicum* Merril.	C	X
Portulaceae		
* *Portulaca oleracea* L.	C	B
Elatinaceae		
● *Bergia odorata* Edgew.	C	C
Malvaceae		
** *Hibiscus sabdariffa* L.	A	X
● *Sida acuta* Burm.	C	C
** *Sida rhombifolia* Mast.	B	X
** *Sida spinosa* L.	C	X
* *Sida veronicifolia* Lamk.	C	B
** *Urena lobata* L.	A	X
Sterculiaceae		
● *Melochia corchorifolia* L.	B	B
Tiliaceae		
● *Corchorus aestuens* L.	C	B
● *Triumfetta rotundifolia* Lamk.	C	B
Zygophyllaceae		
* *Tribulus terrestris* L.	C	B
Rhamnaceae		
+ *Zizyphus mauritiana* Lamk.	A	B
Vitaceae		
+ *Vitis trifolia* L.	A	B
Papilionaceae		
● *Abrus precatorius* L.	A	A
* *Aeschynomene indica* L.	C	B
* *Alhagi camelorum* Fisch.	C	A
** *Alysicarpus longifolius* Wt. & Arn.	A	X
● *Alysicarpus monilifer* DC.	C	C
● *Alysicarpus procumbens* Roxb.	B	B
** *Alysicarpus viginalis* DC.	B	X
+ *Clitoria ternatea* L.	A	B
** *Crotalaria juncea* L.	A	X
+ *Crotalaria medicaginea* Lamk.	A	B
+ *Heylandia latebrosa* DC.	A	C
+ *Indigofera cordifolia* Heyne	A	B
* *Indigofera enneaphylla* L.	C	B
** *Indigofera linifolia* Retz.	A	X
** *Indigofera trifoliata* L.	B	X
** *Indigofera trigonelloides* Jb. & S.	C	X
** *Mucuna prurita* Hook.	A	X
* *Rhyncosia minima* DC.	A	B
● *Tephrosia purpurea* Pers.	C	C
+ *Zornia diphylla* Pres.	A	C
Caesalpiniaceae		
● *Cassia occidentalis* L.	B	B
● *Cassia tora* L.	C	C
Mimosaceae		
● *Neptunia oleracea* Lour.	C	C
Lythraceae		
* *Ammannia baccifera* L.	C	B
* *Ammannia multiflora* Roxb.	C	B
Onagraceae		
* *Ludwigia parviflora* Roxb.	C	B
Cucurbitaceae		
** *Blastania fimbristipula* K. & P.	A	X
** *Luffa acutangula* Roxb.	A	X
● *Momordica dioica* Roxb.	A	A
Aizoaceae		
** *Trianthema monogyna* DC.	C	X
Molluginaceae		
● *Glinus lotoides* L.	C	C
● *Glinus oppositifolius* DC.	C	C
Rubiaceae		
● *Dentella repens* Forst.	C	C
● *Oldenlandia corymbosa* L.	C	C
● *Spermacoce hispida* L.	C	C

Table 1. Contd...

Asteraceae			
*	*Acanthospermum hispidium* DC.	C	B
*	*Blumea lacera* DC.	C	B
**	*Blumea wightiana* DC.	C	X
*	*Caesulia axillaries* Roxb.	C	A
●	*Eclipta alba* Haask.	C	C
**	*Emilia sonchifolia* DC.	C	X
**	*Gnaphalium indicum* L.	C	X
**	*Gnaphalium pulvinatum* Del.	B	X
*	*Grangea maderaspatana* Poir.	C	A
**	*Sclerocarpus africanus* J.	A	X
*	*Sphaeranthus indicus* L.	B	A
●	*Tridax procumbens* L.	C	C
*	*Vernonia cinerea* Less.	C	B
**	*Vicoa auriculata* Cass.	A	X
●	*Xanthium strumarium* L.	C	C
Gentianaceae			
**	*Enicostemma littorale* Bl.	A	X
*	*Limnanthemum cristatum* Griseb.	C	A
*	*Limnanthemum indicum* Thw.	C	B
Boraginaceae			
●	*Coldenia procumbens* L.	C	C
●	*Heliotropium scabrum* Retz.	A	A
●	*Heliotropium supinum* L.	C	C
Convolvulaceae			
●	*Convolvulus microphyllus* Sieb.	C	C
●	*Cressa cretica* L.	C	C
●	*Evolvulus alsinoides* L.	C	C
●	*Ipomoea aquatica* Forsk.	C	C
●	*Ipomoea obscura* Ker.	B	B
**	*Ipomoea pilosa* Sweet	A	X
+	*Merremia emarginata* Hall.	B	C
Solanaceae			
**	*Solanum nigrum* L.	A	X
+	*Solanum xanthocarpum* Schrad. & Wendl.	A	C
Scrophulariaceae			
**	*Celsia coromandeliana* Vahl.	C	X
*	*Dopatrium junceum* Ham.	C	A
*	*Limnophila gratioloides* Br.	C	B
**	*Lindernia ciliate* Penn.	A	X
*	*Lindernia oppositifolia* Spreng.	C	B
●	*Lindernia parviflora* Benth.	A	A
**	*Striga euphrasioides* Benth.	C	X
Lentibulariaceae			
*	*Utricularia stellaris* L.	C	A
*	*Utricularia reticiulata* Sm.	C	A
Martyniaceae			
●	*Martynia annua* L.	A	A
Acanthaceae			
*	*Hygrophila auriculata* Heyne	C	B
**	*Barleria prionitis* L.	A	X
*	*Blepharis maderaspatensis* Roth	C	B
**	*Blepharis molluginifolia* Pres.	C	X
*	*Hygrophila serphyllum* Anders.	C	A
**	*Justicia procumbens* L.	A	X
●	*Peristrophe bicalyculata* Nees	C	C
*	*Rungia elegans* Dalz.	C	B
●	*Tubiflora acaulis* Kuntz.	B	B
Verbenaceae			
●	*Phyla nodiflora* A. Rich.	C	C
Labiatae			
**	*Anisomeles indica* O. Kuntze	A	X
**	*Leucas aspera* Spreng.	A	X
**	*Ocimum gratissimum* L.	A	X
Nyctaginaceae			
●	*Boerhaavia diffusa* L.	C	C
+	*Boerhaavia repanda* Willd.	A	B
Amaranthaceae			
*	*Achyranthes asper* L.	C	B
●	*Alternanthera sessilis* R. Br.	C	C
*	*Digera arvensis* Forsk.	C	B
●	*Gomphrena celosioides* R. Br.	A	A
**	*Nothosaerua brachiata* Wight	C	X
Polygonaceae			
*	*Polygonum plebejum* Br.	C	A
Euphorbiaceae			
*	*Chrozophora prostrata* Dalz.	C	B
●	*Euphorbia hirta* L.	C	C
+	*Euphorbia microphylla* Heyne	A	C
●	*Euphorbia neriifolia* L.	C	C
*	*Euphorbia parviflora* L.	C	B
*	*Euphorbia thyamifolia* L.	C	C
●	*Phyllanthus niruri* L.	B	B

Table 1. Contd...

Hydrocharitaceae			
*	*Hydrilla verticillata* Presl	C	B
**	*Nechamandra alternifolia* Thw.	C	X
Pontederiaceae			
**	*Monochoria vaginalis* Presl	A	X
Commelinaceae			
**	*Aneilema nudiflorum* R. Br.	C	X
●	*Commelina benghalensis* L.	C	C
**	*Cyanotis axillaries* Schult.	C	X
Alismataceae			
**	*Butomopsis lanceolate* Kunth.	B	X
*	*Sagittaria guayanensis* H.&.K.	B	A
*	*Sagittaria sagittifolia* L.	C	A
Najadaceae			
**	*Najas minor* All.	C	X
Aponogetonaceae			
**	*Aponogeton monostachyon* L.	A	X
Potamogetonaceae			
**	*Potamogeton indicus* Roxb.	C	X
Eriocaulaceae			
*	*Eriocaulon quinquangulare* L.	C	X
Cyperaceae			
●	*Cyperus iria* L.	C	C
●	*Cyperus rotundus* L.	C	C
●	*Cyperus triceps* Endl..	C	C
●	*Eleocharis acutangula* Schult.	C	C
●	*Scripus articulatus* L.	C	C
*	*Scripus supinum* L.	C	A
Gramineae			
*	*Apluda varia* Hack.	C	B
*	*Aristida adscensionis* Linn.	C	B
●	*Cenchrus biflorus* Roxb.	C	C
●	*Cynodon dactylon* Pers.	C	C
●	*Dactyloctenium aegyptiacum* Willd.	C	C
●	*Echinochloa colonum* Lamk.	C	C
●	*Elytrophorus articulatus* Beauv.	C	C
*	*Hygrorhiza aristata* Nees.	C	B
**	*Iseilema anthephoroides* Hack.	C	X
●	*Paspalidium* sp.	C	B
*	*Pseudoraphis asper* Pilger.	C	A
**	*Saccharum spontaneum* L.	B	X
●	*Setaria glauca* Beauv.	C	C

Table 2. List of new documentation of plants in 2000-02 and their density status; (A=Rare, B=Not Common, C=Common)

Plant Name and Family	Density Status 2000-02
Capparidaceae	
Cleome viscosa L.	C
Gynandropsis pentaphylla DC.	B
Papilionaceae	
Desmodium triflorum DC.	C
Teramnus labialis Spreng.	B
Caesalpiniaceae	
Cassia pumila Lamk.	A
Mimosaceae	
Prosopis juliflora DC.	C
Cucurbitaceae	
Coccinia Indica Wt. & Arn.	B
Melothria maderaspatana Cog.	A
Aizoaceae	
Trianthema portulacastrum L.	C
Compositae	
Launaea nudicaulis Hk. f.	C
Parthenium hysterophorus	C
Asclepiadaceae	
Calotropis procera R. Br.	C
Daemia extensa R. Br.	C
Convolvulaceae	
Evolvulus nummularius L.	C
Ipomoea nil L.	A
Ipomoea pes-tigridis L.	B
Solanaceae	
Datura matel L.	B
Physalis minima L.	C
Withania sominifera L.	A
Amaranthaceae	
Alternanthera pungens HB. & K.	A
Amaranthus spinosus L.	C
Amaranthus viridis L.	C
Euphorbiaceae	
Croton bonplandianum Baill.	B
Lemnaceae	
Lemna gibba L.	B
Alismataceae	
Limnophyton obtusifolium Miq.	C
Cyperaceae	
Cyperus difformis L.	C

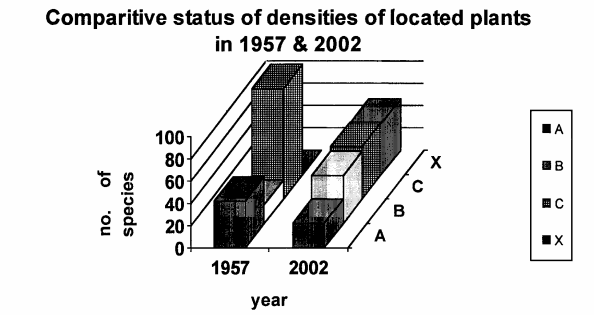

Fig. 2. A comparative account of the variation noted in the density of located plants compared to the initially documented plants; A = Rare, B = Not Common, C = Common, X = Plants lost from the area.

Results from Fig. 2 explain variation in the densities of the plants that have come up due to habitat alterations. The diversity of plants growing in and around pond area in 1957 has declined. The decline is across the board, irrespective of larger/lesser densities. A good number of plants with low density have undergone local extinction and the populations of commonly occurring plants have shown a reduction. Comparison with the previously documentation exemplify that the area has lost 46 initially documented species i.e. a total loss of 29.11%, 43 plants (27.22%) has shown decline in their density, 13 plants (8.23%) has shown increase in their density and 56 plants (35.44%) have maintained constant density.

The major reason notable behind the diversity decline is the high reduction in seed bank of the pond area. As mentioned earlier, every year in summer the dried pond soil beds are continuously excavated for brick preparation. The top layer of soil which contains the seed bank of previous season gets carried away with the exhumed soil leaving a barren trench. The process is repeated every year and has resulted in widening and deepening of the dugout area. In addition to this, a sizable portion of pond is now being utilized for human habitation (Fig. 1), which is the major reason for the reduction of pond area. As a sizable area of the excavated portion of pond is getting widened and deeper every year, during monsoon the rain water from the peripheral portion of pond gets drained into the excavated area leaving the major portion of pond area devoid of water accumulation except the small scattered ditches. Whilst the seed bank is being depleted due to excavation, the hydrophytes are cornered to small-scattered ditches. The agricultural area surrounding the pond during 1957 is now being rehabilitated into residential area, which has pressurized pond for various daily household activities of human population residing in the surrounding area and cattle grazing. The consequences of these factors are the hampered diversity and the density of the hydrophyte population growing in and around the Harni pond area.

If the habitat on a landscape is dispersed, the overall colonization rate will go down. This increases the overall mortality rate of population, which increases extinction rate (Lenore 2002). Similar observations can be seen in this study. Typical water loving/dwelling plants viz. *Aeschynomene indica, Alhagi camelorum, Neptunia oleracea, Ammannia baccifera, Ammannia multiflora, Ludwigia parviflora, Limnanthemum indicum, Limnophila gratioloides, Dopatrium junceum, Utricularia stellaris, Utricularia reticiulata, Polygonum plebejum* etc. have shown decline in the overall population, which is due to the habitat alteration.

Fragmentation, which subdivides sites and isolates populations, also induces negative effects of small population size on population viability (Young *et al.* 1996). The persistence of small, isolated populations is threatened by environmental, demographic and genetic stochasticity (Lienert *et al.* 2002). Negative effects of small population size on plant fitness can further increase extinction risks of small populations (Courchamp *et al.* 1999; Stephens & Sutherland 1999). According to Tilman *et al.* (1994), rare species are always subjected to stochastic extinction in fragmented habitat. Rare species in altered habitat will be more susceptible to extinction than common species because their population becomes smaller than those of co-occurring species of higher abundance (Kendi *et al.* 2001). If a species with a fragmented distribution suffers further range contraction, vulnerable small and/or isolated populations will go extinct first (Alejandro & Delibes 2003). Similar conclusions can be drawn from the findings of this study. Plants such as *Hibiscus sabdariffa, Urena lobata, Alysicarpus longifolius, Indigofera linifolia, Enicostemma littorale, Anisomeles indica, Leucas aspera, Ocimum gratissimum, Aponogeton monostachyon* etc. are totally lost from the area.

Interestingly, some of the commonly occurring plant species in 1957 have been subjected to local

extinction. These plants are *Polycarpon indicum, Sida spinosa, Indigofera trigonelloides, Trianthema monogyna, Blumea wightiana, Emilia sonchifolia, Gnaphalium indicum, Gnaphalium pulvinatum, Celsia coromandeliana, Striga euphrasioides, Blepharis molluginifolia, Nothosaerua brachiata, Nechamandra alternifolia, Cyanotis axillaris* etc. This supports the findings of Lenore (2002) who mentioned that, populations can only persist if long term reproduction outweighs long term mortality. As the amount of habitat in the landscape declines coupled with a larger decline in the seed bank of the area, the overall mortality rate increases relative to the overall reproduction rate.

Plants species, which requires less water to grow, have now started dominating the barren areas of the pond. Slowly and gradually, the amphibious species are being replaced by the dominating road side and waste land weeds like *Argemone mexicana, Crotalaria medicaginea, Cassia tora, Xanthium strumarium, Tridax procumbens, Solanum xanthocarpum, Vitis trifolia, Heylandia latebrosa, Indigofera cordifolia, Boerhaavia rependa* etc. Even local densities of these plants have shown a rise compared to earlier documentation (1957).

The plants which are substituting the pond dwellers are stated in Table 2. These plants have started colonizing the barren areas of pond and surrounding areas. The major species colonizing the barren area are *Prosopis juliflora* & *Calotropis procera* which are now seen occupying the peripheral portion of the pond area and slowly and gradually widening their occupancy to the central areas of pond i.e. gradually the pond ecosystem is getting rehabilitated to a scrub area.

According to Tilman *et al.* (1994), habitat destruction is the major cause of species extinctions, but few dominant species often are considered to be free of this threat because they are abundant in the undisturbed fragments that remain after disturbance. Similar conclusion can be made looking at the distribution of species viz. *Nymphaea nouchali, Coldenia procumbens, Phyla nodiflora, Boerhavia diffusa, Glinus lotoides, Glinus oppositifolius, Dentella repens, Heliotropium supinum, Bergia odorata, Cressa cretica, Cyperus triceps, Cyperus iria, Scripus articulatus, Cynodon dactylon* etc., which were dominants in 1957, are still maintaining high densities.

Finally, it can be concluded that the degradation in diversity and density of species and the overall change in the community structure can be attributed to the urbanization and anthropogenic pressure in the study area.

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