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Action-oriented Environmental Education

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ABSTRACT

Various governments as well as private bodies have incorporated environmental education in their policies and programmes. Outdoor activities provide an opportunity to explore environmental issues beyond curriculum and classroom studies. The two major types of outdoor activities are field trips and small environment related projects conducted both inside and outside the school campus. Outdoor activities such as field trips serve as an excellent learning opportunity, especially for 'urban students who otherwise have very little interaction with nature. Nature clubs started in schools encourage students to participate voluntarily. From CPREEC's experience of the "Scheme of Environmental Orientation to School Education" programme, we were able to perceive a positive shift in attitudes among students as well as teachers. This has strengthened the belief that action-oriented programmes will yield constructive results. The new century offers great challenges for those who are involved in the protection and preservation of nature and its heritage. The gloom of increasing environmental problems is being dispelled by millions who support the cause of environment. Though we have been concerned for the last four decades about environmental education in India, our efforts have not yielded the desired results. The lack of coordination of efforts is the major reason.

Introduction

The new century is more challenging for those who are involved in the preservation and protection of nature and its heritage. The gloom of increasing environmental problems is being dispelled by millions who support the cause of environment. Over the last four decades, we have been talking about environmental education. Various governments as well as private bodies have incorporated environmental education in their policies and programmes. However, this has not yielded the desired results. The lack of coordination of efforts is the major reason.

Outdoor activities provide an opportunity to explore environmental issue beyond curriculum and classroom studies. The two major types of outdoor activities are field trips and small environment-related projects conducted both inside and outside the school campus.

Outdoor activities such as field trips serve as an excellent learning opportunity, especially for urban students who otherwise have very little interaction with nature. Field trips expose them to a wide range of environmental issues such as garbage, water quality, sanitation, various types of pollution, biodiversity etc. The cost involved in these activities is low but the extent of awareness created among the students is enormous.

Nature clubs started in schools encourage students to participate voluntarily. These clubs function outside classroom and school education and are very effective in encouraging student's participation.

The Geographical Association stresses the importance of field study as "all developments in education demand that students have first hand experience of real people, real situations, real action and real places". Fieldwork provides this type of experience. Living in today's challenging world demands several skills such as observation, maintaining records, analysing data, experimenting, problem-solving, decision-making, communicating and coordinating. Participation in fieldwork develops all these skills.

Activity-oriented approach offers students

- ❖ an alternative to monotonous indoor activities
- ❖ first-hand learning experience
- ❖ an opportunity to collect original data
- ❖ to observe, record, analyse, present and interpret their own investigations
- ❖ opportunities to study various aspects of local environment
- ❖ opportunities to work in a coordinated manner using academic, practical and social skills

Activity-oriented approach

- ❖ Familiarity with a range of activities that can be conducted with students in the classroom as well as outdoors

❖ An understanding that the outdoor activity can be a powerful source of learning.

❖ To develop logistics that help make outdoor activity a success

❖ To experience nature and reflect on their own feelings about the natural environment.

Planning for environmental activities

❖ Arousing interest for participation
❖ Investigation
❖ Drawing up the action plan
❖ Implementation
❖ Evaluation study

Creation of interest

The students may suggest some local activities based on their own knowledge and observation. Any activity, which can supplement local effort in restoration of the environment, should be acceptable. Discussing these issues during regular classroom sessions may be effective to create interest among the students. Site visit with an outside expert is more beneficial in creating a desire and devising appropriate programmes.

Types of activities

❖ Awareness activities - matching colours, trust walks, habitat studies, resources checklist and weather watch.

❖ Skills based activities - measurement and monitoring like water and soil testing, noise level monitoring, habitat analysis, wealth from waste.

❖ Concept based activities – web of life, equitable distribution of resources, conservation games.

Implementation

Implementation process varies based on the type of activities. The implementation process can even continue throughout the academic year to attract the student's involvement. It is a coordinated effort both inside as well as outside the school campus. Various experts, NGOs, and local people can take part along with students depending on the type of activity undertaken.

Evaluation

Any successful project needs an evaluation. In this case, students and teachers can jointly evaluate the project. They should identify the components which yielded results and those which did not. Any suggestions or comments from the public should also be considered.

Case study

CPREEC has executed a scheme on "Environmental Orientation to School Education" supported by the Ministry of Human Resource Development (MHRD), Government of India. Under this programme, which is part of outdoor activities, CPREEC involved students in the Kanchipuram district to collect water samples and analyse them using the water testing kit developed by CPREEC to find out the quality of the water of their area.

Sample water from lakes, ponds, open wells and bore wells from various blocks of the district as well as drinking water supplied by the Panchayat were collected for testing by the students.

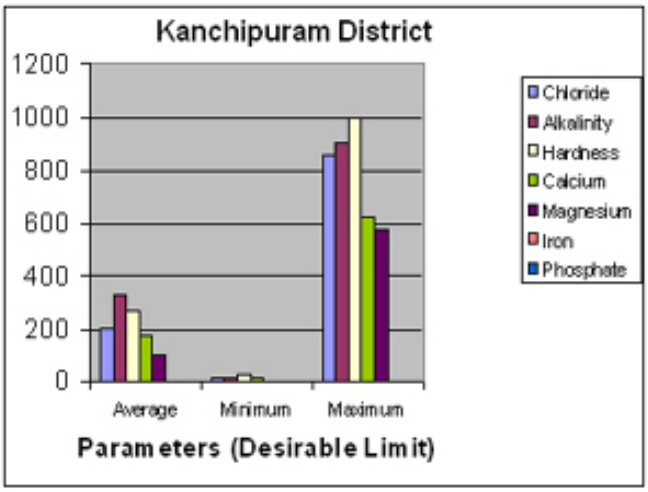
Parameters such as colour, odour, turbidity, pH, chloride, alkalinity, hardness, calcium, magnesium, phosphate, sulphate and iron were tested.

Results

The following were the results of the water analysis:

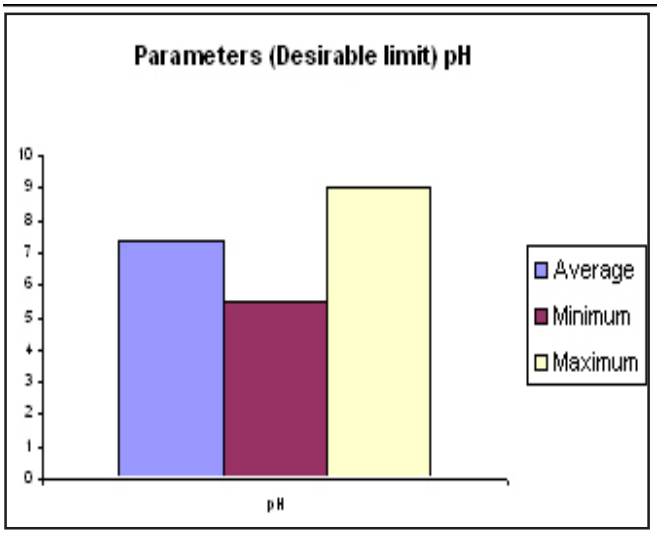
❖ The colour of water samples varied from yellowish-brown to nil colour.

❖ Majority of the water samples were odourless and some of them had an earthy smell.



❖ The turbidity was very low.

❖ The minimum pH level was at 5.50 and maximum 9.00, with 7.34 as average



❖ The chloride level was generally low and well within the permissible limit in 81% of samples tested. The minimum reading was 20 mg/l, maximum was 860 mg/land and the average was 206 mg/l.

❖ Alkalinity in most of the samples (74%) tested was well within the permissible limits with a minimum of 20 mg/l, maximum of 900 mg/l and an average of 328 mg/l.

❖ Hardness level was also within permissible limits in the district. The minimum level was 30 mg/l; the maximum was 1000 mg/l with an average of 269 mg/l.

❖ Calcium readings were also within the limits with a minimum of 20 mg/l, maximum of 620 mg/l and an average of 178 mg/l.

❖ The magnesium level was very low in all the samples analysed. The minimum was nil, maximum was 580 and average was 100 while the permissible limit is 140 mg/l.

❖ The minimum phosphate level was nil, while the maximum was 1 mg/l and average was just 0.5 mg/l equalling the permissible limit.

❖ The sulphate content was less in the samples. 85% of the samples were below the permissible limit of 200 mg/l and the balance 15% were above the limit.

❖ The iron content was very minimal in the samples. The minimum reading was nil, maximum was 1 mg/l and the average was 0.33 mg/l.

From this study, students gained valuable knowledge about water resources, water quality analysis, effects of water pollution and measures to curb water pollution. Besides, they also learnt the importance of water conservation and also obtained practical experience by testing their own drinking water for potability. The rural children found this to be a fascinating experience.

Conclusion

During the past decade, as the concept of sustainable development gained widespread recognition, the need for and importance of environmental education received world-wide acceptance. The activity-based education stresses on the importance of bottom-up process rather than top-down process. Environmental education should not be simply imposed on the learners but presented in a way that motivates the audience to listen and learn.

From our case studies, a positive shift in attitudes was discernible among the students as well as the teachers. So, environmental education should be an action-oriented and problem-solving programme to solve the environmental problems of the new century. Environmental education should also help to develop among the future citizens the ability and power to act.

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Conservation of bird population in the Vembanad-Kole Ramsar Site, Kerala

C. Sivaperuman and E.A. Jayson***

ABSTRACT

This study was conducted in the Vembanad-Kole Ramsar site, Kerala from November 1998 through October 2001. The total count method was employed to census the bird population. A total of one hundred and eighty-two species of birds belonging to 50 families under 16 orders were recorded. Of the recorded species, 100 species were residents, 81 were migrants and one was a straggler. One vulnerable and five near- threatened species were recorded. They include Pelecanus philippensis (V), Anhinga melanogaster, Mycteria leucocephala, Threskiornis melanocephalus, Aythya nyroca, and Circus macrourus. The information regarding conservation problems was obtained from a questionnaire, direct interviews and field studies. Important conservation problems were habitat alteration, poaching, fire and fishing. Solutions to mitigate these problems are discussed in this paper.

Keywords: *Conservation, Distribution, Kerala, Kole wetlands, Ramsar site.*

Introduction

Water birds are important biotic components of most of the wetland ecosystems, as they occupy several trophic layers in the food web of wetland nutrient cycles. Water birds are broadly defined as 'birds ecologically dependent on wetlands' and include recognized groups, popularly known as wild fowls, waterfowls and shorebirds. In the Asia-Pacific region, 243 bird species undertake annual migrations between the breeding areas and non-breeding grounds in their flyways. Wetlands in Kerala come under Central Asian-Indian flyway (Anon., 1996). During the annual migration, water birds halt at various sites for very short periods to rest and feed. These 'stepping stones' are essential for their survival.

The ornithology of Kerala wetlands caught the attention after Neelakantan's extensive explorations (Neelakantan, 1969 and 1970; Neelakantan et al., 1981; Neelakantan and Suresh Kumar, 1981). Uthaman and Namasivayam (1991) explored the birds of Kadalundy. The presence of only a few of the species of wetland birds of the Kole wetlands of Thrissur were reported earlier. Ravindran (1993, 1999 and 2001) had reported the presence of Glossy Ibis (*Plegadis falcinellus*), White-necked Stork (*Ciconia episocopus*) and White-winged Black Tern (*Chlidonias leucopterus*). Sivaperuman and Jayson (2001a, 2001b, 2002a, 2002b and 2003) reported the structure, species composition, diversity, population dynamics and habitat utilisation of birds of Kole wetlands. The aim of this study was to document the status of the bird community and conservation of wetland birds in the Kole wetlands of Thrissur, Kerala.

Study Area

The Kole wetlands lie between 10^0 20' and 10^0 40' N latitudes and between 75^0 58' and 76^0 11' E longitudes. The Kole wetlands with an extent of 13,632 ha are spread over Thrissur and Malappuram districts of Kerala. It extends from the northern banks of Chalakudy River in the south to the southern banks of Bharathapuzha River in the north. Eastern side of the Kole wetlands is the Thrissur town and the western side extends up to the Arabian Sea. The Kole wetlands are low- lying tracts located at 0.5 to 1 m below MSL and it remains submerged for about six months in a year. Keecheri and Karuvannur rivers bring the floodwater into the wetlands, which finally reach the Arabian Sea. The average annual rainfall is 3,200 mm and the temperature varies from 28^0 C to 31.5^0 C. Kole wetland is a part of the Vembanad-Kole wetland Ramsar site declared in the year 2002. The name 'Kole' refers to the unique type of cultivation practices carried out from December to May. 'Kole' a Malayalam work indicated bumper yield or high returns if floods did not damage the crops (Johnkutty and Venugopal, 1993).

Study Methods

The study was conducted throughout the period November 1998 to October 2001 and the bird population was estimated by total count method (Hoves and Bakewell, 1989). By this method, representative blocks were identified and birds in the blocks were counted using a telescope (15x - 45x). Four

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areas - Chettupuzha, Kanjany, Enamavu and Parappur - were selected for intensive studies.

Information regarding conservation problems was obtained through a structured questionnaire, direct interview and field studies. The questionnaire consisted of 35 questions with sub divisions seeking details about identification, profile of the respondents, crop damage, poaching, fishing and fire. The Conservation Awareness Index was formulated by adding the responses to the questions related to conservation. The answers given in favour of conservation were assigned one mark and the rest zero. The data were analysed using SPSS 10.0 statistical software package.

Results

Occurrence of species

One hundred and eighty two taxa of birds were recorded from the Kole wetlands. These belong to 50 families under 16 orders. Of the 182 species, 100 species were residents, 81 were migrants and one was a straggler. Out of these, 48 species were new records for the area. The highest number of species were recorded from Kanjany (121) followed by Parappur (117), Enamavu (94) and Chettupuzha (71). The Little Egret (*Egretta garzetta*), Cattle Egret (*Bubulcus ibis*), Little Cormorant (*Phalacrocorax niger*), Whiskered Tern (*Chlidonias hybridus*) and Indian Pond-Heron (*Ardeola grayii*) were the predominant species in the Kole wetlands.

Endemic and globally threatened species

Out of the 16 species of birds which are endemic to the Western Ghats (Jhunjhunwala et al., 2001), the Indian Rufous Babbler (*Turdoides subrufus*) was recorded from the Kole wetlands. According to Bird Life International (2001), 121 threatened bird species are present in India. Of these, six species namely Oriental White Ibis (*Threskiornis melanocephalus*), Darter (*Anhinga melanogaster*), Ferruginous Pochard (*Aythya nyroca*), Pallid Harrier (*Circus macrourus*), Painted Stork (*Mycteria leucocephala*) and Spot-billed Pelican (*Pelecanus philippensis*) were recorded from the Kole wetlands.

Socio-demographic characteristics of the respondents

Seven locations were covered by the questionnaire survey. 145 men and 10 women were interviewed during the survey (Table 1). Majority of the people surveyed were educated above upper primary school level (43%) followed by those educated above lower primary level (34%), and those above higher secondary (21%) level. Only 2% of the respondents were uneducated.

Poaching of birds

Seventy four percent of the respondents replied that the people from outside the Kole wetlands were responsible for poaching while 5% reported that the farmers of the Kole wetlands were engaged in poaching (Table 2). People informed that poachers preferred Egrets (Table 3).

Approximate number of birds killed per day in a locality was assessed during the survey. Eighty eight per cent of the people reported that up to 20 birds were killed in their neighbourhood at a stretch, whereas 7% of people reported that 10 to 25 birds were usually killed and 4% put the figure as more than 25 birds per day. Several people (89%) knew about the migratory nature of birds coming to the Kole wetlands and only a small percentage of respondents (3%) werenot aware of this fact. Most of the people (74%) were aware of the harmful effects of poaching of migratory birds. Majority of the people reported that the best way to stop poaching was by strictly enforcing the laws (49%), whereas 36% were of the view that education and awareness will reduce the problem and 14% of people voiced no opinion.

Table 1: Gender-wise distribution of respondents at different locations in the Kole wetlands

Name of the area	Number	Men %	Number	Women %	Number	Total %
Alapatt	22	15.2	3	30.0	25	16.1
Anthikad	4	02.8	0	00.0	4	02.6
Enamavu	27	18.6	0	00.0	27	17.4
Kanjany	32	22.1	1	10.0	33	21.3
Kodatti	4	02.6	0	00.0	4	02.6
Parappur	34	23.5	6	60.0	40	25.8
Pullu	22	15.2	0	00.0	22	14.2
Total	145	100	10	100	155	100.0

Poaching of birds was mostly for food (90%) and for sale by professional hunters (5%) and as leisure time activity (0.65%). Except one percent, all those interviewed were non-vegetarians and except three percent, all the respondents consumed fish. Marine fish was the most preferred food item (71%) whereas a small number of respondents opted for fresh water fish (9%). Many interviewees (66%) were of the opinion that fish in the form of fingerling need not be caught, whereas others (33%) supported catching the fry also. Majority (84%) were aware of the negative effect of excessive use of pesticides and only 5% were unaware of this. Fifty five percent (55%) of the respondents reported that there was no change in the pattern of crop damage by birds compared to the earlier periods. However, 37% were of the opinion that the damage had drastically reduced in recent times. Seven percent of the

Table 2: Details of poaching reported from the Kole Wetlands

Sl. No.	Category of poachers	Number of respondents	%
1.	Farmers	08	05.1
2.	People from out side	114	73.5
3.	Youngsters	02	01.3
4.	Workers	02	01.3
5.	No idea	28	18.1
6.	Farmers and outside people	01	00.7
	Total	155	100.0

Table 3: Bird species preferred by poachers

Sl. No.	Preferred species of birds	Number of respondents	%
1.	Egrets	118	76.2
2.	Ducks	01	00.7
3.	Egrets and Little cormorant	11	07.1
4.	Egrets and Ducks	11	07.1
5.	Egrets, Storks and Little Cormorant	01	00.6
6.	No idea	13	08.3
	Total	155	100.0

respondents reported that there was an increase in the incidences of damage. A majority of respondents (54%) had no idea about the reasons for change in bird numbers, but 39% reported that there was a reduction in the number of birds coming to the Kole lands compared to the earlier years. A few (6%) were of the opinion that as the food availability in the form of fish was reduced, incidence of crop damage by birds also declined.

Poaching of birds for food was the major problem of Kole wetlands like in many other wetlands of Kerala. Poaching was done using shotguns, air guns and poison and in certain cases; poaching was done by professional gunmen with the co-operation of farmers. In such cases, half the number of poached birds was given to the owner of the land. Group of youngsters from remote places also arrived in vehicles and killed the migratory and resident birds. Another method used by the local people to kill the birds was to feed the flock of egrets with small fishes, stuffed with insecticides. The birds killed with poison were then gathered from the paddy fields and consumed after removing the viscera. During the study period, 34 cases of poaching were recorded. Out of these, 9 cases were by shooting and 25 by poisoning. Poisoning method was mainly used to catch Indian Pond-Heron, Egrets and Night Heron.

In one typical instance of poaching, a middle-aged man was seen firing on Little Cormorant. He killed 12 Little Cormorants and concealed them in weeds and later sold them to the local eateries. One Curlew, with injury from gunshots, was recovered on 19th October 2000 from Enamavu. The bird was treated at the College of Veterinary and Animal Sciences, Mannuthy, Thrissur but it died on 21st October 2000.

Detailed analyses were carried out for assessing the poaching in Kole wetlands, which showed that the farmers knew about poaching in the wetlands followed by the farm labour (Table 4).

Fishing

Fishing is a common practice of the local people and is usually carried out using small size mesh nets. Catching of small fry from the wetlands is a serious problem, as it reduces the food availability to birds. Using small size mesh net; the farmers catch all the fry and process it as duck feed for sale.

Burning of grass in the dykes is another practice, which is harmful to the bird community. Nestlings and eggs of resident birds are destroyed due to this practice. Fire created in the bunds affected the breeding of species like Weaverbird, Warblers and Tailorbird. Farmers burnt the grass on the bunds each year (85% of respondents) and only few people were not attempting it (12% of respondents). Everyone (71%) knew that burning of grass would destroy the eggs and nests of resident birds. However, few persons reported, that they were not aware of this. Main reason for burning the grass was to remove the excess growth of grass (79%), but 12% was of the opinion that burning was carried out purposefully to stop the growth of grass.

Some people (22%) were aware that certain species of birds are extinct, whereas 56% of the respondents had no idea about this fact. 29% were of the view that conservation of migratory birds is highly essential whereas 55% reported it was an excellent proposition. 10% of the people thought that it was not needed and 4% did not even know about conservation of birds.

Benefits from birds

About 90% of the local people knew that it was beneficial to conserve the birds and only 3% thought otherwise. Many (39%) people were of the view that manure obtained from the birds are important whereas 43% of the people were of the view that insect control is the main advantage derived from the birds and the rest had no opinion.

Conservation awareness among people

Conservation awareness among people based on their occupation and education are presented in Tables 5 and 6. Among the respondents, only 29%, predominantly farmers and farm labourers, felt it is highly essential to conserve birds. About 56% considered that it is good to conserve and only 7% did not consider it necessary. Farmers highly preferred the conservation of Kole wetlands followed by farm labourers. The people having education up to upper primary school level preferred conserving

Table 4: Number and occupation of respondents knowledge on poaching of birds

	FAR	FM	FHM	MW	NH	SHOP	SP	TOTAL	%
Yes	24	21	10	15	15	2	2	88	56.8
No	20	26	1	4	11	1	1	64	41.3
Don't Know	0	1	1	0	1	0	0	3	01.9
Total	44	48	12	19	27	3	3	155	100

FAR: Farmer, FM: Farm labour, FHM: Fisherman, MW: Motor shed worker, NH: Neighbour, SHOP: Shop keeper, SP: Society people

the Kole wetlands followed by the individuals having higher secondary school level education.

The education had its impact on awareness. However, this was found to be not very strongly correlated with the level of education. Eighty four per cent of the educated informants considered the conservation of wetlands as necessary while about 5% had no opinion and 10 per cent were against the conservation.

Crop damage by birds

Certain birds are partially damaging the paddy cultivation in the Kole wetlands. The species responsible for crop damage are Egrets, Teals, Munias, Weaverbirds, Blue Rock Pigeon and Parakeets. Sown paddy grains were consumed by Ducks and Blue Rock Pigeons even before they sprouted. During the study period, the number of migratory ducks arriving in the Kole wetlands was low compared to earlier years, and when these were coming in huge flocks, they resembled dark clouds. Egrets damaged the paddy by trampling while searching for food in the paddy fields. When paddy ripens, Parakeets, Weaverbirds and Munias caused heavy crop depredation by feeding on the immature bunches of the paddy. Little Egret, Median Egret and Cattle Egret feed on grains in the ripened fields. Munias and Weaverbirds destroy paddy during the flowering and harvest seasons. Farmers and the farm labourers complained that the birds damaged the paddy fields (Table 7).

Socio-demographic variables and conservation awareness Index

The levels of conservation awareness varied significantly depending on the occupation and religion of the respondents. However, it was not significant with respect to other variables (Table 8). The shopkeepers had greater awareness followed by motor shed workers, cultivators, fisherman, farm labour and others ($P<0.05$). The persons belonging to religion other than the Hindu are ($P<0.05$).

Table 5: Conservation awareness among the respondents according to occupation

	FAR	FM	FHM	MW	NH	SHOP	SP	TOTAL	%
Highly essential	14	11	4	3	11	1	1	45	29.0
Good	27	29	4	14	11	1	0	86	55.5
Not Needed	2	7	4	0	0	0	0	13	08.5
Don't Know	1	3	1	2	2	2	1	11	07.0
Total	44	50	13	19	24	4	2	155	100.0

FAR: Farmer, FM: Farm labour, FHM: Fisherman, MW: Motor shed worker, NH: Neighbour, SHOP: Shop keeper, SP: Society people

Table 6: Conservation awareness according to educational level of the respondents

	Illiterate	Lower Primary Level	Upper Primary Level	Higher Secondary Level	Total	%
Highly essential	0	10	22	13	45	29.0
Good	4	34	34	14	86	55.6
Not needed	0	8	6	3	17	10.9
Don't Know	0	3	2	2	7	4.5
Total	4	55	64	32	155	100.0

Reclamation of wetlands

Wetlands are filled for purposes like raising coconut plantation and for building houses. Roads are aligned through the Kole wetlands as it is considered as wasteland and paddy cultivation is considered as non-profitable. The link road proposed from Pulikkakadavu to Thrissur, if laid, will destroy the continuity of wetlands and large tracts of area will succumb to real estates. An environmental impact assessment should be conducted before constructing the road. Reclamation of land for coconut cultivation is another threat to the shrinkage of the Kole wetlands. For this purpose, wetlands are converted to dry lands, affecting the water birds. In addition to this, some areas are excavated for clay and soil for making country bricks in the south part of the Kole wetlands. Due to this, water gets deeper and is of no use to the water birds, which prefer shallow waters.

Infestation of weeds

The *Eichhornia* sp. was growing as a weed in the main canals of the wetlands and as such the water spread of the wetlands was not available to the birds for feeding.

Discussion

The Kole wetlands provide wintering ground and important stop-over places for many trans-continental migrants. However, with the increase in human population and the industries, the water birds in the Kole wetlands are endangered. The main threats are from habitat alteration, fire, poaching and fishing.

Habitat fragmentation has three types of impacts on the fauna of remnant habitats - loss of species in fragments, changes in the composition of faunal assemblages and changes to ecological processes that involve animal species ultimately leading to species loss at local and landscape levels. The most important threat to the wetland birds is the impact last mentioned. The mud flats of the Kole wetlands have been severely degraded through burning, drainage and clearance. These have affected the abundance of flora and fauna in the area as well as the hydrological values and functions of the mud flats. Roads are aligned through the Kole wetlands and paddy cultivation is not yielding high profits. Reclamation of land for coconut cultivation is another threat leading to the shrinkage of the wetlands. Due to this practice, wetlands are converted to dry lands, rendering them unsuitable for the wetland birds. Extensive clay mining is practised in southern part of this wetland. Paddy fields are being converted into large ovens for burning bricks. The process of reclamation of paddy fields in the area has been accelerated by human activities thereby reducing their water holding capacity. The economical and ecological values of wetlands should be highlighted among the local people.

Indiscriminate fire is considerably threatening the avifauna of the Kole wetlands. Every year, during the summer months, farmers burn the grass on the bunds. Due to this burning, many of the nests of breeding birds like warblers, tailorbirds and water birds are destroyed. Poaching of wetland birds is another threat to the Kole wetlands. Strong legislation exists for the protected areas of Kerala, which are strictly enforced. But species outside the protected areas are not effectively covered and the existing fines do not act as a deterrent to poachers. Fishing is yet another area of concern and fishing must be stopped to make available small fishes to wetland birds.

Like the Kole wetlands, increasing developmental activities have affected wetlands throughout Asia. Mining activities, water pollution, inadequate protected area management and lack of adequate environmental impact assessment procedures were identified as the major causes. With respect to wetlands in protected areas, issues that need attention include creating awareness, imparting training and strictly enforcing protection measures. Water resources have been identified as a key resource in the future development of countries. Evolving suitable policy and legislative review and amendment with respect to wetlands and water resources is required. It is also necessary to incorporate water resource management into sustainable development and wetland conservation policy (D'Cruz, 1997).

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Table 7: •Crop damage by birds - awareness among the respondents occupation wise

	FAR	FM	FHM	MW	NH	SHOP	SP	TOTAL	%
Yes	42	44	9	17	19	3	2	136	87.7
No	2	2	1	1	6	0	0	12	07.7
Don't Know	0	2	2	1	2	0	0	7	04.5
Total	44	48	12	19	27	3	2	155	100

FAR: Farmer, FM: Farm labour, FHM: Fisherman, MW: Motor shed worker, NH: Neighbour, SHOP: Shop keeper, Society people

Table 8: Selected socio demographic variables and conservation awareness Index

Sl. No.	Variables	n	Mean Conservation Value	SD	F-Value	Sig. of F
1.	Gender					
	Men	145	5.12	1.08	1.980	0.161 (ns)
	Women	10	4.60	1.65		
2.	Age (in years)					
	< 30	13	4.92	0.86	0.741	0.529 (ns)
	31 - 40	42	4.90	1.23		
	41 - 50	59	5.22	1.05		
	> 50	41	5.12	1.21		
3.	Religion					
	Hindu	105	4.61	1.07	91.347	< 0.05 (*)
	Others	50	6.08	0.27		
4.	Education					
	Lower Primary School	57	5.02	1.19	1.305	0.274 (ns)
	Upper Primary School	66	5.24	1.02		
	Higher Secondary School	32	4.88	1.21		
5.	Occupation					
	Cultivation	44	5.30	0.88	2.353	< 0.05 (*)
	Farm Labour	48	4.92	1.23		
	Fisherman	12	4.92	1.24		
	Motor shed worker	19	5.58	1.07		
	Shop Keeper	5	5.60	1.34		
	Others	27	4.67	1.11		

(ns) = not significant; (*) = significant at 5% level

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Conservation of Urban Wetlands in Tamilnadu

Dr. T. Sundaramoorthy

ABSTRACT

This paper deals with the status of urban water bodies in Tamil Nadu. The status, spread and management of water bodies are discussed. A total of 358 water bodies exist in all the six municipal corporations and 24 district headquarters of Tamil Nadu. The total area covered by the 358 water bodies is 10,699 hectares. Of the 358 water bodies, 90 have been prioritized for immediate attention. The major threats encountered by many of the water bodies are disposal of solid waste, sewage, weed growth, encroachment and siltation. Hutments and nomadic settlements around the water bodies also pose a great threat. The inlets and outlets are totally blocked in many of the water bodies leading to eutrophication. Measures for the conservation of water bodies are suggested.

Introduction

Wetlands are areas of land where the water level remains near or above the surface of the ground for most part of the year. The association between people and wetlands is ancient, with the first signs of civilization originating in wetland habitats such as the flood plains of the Indus, the Nile Delta and the Fertile Crescent of the Tigris and Euphrates. There are several kinds of wetlands such as marshes, swamps, lagoons, bogs, fens, lakes and mangroves. They are home to some of the richest, most diverse and fragile natural resources and biologically they are one of the most productive ecosystems (Maltby, 1986). Many people consider wetlands as unproductive areas and hence destroy or drain them for developmental activities. The importance and usefulness of wetlands was first brought to the notice of the world by the Convention on Wetlands held at the Iranian city Ramsar, in the year 1971 (Trisal, 1993).

Wetlands of India

India has a wealth of wetland ecosystems distributed among different geographical regions. Most of the wetlands in India are either directly or indirectly linked to the major river systems. India has a total of 67, 429 wetlands covering an area of 4.1 million hectares (Anon, 1990). Out of these 2,175 are natural and 65,254 are man-made wetlands. Wetlands in southern peninsular India are mostly man-made and are known as '*yeris*' (tanks). They are constructed in every village and provide water for various human needs, besides serving as nesting, feeding, and breeding sites for a large variety of bird species. Prasad, et.al. (2004) has brought out a comprehensive atlas on inland wetlands of India and a GIS database on the distribution of wetlands in 232 districts spanning almost all states. According to this study, about 38% of Indian wetlands have vanished during the last 10 years. The Wildlife Institute of India's survey reveals that 70-80% of individual freshwater marshes and lakes in the Gangetic flood plains have been lost in the last five decades. At present, only 50 percent of India's wetlands remain and they are also disappearing at a rate of 2% to 3% every year.

Importance of wetlands

Wetland systems directly and indirectly support lakhs of people, providing them goods and services. Inundated areas are very effective in storing rainwater and are the primary sources for recharging ground water aquifers. Wetlands are important for the survival of aquatic flora and fauna, including various threatened species as they provide food and shelter. About 20% of the known species directly or indirectly depend on wetlands for their survival. Many wading birds and waterfowl like egrets, herons and cranes nest in wetlands. Wetlands also provide food and shelter for mammals. They act as natural filters and help to remove a wide range of pollutants from water, including harmful viruses from sewage and effluents from industries. Wetlands retain the nutrients by accumulating and storing elements like nitrogen and phosphorus in the sub-soil, thereby decreasing the potential for eutrophication. They also provide significant socio-economic benefits such as constant water supply, fisheries, fuel wood, medicinal plants, livestock grazing, agriculture, energy resource, wildlife resource, transport, recreation and tourism. The loss of wetlands leads to environmental and ecological imbalances, which have a direct impact on the socio-economic factors. Wetlands are also important as a genetic reservoir for various species of plants particularly rice, which is a staple food for three-fourths of the world's population.

Wetlands of Tamil Nadu

Tamil Nadu is a water-starved state (Karmegam and Krishnaveni, 2003). In Tamil Nadu, more than 90% of the available surface water and more than 60% of the available ground water have been utilized. Since Independence, many dams have been constructed to utilize the surface water. Drinking water source for many of the cities in Tamil Nadu is from rivers, lakes and tanks. About 39,202 water bodies are said to exist in Tamil Nadu, of which 20,413 are panchayat union tanks, 8,903 are PWD tanks, and 9,886 are ex-Zamin tanks (Natarajan, 2003). A few studies provide data on the distribution and present status of wetlands in Tamil Nadu (Krishnan 1993, Sampath 1996).

Table 1:•Number of water bodies existing in the six Corporations and District Headquarters of Tamil Nadu

Name of	No. of water	Net area of the water	Maintaining Authority						
City	bodies	bodies (in ha.)	CMWSSB	M	PWD	HR & CE	T	C	O
Chennai	46	8680.84	24	1	19	-	-	-	2
Coimbatore	10	522.37	-	-	8	-	-	2	-
Cuddalore	15	9.08	-	11	-	1	3	-	-
Dharmapuri	4	318.67	-	2	2	-	-	-	-
Dindigul	9	1.33	-	9	-	-	-	-	-
Erode	2	5.73	-	-	-	-	1	-	1
Kanchipuram	24	51.33	-	9	1	14	-	-	-
Karur	1	NA	-	1	-	-	-	-	-
Krishnagiri	5	114.15	-	-	4	-	1	-	-
Madurai	6	51.50	-	-	2	4	-	-	-
Nagapattinam	16	9.14	-	10	-	-	6	-	-
Nagarcoil	5	12.37	-	4	-	-	1	-	-
Namakkal	4	20.09	-	1	-	3	-	-	-
Perambalur	5	208.60	-	2	3	-	-	-	-
Pudukottai	27	26.92	-	25	-	-	2	-	-
Ramanathapuram	24	49.43	-	23	-	-	1	-	-
Salem	4	91.61	-	-	2	-	2	-	-
Sivagangai	10	21.59	-	10	-	-	-	-	-
Thanjavur	19	37.59	-	13	2	-	4	-	-
Theni	4	64.43	-	1	3	-	-	-	-
Thiruchirapalli	14	5.56	-	-	-	5	2	6	1
Thiruvallur	4	146.56	-	-	3	1	-	-	-
Thiruvarur	20	24.82	-	16	-	1	3	-	-
Tirunelveli	17	175.29	-	-	3	2	-	12	-
Tiruvannamalai	19	18.18	-	2	-	17	-	-	-
Tuticorin	2	3.03	-	1	-	-	1	-	-
Udhagamandalam	11	NA	-	-	11	-	-	-	-
Vellore	3	1.12	-	1	1	-	1	-	-
Villupuram	27	25.11	-	26	-	-	1	-	-
Virudhunagar	1	3	-	-	-	-	-	-	1
	358	10699.44	24	168	64	48	29	20	5

NA - Data Not Available, CMWSSB - Chennai Metropolitan Water Supply and Sewerage Board, M - Municipality, PWD - Public Works Department, HR & CE - Hindu Religious and Charitable Endowment Board, T - Trust, C - Corporations, O - Others.

The tradition of local people maintaining these water bodies has been eroded over the past few decades.

Objective of the study

The main objectives of the study are:

- ❖ to collect information on the present status of the water bodies available in the district headquarters and in the six municipal corporations of Tamil Nadu.
- ❖ to collect data on the size, location and management practices of the water bodies surveyed.
- ❖ to identify the present ecological status of the water bodies and suggest appropriate measures for conservation.

Methodology

The study was carried out during 2004-2005. Water bodies of various district headquarters were surveyed and the data were documented. The data were also collected by interacting with the government officials and the local people of the respective areas. Details about area, present status, and water utilization pertaining to each water body were collected.

Result and Discussion

A total of 358 water bodies were recorded in all the 6 municipal corporations and 24 district headquarters in Tamil Nadu. The total area of the 358 water bodies is 10,699 hectares (excluding

12 water bodies in Udhagamandalam and Karur). Details on the number of water bodies and the management authority are given in the Table No. 1. The maximum number of water bodies are recorded in Chennai Corporation (46 water bodies) followed by Pudukottai and Villupuram districts (27 water bodies).

The 46 water bodies found in the Chennai Corporation cover a total area of 8, 680 hectares. Of the thirty district headquarters only seven are having more than hundred hectare of water spread area. The Tirunelveli Corporation has seventeen water bodies with an area of only 175 hectares. The study indicates that still there is scope for conservation of urban water bodies in 75% of district headquarters. The management of water bodies rests with six authorities namely, Municipalities, PWD, HR& CE, Corporations, CMWSSB and Trust (Fig.1). About 47% of water bodies are managed by municipalities. The commissioners of the various municipalities may be asked to initiate the conservation activities.

Of the 358 water bodies, 90 have been prioritized for immediate attention. Most of the water bodies of the six corporations and district headquarters have been converted into residential areas and construction sites for buildings for public utilities (bus stand, schools and shopping complexes). Based on the study, about 90 water bodies measuring about 2740 hectares have been identified for immediate action. The details are given in Table -2.

Water bodies in the district headquarters of Coimbatore, Pudukkottai, Tiruvannamalai and Tirunelveli are being maintained in a good condition. The overall situation like water availability, water quality and utility is satisfactory in these district headquarters. On the contrary, water bodies in Dindigul, Madurai, Krishnagiri, Nagapattinam, Nagercoil, Namakkal, Ramanathapuram, Thanjavur, Tiruchirapalli, Tiruvarur and Villupuram town are poorly maintained. Dumping of garbage, sewage inflow and weed growth are the main reasons for the poor status of these water bodies.

Table 2: List of water bodies prioritised for immediate protection

Sl. No.	District Headquarters	No. of water bodies'	No. of water bodies to be given priority	Area in ha.	Name of the Water bodies	Place of the water bodies'	Maintaining authority
1.	Chennai	46	13	1435.80	Velachery lake	Velachery	CMWSSB
					Puzhuthivakkam lake	Puzhuthivakkam	CMWSSB
					Madipakkam lake	Madipakkam	PWD
					Moovarasanpattu lake	Moovarasanpettai	PWD
					Kilkattalai lake	Kilkattalai	PWD
					Kovilambakkam lake	Kovilambakkam	CMWSSB
					Narayanapuram lake	Narayanapuram	CMWSSB
					Avadi lake	Avadi	CMWSSB
					Ambattur eri	Ambattur	CMWSSB
					Korattur lake	Korattur	CMWSSB
					Rettai eri	Madhavaram / Kolathur	PWD
					Ayapakkam lake	Ayapakkam	PWD
					Chetpet lake	Chetpet	PWD
2.	Coimbatore	10	4	303.60	Coimbatore big tank	Near Ukkadam	PWD
					Kumarasamy tank	Kumarapalayam	PWD
					Krishnanpatti tank	Telungapalayam	PWD
					Vellan kulam	Puliankulam	PWD
3.	Cuddalore	15	3	1.41	Murugan pond	Vandipalayam	TRUST
					Vilvarayan pond	Near Housing board	M
					Vannan pond	Beach road	M
4.	Dharmapuri	4	2	118.50	Anna Sagaram lake	Anna Sagaram	PWD
					Dharmapuri Periya Lake	Old Dharmapuri	PWD
5.	Dindigul	9	3	0.31	Gobalasamudram	near Government Hospital	M
					Chinnan kulam (or) Muthusami kulam	Natham road	M
					Aranmanai kulam	Sivan koil, Madurai road	M

Sl. No.	District Headquarters	No. of water bodies'	No. of water bodies to be given priority	Area in ha.	Name of the Water bodies	Place of the water bodies'	Maintaining authority
6.	Erode	2	1	5.66	Gani Rawther tank	Saththi Main road, Periya Semoor	LOCAL
7.	Kanchipuram	24	3	42.26	Natha pettai tank / Thiruvidaipallam tank Chetty kulam	Natha pettai Silar chetty kulam street	PWD M
					Periya Veppankulam	Thirukalimedu	M
8.	Karur	1	nil				-
9.	Krishnagiri	5	2	61.34	Papparapatti eri	Papparapatti	PWD
					Lingammal eri	Biran Hill near Kuppam road	PWD
10.	Madurai	6	2	39.00	Vandiyur lake	Vandiyur	PWD
					Thallakulam Kanmai	Thallakulam	PWD
11.	Nagapattinam	16	3	4.23	Vannan kulam	Melkarai, Nagoor	M
					Thamarai kulam	Opp. DSP Office	M
					Akkarai kulam	Anna Nagar	M
12.	Nagercoil	5	2	7.44	Subbiah kulam	Pudhu Kudiyiruppu	M
					Poochatha Amman kulam	Vaidya Mathapuram	M
13.	Namakkal	4	2	19.01	Kamalalaya kulam	Near Uzhavar santhai	HR & CE
					Kosavampatti tank	Near Burial ground	M
14.	Perambalur	5	2	165.57	Vellanthangi lake / Perambalur eri	Opp. Govt. Hospital	PWD
					Thoramangalam lake	Thoramangalam	PWD
15.	Pudukkottai	27	5	8.90	Servarayan kulam	Thirukoharnam	M
					Adappankulam	Singamuthu Iyanar street	M
					Ayyar kulam	Machuvadi	M
					Alangulam	near Housing Unit	M
					Santhaipettai kulam	West VI street	M
16.	Ramanathapuram	24	4	15.53	Mugavai oorani	Near Sivan koil	M
					Nochivayal oorani	Periyar Nagar	M
					Draupathi Amman near koil oorani	Draupathi Amman koil	M
					Sayakara oorani	Chetty street	M
17.	Salem	4	2	0.40	Theppakulam	Market railway station	TRUST
					Kumarasamypatti Lake / Mookaneri	Kumarasamypatti	-
18.	Sivaganagai	10	3	12.05	Chetti oorani	Near Taluk Office	M
					Sathappaiyer oorani	Masjid Road	M
					Aatha oorani	Near Little Flower Nursery School	M
19.	Thanjavur	19	4	9.69	Thulukkan pond	South Street, Karanthai	M
					Ayyan pond	Gudalur Road	M
					Samandham tank	Samandham tank road	M
					Samudhram lake	Mariamman koil road	PWD

Sl. No.	District Headquarters	No. of water bodies'	No. of water bodies to be given priority	Area in ha.	Name of the Water bodies	Place of the water bodies'	Maintaining authority
20.	Theni	4	2	56.08	Periya kanmai	Allinagaram	PWD
					Chinna kanmai	Allinagaram	TRUST
21.	Tirunelveli	17	4	104.25	Udayarpatti kulam	Udayarpatti road	MC
					Thanneer kulam	Thachanallur	MC
					Nainar kulam	Near Nellai town	PWD
					Ilankanniamman kulam / Elandhai kulam	Backside of Pallai bus stand	MC
22.	Tiruvallur	4	2	105.04	Pungathur Lake	near Chennai - Tirupati highways	HR & CE
					Perumbakkam Lake	Near new Collector's office	M
23.	Thiruvannamalai	19	4	13.17	Ayyan tank	Ayyan Kulam street	HR & CE
					Thamarai tank	Thandarampet Road	M
					Agnitheertham tank	Girivalam Road	HR & CE
					Manikavasagar tank	Girivalam Road	HR & CE
24.	Tiruchirapalli	14	3	1.79	Periya Nachiamman Tank	Thennur	TRUST
					Telugu Chetty Tank	Uraiyur	MC
					Theppakulam	Sri Rangam	HR & CE
25.	Tiruvarur	20	3	3.55	Virupatchi tank	Sengam Talkie road	M
					Kulundan tank	Hospital road	M
					Thamarai tank	Madappuram	TRUST
26.	Tuticorin	2	1	0.40	Theppakulam	Mariamman koil	TRUST
27.	Udhagamandalam		11	4	0.00	Doddabetta Upper	PWD
					Kodappamund Lower		PWD
					Gorishola		PWD
					Ooty lake		PWD
28.	Vellore	3	1	0.00	Kottai Agazhi (Fort Ditch)	Vellore Fort	PWD
29.	Villuppuram	27	5	2.12	Pappan Tank	near Katpadi Railway Line	M
					Bungalow Tank	near Traveler's Bungalow	M
					Thachan Tank	near District Government Hospital	M
					Kanniya Kulam 1	near Burial ground	M
					Lalkan pond	Near Vandimedu Road	M
30.	Virudhunagar	1	1	3.00	Theppakulam	Main bazaar	OTHERS
	Total	358	90	2740.01			

CMWSSB - Chennai Metropolitan Water Supply and Sewerage Board, M - Municipality, PWD - Public Works Department, HR & CE - Hindu Religious and Charitable Endowment Board, T - Trust C - Corporations, O - Others.

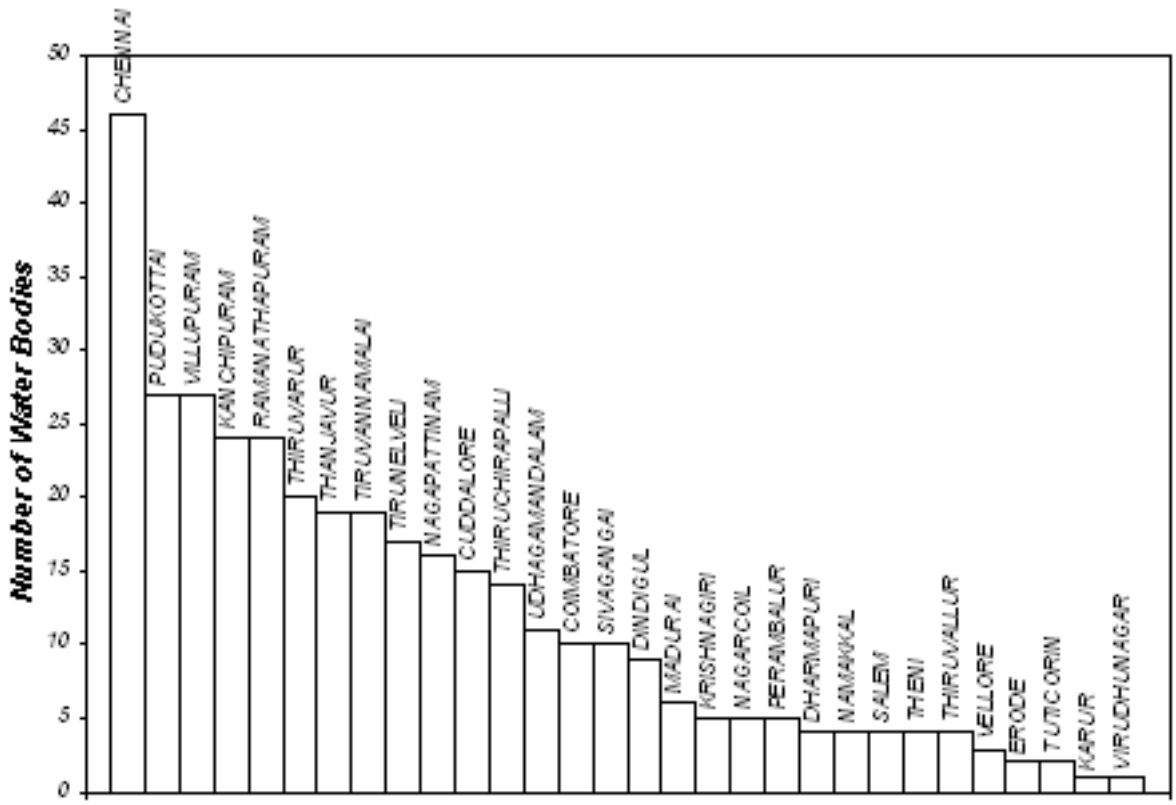

Fig. 1: Distribution of Waterbodies in the District Headquarters

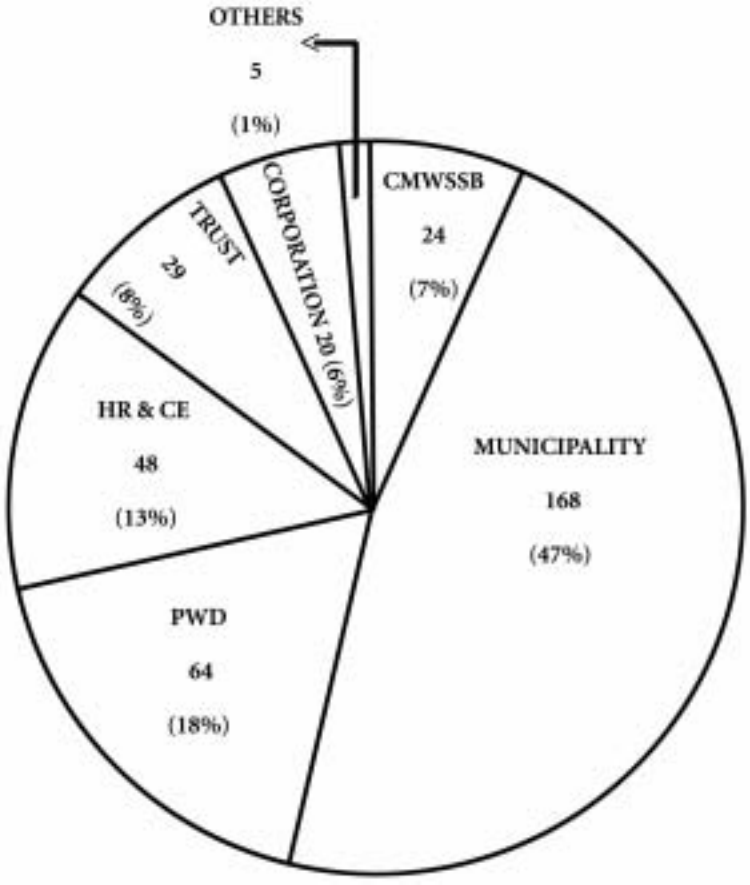

Fig. 2 : Management of water bodies by various agencies

Out of 46 water bodies in Chennai, only eight water bodies that were analysed for water quality, had water before the monsoon. The results revealed that the quality of water of Ayapakkam and Velachery Lakes were reasonably good. In Chennai, most of the arterial roads have been constructed on the water bodies.

Temple tanks are maintained properly by the Hindu Religious and Charitable Endowment Board (H.R & C.E.) and temple authorities. These tanks are fenced and desilted at regular intervals.

Major threats faced by many of the water bodies are disposal of solid waste and sewage, weed growth, encroachment and siltation. Hutments and nomadic settlements, around the water bodies pose a great threat. The inlets and outlets are totally blocked in many of the water bodies which lead to eutrophication. In a few water bodies where there is no water, bore wells have been dug to draw ground water. Restoration of urban water bodies is a challenge and it can be achieved only by the joint efforts of the various departments of government and the local community. There is an imperative need to take necessary steps for conservation and sustainable utilization of urban water bodies. These are:

- Survey and documentation of the value of each and every water body.
- Periodical monitoring of water quality of urban water bodies.
- Habitat improvement of water bodies - improvement of water quality and exercising vigil over the dumping of municipal solid waste and cleaning of weeds.
- Capacity building programmes for the local community training on sustainable management of wetlands.
- Strict enforcement of water pollution control act 1974 and other related laws for the conservation of wetlands.

Conclusion

The variation of actual rainfall in Tamil Nadu for the last two decades is not very high. However, there is a drastic decline in the total number of rainy days. Hence, it is necessary to collect and preserve the rainwater for use and also to recharge the ground water for which the urban water bodies play a significant role. The values and importance of urban wetlands were not properly recognized by the town planners and local communities - thanks to the pressing demand for developmental activities. Conservation and management of urban water bodies should become one of the top priorities for all the urban water bodies.

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Role of Parks in the Environmental Conservation of Chennai City

M. Amirthalingam

ABSTRACT

Parks are so versatile that they satisfy each group and provide what they need in one place. People visit parks mostly in the evenings to spend time. Parks are the lungs of cities and towns generating fresh air and providing cool atmosphere because of its green cover. A park enjoys protection of both flora and fauna and congenial and salubrious conditions are created to maintain the natural habitat. The main objective of this study is to examine the existing conditions of the parks and suggest ways and means for improvement. The direct survey method was adopted in the study of major and minor public parks in Chennai. The parks for the study were selected randomly. Out of 250 parks in Chennai, 40 are public parks that cover a total area of 59.6 hectares and were surveyed for this study. The remaining 210 parks that were not surveyed cover an area of 312.84 hectares. This study found that the parks were rich in flora than fauna. The primary reason for this being, that the atmosphere in the parks was conducive for the flora than for the fauna.

Introduction

Mother nature is always merciful and generous to human kind. But the avarice of the people is reaching unimaginable proportions and today they are in a sorry state not knowing how to alter the atmosphere and make it more conducive for the present generation and posterity. The irony is that humans must live with all deficiencies and constraints, but at the same time his ingenuity demands creation of a kind of simulated atmosphere of greenery within the available space. This is to enable the people living nearby feel the effect of greenery and act as conduits to stop the complete denudation of green coverage. Once the abundant greenery is destroyed there will be no other recourse for people to survive, as their lives are is intertwined with flora and fauna. People have to find ways and means to improve the available open spaces and try to design artificial green covers in the form of parks to obtain relief.

Importance of parks

Parks are so versatile that they satisfy each group and provide what they need in one place. People visit parks mostly in the evenings to spend time. Each one has a different purpose to spend their leisure hours in the park. It is a general scene if one were to visit parks in the evenings to come across the hordes of people there on different purposes. Senior citizens obviously need fresh air and relaxation; students need a calm and tranquil atmosphere to get engrossed in their studies; children, in large numbers, want to play and gambol on the swing, slide and the see-saw; cupid-struck pairs are in need of privacy.

Parks are invariably artificial in nature, in the sense that humans recreate natural settings and try to infuse a sense of realism to make the park appear natural. Parks are the lungs of cities and towns generating fresh air and providing cool atmosphere because of its green cover. But for parks, people will be deprived of the required sustaining force of rejuvenation. They are home to different natives and introduced plant species. They are also dwelling places for many birds, reptiles, insects and other denizens. They are recreation outlets for many people. A park enjoys protection of both flora and fauna and salubrious conditions are created to maintain natural habitat (Amirthalingam, 2004).

Classification of parks

According to the nature of the existing flora and fauna, parks are categorized as follows:

❖ Heritage parks: Parks with historical, archaeological features or with a history of horticultural quality (such as a botanical garden).

❖ Conservation Parks: Parks with a strong ecological and nature conservation value. Main activities in these kinds of parks include bird watching, morning walks and environmental camps (an example – The Theosophical Society, Chennai).

❖ Recreation Parks: Parks with children's playgrounds, leisure facilities etc.

❖ National Parks: The history of national parks in India begins in 1936. These are relatively large areas preserved for their unspoiled landscapes and native flora and fauna.

❖ Regional Parks: Situated near thickly-populated centres, these parks offer open space and recreational and cultural opportunities for urban residents.

❖ Marine Parks: These are unique and outstanding marine areas set aside to conserve under-water plants and animals.

Area covered by parks in Chennai

Although Chennai City has not been endowed with beautiful lush gardens and parks like other cities viz., Bangalore, Chandigarh and Kashmir, the Chennai city administrators with limited resources are doing their best. The maintenance of parks requires special attention and skills to improve the conditions of the parks and also the services of officials who are experts in this field. Overall maintenance will facilitate to enhance the aesthetic beauty of the parks and make them a resort not only for the people, but also for many winged creatures, swarms of bees, insects, reptiles and other related species.

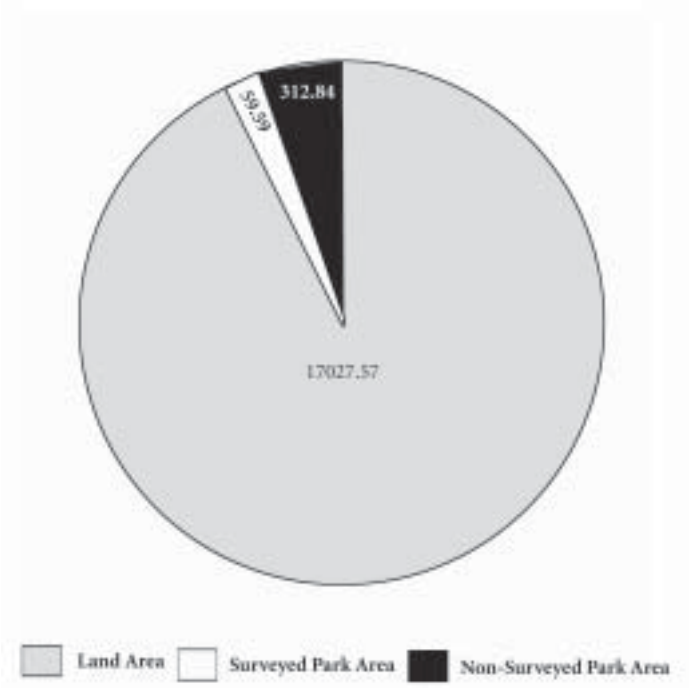
Out of 17,400 hectares of area of Chennai City, the area covered by the public parks numbering 250 would be around 372.43 hectares. Out of 250 parks, 40 public parks were surveyed for this study, spread over an area of 59.6 hectares. The remaining 210 parks not surveyed cover an area of 312.84 hectares (pie diagram No.1).

Objective

- ❖ To identify the present status of parks in Chennai with special reference to flora and fauna
- ❖ To evolve a proper strategy to establish ideal public parks in Chennai
- ❖ To offer suggestions for proper maintenance of parks in Chennai to improve the flora and fauna

Methodology

The study has been carried out by random visits to major and minor public parks in Chennai, so as to obtain first-hand knowledge. Details of demographic data of the parks, their locations, extent of areas, their methods of maintenance, their existing flora and fauna and other available attractions of general amusement were collected. Interactions with the supervisors, gardeners and visitors to the parks comprising of all age groups, helped to identify the existing conditions in the parks.



Pie diagram - 1: Status of Parks in Chennai

Results and Discussion

Forty (40) parks were randomly selected with a view to study the flora and fauna. Flora and fauna, not only enrich the ambience of the parks, but also exude green canopy which is highly required to present a pleasant atmosphere and attract a plethora of fauna. An attempt is made not only to manicured lawns, nurseries, temples, lighting arrangements, provision of benches, fountains, locations for movie-making etc.

Parks which were covered for study have been reflected in the Tables presented. Statistical details are provided for easy understanding. For qualitative analysis, pie diagrams and bar diagrams have been presented at appropriate places.

Location of the parks

Invariably, the location of the parks are chosen by the authorities in such a manner that people may have easy access to spend their leisure time, especially in the evenings and to enjoy pleasant breeze without any hindrance. The name, establishment, area and location of the 40 parks have been given in the Table I.

Establishment of the parks

Out of 40 parks selected, Panagal Park (T.Nagar), was established on 1st May 1935 with an area of 4.050 hectares and is the oldest park. Visitors who throng the park are the elite. Thelugu Chetti Park, (Vannarapettai), which was established on 8th July 2004 is of recent origin with an area of 0.203 hectares.

Sizes of parks

There are no defined rules to establish parks in a given locality. Parks have been established depending upon the area available and subject to other local constraints. Among the 40 parks, Tower Park (Anna Nagar), is considered to be largest area covering 14.580 hectares, next to follow is the May Day Park, [Chintadripet) covering an area of 5.873 hectares and followed by Lady's Garden (Park Town) covering an area of 5.670 hectares. The smallest among the 40 parks is NSK Park (Pulianthope) measuring an area of 0.002 hectares.

Maintenance of parks

The over-all maintenance of the 40 parks taken for this study is under the auspices of the Corporation of Chennai. The details gathered by the researcher revealed that two parks viz., Siva Park at K.K.Nagar was originally started by the Tamil Nadu Housing Board [TNHB] and subsequently developed by the Corporation of Chennai. Another park named to commemorate the great Tamil scholar and a pioneer of labour union movement, Thiru V.Ka, was started by Mr.Sundar Rao Naidu during 1947 and was later developed by the Corporation of Chennai. It is presently under the sponsorship of Touch Tel Company. May Day Park, popularly known as "Napier Park" was earlier started by Mr.A.B.Shetty during 1950s. The then Minister of Agriculture later brought it under the control of Corporation of Chennai. All the remaining 37 parks are under the direct supervision and control of Corporation of Chennai. Though the maintenance and funding of parks are under the direct supervision of the Corporation of Chennai, the allocation of funds for the up-keep of the parks to suit the modern trends and convenience of the people rests with the Ministry of Local Administration.

Bio-diversity of parks

Flora

To get glimpses of the types of flora in the parks studied, an attempt was made to project them in a conceptualized form indicating the highest and lowest representation of flora in form of a pie diagram No.2.

Amongst the parks studied, the Tower Park (Anna Nagar) manifests the highest range of flora comprising of 46 species. Second in line is the Jeeva Park (T.Nagar) representing 39 species of flora. Third in order includes three parks namely, Thiru Vi. Ka Park (Aminjikarai), May Day Park (Chintatripet), and Mahatma Gandhi Memorial Park (Perambur).

Brogan villa park (Anna Nagar) representing 10 species has the least concentration of flora. Next in the order, are two parks namely Bakthavatchalam Park (Pattalam) and N.S.K Park (Puliyanthoppu) both containing 11 species.

If the focus is shifted to rearing flora of ornamental value, the aesthetic aspect of parks would definitely improve. A concerted effort is required to blend and harmonise different varieties of flora depending upon the fertility of the soil, the space available, the quantum of water resources and the topography of the place.

Fauna

Unlike the flora, fauna is an inconsistent factor. However, an attempt was made to capture a glimpse of it and a clear plan was made to ascertain the range of fauna and its significance. This was needed to understand if there is a possibility to make the habitats of parks conducive for faunal diversity. There are groups of fauna that fall under the category of smaller creatures of animal kingdoms. Another distinct feature of fauna is that, unlike flora, they fall into a set pattern and there is not much difference. The entire gamut of fauna that were observed in the parks has been given in pie diagram no. 3. Birds occupy the second position followed by reptiles and the domestic animals and the last being the aquatic forms, which could thrive only in the presence of ponds in parks.

Other attractions of parks

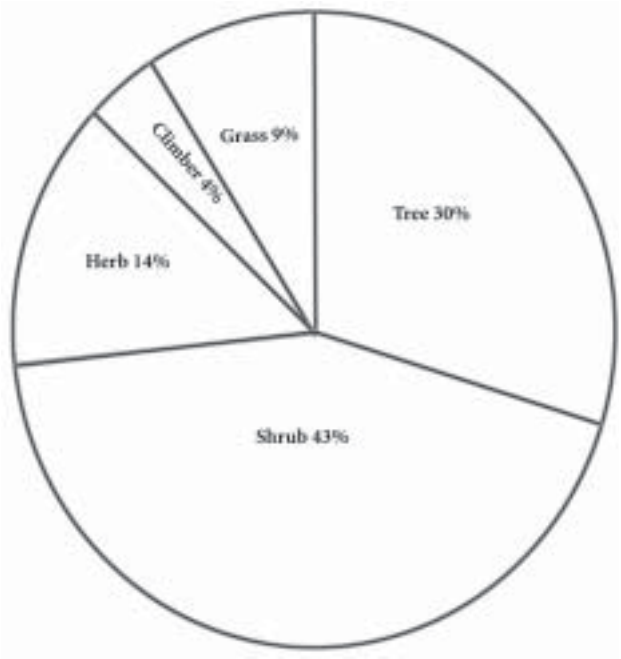
Even though the flora and fauna is the cynosure of all eyes who visit the parks, the beauty and aesthetic importance of parks get enhanced by other attractions such as:

Ponds

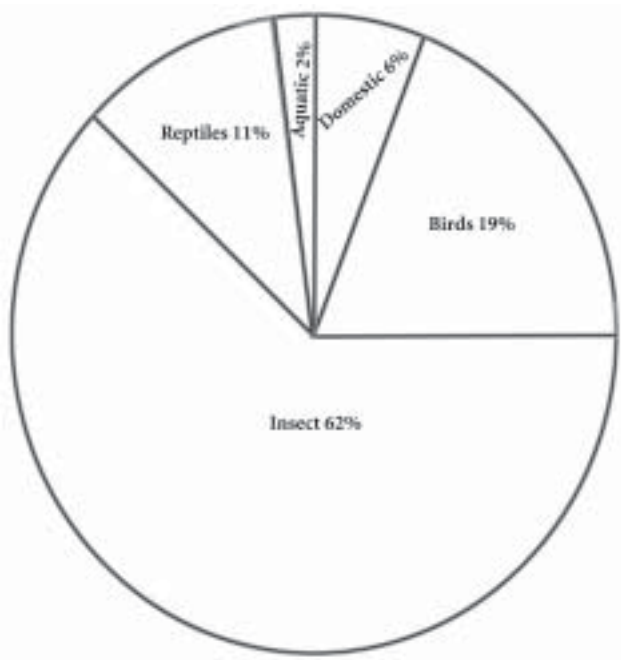
Out of 40 parks taken up for study, 9 parks have been equipped with ponds. Ponds are rain water dependent and there is no other source of water. Only when water is made available in ponds, there is a possibility of aquatic creatures and forms to survive.

Table 1: Particulars of the Park

Sl. No.	Name of the park	Establishment of the park	Area of the park	Location of the park
1	Anna park	-	0.50625	Kodambakkam
2	Anna park	-	0.810	Kilpauk
3	Arignar Anna park	2/28/94	4.05	Royapuram
4	Bakthavatchalam park	7/29/68	0.0045	Pattalam
5	Brogan villa park	-	1.215	Annanagar
6	Cross road park New Washermenpet	10/20/68	1.72125	
7	Dharmambal park	-	0.6075	R.A.puram
8	Dr. Muthulakshmi park	-	0.6075	Adyar
9	Dr. Natesan park	15/09/50	1.620	T.Nagar
10	Independence day golden jubilee memorial park	-	1.0125	Numgambakkam
11	Independence day golden jubilee memoriyal park	-	1.0126	Nanganallur
12	Jeeva park	12/30/66	1.215	T.Nagar
13	Jeeva park	1/31/66	0.50625	Thandayarpet
14	Jeeva park	6/22/66	0.0216	Aynavaram
15	Jermiah park	-	0.0072	Vepery
16	Kaaythymillath park	5/31/00	0.0036	Puliyanthoppu
17	Karunanidhi park	4/27/68	0.0054	Pattalam
18	Ladye's garden park	-	5.670	Parktown
19	Mahatma Gandhi memorial park	3/1/52	1.620	Perambur
20	May day park	9/13/50	5.87250	Chindaripet
21	Mettuppalayam park	8/20/92	0.405	Mettupalayam
22	N.S.K park	-	0.0018	Puliyanthoppu
23	Nageswara Rao park	0ct'1940	1.620	Mylapure
24	Panagal park	01-05-35	4.050	Mambalam
25	Pattel park	-	0.50625	Kosapet
26	Sajjad usain park	-	0.405	Perambur
27	Sathyamoorthy park	-	0.50625	Chettupet
28	Selvapathi park	9/13/65	0.2025	Pattalam
29	Sharma park	-	0.6075	T.Nagar
30	Sivagami ammal park	1/20/76	0.10125	Vannarapettai
31	Sivan park	-	2.430	K.K.Nagar
32	Sri Ragavendra Rao park	-	0.405	Choolai
33	Swamy Thysingaananthan park	-	0.0036	Vayasarpadi
34	Thelugu chetti park	7/8/04	0.2025	Vannarapettai
35	Thiru V.Ka. Park	2/17/47	4.050	Aminjikarai
36	Thirumalai pillai park	-	0.0054	Vepery
37	Thiyagaraya park	-	0.405	Thandayarpet
38	Tower park	1/21/68	14.58	Annanagar
39	Vadiyaa park	11/16/99	0.2025	Pattalam
40	Valluvar park	-	0.810	Numgambakkam



Pie diagram 2: Distribution of Flora



Pie diagram 3: Distribution of Fauna

Temples

In the 40 parks taken up for survey, temples could be found in Sivan Park (K.K.Nagar), Jeeva Park (T.Nagar), Dr.Natesan Park (T.Nagar) and Lady's Garden Park (Park Town). Though, parks are normally not the place for locating temples, they exist because of the patronage of some locals who visit the parks; they have made it a place of worship when they visit parks on a daily routine.

Playgrounds

When elders visit the parks, children invariably accompany them. To keep them engaged, it is quite common that the parks have small playgrounds for tiny tots to move around and play in the open atmosphere. Out of 40 parks surveyed, 13 parks were equipped with playgrounds.

Fountains

In the 40 parks surveyed 18 fountains were observed. Fountains no doubt, are additional attractions for visitors as the spurt of water which comes out of pipes gives immense pleasure to onlookers and also adds chillness to the breeze.

Nurseries

There are 10 parks endowed with nurseries. The parks, that have good space and the right environment, rear nurseries for their own use to enhance the beauty of the parks and also to distribute them to other parks.

In most of the parks, it could be found that lawns are well-maintained. Certain parks are also used for shooting films.

Conclusion

Population explosion has become the order of the day and the much required space meant to get fresh breeze has become a rarity. It is for the town planners to design the layout of the city to improve living conditions for citizens. It is also imperative on the part of the people to take special interest to safeguard the ecology by liberally establishing parks and gardens. Several environmentalists and enthusiasts are urging policy-makers on the need to establish parks and gardens. As the subject has practical importance not only for the present generation but also for posterity, the study of parks in Chennai has been done with lot of care and initiative.

It is once again emphasized that parks and gardens are the real saviour for urban citizenry. It would be unfortunate if people think that parks as an encroachment of their areas. We cannot absolve our responsibility of keeping the parks and gardens in good shape. The more attention we bestow upon the parks, the better it would be for all of us. It is an accepted fact that a tree generates plenty of oxygen to give a fresh lease of life to humans. But humans unthinkingly cut trees not knowing that they are seriously disturbing the ecological balance. No prudent human being will dare to disturb the ecology and environment. The future well-being of man lies in his need to breathe fresh air and live in a pollution-free atmosphere and parks can serve this end to a large extent.

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Management of Drinking Water in a Semi-arid Village in Tamil Nadu

B. Arulananthan

ABSTRACT

Tamil Nadu is one among the water shortage states of India. This paper deals with the importance of drinking water, its usage and wastage and waste water management techniques in a rural area. The study was carried out in Thalavai Panchayat of Perambalur District of Tamil Nadu. Water is supplied through 12 overhead tanks from a single bore well for the entire 600 houses. The improvement of drinking water facility in their villages after independence is mainly due to Tamil Nadu Water Supply and Drainage Board (TWAD). Apart from drinking purposes, the excess water is also used for various other purposes such as bathing, washing and watering kitchen garden. The study results were discussed with the villagers and they took various measures for conservation of water resources especially for drinking water management.

Introduction

Water scarcity is a serious problem throughout the world, for both urban and rural communities. The rate of withdrawal is far in excess of the rate of recharging as seen from the water tables. Fresh water, once considered an inexhaustible resource, is now becoming a scarce commodity. The water policy of India has calculated 180 litres per capita for domestic needs. But it is not possible to supply even 100 litres per head even in urban areas. In India, 4.5 crore people are denied clean drinking water. Tamil Nadu is one among the water shortage states in India. About 60% of the area is affected by water scarcity. Statistics show that due to over exploitation, 1.5 lakh out of 1.8 lakh wells have dried up in Tamil Nadu.

In this context, a study was necessary to know the drinking water management practices of rural people. Importance given to drinking water by the people, water usage, water wastage, and waste management techniques were studied.

Study area

The area chosen for study was Thalavai panchayat of Perambalur district, Tamil Nadu. The geographical area of the Perambalur district is 3, 69,007 hectare. The district lies in the southern plateau and hill zone of agro-climate regional planning with characteristics of semi arid climate. The soil is predominantly red loamy and black soil. The normal rainfall of the district is 908 mm.

Cauvery is the major river flowing in this region and the composite district has a canal systemof 47Kms stretch and ayacut of 11,610 ha. The ground water resource through tube wells and wells contribute nearly 68% of irrigated area.

Thalavai Panchayat is situated 5 km south of river Vellar near Pennahadam town and includes 12 habitats - Thalavai, Thalavai Colony, Madura Nagar, Sengamedu, Sengamedu Colony, Eachangadu, Eachangadu Colony, Siluppanur, Silappanur Colony, Silupanur new colony, T.Gudalur and T.Senthamangalam. The total population of the Thalavai Panchayat is 6,170 - of which 3,114 are male and 3,056 are female (year 2004). The total households within this panchayat are about 600. People from all the habitats are receiving water from a single bore well. The bore well has been dug at the river Vellar, which flows on the northern side of the hamlets. Water is supplied through pipelines to the hamlets from the overhead tanks. There are about 11 overhead tanks, 11 India mark hand pumps, 72 public taps, and 72 house connections. The Panchayat also maintains 3 open wells. The number and capacity of overhead tanks, the number of taps, hand pumps and open wells in Thalavai Panchayat and the details regarding demand for drinking water and its allocation are provided in the Tables (1-3).

Table 1: Numbers and capacity of Overhead Tank

Sl. No.	Hamlets	60,000 litres	30,000 litres	10,000 litres	Total
1	Madura Nagar	1	-	-	1
2	Sengamedu	1	-	-	1
3	Sengamedu colony	-	1	-	1
4	Eachangadu colony	-	1	-	1
5	Siluppanur colony	-	-	-	-
6	Siluppanur	1	-	-	1
7	Eachangadu	-	1	-	1
8	Thalavai colony	1	-	-	1
9	T.Gudalur	-	1	-	1
10	Thalavai	1	1	-	2
11	T.Senthamangalam	-	-	1	1
	Total				11

Table 2: Number of Taps, Hand pumps and Open Wells in Thalavai Panchayat

Sl. No.	Hamlets	House connections	Public taps	Hand pump	Open well
1	Madura Nagar	4	1	-	-
2	Sengamedu	10	15	-	-
3	Sengamedu colony	4	-	1	-
4	Eachangadu colony	2	5	1	-
5	Siluppanur colony	-	5	2	-
6	Siluppanur	-	-	2	-
7	Eachangadu	15	10	1	1
8	Thalavai colony	7	7	1	-
9	T.Gudalur	10	12	1	1
10	Thalavai	15	12	-	-
11	T.Senthamangalam	5	5	2	1
	Total	72	72	11	3

Table 3: Drinking water demand and allocation

Habitation	Drinking water demand MCM	Present level in LPCD	Drinking water draft MCM	Drinking water allocation as%
Madura nagar	0.0055	45	0.0062	2.5
Sengamedu	0.0061	35	0.0053	3.6
Sengamedu colony	0.0044	35	0.0038	2.7
Eachangadu colony	0.0029	35	0.0026	4.1
Silluppanur colony	0.0077	35	0.0067	3.7
Silluppanur	0.0120	20	0.0060	5.8
Eachangadu	0.0125	35	0.0109	7.3
Thalavai colony	0.0112	35	0.0098	4.3
T.Gudalur	0.0125	40	0.0125	7.3
Thalavai	0.0099	40	0.0099	4.1
T. Senthamangalam	0.0092	30	0.0069	5.4

Methodology

Thalavai panchayat has about 600 households. The number of members in each family varies from 2 to 12. A questionnaire was prepared for the survey that sought details about family structure, water usage, water wastage, wastewater management techniques etc. For this study, 10% random sampling method was followed. Hence, study was conducted in 60 out of 600 households that were selected randomly in the Thalavai panchayat. Also, this panchayat was visited at a time when water was being supplied. Collection of drinking water by the people, water usage, water wastage and waste management techniques were observed. Three meetings were conducted for the villagers to take suitable measures for future water management.

Results and discussion

The following results were obtained from the study.

The information collected is given in the table.

S.No.	Particular	Information
1.	Water supply	60 lit. per capita per day (lpcd).
2.	Family structure	Number of members in the family – 2 to 12Level of literacy – Std. IV to Post graduationWorking members – 1 to 5.
3.	Water consumption at house level	Average water consumption per day per family – 40 to 225 lit. Drinking per day per person - 2 to 8 lit. Bathing per day per person – 7 to 50 lit. Cooking per day per family – 8 to 150 lit. Household use per family – 40 lit. Drinking water storage in house – 15 to 90 lit for 2 days.
4.	Drinking water usage	Villagers are using the panchayat water for drinking and cooking purposes. Villagers are using water from the panchayat pipe; bore well, pond, hand pump, eri and agricultural pump sets for washing clothes. During festivals / functions, villagers get additional water on request from panchayat (supply extra 1 hour) or from cement factory and through hand pump. Drinking water is also diverted to kitchen gardens or drainage. The villagers carry drinking water while going for work and during pilgrimage.
5.	Kitchen garden	They grow one or two neem, drumstick, coconut or Thespesia trees along with seasonal vegetables in their kitchen gardens by using wastewater. Few cultivate banana, brinjal, teak, tomato, chilly by using drinking water.
6.	Water conservation	Less than 20% of the households have installed rainwater-harvesting units in front of their houses and are at present defunct. Remaining are silted. Ponds and tanks store rainwater in the village and during heavy rains; excess water drains into the adjoining river Uppodai and Vellar.
7.	Water borne diseases	Villagers suffer from water borne diseases during rainy season (October, November and December).

By observation, many villagers are misusing panchayat water for their kitchen gardens. Hamlets lack proper drainage facility. Wastewater goes to the village pond and pollutes it. When questioned about the improvement in drinking water facility in their villages post independence, the villagers unanimously thanked the TWAD Board for supplying drinking water through the panchayat.

In this connection, three meetings were conducted for villagers. Water managers, TWAD Board officials, environmentalists, farmers, women, school students and general public of the panchayat participated and shared their views. From the above village meeting, following decisions were taken by the villagers for future management of drinking water of Thalavai panchayat.

- Drinking water is to be used only for drinking and cooking purposes
- Washing clothes is to be done at ponds, lakes or rivers.
- Wastage of drinking water is to be stopped.
- Drinking water will not be used for kitchen gardens.
- Duration of water supply is to be one hour per day.
- Lakes and ponds should be desilted once in five years.
- Rainwater harvesting units are to be installed permanently in all the houses.

Conclusion

Though the Thalavai panchayat gets enough drinking water, people were not aware of its importance and conservation. The quality of underground water is good at T.Gudalur and T.Senthamangalam. Remaining habitats have salty water. If this situation persists, people would have to face severe water scarcity in future. So, the above decisions were taken during the final meeting which are going to be implemented at the earliest.

Water is everyone's concern. Conserving and protecting water sources is a crucial issue, demanding the participation of every individual in a village, city, state or country. Each one of us must take stock of how much water one consumes, for what purpose it is used, the state of the water after consumption and where the used water ends up. Human survival is dependent on water. Water has been ranked by experts as second only to oxygen as essential for life.

DRINKING WATER MANAGEMENT
C.P.R. ENVIRONMENTAL EDUCATION CENTRE, CHENNAI

Date: _____ Name of the Official: _____

Questionnaire

1. Name of the person : .....
2. Address : .....
3. Number of family members : .....
4. Level of literacy : .....
5. Working members : .....
   Agriculture : .....
   Others : .....
6. Average water consumption per day per family : .....
   Drinking : .....
   Bathing : .....
   Cooking : .....
   Household use : .....
   Animals : .....
   Others : .....

7. For the above, how many litres of water you consume supplied by panchayat (by pipe line) : .....
well / bore well / other source : .....

8. Own well / bore well /others : .....
Water availability in summer (ft.) : .....

9. Where do you wash your clothes? : .....

10. Do you use the panchayat tank water for drinking and cooking? : .....

11. Have you installed rainwater harvesting unit in your house? : Yes / No

12. Where does the excess water get stored in your village? : .....

13. How much water do you consume during festivals / functions? : .....

14. How much water do you use to water your garden? : .....
Which water? : .....
Piped water / well / bore well
Number of plants in your garden : .....

15. How do you manage your wastewater? : .....
Kitchen garden : .....
Public drainage : .....

16. Does the waste water pollute your village? : .....
Does water-borne disease affect your village?
Which month? : .....
How do you solve? : .....

17. Do you have any other problems? : .....

18. Is there any ancient water body and do you use the water for any purpose? Temple tank / sacred water : .....

19. How do you store water and what quantity?
How many days? : .....

20. Do you buy water while going out or do you carry water? : .....
Total amount spent : .....

21. Your suggestion towards ground water management in your village in future : .....

22. Other suggestion / remarks : .....

Health Status of Tribes of Warangal District - A Case Study

Dr.Syeda Azeem Unnisa[1], G. Narasimha Rao[2], Prof. A.V.S. Prabhakar Rao[3], and Prof. Y. Anjaneyulu[4]

ABSTRACT

A study was undertaken among the tribal living in Tadvai Mandal, consisting of 41 villages in Warangal district of Andhra Pradesh to ascertain their knowledge about tuberculosis. In all, 300 households belonging to ten villages were selected at random and the heads of these households or the next responsible persons were interviewed. A total of (45%) had heard of tuberculosis and of these (55%) attributed it to tubercule bacilli.

Key words: *Tribes, Health, Tuberculosis, Nutrition and Sanitation.*

Introduction

In this modern age of science and technology and the availability of modern sophisticated diagnostic methods to help prevent and even cure diseases, there are still some people living untouched by all these developments. Even as the rest of the world goes through a variety of changes, they remain rooted in their culture, behaviour and beliefs. They continue to lead their lives completely ignorant of these changes, These people, tucked far away from all civilization are the children of our Mother Nature (Forests) and are called the "Tribal". The healthcare problems of tribal are more due to illiteracy, poor sanitation and their customs and traditions (Ali, 1980).

Material and Method

Area of Study

The study was conducted at Tadvai Mandal, which falls under Mulugu taluk of Warangal district in Andhra Pradesh. The district lies between the latitude of 17^0-19' and 18^0–36 North and longitudes of 78^0-49' and 80^0-43 East. It is above mid-sea level by 870 ft. Tadvai mandal has a varied landscape with scattered hills covered with dense forests. Minor streams meander through the area. It is a difficult terrain as there are no proper roads to the villages. Quite a few villages have to be reached on foot while a few others can be reached by bus. The majority of the tribal in this area are the Koyas who live in the densely covered forest area. There are 41 villages with a total tribal population of 19,727 in this mandal. Of these 10 villages with a population of 1000 were randomly selected. Tribal communities predominantly inhabit these villages (Handbook, 2005).

Method

A total of 300 households in these villages were selected at random for the study. The heads of these households or the next responsible persons were interviewed by using a structured interview schedule. The school teachers of Integrated Tribal Development Agency (ITDA) were trained by the centre's staff in filling up the interview schedules and utilized to visit the tribal' homes to fill up the schedules which were checked on a sample basis by the TRC (Tuberculosis Research Centre) team.

Results and Discussion

From the present study, it was concluded that out of 300 respondents 250 tribal respondents were suffering from tuberculosis. Of the 300 tribal respondents, 45% were males and the age varied from 20 to 76 years; 67% were illiterate and 65%

Table 1: Village - wise population (census , 2001)

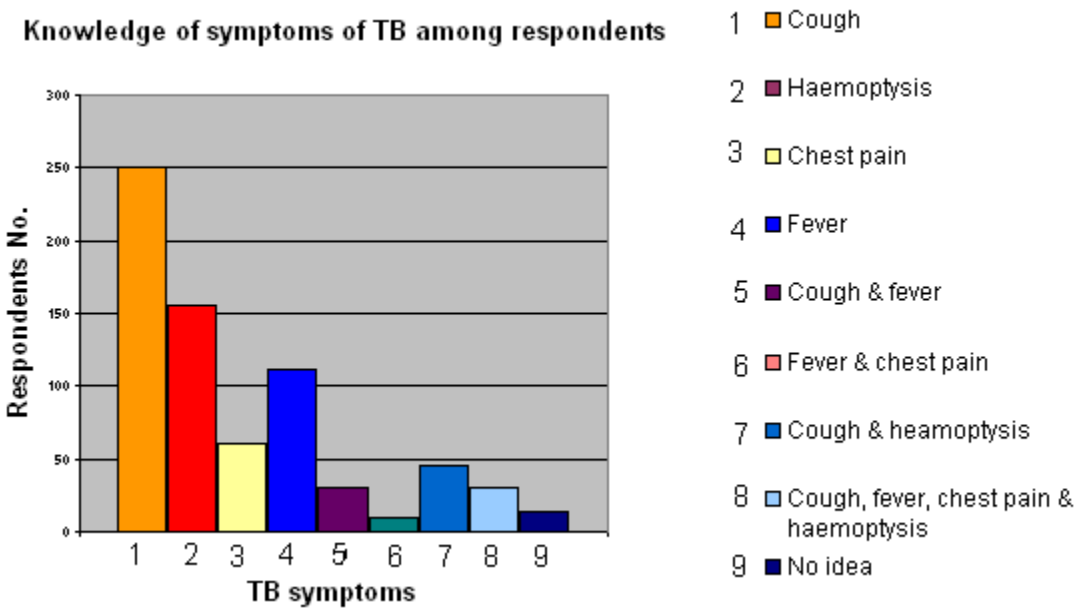
Sl. No.	Name of the villages	No. of Households	Population Male	Female	Literates
1	Kalwapalle	276	631	616	434
2	Narlapur	440	955	921	995
3	Tadvai	356	676	657	677
4	Kamaram	233	481	466	570
5	Katapuram	581	1340	1345	1431
6	Narsapur	148	325	380	233
7	Lingala	152	302	298	297
8	Beerelli	203	443	443	423
9	Rangapuram	124	299	289	205
10	Oorattam	101	207	190	201

Table 2: Knowledge about symptoms of TB among respondents

Sl. No.	TB symptoms	Respondents No.
1	Cough	250
2	Haemoptysis	156
3	Chest pain	60
4	Fever	112
5	Cough & fever	30
6	Fever & chest pain	9
7	Cough & haemoptysis	45
8	Cough, fever, chest pain & haemoptysis	30
9	No idea	14

were involved in agricultural work earning a monthly income of Rs. 450 or less (Table 1). Regarding the reasons for sickness, 61% of the respondents believed in superstitions such as sin, evil spirit and god's curse; 20% said that the use of fertilizers and pesticides were the cause of sickness; 12% had mentioned unhygienic conditions as the reason and the remaining 12% blamed change of food habits. From the study it was found that the knowledge about the correct reasons for tuberculosis among them was very few.

About the prevalence of tuberculosis 56% said that it was prevalent in rural areas, while 30% was of the opinion that it was more prevalent in urban areas, whereas the remaining 14% were ignorant about the prevalence of the disease. Regarding knowledge of the symptoms of tuberculosis among the persons who had heard of TB, cough was considered to be the main symptom by 42%, haemoptysis by 29%, cough, fever chest pain and haemoptysis combined by 15% and the remaining 14% had no idea about symptoms (Table 1 and graph: 1).



This study brings out the attitude towards sickness among the tribals, their faiths and beliefs, treatment seeking behaviour, their utilisation of available health facilities and their knowledge about tuberculosis. In this study, 61% of the respondents had superstitious beliefs regarding the causes of sickness. (Sujatha, 1998).

Conclusion

Awareness is needed to improve the basic health needs of tribal and proper health education. Better medical facilities with sympathetic attitude of the doctor and health officials are required. It is also essential to organize services of mobile clinics. These are some of the remedial measures suggested by the Regional Medical Research Centre for Tribal Health.

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Assessment of Soil Quality: the First Step towards Wasteland Development – A Case Study

N. Muthukrishnan

ABSTRACT

The first step towards reclamation of any wasteland is the assessment of the soil quality including the soil profile. A soil test will establish whether the soil is saline, sodic, saline-sodic, alkaline, acidic or neutral. Soil tests also identify the reason and remedial measures for problem soils. For a wasteland development in Kallathikulam village, soil samples were first analysed and based on the analysis report, soil correction and nutrients application were made.

Introduction

The first step towards reclamation of any wasteland is the assessment of the soil including the soil profile. A soil test will establish whether the soil is saline, sodic, saline-sodic, alkaline, acidic or not affected. Soil tests also identify the reason and remedial measures for problem soils. Further, soil tests measure the relative nutrient status of soils and are used as a basis for profitable and environmentally responsible nutrient application.

Kallathikulam is a small village in Thirunelveli district. About 40 acres of wasteland in this village was planned for development by a farmer. He approached CPREEC for soil analysis and a systematic plan was developed to collect soil samples in appropriate locations and depth. Based on the analysis report, soil correction and nutrients application were made. Now more than 3500 saplings of sapota, 200 saplings each of teak, casurina, pungam and jackfruit have been planted and the entire wasteland developed.

Kalathikulam

Kallathikulam is a small village situated in Thirunelveli District, 26 km away from Thirunelveli Town, coming under Maranthai Panchayat and Alankulam Taluk. It is a semi-arid area with 600 to 800 mm of annual rainfall. The two major types of soils in this district are red and black. The black soil is restricted to the cultivated area. Red loam is the predominant soil type in this district accounting for 48.21% followed by black soil of 30.09%. The other types of soils are laterite soil, sandy coastal alluvium, red sandy soil and others.

Soil sampling

A routine soil sample weighs approximately one kg. This represents only 0.00005 percent or less of the average top 12 inches of an acre of soil. Thus sample collection is extremely important in the accuracy and repeatability of a soil test. A soil sample which does not represent the area being sampled will be misleading - resulting in either over application or under application of soil amendments or fertilizer.

As the field to be sampled covered a large area (40 acres) with varied topography in Kalathikulam, it was sub-divided into relatively uniform sampling units. Within each sampling unit soil sub-samples were taken from several different spots in a zig-zag pattern and these sub-samples were mixed into one composite sample. Thus 36 composite samples were collected from a soil profile of 12" x 24" and 36"deep. After collection, samples were dried and packed in plastic bags, labelled with sample number, date of collection, location, etc.

Table 1: •Minimum, Maximum and Mean Values of Each Parameter

Sl. No.	Parameter	Unit	Min	Max	Mean	Normal Range
1	pH	-	4.90	10.05	7.20	6.50 to 7.50
2	EC	mmhos/cm	0.02	4.62	0.62	< 4.00
3	Nitrogen	%	0.05	0.10	0.07	0.10 to1.00
4	Phosphorus	µg/gm	0.90	93.50	13.60	20 to 40
5	Potassium	meq/100gm	0.02	0.54	0.18	0.20 to 0.60
6	Calcium	meq/100gm	1.50	24.00	6.69	4.00 to 10.00
7	Magnesium	meq/100gm	0.41	8.40	3.23	0.50 to 4.00
8	Zinc	µg/gm	10.80	38.30	21.39	0.02 to 0.20
9	Boron	µg/gm	<0.10	<0.10	<0.10	0.10 to 1.00
10	Sodium	meq/100gm	0.16	44.00	6.73	<5.00 (SAR)
11	CEC	meq/100gm	2.90	48.25	16.92	5.00 to 25.00
12	ESP	-	0.75	91.20	22.25	< 15.00

Analysis of parameters

After receiving the soil samples in the laboratory they were air dried, stones and plant residues removed, and later crushed and passed through a 2 mm sieve. Then, the following parameters were analysed: pH, electrical conductivity, nitrogen, phosphorus, potassium, calcium, magnesium, zinc, boron, sodium, cation exchange capacity (CEC) and exchangeable sodium percentage (ESP).

All the parameters were analysed using specific standard methods. The pH value and electrical conductivity were measured in the water extract of the soil. Available nitrogen was analysed by the alkaline potassium permanganate distillation. Potassium, calcium, magnesium, sodium and zinc were analysed by atomic absorption spectrometer. Boron was analysed by carmine method. CEC and ESP were calculated from the potassium, calcium, magnesium and sodium values.

Results and discussions

The minimum, maximum and mean values of each parameter and the normal range required for most of the plants are provided in Table 1.

The pH value

The pH is a measure of how acidic or alkaline the soil is. This pH scale ranges from 0 to 14. The lower the number, the more acidic the soil; the higher the number, the more basic; with a pH of 7 being Neutral. For maintaining a balanced soil, pH value is very important. It helps in producing high yields of crops. While every crop is different, most favour a neutral pH range of 6.5 to 7.5. Classification of soils based on pH values is detailed in Table 2.

Table 2: Classification of soils based on pH values

Soil pH	Soil classification
< 5.0	strongly acid
5.0 to 6.5	moderately acid
6.5 to 7.5	Neutral
7.5 to 8.5	moderately alkaline
> 8.5	strongly alkaline

In natural ecosystems, soil pH is balanced by the varied plant species and natural processes. Mono cropping, unbalanced fertilizer application, acid rain and improper lime/gypsum application create an artificial ecosystem, which alters the pH of the soil. Each plant has its own recommended soil pH value range. The nutrient nitrogen, a very important plant nutrient, is readily available in soil when the pH value is above 5.5. Similarly the

nutrient phosphorous is available when the pH value is between 6 and 7. If a plant is placed into the wrong kind of soil, it will be starved of nutrients that it needs, inviting disease.

In Kallathikulam, the soil samples showed a minimum pH of 4.90 to maximum of 10.05, whereas the mean pH value was 7.20. Out of 36 samples analysed, 8 samples had a pH value of more than 8.5 (strongly alkaline) and one sample showed a pH value of 4.9 (strongly acidic). Addition of gypsum for alkaline soil and addition of lime for acidic soil were recommended.

Electrical conductivity (Salinity)

Soil salinity refers to the concentration of soluble inorganic salts in the soil. It is measured by extracting the soil sample with water and salinity is measured by electrical conductivity (EC). EC is expressed in millimhos per cm (mmhos/cm). Generally, an EC value of 4 mmohs/cm and above is termed saline soil.

The most likely effects of salinity on plants:

- ❖ Stunted growth
- ❖ Water stress
- ❖ Physical damage and mortality
- ❖ Delay in germination and seedling development

Fortunately, in Kallathikulam only 2 samples (out of 38 samples analysed) had EC value above 4 mmhos/cm. The mean value was only 0.62 mmhos/cm, thus the soil was mostly non-saline.

Nitrogen

Though nitrogen is the most important soil nutrient and crops require large quantities of this nutrient, the availability of nitrogen is low in virtually all type of soils in India. Nitrogen occurs in many forms, both organic and inorganic. The inorganic fraction composes of ammonia, nitrates and nitrites.

Nitrogen is a part of all living cells and is a necessary part of all proteins, enzymes and metabolic processes involved in the synthesis and transfer of energy. Nitrogen is a part of chlorophyll, which helps plants to grow rapidly, increases seed and fruit production and improves the quality of leaf and forage crops. Nitrogen often comes from fertilizer application and from the air (legumes get their N from the atmosphere, while water or rainfall contributes very little nitrogen).

From the analysis report, it was found that the availability of nitrogen in almost all the samples were less than 0.1% and the mean value was only 0.07%. Addition of organic manure in huge quantities was recommended to increase the nitrogen level.

Phosphorus

Like nitrogen, phosphorus is also an essential part of the process of photosynthesis and is involved in the formation of all oils, sugars, starches, etc. It helps in the transformation of solar energy into chemical energy; proper plant maturation and to withstand stress. It effects rapid growth and encourages blooming and root growth.

About 15 to 80% of the phosphorus in soils occurs in organic forms, the exact amount being dependent upon the nature of the soil and its composition. The higher percentages are typical of peat and uncultivated forest soils. From the standpoint of plant nutrition, phosphorus is absorbed by plants largely as the negatively charged primary and secondary orthophosphate ions (H_2PO_4 and HPO_4^{2}) which are present in the soil solution. In Kallathikulam village, out of 36 samples analysed, only 7 samples had more than 20 µg/g of available phosphorus. The mean value was also very less (13.6 µg/g).

Potassium

Next to nitrogen, potassium is the most absorbed mineral element. It helps in the building up of

proteins, facilitating photosynthesis, enhancing fruit quality and reducing susceptibility to diseases. Potassium is supplied to plants by soil minerals, organic materials, and fertilizer. Out of 36 samples analysed in Kallathikulam only 9 samples showed more than 0.2 meq/100g of Potassium.

Calcium

Calcium plays a major role in the overall health of both plant and soil. If well-balanced on the soil-colloid, it will help in physically opening up the soil for better air and water movement. This in turn creates the necessary conditions for the production of beneficial bacteria creating checks and balances for disease. It helps in root and leaf development and makes phosphorous and micro-nutrients available. If well-balanced, proper levels of calcium reduce the need for nitrogen by making decomposition of organic matter more efficient. In Kallathikulam, 25 samples had more than 4 meq/100g of calcium. Mean value of all the samples was also more than 4meq/100g.

Magnesium

Magnesium is a secondary macro-nutrient and is important for plant production. This nutrient is taken up by plants and plays a key role in many processes. It is an essential element in a plant's physiology and in metabolism through photosynthesis, glycolysis, the citric acid or Krebs cycle. Chlorophyll is the green pigment, which enables a plant to convert sunlight into biological energy. Magnesium is the central atom in the chlorophyll. Magnesium is also a structural element in rhibozome. It stabilizes the rhibozome in the arrangement essential for protein synthesis. In Kallathikulam 35 samples had more than 0.50 meq/100g of magnesium. Mean value of all the samples was also more than 0.50meq/100g.

Micro-nutrients

Micro-nutrients are those elements essential for plant growth, but needed in only very small (micro) quantities. Generally, plants require seven micro-nutrients namely, boron, copper, iron, chloride, manganese, molybdenum and zinc. Recycling organic matter such as grass clippings and tree leaves is an excellent way of providing micro-nutrients (as well as macro-nutrients) to growing plants. Out of these seven micro-nutrients, we tested only boron and zinc in the soil samples. Boron is a constituent of cell membrane and essential for cell division and acts as a regulator of potassium/calcium ratio in the plant. It also helps in nitrogen absorption and translocation of sugars in plant. None of the samples had sufficient quantity of boron.

Zinc is a constituent of several enzyme systems, which regulate various metabolic reactions in the plant. Zinc is thus associated with water uptake and water relation in the plant. Availability of zinc in all the samples was sufficient.

Sodium and sodium exchange percentage

The two main risks of high sodium levels in soil water are toxic effects and impacts on plant growth from changes in soil structure. Soils with high levels of exchangeable sodium and low levels of total salts are called sodic soils. Sodic soils may impact plant growth by:

- ❖ Specific toxicity to sodium sensitive plants
- ❖ Nutrient deficiencies or imbalances
- ❖ High pH
- ❖ Spread of soil particles that cause poor physical condition of the soil.

Sodic soils tend to develop poor structure and drainage over time because, sodium ions on clay particles cause the soil particles to de-flocculate, or disperse. The soil's pH is usually high, often above 9.0 and plant nutritional imbalances may

Table 3:Sodium hazard of soil based on ESP values

Classification	ESP	Electrical conductivity (mmhos/cm)	Soil pH	Soil physical condition
Sodic	>15	<4.0	>8.5	Poor
Saline-Sodic	>15	>4.0	<8.5	Normal
High pH	<15	<4.0	>7.8	Varies
Saline	<15	>4.0	<8.5	Normal

occur. A soil pH above 8.5 typically indicates that a sodium problem exists. Sodic soils have exchangeable sodium percentages of more than 15. This means that sodium occupies more than 15 percent of the soil's cation exchange capacity (Table 3)

Out of 36 samples analysed, 9 samples were identified as sodic soils. Reclamation of sodic soils is difficult; excess sodium must be replaced first by another cation and then leached. Sodic soils are treated by replacing the sodium with calcium from a soluble source like gypsum. Once gypsum is applied and incorporated, sufficient good quality water must be added to leach the displaced sodium beyond the root zone.

Cation exchange capacity (CEC)

Cation exchange capacity is defined as the degree to which a soil can absorb and exchange cations like calcium, magnesium, potassium and sodium. It depends on the quantity of particles on soil surfaces that can retain positively charged ions (cations) by electrostatic forces. Cations retained electrostatically are easily exchangeable with other cations in the soil solution and are thus readily available for plant uptake. Thus, CEC is important for maintaining adequate quantities of available calcium, magnesium and potassium in soils. CEC is highly dependent upon soil texture and organic matter content. In general, the more clay and organic matter in the soil, the higher the CEC. As calcium and magnesium were found in sufficiently good quantities the CEC value was also high. Out of 36 samples, 34 samples had more than 5 meq/100g.

Conclusion

Today's wastelands were once cultivable lands. Intensive cultivation, failure of rainfall, saline water irrigation and improper fertilizer application can convert any land into wasteland. In most of the cases, however, it is reversible. By adopting scientific approaches, it is easy to re-convert a wasteland into cultivable land. The first step towards reclamation of any wasteland is the assessment of the soil. If we are able to do the soil correction and nutrients application based on the analysis report, any wasteland can be made cultivable. The wasteland in Kallathikulam is one example.

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