

Vegetation structure and faunal composition of Wathurana Wetland ecosystem Tebuwana, Kalutara, Sri Lanka

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Abstract

A study was conducted in Tebuwana Wathurana Wetland ecosystem to understand its vegetation structure and faunal composition in order to assess its conservation needs. As there are no published records on the flora and fauna of Wathurana Wetlands in Tebuwana, it is necessary to understand the ecological and other relevant features in order to develop strategies to conserve this wetland. These objectives were pursued by surveying the vegetation of the wetland and by identifying fish and bird species present.

A total of 66 species of flora and 61 species of fauna were identified in the survey. Of the 27 fish species recorded from the Tebuwana Wetland, 9 species were endemic and 17 species belonged to the indigenous category. With regard to the flora in the wetlands, the dominant families were Rubaceae, Fabaceae and Arecaceae. The 66 species belonged to 39 families and 61 genera while 12 species were endemic and 4 species were considered highly threatened. These flora were found in four layers. Of the 22 species of birds recorded, two species were endemic.

This study revealed that these Wathurana Wetlands have a high species diversity but that they face many threats including encroachments, extraction of forest products mainly as timber, land filling, mining and occurrence of invasive species. It is essential to minimize the exploitation of natural resources from this wetland in the future and in particular to mark the boundary, conduct awareness programmes and continue research.

Keywords: Wathurana, wetland, Tebuwana, vegetation structure and faunal composition

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Introduction

Wetlands are among the most important ecosystems on the Earth and are basically habitats with permanent or temporary accumulation of water and associated flora and fauna. Swamp wetlands are dominated by trees or shrubs and are frequently or continuously inundated (William and Gosselink, 1986). Wetlands are further defined as areas of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water where the depth at low tide does not exceed 6 meters (Ramsar convention, 1987). Wetlands are also described as “the kidneys of the landscape”, for the functions they perform in hydrological and chemical cycles and as the downstream receivers of waste from both natural and human sources (William and Gosselink, 1986). Wetlands play an important role in conservation of gene pools of wild varieties of fish, amphibian, reptiles, mammals, birds and endemic tree and herbivorous species. Wetland vegetation influences hydrological conditions by trapping and binding sediments to reduce erosion, by interrupting water flow, and by building peat deposits (Gosselink, 1984). Swamps and marshes function as ground water aquifers and are of indirect use in protecting the shoreline by regulating water flow.

Walauwatta Wathurana Wetland is the only site that records the rare endemic tree species *Stemonoporus moonii* as well as *Mesua stylosa* and a very rare endemic fish species, *Lepidocephalichthys jonklaasi* (CEA, 1994b). The Central Environmental Authority of Sri Lanka has prepared a wetland directory in which it has identified 41 wetlands in Sri Lanka (CEA, 1994a). This does not, however, include Tebuwana Wetlands and its wetland islets. There are also no published records on the flora and fauna of Wathurana Wetland which is considered highly threatened by human activities. The aim of the present study was to identify the structure, dynamics and species composition of the vegetation and fish and bird fauna and to assess the threats to the Wathurana Wetlands in order to develop conservation strategies.

Materials and Methods

Tebuwana is located in the Dodangoda Divisional Secretariat Division (DSD), Kalutara district (CEA, 1992). It has many wetland islets that are interconnected with small strips of scrub wetland forests. Irriyangala-Wathurana, Ulpath-Wathurana and other wetland patches form the catchments of the Irriyangala Stream (Fig. 1). Most of the flat valley bottoms are planted with paddy. The Wathurana Wetland forest is used as a free grazing area for water buffaloes. The landform of Dodangoda area is undulating to rolling where the annual rainfall is higher than that in other parts of the low country wet zone. Soils in Wathurana Wetlands area are classified as Red-yellow Podzolic with alluvial of variable drainage and texture in the valleys. Deep weathering of rocks, as observed in embankments and cuttings, has resulted in the development of low ferruginous clays and sand that have been washed down during erosion and have collected in areas such as

Wathurana. These soils exhibit poor drainage capacities that could inhibit normal root growth in plant species (CEA, 1994b).

A field survey was carried out from May to July 2004 and April to December 2006. Flora of wetlands were sampled using 10 m x 10 m plots laid at three different locations (Zelený and Chytrý, 2007). Plots were selected using a random sampling technique and three belt transect visits were made during the study period (Jerrold, 1984). Visual observations were made during these visits to identify the different plant species. The vertical structure and dominant species of the vegetation types were noted. Identification in the field was based on morphological characters (Ashton *et al.*, 1997) and in the case of those that could not be identified, specimens were collected and subsequently identified by comparing with the collection available in the National Herbarium (PAD) at the Royal Botanic Gardens, Peradeniya. The survey for fish was carried out in streams within Wathurana Wetland areas by kick sampling, and by inspecting the streams and the commercial catches of local fishermen. Identification of species was made using the guide, “Fresh water fish of Sri Lanka” (Pethiyagoda, 1991). Birds were recorded by visual observations and identifications were made using field guides (Kotagama and Fernando, 1994; Kotagama and Wijayasinha, 1998; Harrison, 1999; Kotagama, 2006; and Wijeyeratne, 2007). Secondary data were collated from sources such as survey maps, published literature and documents available at the Divisional Secretariat at Dodangoda. Discussions with key informants were used to obtain additional qualitative information about flora and fauna. Field interviews, discussions and personal observations were used to identify threats, uses and appropriate actions to conserve the wetland.

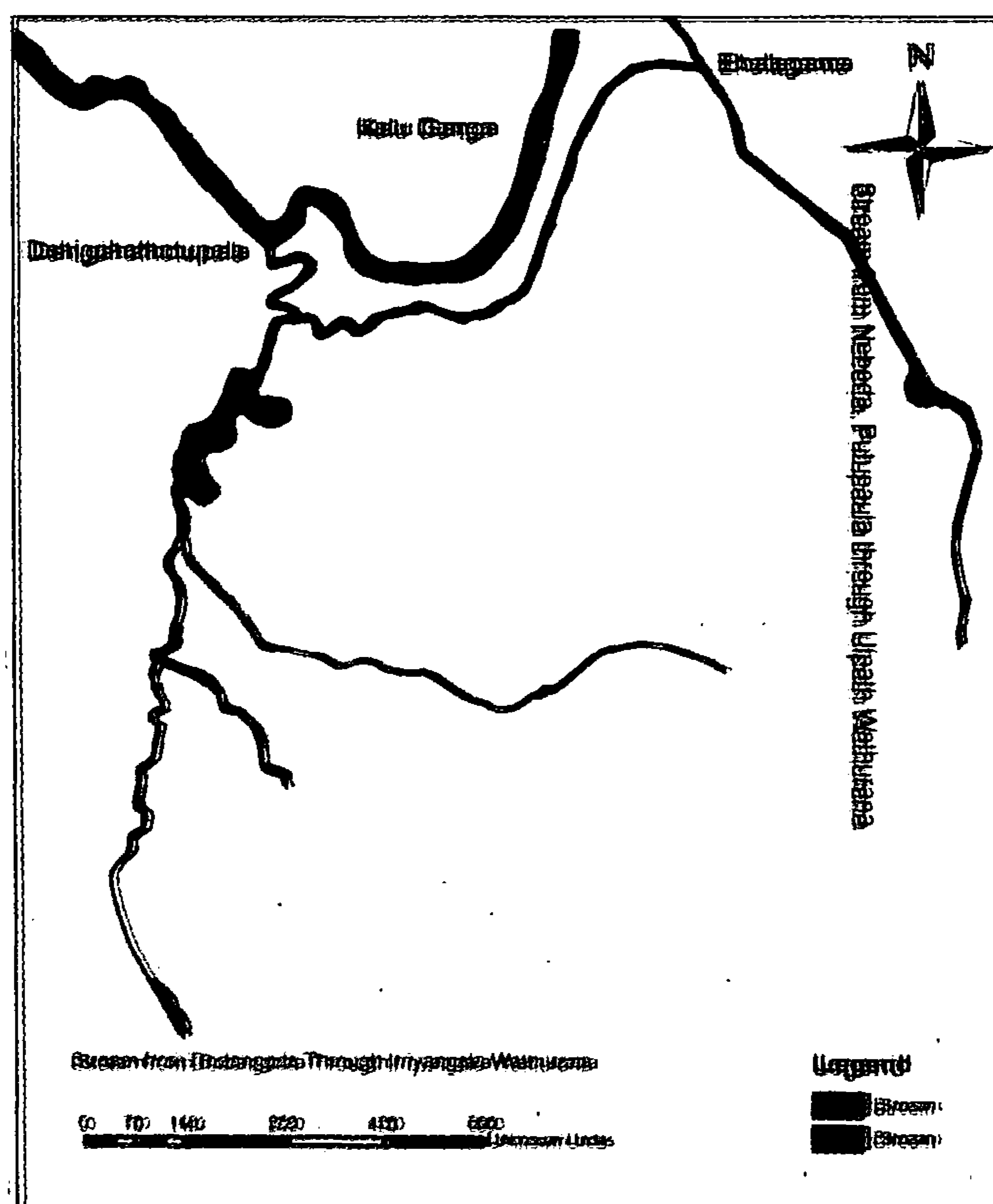


Fig. 1. Water resources in Tebuwana

The extent of the Irriyangala Wathurana is approximately 45 hectares. Three sampling locations (10 m x 10 m) were used to analyse the flora. The Simpson and Shannon-Wiener index was used to calculate the diversity of flora. This index measures the order (or disorder) observed within a particular system. In ecological studies, this order is characterized by the number of individuals observed for each species in the sample plot.

$$P_i = n_i / N \quad (\text{Equation 1})$$

$$H' = - \sum_{i=1}^S p_i \ln p_i \quad (\text{Equation 2})$$

n_i = number of individuals of species "i"

N = total number of individuals of all species

p_i = relative abundance of species "i" (see equation 1)

S = total number of species

H' = The Shannon Diversity Index (see equation 2)

This index assumes that individuals are randomly sampled from an effective infinite population. It also assumes that all the species are represented in the sample (Magurran, 1988). Using biodiversity statistical software produced by Shannon-Wiener diversity index, evenness was calculated. Simpson's Index (D) measures the probability that when two individuals are randomly selected from a sample, they will belong to the same species. With this index, 0 represents infinite diversity and 1 indicates no diversity. That is, the bigger the value of D, the lower the diversity (<http://www.mdsg.umd.edu/>; Jerrold, 1984). The formula for the calculation is given below:

$$D = \sum n(n-1) / N(N-1)$$

n = the total number of organisms of a particular species

N = the total number of organisms of all species

During the study, threats to the Wathurana Wetland ecosystem were also identified.

Results and Discussion

Landscape and physical features

Tebuwana is located in the Kalu Ganga river basin 15 km inland from the coastal town of Kalutara. More precisely, the site is situated along a stream locally known as the Irriyangala stream, a tributary of the Kalu Ganga. Irriyangala Stream (Fig. 1) is fed by five streams originating in the Irriyangala Wathurana Wetland forest. The main wetlands in the area are known as Irriyangala Wathurana and Ulpath Wathurana (Fig. 3). The landscape surrounding this wetland complex constitutes several ridges and a broad valley. The most prominent ridges are Pulunukanda in the Southeast, Kethena in the South and Inimangala in the Southeast. The valley is 3-5 km wide and is used mainly for

rice cultivation. Narrow streams are present in the valley and along which the Wetland has developed. These wetlands are located around the Tebuwana, Neboda and Dodangoda areas and they connect with each other to form the Wathurana Wetland complex. Irriyangala stream is a tributary of the Kalu Ganga and connects with the sea near Payagala so that when the water level in the Kalu Ganga is high, the excess water is drained via the Irriyangala stream. At present, however, the Irriyangala stream is highly silted and the areas along the banks are encroached and blocked. As a result, water cannot move through the Irriyangala stream. The Ulpath Wathurana wetland is less disturbed due to anthropogenic activities than the Irriyangala Wathurana and is, therefore, less silted.

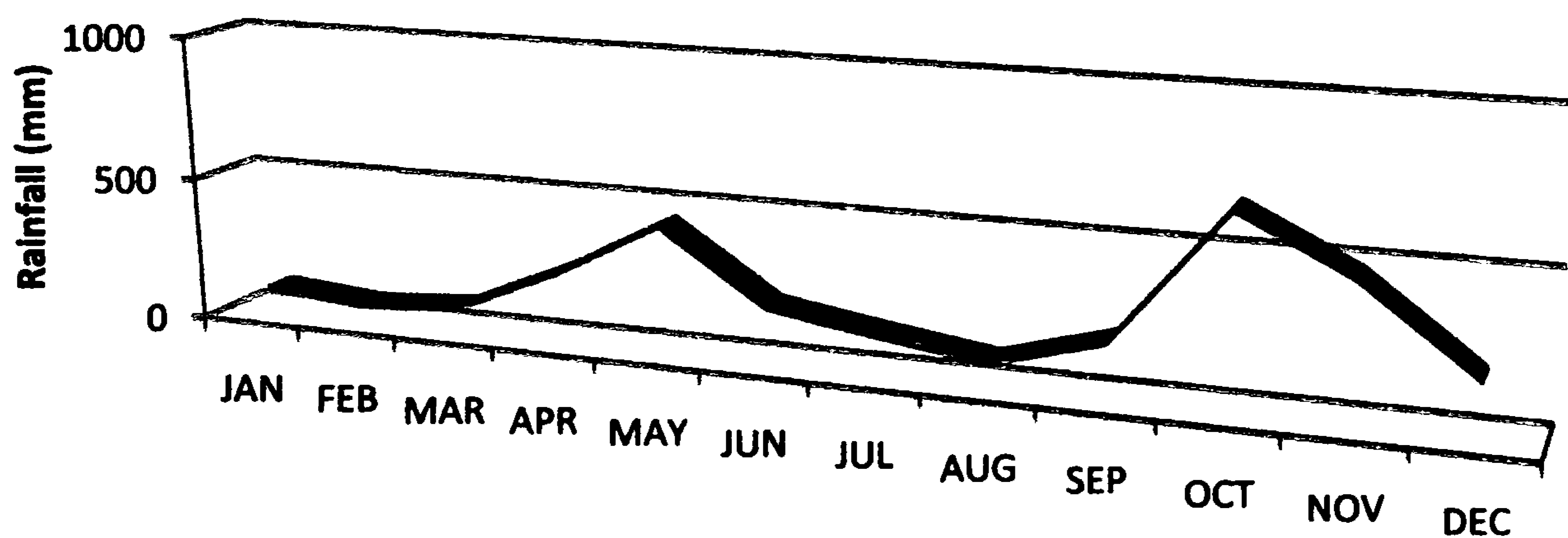


Fig. 2. Rainfall pattern of the Tebuwana in 2004.

Source: Meteorological Department

The study area lies within the country's wet zone and has a mean annual rainfall over 2500 mm. The South–West monsoon prevails from May to September and the North–East monsoon from December to February. The rainfall is well distributed during the year since rain also occurs during the two inter monsoonal periods. Indeed, the highest rainfall is received during the inter-monsoon periods often causing flooding. Tebuwana is flooded three to four times in a year and thus the Wathurana Wetland is submerged the same number of times during the year. The period of flooding can vary from a few days to 2-3 weeks. The rainfall received by the area during the study period is presented in the Fig. 2 and it can be seen that most rain was recorded in March-May and October-November periods.

Socio-economic status of communities around Tebuwana Wetlands

The Wathurana Wetland complex traverses through Tebuwana-west, Tebuwana-east and Thudugala-west Grama Niladari (GN) administrative divisions. The Alegoda and

Thudugala villages are located close to the southeast border of the Irriyangala Wathurana Wetland forest. Of the total population in these three Grama Niladari (GN) administrative divisions, 7.81 % work in the state sector, 32.60 % in the private sector, 13.57 % are involved in the agriculture sector whilst the rest (46.02 %) are considered unemployed (Table 1). The high rate of unemployment can be expected to lead to significant levels of poverty as a large number of families do not have regular work. Most of them work as hired labour. This socio-economic setting is also a contributory factor to the destruction of the wetland ecosystem due to human activities. They include illegal felling of trees, uncontrolled exploitation of mineral resources (gem mining and sand mining), illegal clearing of wetlands for industrial purposes and filling up of low-lying areas. Marshy areas of the wetland have been used for dumping domestic and industrial solid waste as well as industrial effluents and partially treated sewage.

Table 1. Employment in Tebuwana

GN Division	Government	Private	Agriculture	Unemployed
Thudugala-West	59	298	20	150
Tebuwana-West	33	130	80	250
Tebuwana- East	68	240	178	543

Vegetation types of Wathurana Wetland in Tebuwana

Three main types of wetlands can be seen in Tebuwana. They are agricultural Wetlands (i.e. rice lands, rubber), rivers, streams and marshlands. Rice lands and rubber are the dominant types of land-use in the area followed by freshwater flood plain Wetlands developed due to over flowing of the tributaries of the Kalu Ganga. A few Wathurana Wetland forest patches and narrow forest belts that connect these patches are found in the Wathurana Wetland. Irriyangala Wathurana area has the largest patch of forest (Fig. 3).

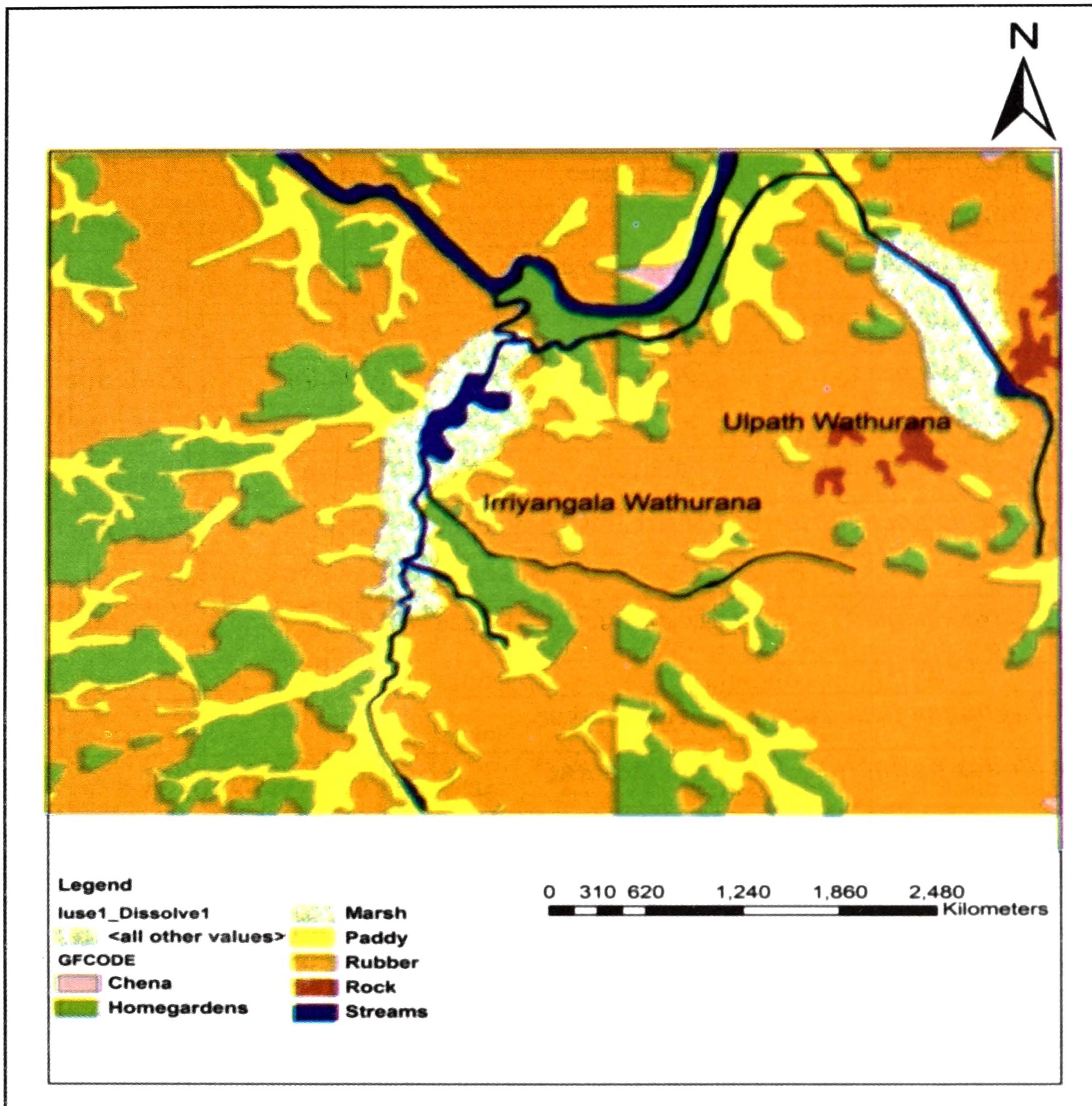


Fig. 3. Study sites and land-use features in the Wathurana Wetlands

The total extent of the Wathurana Wetland complex is approximately 100 hectares. The original Wathurana Wetlands area had declined due to the establishment of rubber plantations by private parties during the Colonial period. These lands have more recently been allocated to private individuals by the Land Reform Commission during the Implementation of Act No. 43 of 1979, State Land Grants (Special Provisions).

Flora of Wathurana Wetlands

A list of flowering and non flowering plant species identified in this study, from the Wathurana Wetland complex is presented in Table 2. Sixty-six plant species were recorded during the study belonging to 39 families and 61 genera, including several endemic and rare plant species.

Table 2. Identified plant species in Wathurana Wetland in Tebuwana.

No	Scientific Name	Family	Sinhala Name	Endemic / Threatened / Exotic
1	<i>Syzygium caryophyllatum</i>	Myrtaceae	Dan	-
2	<i>Annona glabra</i>	Annonaceae	Wel atha	-
3	<i>Nauclea orientalis</i>	Rubiaceae	Bakmi	-
4	<i>Stemonoporus acuminatus</i>	Dipterocarpaceae	Mandora	Endemic / rare
5	<i>Pericopsis mooniana</i>	Fabaceae	Nadun	HT
6	<i>Osbeckia octandra</i>	Mstreamstomataceae	Heen bovitiya	Endemic
7	<i>Mstreamstoma malabathricum</i>	Mstreamstomataceae	Maha bovitiya	-
8	<i>Lygodium flexuosum</i>	Schizaceae	Paba wal	-
9	<i>Smilax prolifera</i>	Smilacaceae	Heen kabarasa	-
10	<i>Smilax zeylanica</i>	Smilacaceae	Maha kabarasa	-
11	<i>Flagellaria indica</i>	Asclepiadaceae	Govi wal	-
12	<i>Carex iria</i>	Cyperaceae	Hiri	-
13	<i>Dillenia triquetra</i>	Dilleniaceae	Diyapara	Endemic / CR
14	<i>Ardisia gardneri</i>	Myrsinaceae	Balu dan	Endemic
15	<i>Ixora coccinea</i>	Rubiaceae	Rathabala	Native
16	<i>Aporosa lanceolata</i>	Euphorbiaceae	Heen Kebella	VU/ Endemic
17	<i>Lagerstromia speciosa</i>	Lythraceae	Murutha	-
18	<i>Lassia spinosa</i>	Araceae	Kohila	-
19	<i>Hunteria zeylanica</i>	Apocynaceae	Midella	Protected
20	<i>Calamus rotang</i>	Arecaceae	Wewal	-
21	<i>Salacia chinensis</i>	Hippocrateaceae	Heen Hibutu	-
22	<i>Cuscuta chinensis</i>	Convolvulaceae	Wathu palu	-

23	<i>Marsilea</i> spp.	Marsileaceae	Pothupala	-
24	<i>Mitragyna tubulosa</i>	Rubiaceae	Hstreammba	-
25	<i>Oxalis corniculata</i>	Oxalidaceae	Ambul Ambiliya	-
26	<i>Nelumbo nucifera</i>	Nelumbonaceae	Nelum	-
27	<i>Vitex altissima</i>	Verbenaceae	Milla	-
28	<i>Vernonia cinerea</i>	Asteraceae	Monera kuddumbiya	-
29	<i>Nymphaea pubescens</i>	Nymphaeaceae	Olu	-
30	<i>Spermacoce suffrutescens</i>	Rubiaceae	-	-
31	<i>Aponogeton jacobsenii</i>	Aponogetonaceae	Kekatiya	-
32	<i>Carallia brachiata</i>	Rhizophoraceae	Dawata	-
33	<i>Symplocos bractealis</i>	Symplocaceae	Bombu	VU
34	<i>Areca catechu</i>	Arecaceae	Puwak	-
35	<i>Erythrina lithosperma</i>	Fabaceae	Erabadu	-
36	<i>Mimosa pudica</i>	Fabaceae	Nidikumba	-
37	<i>Ochilandra stridula</i>	Poaceae	Unabata	Endemic
38	<i>Albizia chinensis</i>	Fabaceae	Mara	-
39	<i>Canthium coromandelicum</i>	Rubiaceae	Kara	-
40	<i>Diplazium</i> spp.	Woodsiaceae	Miyana	-
41	<i>Ficus racemosa</i>	Moraceae	Attikka	-
42	<i>Ficus hispida</i>	Moraceae	Kotadibula	-
43	<i>Wormia triquetra</i>	Dilleniaceae	Diyapara	Endemic
44	<i>Schoenoplectus grossus</i>	Cyperaceae	Thunhiria pan	-
45	<i>Pothos scandens</i>	Araceae	Pota wal	-
46	<i>Pongamia pinnata</i>	Fabaceae	Magul karada	-
47	<i>Drymoglossum heterophyllum</i>	Polypodiaceae	Kasipetthi	-
48	<i>Drynaria quercifolia</i>	Polypodiaceae	Beduru	-

49	<i>Mimusops elengi</i>	Sapotaceae	Munamal	-
50	<i>Areca concinna</i>	Areaceae	Lenthare	Endemic / EN
51	<i>Vateria copallifera</i>	Dipterocarpaceae	Hal	Endemic / EN
52	<i>Dillenia retusa</i>	Dilleniaceae	Godapara	-
53	<i>Psidium guineense</i>	Myrtaceae	Abul pera	-
54	<i>Monochoria hastate</i>	Portulacaceae	Diya habarala	-
55	<i>Garcinia quaesita</i>	Clusiaceae	Goraka	Endemic / VU
56	<i>Gyrinops walla</i>	Thymstreameaceae	Walla gas	
57	<i>Glochidion stellatum</i>	Euphorbiaceae	Kirilla	Endemic
58	<i>Ficus exasperata*</i>	Moraceae	Sevstreamm adia	
59	<i>Phaphidophora decursina</i>	Araceae	Wal Kohila	Endemic / HT/ protected
60	<i>Phoenix farinifera</i>	Areaceae	Wal ede (bos)	Native
61	<i>Nephrolepis hirsutula</i>	Oleandraceae	Wal meyana	-
62	<i>Combretum albidum</i>	Cochlospermaceae	Kaduruketiy a wel	-
63	<i>Palaquium petiolare</i>	Sapotaceae	Kiri habiliya	Endemic
64	<i>Tylophora tenrissima</i>	Asclepiodiaceae		
65	<i>Cleistocalyx nervosum</i>	Myrtaceae	Bata-damba	Endemic / HT/
66	<i>Caryota urens</i>	Areaceae	Kithul	Native

Key: HT - Highly threatened
VU - Vulnerable
NT - Near threatened
CR - Critically Endangered
EN - Endangered

The most dominant families are Rubiaceae, Fabaceae and Arecaceae (five species each) and the most dominant genus is *Ficus* (three species). A general vegetation profile of the area and vegetation profile during the flooding season are presented in the Fig. 4. The forest has four layers, namely, the ground cover, herbaceous layer, sub-canopy and canopy. The ground layer consists mainly of pteridophytes (ferns). The Herbaceous layer has many small trees including Maha Bovitiya (*Mstreamstoma malabathricum*), Heen Bovitiya (*Osbeckia octandra*), Baludan (*Ardisia gardneri*) and Rathabala (*Ixora coccinea*).

The sub canopy has Dan (*Syzygium caryophyllatum*), Kebella (*Aporusa lindleyana*), Diyapara (*Dillenia triquetra*), Midella (*Hunteria zstreamnica*) and Bommbu (*Symplocos cochinchinesis*). Trees in the canopy include Murutha (*Lagerstromia speciosa*), Karanda (*Pongamia pinnata*), Mandora (*Stemonoporus acuminatus*), Milla (*Vitex altissima*), Attikka (*Ficus racemosa*) and Bakmi (*Nauclea orientalis*). Of these, three species were native and a few protected species were also present. Thirteen species were identified as endemic plants (Table 2), thus giving an endemism of 19.6% in the Wathurana Wetlands. Out of 66 species present, four species, namely, *Phaphidophora decursina*, *Areca concinna*, *Pericopsis mooniana* and *Cleistocalyx nervosum* are considered highly threatened.

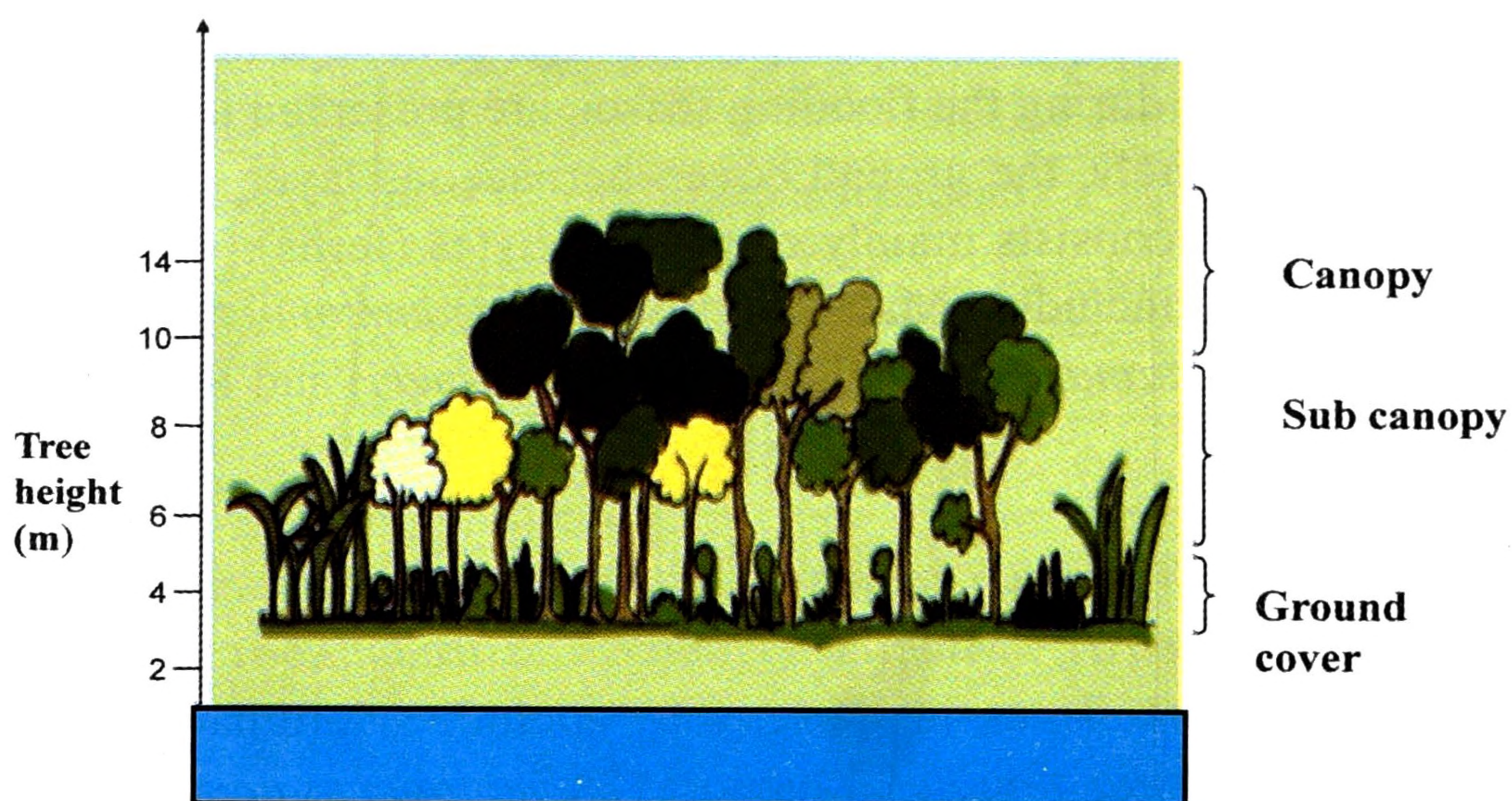


Fig. 4 a. General vegetation profile and Transect view during the dry season in the Wathurana Wetlands

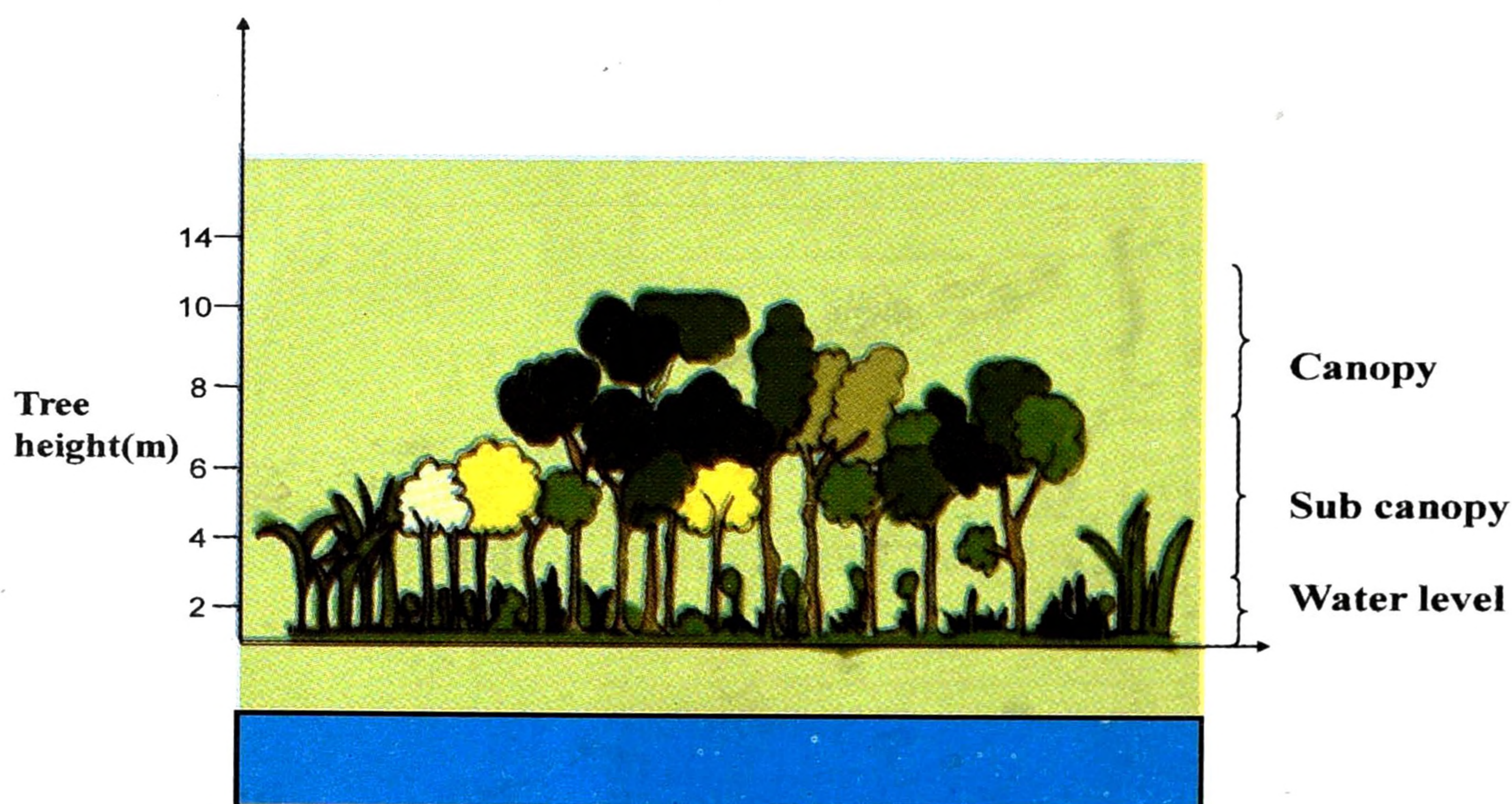


Fig. 4b. General vegetation profile and Transect view during the flood season in the Wathurana Wetlands

During the flooding season these lower layers get submerged and only the upper part of the sub canopy and canopy trees are found above the water level. A general vegetation profile of the area during floods is shown in Fig. 4. Aquatic plants can be seen on the surface of the water bodies during both normal and flooded periods. *Nymphaea*, *Aponogeton*, *Jacobsenii* and *Nelumbo* are the main aquatic plant genera found in the waters. During the flooding season the water level reaches five to ten feet and in certain

years flooding of the Wathurana Wetland forest could continue for up to two or three weeks. During these periods most of the animal species move to higher grounds.

Diversity of floral species in the Wathurana Wetland Forest

The extent of the Irriyangala Wathurana is approximately 45 hectares. The results of the vegetation survey are given in Table 3. The Wathurana Wetland complexes in Tebuwana have high floristic richness and 66 flowering plants were recorded from the Irriyangala-Wathurana Wetland. The low value of 0.104 for Simpson's Index (D) indicates a high diversity of flora in the Wathurana-Wetland. The diversity of the Wathurana-Wetland based on the Shannon-Wiener Index in site 1 is 2.733 (Table 3). The value for evenness (E) - a measure of how similar the abundance of different species was - is 2.101 showing that the abundance of plant species is dissimilar, some being rare and others common. There were also dissimilarities within these sites.

Table 3. Plant diversity of the wetland ecosystem

Index	Site 01	Site 02	Site 03
Shannon-Wiener	2.733	1.306	2.377
Evenness	2.101	1.546	2.021

Fauna of Wathurana-Wetlands in Tebuwana

There were no published records on the fauna of Wathurana-Wetland in Tebuwana. The present study identified faunal species present in Wathurana and its immediate environment. Fish species were identified by examining the commercial catch from the wetland. Both expert knowledge and indigenous knowledge were used for identification. The fish species of Wathurana Wetlands in Tebuwana are listed in Table 4. All the major streams including 2nd and 3rd order streams were observed. Most of the streams are slow flowing, shady and densely covered with marginal vegetation. A large amount of leaf debris was observed in the streams. A total of 27 species were recorded belonging to the families of Anguillidae, Aphlocheilidae, Bagridae, Belonidae, Belontiidae, Channidae, Cobitidae, Clariidae, Cyprinidae, Heteropneustidae, Mastecembelidae, Osphronemidae, Gobiidae and Cichlidae. Of these, 9 species were recorded as being endemic. Out of a total 62 fresh water species, at least 30 species were endemic to Sri Lanka (Pethiyagoda, 1991; Bambaradeniya, 2001). It can be seen, therefore, that nearly a third of endemic fish species in Sri Lanka are found in the Wathurana-Wetlands. Endemicity of the Wetland at 25% is comparatively high.

Table 4. Identified fish species in Wathurana Wetland in Tebuwana

No	Scientific Name	Common Name	Sinhala Name	Endemic / Threatened / Exotic
1	<i>Anabas testudineus</i>	Climbing perch	Kavaiya	Indigenous
2	<i>Anguilla bicolor</i>	Level finned eel	Kalu andha	Indigenous (near threatened)
3	<i>Aphlocheilus weneri</i>	Werner's killi	Iri handcya	Endemic (vulnerable)
4	<i>Rasbora daniconius</i>	Striped rasbora	Iri Dandiya	Indigenous (common)
5	<i>Mystus vittatus</i>	Striped dwarf catfish	Iri Ankutta	Indigenous
6	<i>Xenetodon cancila</i>	Freshwater garfish	Yonna	Indigenous (near threatened)
7	<i>Belontia singnata</i>	Paradise combtail	Thalkossa	Endemic (near threatened)
8	<i>Channa punctata</i>	Spotted snakehead	Mada Kanaya	Indigenous
9	<i>Channa strait</i>	Murrel	Loola	Indigenous
10	<i>Claris brachysoma</i>	Walking catfish	Magura	Endemic (common)
11	<i>Etroplus suratensis</i>	Pearl spot	Mal Koraliya	Indigenous
12	<i>Etroplus maculatus</i>	Orange chromide	Kaha koraliya	Indigenous
13	<i>Lepidocephalichthys thermalis</i>	Common spiny loach	Iri ehirawa	Indigenous
14	<i>Puntius singhala</i>	Filamented barb	Hora kolaya, Pethiya	Endemic
15	<i>Puntius vittatus</i>	Silver barb	Podi Pethiya	Indigenous

16	<i>Devario malabaricus</i>	Giant danio	Rath Kailaya	Indigenous
17	<i>Garra ceylonensis</i>	Stone sucker	Gal pandiya	Endemic
18	<i>Puntius cuningii</i>	Cuming's barb	Depulliya	Endemic (vulnerable)
19	<i>Puntius dorsalis</i>	Long snouted barb	Katu kuriya, Bimthulla	Indigenous
20	<i>Puntius nigrofasciatus</i>		Bulath hapaya	Endemic
21	<i>Puntius titteya</i>	Cherry barb	Lee thiththeya	Endemic (vulnerable)
22	<i>Puntius bimaculatus</i>	Cherry barb	Lee thiththeya	Endemic (vulnerable)
23	<i>Glossogobius giuris</i>	Bar cyed Goby	Weligouva	Indigenous
24	<i>Heteropneustis fossilis</i>	Stinging catfish	Hunga	Indigenous (common)
25	<i>Mastacembelus armatus</i>	Marbled spiny eel	Gan Theliy	Indigenous
26	<i>Wallago attu</i>	Shark catfish	Walaya	Indigenous (common)
27	<i>Osphronemus goramy</i>	Giant gourami	Waraliya /Seppali	Exotic

Species of birds were identified through direct observations and through discussions with local inhabitants. A total of 22 species of birds were recorded during the study (Table 5). Among these were two endemic species, *Loriculus beryllinus* and *Gracula ptilogenys*.

Table 5. Species of birds identified in the Wathurana Wetland in Tebuwana

No	Scientific Name	Common Name (English)	Common Name (Sinhala)	Endemic (E) / Threatened(T) / Resident (R)
1	<i>Accipiter badius</i>	Shikra	Kobeyi-ukussa/ Kurulugoya	
2	<i>Mesophoyx intermedia</i>	Intermediate Egret	Sudu modi-koka	R
3	<i>Centropus sinensis</i>	Greater Coucal	Ati kukula	R
4	<i>Vanellus indicus</i>	Red Wattles Lapwing	Ratyatimal Kirala	R
5	<i>Chalcophaps indica</i>	Emerald Dove	Nestream kobeyiya	R
6	<i>Streptopelia chinensis</i>	Spotted Dove	Alu kobeiya	R
7	<i>Treron bicincta</i>	Orange Brest Green Pigeon	Layaran Batagoya	R
8	<i>Corvus macrorhynchos</i>	Large Billed Crow	Kalu kaputa	R
9	<i>Dicrurus caerulescens leucopygialis</i>	White bellicd Dronge	Podi kauda	R
10	<i>Terpsiphone paradisi paradise</i>	Indian Paradise Flycatche	Suduredi Hora	-
11	<i>Terpsiphone paradise ceylonensis</i>	Brown Paradise Flycatcher	Siuru Hora	R
12	<i>Megalaima zeylanica</i>	Brown Hecaded Barbet	Polos kottoruwa	R

13	<i>Nectarinia zeylonica</i>	Purple rumped Sunbird	Sutikka	R
14	<i>Phalacrocorax niger</i>	Little Cormorant	Punchi Diyakava	R
15	<i>Loriculus beryllinus</i>	Lorikeet	Lanka giramalitha	E/R
16	<i>Copsychus saularis</i>	Oriental Magpie Robin	Polkichcha	R
17	<i>Acridotheres tristis</i>	Common Myna	Myna	R
18	<i>Gracula religiosa</i>	Common Grackle	Podi salalihiniya	R
19	<i>Gracula ptilogenys</i>	Sri Lankan Grackle	Sri lanka salalihiniya	E/R
20	<i>Orthotomus sutorius</i>	Common tailorbirds	Battichcha	R
21	<i>Turdoides affinis</i>	Common Babbler	Demalichcha	R
22	<i>Alcedo atthis</i>	Common Kingfisher	Mal pilihuduwa	-

Benefits and threats to the Wathurana Wetland

The Wathurana Wetland forests are located in a valley and this helps to store the excess water flowing down in the streams from their catchments. Wetlands are known to help in maintaining freshwater flows within river systems. The shallow aquifers of the Gangetic plain are recharged from rainfall during the monsoon and stream and wetland in all seasons (Trisal, 2000). Wathurana Wetland acts as a sponge and helps to keep the water balance of the area. Land filling and encroachment, on the other hand, will increase the flooding in the area. During the study, it was noted that local inhabitants get many benefits from the forest. They obtain plant parts, fuel woods, fruits, medicinal plants, poles for agricultural purposes and timber. Domestic animals, in particular buffaloes, are allowed to graze in the Wathurana Wetland areas. The forest area has high value clay deposits; if these clay deposits are mined using inappropriate methods, it could lead to deforestation and could damage the ecological functions performed by the Wathurana Wetlands.

The Divisional Secretariat has identified the Wathurana Wetlands as a sensitive area, but sufficient action has not been taken due to legal restrictions. Part of Wathurana Wetland

belongs to Kotagala plantation Company and such land ownership issues also cause problems in conserving the wetland. As previously mentioned, the survival of the Wathurana Wetlands is threatened by anthropogenic activities. The Wathurana Wetlands have timber trees and fuel wood trees, and local inhabitants collect timber to be used as building material and poles for agricultural purposes. Apart from that, they extract fruits and collect the barks of some medicinal plants. People also extract medicinal plants such as *Kotala-himbutu*, in large quantities. People have already encroached parts of adjacent lands of the Wathurana Wetlands to construct new buildings and to establish rubber plantations. Some people use this area for other agricultural purposes after clearing the forest. In addition to oil palm and rubber cultivation, construction of houses is a major threat for the Wathurana Wetland biodiversity. Some non-native plant species have invaded the wetlands, causing profound changes in the wetland structure. Two invasive species were recorded from the Wathurana Wetlands. One of them, *Annona glara*, has spread from the edge of the Wathurana Wetlands forests and has replaced native flora. The other, *Diyapara (Dillenia suffruticosa)* is also spreading across the Wathurana Wetland forests. Over several decades, people have also practiced gem mining in the Manik Godalla area although the literature indicates no significant mineral resources. Sand mining is currently ongoing in Irriyangala Wathurana area. It is done mainly in branches of the Irriyangala stream, located on the Southern part of the Wathurana. It can be seen that this wetland is subject to challenge from many aspects of human activity and that introducing a programme to protect this forest is essential.

Conclusions

Wathurana Wetlands located mainly in the Tebuwana East, Tebuwana West and Thudugala West GN divisions and spread inland cover approximately 100 hectares. Protected species of plant, four highly threatened species and fifteen endemic plant species were recorded from the site. A high proportion of endemic fish species and two endemic bird species indicate the higher level of biodiversity found in this site. The Wathurana Wetlands in Tebuwana also act as buffer for flood waters and increase the ground Water recharge. Local inhabitants benefit from this forest but the Irriyangala Wathurana Wetland is highly threatened by human activity. Hence controlling these activities is essential for conservation of this forest.

Acknowledgements

The authors wish to acknowledge Dr. D.S.A. Wijesundara, Director, Royal Botanical Garden, Peradeniya and Mr. M.C.L. Rodrigo, Divisional Secretariat, Dodangoda for their generous help, valuable advice and constant guidance. We are also grateful to Mr. D.D.K. Wimal Siripala, Mr. Udaya Ubeseckara, Mr. W. Tenison and Mr. M.L. Sisira Jayantha for the success of the project and K.P. Chandrasiri, K.P. Chandrika and S.A. Raveendra, Grama Niladaries of Tebuwana West, Tebuwana East and Thudugala West and officials of Natural Resource Protection Movement (NRPM) who helped us to successfully complete the field research work.

References

- Ashton S.M., Gunathilake, S., De zoysa N., Dassanayake, M.D., Gunathilake, N., and Wijesundera, S. (1997). A field Guide to the Common Trees and Shrubs of Sri Lanka. Wildlife Heritage Trust Found, WHT Publication.
- Bambaradeniya, C.N.B. (2001). The Fauna of Sri Lanka; Status of taxonomy, research & conservation, p 114. The world Conservation Union, Colombo, Sri Lanka.
- CEA (1992). An Environmental profile of the Kalutara District, Central Environment Authority, MEAP.
- CEA (1994a). Wetlands are not wastelands, Wetland conservation project, Central Environment Authority, Colombo.
- CEA (1994b). Waluwatta Wathurana Wathurana Wetland forest, Wetland Conservation Project, Central Environmental Authority, Sri Lanka.
- Gosselink, J.G. (1984). The ecology of delta marshes of coastal Louisiana: A community profile. U.S. Department of Interior Fish and Wildlife Service, Circular 39, Washington, D.C, p 143.
- Harrison, J. (1999). A Field Guide to the Birds of Sri Lanka. Oxford University Press, Oxford.
- Jerrold, H. Z. (1984). Bio-statistical Analysis, 2nd ed. Department of Biological Sciences, Northern Illinois University.
- Kotagama, S. and Fernando, P. (1994). A field guide to the birds of Sri Lanka. Wildlife Heritage Trust, Colombo.
- Kotagama, S. (2006). Common, Endemic and Threatened Birds in Sri Lanka. A Pictorial Pocket Guide. Field Ornithology Group of Sri Lanka, University of Colombo, Sri Lanka.
- Kotagama, S. and Wijayasinha, A. (1998). (Sirilaka Kurullo-Birds of Sri Lanka). Wildlife Heritage Trust, Colombo.
- Magurran A. E., (1988) Ecological diversity and its measurements. Chapman and Hall Limited, London.
- Pethiyagodā, R. (1991). Freshwater Fishes of Sri Lanka. Wildlife Heritage Trust of Sri Lanka, Colombo.

Trisal, C.L. (2000). Integrating Wetlands in to River Basin Management in Asia. The Newsletter of Wetland International, Number 09, April 2000.

Wijeyeratne, de S.G. (2007). The Endemic Birds of Sri Lanka. Jetwing Eco Holidays, Colombo. Wildlife Heritage Trust, Colombo.

William, J.M. and Gosselink J.G. (1986). Wetlands, Van Nostrand Reinhold Company, New York.

Zelený, D. and Chytrý, M. (2007). Pattern of α - and β -diversity of vegetation, European Vegetation Survey, 16th Workshop, Rome (Italy), March 22-26, 2007.

http://www.mdsg.umd.edu/programs/education/interactive_lessons/biofilm/diverse.htm#2 cited on 27th May 2004