

# 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.

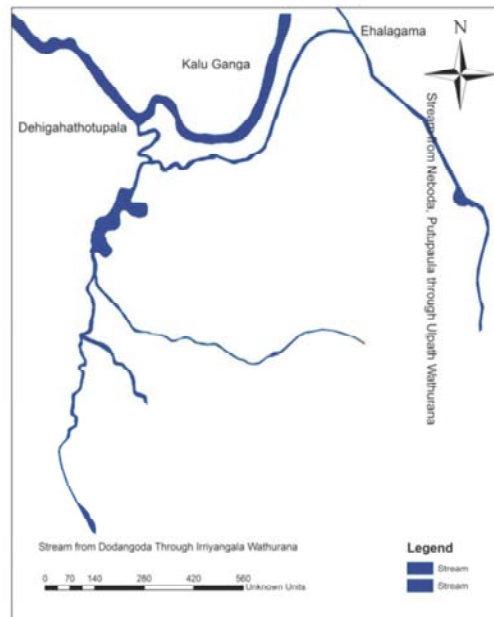
Walauwatta Wathurana Wetland is the only site that records the rare endemic tree species *Stemnoporus moonii* as well as *Mesua stylosa* and a very rare endemic fish species, *Lepidocephalichthys jonklaasi* (CEA, 1999). The Central Environmental Authority of Sri Lanka has prepared a wetland directory 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 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, *et al.*, 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

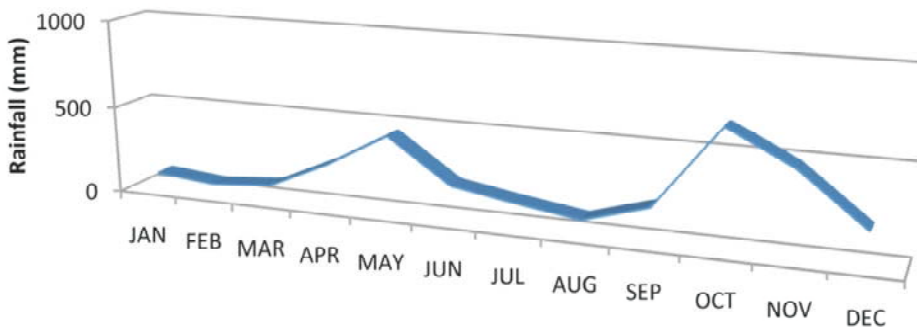
During the study, threats to the Wathurana Wetland ecosystem were also identified.

## 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

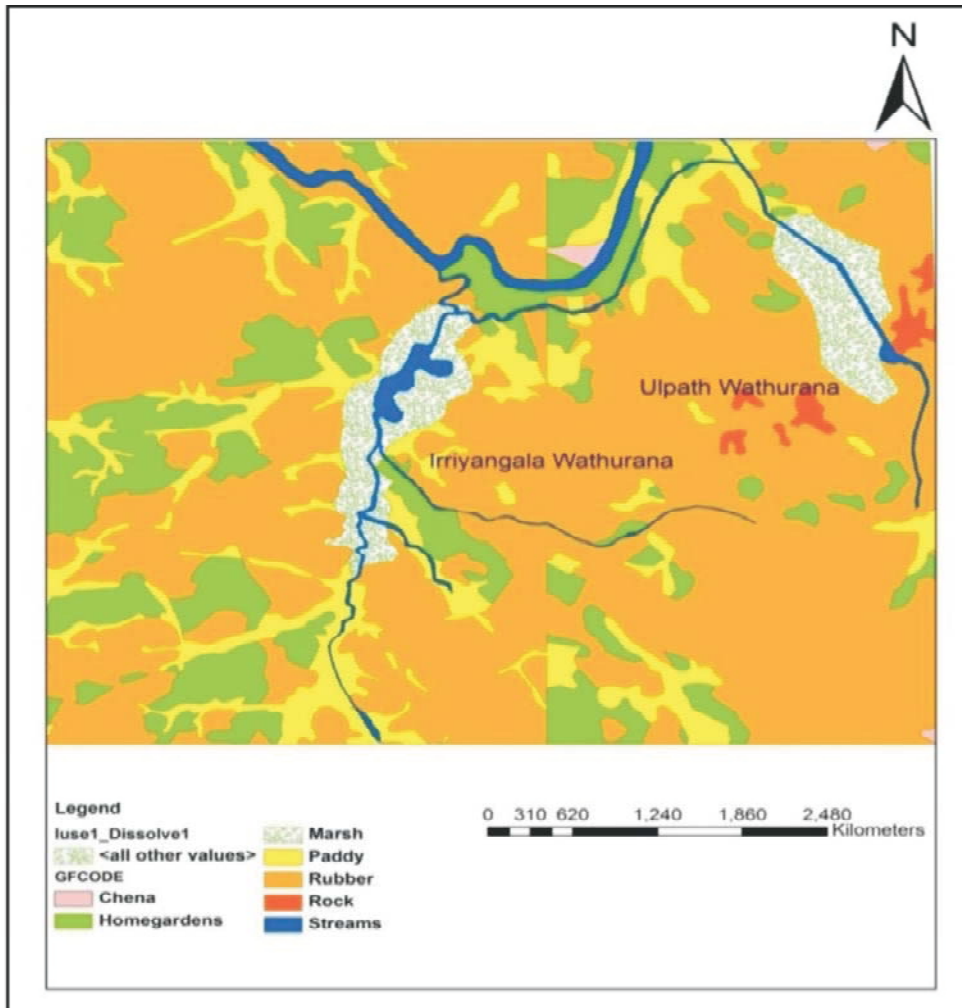
Thudugala villages are located close to the southeast border of the Irriyangala Wathurana Wetland forest. Of the total population in these three Grama Niladari (GN) administrative divisions, 7.81 % work in the state sector, 32.60 % in the private sector, 13.57 % are involved in the agriculture sector 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

| <b>GN Division</b> | <b>Government</b> | <b>Private</b> | <b>Agriculture</b> | <b>Unemployed</b> |
|--------------------|-------------------|----------------|--------------------|-------------------|
| 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>         | Schizacaceae       | 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 Hibu     | -                             |
| 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<br>Ambiliya    | -              |
| 26 | <i>Nelumbo nucifera</i>               | Nelumbonaceae   | Nelum                | -              |
| 27 | <i>Vitex altissima</i>                | Verbenaceae     | Milla                | -              |
| 28 | <i>Vernonia cinerea</i>               | Asteraceae      | Monera<br>kuddumbiya | -              |
| 29 | <i>Nymphaea pubescens</i>             | Nymphaeaceae    | Olu                  | -              |
| 30 | <i>Spermacoc<br/>suffrutescens</i>    | Rubiaceae       | -                    | -              |
| 31 | <i>Aponogeton jacobsonii</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              | <b>Endemic</b> |
| 38 | <i>Albizia chinensis</i>              | Fabaceae        | Mara                 | -              |
| 39 | <i>Canthium<br/>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             | <b>Endemic</b> |
| 44 | <i>Schoenoplectus<br/>grossus</i>     | Cyperaceae      | Thunhiria<br>pan     | -              |
| 45 | <i>Pothos scandens</i>                | Araceae         | Pota wal             | -              |
| 46 | <i>Pongamia pinnata</i>               | Fabaceae        | Magul<br>karada      | -              |
| 47 | <i>Drymoglossum<br/>heterophyllum</i> | Polypodiaceae   | Kasipetthi           | -              |
| 48 | <i>Drynaria quercifolia</i>           | Polypodiaceae   | Beduru               | -              |

|    |                                |                  |                   |                                |
|----|--------------------------------|------------------|-------------------|--------------------------------|
| 49 | <i>Mimusops elengi</i>         | Sapotaceae       | Munamal           | -                              |
| 50 | <i>Areca concinna</i>          | Arecaceae        | Lenthare          | <b>Endemic / EN</b>            |
| 51 | <i>Vateria copallifera</i>     | Dipterocarpaceae | Hal               | <b>Endemic / EN</b>            |
| 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            | <b>Endemic /VU</b>             |
| 56 | <i>Gyneros walla</i>           | Thymstreamcaccac | Walla gas         |                                |
| 57 | <i>Glochidion stellatum</i>    | Euphorbiaceae    | Kirilla           | <b>Endemic</b>                 |
| 58 | <i>Ficus exasperata*</i>       | Moraceae         | Sevstreamm adia   |                                |
| 59 | <i>Phaphidophora decursina</i> | Araceae          | Wal Kohila        | <b>Endemic / HT/ protected</b> |
| 60 | <i>Phoenix farinifera</i>      | Arecaceae        | 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     | <b>Endemic</b>                 |
| 64 | <i>Tylophora tenrissima</i>    | Asclepiodiaccac  |                   |                                |
| 65 | <i>Cleistocalyx nervosum</i>   | Myrtaceae        | Bata-damba        | <b>Endemic / HT/</b>           |
| 66 | <i>Caryota urens</i>           | Arecaceae        | 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 (*Osbekia 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

| <b>Index</b>   | <b>Site 01</b> | <b>Site 02</b> | <b>Site 03</b> |
|----------------|----------------|----------------|----------------|
| 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 2<sup>nd</sup> and 3<sup>rd</sup> 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 handeya          | <b>Endemic</b> (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            | <b>Endemic</b> (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               | <b>Endemic</b> (common)          |
| 11 | <i>Etroplus suratensis</i>            | Pearl spot            | Mal Koraliya         | Indigenous                       |
| 12 | <i>Etroplus maculatus</i>             | Orange chromide       | Kaha koraliya        | Indigenous                       |
| 13 | <i>Lepidocephalich thys thermalis</i> | Common spiny loach    | Iri ehirawa          | Indigenous                       |
| 14 | <i>Puntius singhala</i>               | Filamented barb       | Hora kolaya, Pethiya | <b>Endemic</b>                   |
| 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               | <b>Endemic</b>                 |
| 18 | <i>Puntius cuningii</i>        | Cuning's barb     | Depulliya                 | <b>Endemic</b><br>(vulnerable) |
| 19 | <i>Puntius dorsalis</i>        | Long snouted barb | Katu kuriya,<br>Bimthulla | Indigenous                     |
| 20 | <i>Puntius nigrofasicatus</i>  |                   | Bulath hapaya             | <b>Endemic</b>                 |
| 21 | <i>Puntius titteya</i>         | Cherry barb       | Lee thiththeya            | <b>Endemic</b><br>(vulnerable) |
| 22 | <i>Puntius bimaculatus</i>     | Cherry barb       | Lee thiththeya            | <b>Endemic</b><br>(vulnerable) |
| 23 | <i>Glossogobius giuris</i>     | Bar eyed Goby     | Weligouva                 | Indigenous                     |
| 24 | <i>Heteropneustis fossilis</i> | Stinging catfish  | Hunga                     | Indigenous<br>(common)         |
| 25 | <i>Mastacembelus armatus</i>   | Marbled spiny eel | Gan Theliy                | Indigenous                     |
| 26 | <i>Wallago attu</i>            | Shark catfish     | Walaya                    | Indigenous<br>(common)         |
| 27 | <i>Osphronemus goramy</i>      | Giant gourami     | Waraliya<br>/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/<br>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 bellied 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>Megalatma zeylanica</i>                 | Brown Headed 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      | <b>E/R</b> |
| 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 | <b>E/R</b> |
| 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.

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## 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.
- 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. & Wijayasinha, A. (1998). (Sirilaka Kurullo-Birds of Sri Lanka). Wildlife Heritage Trust, Colombo.
- Ministry of Forestry and Environment (1999). Biodiversity conservation in Sri Lanka: A Framework of Action, Reprinted in December 2005. Protected Area Management and Wildlife Conservation Project, Colombo, 2005.
- Pethiyagoda, 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.

Zar Jerrold H. (1984). Bio-statistical Analysis, 2<sup>nd</sup> edn. Department of Biological Sciences, Northern Lllinois University.

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

<http://teacherweb.capousd.org/custom/WMRedding/SHANNONWIENERDIVERSITYINDEXEXAMPLES.htm> cited on 27<sup>th</sup> May 2004.

[http://www.mdsg.umd.edu/programs/education/interactive\\_lessons/biofilm/diverse.htm#2](http://www.mdsg.umd.edu/programs/education/interactive_lessons/biofilm/diverse.htm#2) cited on 27<sup>th</sup> May 2004