4.1. GENERAL CLASSIFICATION

The primary goal of wetland classification, according to Cowardin et.al (1979) is “to impose boundaries on natural ecosystems for the purpose of inventory, evaluation and management”. There are several distinct forms of wetlands, each with its own unique characteristics. The main factors that distinguish each type of wetland are location (coastal or inland), source of water (precipitation, rivers and streams, groundwater), salinity (freshwater or saltwater), and the dominant type of vegetation (peat mosses, soft-stemmed, or woody plants). Wetlands are a continuum in which plant life changes gradually from predominantly aquatic to predominantly upland species. The difficulty in defining the exact point at which a wetland ends and upland begins results in much of the confusion as to how wetlands should be delineated.

Wetlands have been classified since the early 1900’s, beginning with the peat land classification of Europe and North America. The US Fish and Wildlife Service (USFWS) conducted the first quantitative of national inventory of wetlands in the mid 1950’s; the results were summarized in the USFWS Circular-39 (Cowardin & Golet, 1995). The inventory was based on a classification developed by Martin et.al (1953), which included 20 classes of wetlands, based on flooding depth, dominant forms of vegetation and salinity regimes. By the mid 1970’s, there had been an explosion of public and professional interest in wetlands that transcended the habitat function for migratory birds. Numerous excellent regional classification schemes like those of Stewart & Kantrud, 1971; Golet & Larson, 1974; Jeglum et.al, 1974; Odum et.al,1974 ; Zoltai et.al, 1975; Millar, 1976, had also been developed since the publication of the classification scheme of Martin et.al (1953). In January of 1975, the USFWS started to formulate the skeleton of a new classification that could serve as the basis for a new national wetland inventory. The system was finalized and published in 1979 (Cowardin et.al, 1979). The classification titled
Classification of wetlands and deepwater habitats of the United States had been used by the National Wetland Inventory for 13 years. The scheme used a hierarchical approach based on systems, subsystems, classes, subclasses, dominance types and special modifiers to define wetlands and deepwater habitats precisely. Later, the Canadian and other international systems provided alternative schemes which recognized 49 and 32 different wetland types respectively. In 1996, G.D. Racey, A.G. Harris, J.K. Jeglum, R.F. Foster and G.M. Wickware proposed a classification system for terrestrial and wetland ecosites of Northwestern Ontario (Racey et al., 1996), which was mainly based on the types of vegetation and landform. More recently, classification based on wetland functions, has been developed, with a function based approach called the Hydrogeomorphic (HGM) classification, described by Brinson (1993).

In 2011, the Space Application Centre (ISRO), Ahmedabad conducted an assessment of wetlands all over India with the objective of wetland mapping and preparation of State-wise wetland atlases under the National Wetland Inventory and Assessment Project sponsored, by the Ministry of Environment and Forests (MoEF), Govt. of India (Panigrahy et al., 2011). In this classification they categorized inland and coastal wetlands at level I followed by natural and man-made wetlands as level II, which were further categorized into 19 types of wetlands. The Ramsar Bureau has coined a ‘Ramsar classification system’ for ‘wetland type’, according to which the wetland habitats are broadly divided into three categories such as, ‘Marine or Coastal’, ‘Inland’, and ‘Man-made wetlands’. Whereas according to Ministry of Environment and Forests, Govt. of India, wetlands are broadly divided into Inland and Coastal wetlands and each class is further divided into different types.

4.1.1. System of classification

Nevertheless, the Ramsar Bureau has set forth a ‘Ramsar classification system’ for ‘wetland types’ as approved by Recommendation 4.7 and amended by Resolution VI.5 of the Conference of the contracting parties. Accordingly, the main wetland habitats represented at each site can be broadly divided into three as follows:
I. Marine / Coastal
a. Permanent shallow marine waters less than six meters deep at low tide - include seabays and straits.
b. Marine subtidal aquatic beds - include kelp beds, sea grass beds and tropical marine meadows.
c. Coral reefs.
d. Rocky marine shores - includes rocky offshore islands, sea cliffs.
e. Sand, shingle or pebble shores - includes sand bars, spits and sandy islets includes dune systems.
f. Estuarine waters - permanent water of estuaries and estuarine systems of deltas.
g. Intertidal mud, sand or salt flats.
h. Intertidal marshes - includes salt marshes, salt meadows, salting raised salt marshes includes tidal brackish and fresh water marshes.
i. Intertidal forested wetlands - include mangrove swamps, nipia swamps and tidal fresh water swamp forests.
j. Coastal brackish / Saline lagoons; brackish to saline lagoons with at least one relatively narrow connection to the sea.
k. Coastal fresh water lagoons - include fresh water delta lagoons.

II. Inland Wetlands
a. Permanent inland deltas
b. Permanent rivers / streams / creeks
c. Seasonal / Intermittent / irregular rivers / streams / creeks
d. Permanent fresh water lakes
e. Seasonal / Intermittent fresh water lakes include flood plain lakes
f. Permanent saline / brackish / alkaline lakes and flats
g. Seasonal / Intermittent saline / brackish / alkaline lakes and flats
h. Permanent saline / brackish / alkaline marshes / pools
i. Seasonal / intermittent saline / brackish / alkaline marshes / pools
j. Permanent fresh water marshes / pools-ponds, marshes and swamps on inorganic soils, with emergent vegetation water logged for at least most of the growing season
k. Seasonal / intermittent fresh water marshes / pools on inorganic soil include sloughs, potholes, seasonally flooded meadows, sedge marshes

l. Non forested peat lands include shrub or open bogs, swamps, fens

m. Alpine wetlands - include alpine meadows, temporary waters from snowmelt

n. Tundra wetlands - include tundra pools, temporary waters from snowmelt

o. Shrub dominated wetlands - shrub swamps, shrub dominated fresh water marsh, shrub carr, alder thicket on inorganic soils

p. Fresh water, tree dominated wetlands, includes fresh water swamp forest, seasonally flooded forest, wooded swamps on inorganic soils

q. Forested peat lands peat swamp forest

r. Fresh water springs; oases.

s. Geothermal wetlands

t. Karst and other subterranean hydrological systems: inland.

III. Man-made wetlands

a. Aqua culture ponds (e.g. fish/shrimp)

b. Ponds; include farm ponds, stock ponds, small tanks (generally below 8 ha)

c. Irrigated land - include irrigation channels and rice fields

d. Seasonally flooded agricultural land

e. Salt exploitation sites; salt pans, salines, etc.

f. Water storage areas (reservoirs/barrages/dams/impoundments- generally over 8 ha)

g. Excavations: gravel/ brick/ clay pits; borrow pits, mining pools

h. Waste water treatment areas: Sewage farms, settling ponds, oxidation basins, etc.

i. Canals and drainage channels, ditches

j. Karst and other subterranean hydrological systems; man-made.

4.1.2. Geo- satellite system of classification

During last thirty years, remote sensing data was much available, which has been extremely useful in generation of spatial information on various
scales and with reasonable classification and control accuracy. In India, coastal wetlands, land use and landform and shoreline change maps have been produced on 1:25,000, 1:5,000 and 1:25,000 scale, using IRS LISS I, II and III, LANDSAT MSS/TM and SPOT data. These maps have been used by many central and state level agencies for a variety of purposes. During 90’s, using high resolution IRS LISS III and PAN merged data, detailed maps of coral reefs and mangroves have been prepared for first time in India (Nayak, 2002). Today in India, satellite data is widely used to study many aspects of coastal zone and for classification of wetlands.

Geomorphologically, the wetlands of Kerala may be divided among the five major systems at the broadest level as marine, estuarine, riverine, lacustrine and palustrine. Due to unique physical characteristics, Kerala endows, like back water systems and a diverse terrain of highland, midland and lowland within a thin strip of landmass, there exists much ambiguity in the classification of wetlands. Thus major classes and types of wetlands are redefined keeping the MoEF classification as the standard. Accordingly the following wetland classification system (Table-05) has been suggested by a detailed study on wetlands of Kerala (CED, 2003 a).

### Table-05: Classification scheme for wetlands of Kerala

<table>
<thead>
<tr>
<th>Wetland classes</th>
<th>Wetland Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inland wetland</td>
<td>Fresh water lakes</td>
</tr>
<tr>
<td></td>
<td>Fresh water swamps</td>
</tr>
<tr>
<td></td>
<td>Reservoirs</td>
</tr>
<tr>
<td></td>
<td>Large ponds</td>
</tr>
<tr>
<td>Coastal wetland</td>
<td>Estuaries / Backwaters</td>
</tr>
<tr>
<td></td>
<td>Mangrove forests</td>
</tr>
<tr>
<td></td>
<td>Kol, Kuttanad and Pokkali wetland systems</td>
</tr>
<tr>
<td></td>
<td>Coastal swamps</td>
</tr>
<tr>
<td></td>
<td>Mud flat</td>
</tr>
<tr>
<td></td>
<td>Aqua culture ponds</td>
</tr>
<tr>
<td></td>
<td>Islets / Thuruth</td>
</tr>
</tbody>
</table>

Delineation of wetlands into the above said categories is mainly done on the basis of various parameters like location, physical extent, depth, salinity, biodiversity, etc. Table-06 presents the unique wetland ecosystems of
Kerala, which could be identified with respect to characteristic agro-ecological features and the land cover attributes.

Table-06: Unique wetland ecosystems of Kerala

<table>
<thead>
<tr>
<th>No.</th>
<th>Ecosystem</th>
<th>District</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Kuttanad paddy fields (padasekharams)</td>
<td>Alappuzha</td>
</tr>
<tr>
<td>2</td>
<td>Pokkali lands</td>
<td>Eranakulam</td>
</tr>
<tr>
<td>3</td>
<td>Kol lands</td>
<td>Thrissur</td>
</tr>
<tr>
<td>4</td>
<td>Karippad lands</td>
<td>Kannur</td>
</tr>
<tr>
<td>5</td>
<td>Myristica swamps</td>
<td>Kollam / Thiruvananthapuram</td>
</tr>
</tbody>
</table>