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WATER MANAGEMENT, AGRICULTURE AND WETLANDS: AN OVERVIEW

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ABSTRACT

Wetlands provide a multitude of ecosystem services such as biodiversity conservation, hydrological land protection and thus have significant impact on the socio-economic sphere of our lives. Purification of water, renewal of ground water, flood and drought management are crucial roles of wetlands. However, Wetlands are threatened by expansion of agricultural land, overexploitation of water resources and climate change. Wetlands serve as a livelihood for Millions of people. So wise use, conservation and restoration of wetland is needed.

WETLANDS AND ITS TYPES

A wetland is a distinct ecosystem where the land is saturated or flooded with water either permanently or seasonally in a static or flowing manner. Inland wetlands include marshes, peat lands, lakes, ponds, rivers, deltas, floodplains, and swamps. Marine and Coastal wetlands include open coasts, saltwater marshes, estuaries, tidal flats, mangroves, lagoons and coral reefs. Human-made wetlands include Fish and shrimp ponds, farm ponds, paddy farm, reservoirs, sewage farms, canals and salt pans.

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SERVICES PROVIDED BY WETLANDS

Wetlands deliver essential services, from filtering, cleaning and storing water , Provide habitat for wildlife and plants, food chain support ,collect and hold flood water, add moisture to atmosphere, maintenance of water tables, ground water replenishment and nutrient retention , absorb wind and tidal forces and keeps rivers at normal levels and also protect from storms and water erosion. They play a vital role in Coastal resilience and livelihood, sustaining biodiversity and Carbon sequestration. Integral to a Wetlands provide healthy environment by offering a multitude of ecosystem service which have significant Socio-economic importance.

Wetlands performance is a function of their characteristics, local conditions and location. The wetlands exhibit a number of distinctive characteristics that are influenced by the salinity of the water, the types of soil, and the local flora and fauna. Fresh water, salt water, or brackish water (a mixture of the two) can be found in wetlands. The wetlands are categorized into different types.

Marine wetlands include rocky shorelines, coral reefs, and coastal lagoons
Estuary includes mangrove swamps, tidal marshes, and deltas
Lacustrine are wetlands associated with lakes
Riverine are wetlands along rivers and streams
Palustrine wetlands are marshes, swamps and bogs

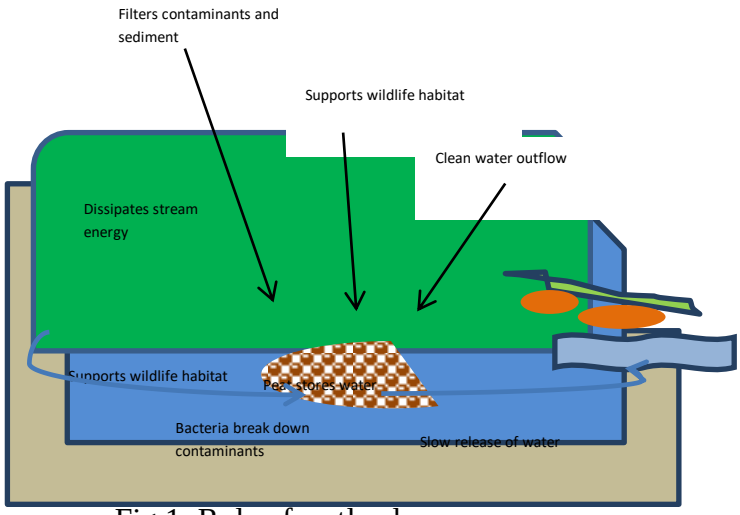

Fig 1. Role of wetlands

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"Water management is done by wetlands. When there is an excess of water, they retain it, and during dry spells, they release it to the ground. This helps in recharge and discharge of ground water". "Wet lands contribute to Healthy Planet. Wetlands plants and soil store carbon instead of relasing it to the atmosphere as carbon dioxide. Thus they help moderate global climate."

CHALLENGES TO WETLANDS

- Biodiversity and ecological services of wetlands are impacted by modifications in natural hydrological regimes.
- Wetland ecosystems are impacted by catchment degradation as it reduces the amount of water that wetlands can hold.
- Exotic species have taken over much of India's inland wetlands, making them a nuisance and seriously affecting the local biota and ecological conditions. Water hyacinth, is an example of such invasive species that was brought to India.
- The wetland ecosystem in India is also impacted by other issues such as overgrazing, unsustainable water abstraction, unsustainable harvesting of wetland resources, and mining (such as salt, sand, or laterite).

Wetlands are known as "kidneys of the landscape" and "Ecological supermarkets". Wetlands are one of the most productive ecosystems on the Earth (Ghermandi et al., 2008).

Conservation Programs to safeguard wetlands

- The National Wetland Conservation Program (NWCP) aims to protect wetlands.
- Water and food security depend on the preservation of wetlands. The Tamil Nadu government chose to carry out the "Tamil Nadu Wetlands Mission" for a five-year duration, from 2021–2022 to 2025–2026.

Wet Lands of Tamil Nadu

Tamil Nadu has 24684 wetlands that have been mapped at a scale of 1:50,000. An estimated 902534 hectares, which is 69.22% of the total area, are considered to be wetland areas.

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S. No	Wettcode	Wetland Category	Number of Wetlands	Total Wetland Area	% of Wetland area	Open Water Area in ha	
						Post-monsoon Area	Pre-monsoon Area
	1100	**Inland Wetlands - Natural**					
1	1101	Ponds/ Lakes	4369	316091	35.02	236456	45436
2	1104	Riverine wetlands	2	127	0.01	121	41
3	1105	Waterlogged wetlands	44	3928	0.44	3382	2168
4	1106	River/Stream	194	136878	15.17	131049	131479
	1200	**Inland Wetlands-Man-made**					
5	1201	Reservoirs/Barrages	99	56419	6.25	46443	31064
6	1202	Tanks/Ponds	19343	237613	26.33	164346	23078
7	1203	Waterlogged	38	10811	1.20	9353	5816
		Total – Inland	**24089**	**761867**	**84.41**	**591150**	**239082**
	2100	**Coastal Wetlands - Natural**					
8	2101	Lagoons	74	25057	2.78	25041	22034
9	2102	Creeks	17	3404	0.38	3339	3403
10	2103	Sand/Beach	73	9798	1.09	-	-
11	2104	Intertidal-mud flats	84	33164	3.67	-	-
12	2105	Salt Marsh	42	6108	0.68	5369	2596
13	2106	Mangroves	78	7315	0.81	-	-

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14	2107	Coral Reefs	36	3899	0.43	-	-
	2200	**Coastal Wetlands –Man-made**					
15	2201	Salt pans	47	22889	2.54	22505	19733
16	2202	Ponds-Aquaculture	144	10739	1.19	10457	9420
		Total – Coastal	**595**	**122373**	**13.56**	**66711**	**57186**
		Sub-Total	**24684**	**884240**	**97.97**	**657861**	**296268**
		Wetlands (<2.25 ha), mainly Tanks	18294	18294	2.03	-	-
		Total	**42978**	**902534**	**100.00**	**657861**	**296268**

Table 1. Wetlands of Tamil Nadu

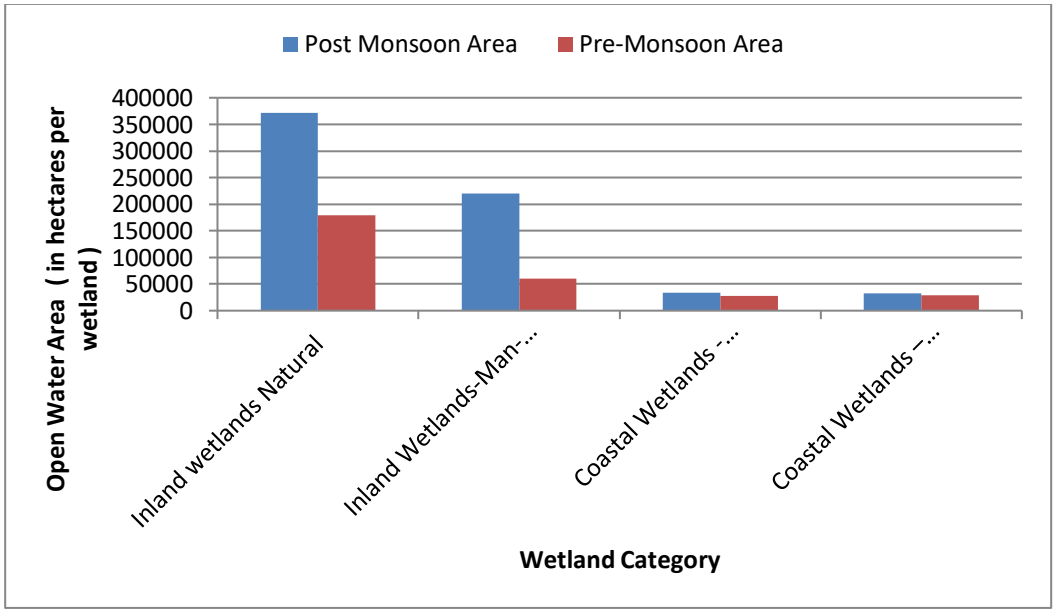

Fig 2: Open Water Area (in hectares) under different wetlands, TamilNadu

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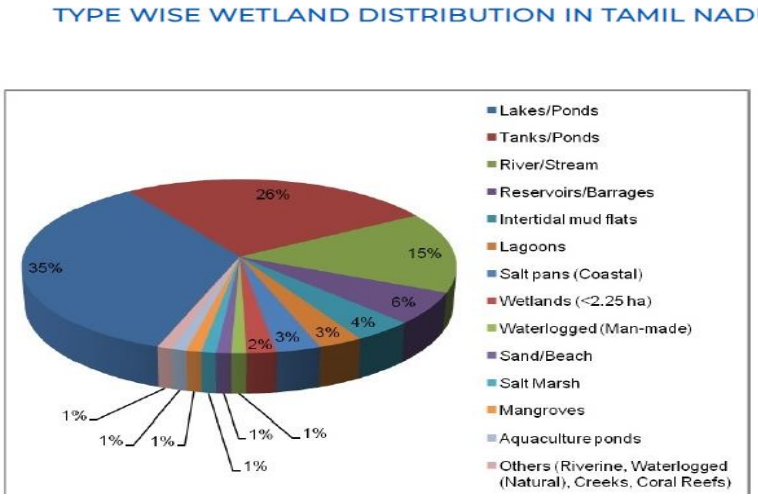

Fig 3: Type wise wetland distribution in TamilNadu

LIST OF RAMSAR SITES IN TAMIL NADU

Sl.No	District	Name of the Wetland	Ramsar site number	Year of Declaration	Area
1	Nagapatinam and Tiruvarur	Point Calimere Wildlife and Bird Sanctuary	1210	2002	38500 ha
2	Chennai	Pallikaranai Marsh Reserve Forest	2481	2022	1247.54 ha
3	Chengalpattu	Vedanthangal Bird Sanctuary	2477	2022	40.35 ha
4	Chengalpattu	Karikili Bird Sanctuary	2480	2022	58.44 ha
5	Cuddalore	Pichavaram Mangrove	2482	2022	1478.64 ha
6	Erode	Vellode Bird Sanctuary	2475	2022	77.19 ha
7	Kanyakumari	Suchindram Theroor wetland complex	2492	2022	94.23 ha
8	Kanyakumari	Vembannur Wetland complex	2474	2022	19.75 ha
9	Ramanathapram	Chitrangudi Bird Sanctuary	2491	2022	260.47 ha

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10	Ramanathapram	Gulf of Mannar Marine Biosphere Reserve	2472	2022	52671.88 ha
11	Ramanathapram	Kanjirankulam Bird Sanctuary	2486	2022	96.89 ha
12	Tirunelveli	Koonthankulam Bird Sanctuary	2479	2022	72.04 ha
13	Tiruvarur	Udayamarthandapuram Bird Sanctuary	2476	2022	43.77 ha
14	Tiruvarur	Vaduvur Bird Sanctuary	2493	2022	112.64 ha
15	Ariyalur	Karaivetti Bird Sanctuary	2537	2024	453.7 ha
16	The Nilgris	Longwood Shola Reserve Forest	2538	2024	116.007 ha

Table 2. Ramsar Sites in Tamil Nadu

RAMSAR SITE AT NAGAPATTINAM

Sl.No	District	Name of the Wetland	Ramsar site number	Year of Declaration	Area
1	Nagapatinam and Tiruvarur	Point Calimere	1210	2002	38500 ha

Table 3. Ramsar Sites in Nagapattinam District

NAGPATTINAM WETLAND AREA

District	Geographic Area*	Wetland Area	% of total wetland area	% of district geographic area
	(sq.km)	(ha)		
Nagapattinam	2716	47833	5.30	17.61

Table 4. Wetland Area - Nagapattinam District

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WETLANDS OF NAGAPATTINAM DISTRICT

Sl. No.	District	Name of the Wetland	Latitude	Longitude	Wetland type
1	Nagapattinam	Thalainayar mangrove	10° 33' 30.0456"	79° 49' 35.5578"	Coastal wetland
2	Nagapattinam and Thiruvarur	Point Calimere*	10° 17’ 22’’	79°25’52’’	Coastal wetland
3	Nagapattinam	Tethteri	10.4049	79.8412	Inland Wetland
4	Nagapattinam	Kuduvaiyar	10° 45' 13.2696"	79° 50' 50.7768"	Coastal wetland
5	Nagapattinam	Vettar	10° 49' 25.446"	79° 50' 23.9964"	Coastal wetland

Table 5. Wetland of Nagapattinam District

Point Calimere (Kalli-medu in Tamil) is also called as Cape Calimere and Kodikkarai is located in Nagapattinam district of Tamil Nadu. It is the apex of the Cauvery river delta. In 1988 or 1967 it was renamed as Point Calimere Wildlife and Bird Sanctuary. The total area of the Point Calimere Wildlife and Bird Sanctuary wetland complex is 38,500 ha. The sanctuary includes Great Vedaranyam swamp, the Talaignayar Reserve Forest, Muthupet mangroves, and Panchanadikulam wetlands, and is flanked by the Bay of Bengal in the east, and Palk Strait in the south.

The sanctuary has a collage of Tropical Dry Evergreen Forest (TDEF), mudflats, grasslands, backwaters and sand dunes. The Great Vedaranyam Swamp extends 48 km towards Muthupet town and is fringed with mangrove vegetation. It includes the Panchanathikulam wetland area and many salt pans/swamps adjoining the sanctuary. Muthupet is situated at the southern end of the Cauvery delta. Paminiyar, Koraiyar, Kilaithathangiyar, Marakkakoraiyar and other distributaries of the river Cauvery flow through Muthupet mangroves. A lagoon is formed at the tail end, before joining the Palk Bay. The Muthupet mangrove wetland is at the southernmost end of the Cauvery delta and occupies an area of approximately 12,000 ha, including a 1,700 ha lagoon.

The Thalainayar mangroves are located about 24 km north of Vedaranayam, in the estuary of the Addapar River. It has area with extensive mudflats, sparse mangroves .The Puduar River runs through the middle of the reserve from east to west, connecting the Vedaranyam canal to the

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Malaialam lagoon, located inside the reserve. The area is flooded, during the northeast monsoon, from October to January.

Different wetland areas of the Point Calimere Wildlife and Bird Sanctuary

Wetland Type	Area (ha)
Point Calimere Wildlife Sanctuary	2250.17
Muthupet Mangroves	11,885.91
Panchanathikulam wetlands	8096.96
Un-surveyed Salt swamps	15,030.19
Thalainayar Reserve Forests	1236.77
TOTAL	38,500.00

WETLAND-AGRICULTURE

Agriculture can provide benefits to wetlands such as creating habitats for wildlife, contributing to poverty reduction, and offering potential for sustainable use, it can also lead to significant loss and degradation of wetlands, affecting biodiversity and ecosystem services, thus requiring careful management to balance conservation and agricultural productivity. Sustainable wetland agriculture can achieve the goals of both agricultural use and wetland protection. The wetland-agriculture shift in ecological interactions requires sustainable modes of development to balance wetland conservation with agriculture.

Wetland conservation, requires coordinated action by managers, policymakers, stakeholders, and scientists. Designing and implementing a system in which agriculture and nature (here, wetland) are allied ecological systems in mutual compensation, according to the way natural elements are embedded in the agricultural system. Wetland agriculture is valuable for poverty reduction, but sustainable use is needed to ensure food security and ecosystem services. Sustainable wetland agriculture balances wetland conservation and agricultural use, ensuring safe, efficient, clean and eco-friendly production.

IMPACT OF WATER MANAGEMENT FOR AGRICULTURE

Globally agriculture is the biggest consumer of water resources. Water is not effectively used as only a fraction of the water diverted for agriculture is effectively used for crop growth, with the rest drained, evapotranspired or run off. The increasing global scarcity of water due to climate

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change and water depletion poses new challenges for food production, processing and preparation, energy, industry, other economic sectors, as well as our ecology and general livelihood. Low agricultural productivity (the performance of crops) and low crop intensity (the seeding of additional crops) are major global causes of inadequate water availability and management. In India, due to low crop intensity caused by lack of water for harvesting, 60% of agricultural land remains unused for 4-6 months.

EFFECT OF WATER QUANTITY DEPLETION

Decreases in flows due to the building of dams and abstraction of surface water and groundwater for irrigation or other purposes, increases in river flows or water levels due to irrigation return flows or dam releases, and changes in the timing and patterns of river flows can all significantly alter and sometimes damage the ecological character of wetlands. For many coastal wetlands to retain their natural characteristics, rivers must deliver sediments and nutrients.

EFFECT OF WATER QUALITY DEGRADATION:

Pesticide, fertilizer, antibiotic, and disinfectant loads are frequently raised as a result of intensive agriculture practices, which also include intensive aquaculture. These have an impact on human health as well as the quality of drinking water derived from wetlands, in addition to altering the ecological characteristics of both inland and coastal wetlands. Enhancing water management has significant effects. Regenerative agriculture is a farming method that increases and improves soil fertility while improving energy and water management, boosting farm diversity, and sequestering and storing atmospheric CO2. Increased interdependencies between wetlands, water, and agriculture, with a focus on the function of wetlands in supplying the natural infrastructure needed to support agricultural for food production. The Ramsar Convention and partner organizations such as FAO and IWMI offer many practical tools and integrated approaches to help in these efforts. Introduction of cutting-edge techniques to maximize water consumption and improve sustainability, artificial intelligence (AI) is revolutionizing agricultural water management.

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