

Environmental village profiles - India

Geographically, the villages of Selvanagar, Pudur and Mannathur fall in the hinterland of the south Coromandel Coast along the Bay of Bengal. The study region consists of vast agriculture landscape and comes under the classification of North-Eastern agro-climatic zone of Tamil Nadu. This zone is characterized by sub-humid condition (annual rainfall 1000-2000 mm) with a potential length of crop growing season about 200 days. Paddy and Sugarcane are traditionally grown as wet crops mostly under groundwater-fed irrigation; otherwise, among the rainfed crops, Groundnut is widely cultivated along with other dry crops like Gingilly, Sorghum and Pearl millet.

Geomorphology

From the paleogeographic point of view, our study region with deep geological history from Archean to Quaternary period is one of the most important sites to understand the evolution of paleoclimate and biota of Peninsular India. The presence of plant fossils, especially in the Cuddalore sandstone series and lignite deposits has thrown significant light on the transformation of wetter climate (precipitation >2000 mm) to drier climate (<1500 mm) in the region between 30 million and 2 million years before present (Meher-Homji, 1974). Thus, the present-day variability in geomorphological features which has evolved through millions of years is the most important factor in determining the potential availability of groundwater in the region.

Encompassed by the river delta system, the study region is bestowed with abundant groundwater compared to other semiarid and hilly regions of Tamil Nadu. With the vast agriculture landscape, farmers in the region are predominantly using the groundwater round the year for irrigation. However, the quantum of availability of groundwater is primarily determined by the lithological, geo-morphological and geo-hydrological features of the terrain across the villages. So, in the absence of any significant variability in topography, to define the landscape units around the villages, we used landform features along with lithological, geo-hydrological and pedological characteristics.

Pudur : 40-50 m above mean sea level (MSL), lies in the flood plain of Ponnaiyar River basin, consists of Quaternary fluvial deposits of alluvial grey-brown soil mixed with sand, silt and clay which are highly suitable for cultivation. In the basin, the aquifers are at depths down to 150 m BGL (below ground level) with unconfined to semi-confined water table; potential yield of ground water is relatively high, about 25-40 liters/second.

Selvanagar: 25-45 m above MSL, on the edge of the pediplain (plateau) formed of semi-consolidated sediments of reddish Cuddalore sandstones along with laterite, lignite and sandy clay loam of Mio-Pliocene origin. Aquifer zone is moderately thick, down to 500 m BGL; water table is shallow to deep and confined to unconfined; the potential yield of groundwater is at medium level, about 10-20 liters/second.

Mannathur: relatively at higher elevation, 50 to 60m above MSL, partly under the recent deposits of Gadilam river with underlain hard rock composed of easily weathering Gneiss of Archean age. The landform is pediplain with gentle slope. Soil is calcareous with whitish topsoil due to low leaching of Calcium Carbonates. Aquifer down to 150 m BGL; unlike other two zones, groundwater restricted to weathered mantle and fractures with low potential yield, about 1-5 liters/second.

River basins

The districts of the study villages are endowed with five east flowing rivers. The villages are situated between Ponnaiyar (or Pennaiyar), Gadilam and Paravannar rivers (Fig. 5). Ponnaiyar and Gadilam rivers together form part of larger Ponnaiyar river basin, which originates at Nandi hills near Bangalore at 1000 m elevation, passes through Karnataka, Tamil Nadu and Pondicherry states (432 km), before draining into the Bay of Bengal near Cuddalore. Due to ancient back and forth shift in the river course, the river basin towards Cuddalore is vastly covered by deposits of alluvium and sand dunes. Because of the presence of 3 dams and several barrages in the upper parts of the basin, the Ponnaiyar river becomes dry by the time it enters the Villupuram district.

A branch of Ponnaiyar river, locally called Malatar forms the Northern boundary of Pudur village. The Malatar branch in the upstream has been currently cut-off from the main course of Ponnaiyar River and further down almost disappeared due to encroachment. As a result of the detachment from the main course, Malatar is completely dry, and the Forest Department is afforesting the dried riverbed with indigenous trees to consolidate sand bed as well as to restore the biodiversity of the region. A sub-branch of Malatar that runs close to south-western border of Pudur also remains dry.

The river Gadilam flows through west and southwestern part of the Mannathur village. This river originating from the western hilly region of Villupuram district runs parallel to the Ponnaiyar River before reaching the Cuddalore coast. Like other rivers in the region, Gadilam is also seasonally dry and, in many places, the dry sandy riverbed is extensively covered by *Prosopis* bushes.

Though the rivers are dry for most of the year, they play a very important role in recharging the groundwater during rainy season. According to the farmers of Pudur the yield of water in the borewells closer to *Malatar* is much higher than that in the southern part of the village. The major threats to these river basins are the encroachment and sand mining. Besides that, the farmers in the downstream expressed their anguish about the diversion of entire river water for irrigation by the farmers in the upper command areas.

Selvanagar village comes under a small Paravannar river basin within Cuddalore district. With a short course, the river is not matured and receives large amount of groundwater pumped out from the Neyveli lignite mine. Some farmers are unhappy that the enormous quantity of water pumped out from the mine not only depletes the borewells in the surrounding villages, but also that the pumped-out water is so muddy that it cannot be used for irrigation and is allowed to drain into the sea.

Water tanks and irrigation infrastructure

The study region is dotted with several rainfed ponds and tanks constructed for irrigation. Each study village has one major water tank. The tanks are currently not much in use for irrigation due to proliferation of borewells in recent years. Because of lack of maintenance, the tank beds especially in Mannathur and Pudur have been substantially covered by silt, grasses and *Prosopis* bushes which have potentially reduced the quantum of water stored in these tanks.

To harvest rainwater, a network of canals has been built by Tamil Nadu Government by linking nearby catchment areas with the major tanks and reservoirs. However, many of these canals are in dilapidated condition.

Climate

Climate is the most important input in farming practice and inextricably linked to cropping pattern, growth and yield, water use, soil fertility etc. Although the precipitation and temperature have wider impact on entire agriculture sector (including livelihood and food security), other climatic components like CO₂ concentration, humidity, photoperiods, wind etc. are critical to plant growth and nutrition. The precipitation and temperature are like a double-edged sword; excessive vagaries in these parameters under the influence of global warming may have devastating short- and long-term consequences on agriculture productivity, irrigation and farmers' wellbeing at local level.

The sharp increase in maximum temperature in our study area is significantly higher (1.4°C) than the rise in maximum (0.6°C) reported by Dash (2007) for the entire east coast region during the last century. He has attributed the rise in temperature in the coastal region of southern Bay of Bengal to increase in the sea surface temperature by 1.0°C during the same period.