

MICROWATERSHED ATLAS OF INDIA

TAMILNADU

Introduction:

The concept of watershed was introduced in India during 3rd Five Year Plan for soil and water conservation planning in the catchment area. It led to delineation and codification of watersheds in the country. This task was entrusted to the Soil and Land Use Survey of India (SLUSI) by the Department of Agriculture and Cooperation, Ministry of Agriculture. Initially, the delineation and codification was carried out up to subwatershed level with respect to the catchment area of the proposed dam site; wherein the size of the sub-watershed ranged from 2000-5000 hectare. Subsequently, the delineation and codification has been expanded to the micro-watershed level following the Watershed Atlas published by the organization that provide a viable size of a hydrological unit for planning developmental activities. The objective of this Atlas is to provide State-wise list of micro-watershed based on the delineation and codification carried out by the organization for conducting Rapid Reconnaissance Survey.

Historical Background and bare facts:

Tamil Nadu is one of the prominent states of the country by virtue of its distinct civilization encompassing an area of 103000 km² covering 30 districts. In the 4th century Tamil Nadu was known as Tamilagam or its part. in the period before 1st century A.D comprising three major kingdoms, i.e., Chera, Chola and Pandiya kingdoms. A number of feudal chiefs ruled in the area namely Ay of Podiyil, Peham of Kannamalai, Evi of Mutharu, Nalliyakkodu of Erumainadu and Adiyaman of Kongu Nadu. During this period trade with Romans flourished through the major ports of that era. also There were dominant cultural impact and well developed exchange between Tamil Nadu and Cambodia, Malaya and Indo-China. As a consequent many centers i.e., Kalinadia, Mallur and Perur developed in the region as the capitals of the kingdoms and centers of trade and administration. However, in the period 850-1300 AD the temples became nucleus for the development of an area and the social life. The areas thus developed were Coimbatore, Salem, Dharmapuri, Namakal, Tiruchengode, Kangayam, Bhavani, Rasipuram, Erode, Vellore, Krishnagiri, dindigul and Nillakkottai etc. During 1650-1800 period muslim rulers of the area developed new towns and renovated the older ones. In the later part of this era administration and economy were disrupted and to some extent destroyed due to the impact of wars between then Muslim rulers and the British. Thereafter during the British period of 1800 to 1947, the area witnessed the growth of urban centers, development of transport and communication system, administration, irrigation and power developments and the development of tea and other plantations in the hilly regions of the Tamil Nadu state.

Population: As per census(2001) data Total population of Tamilnadu was 6,24,05,679, out of which, . Urban Population was 27483998 and Rural Population was 34921681. Population density was 480/KM²

Location:

Tamil Nadu is located between north latitudes 8⁰ degree 5' and 13 degree 35' and east longitudes 76 degree 15' and 80 degree 20'. Tamil Nadu has 30 districts and they are the revenue divisions of the State. The districts are further divided into taluks and villages. Each district has head quarters where the administrative offices function.

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Topographical classification:

Tamil Nadu represents extensive table land studded with remnants of the Ghats scattered at places and stretching from Cape Comorin to Satpuras in the north, Cauvery and its tributaries through erosional processes influenced by tectonic factors sculptured the area. The area thus formed north western hilly region, Sahydari region, Tamilnad Hills, Coimbatore-Madurai Uplands and Middle Cauvery Valley. Mysore plateau lies in the north west of the Tamil Nadu Hills. A crescentic shaped Coimbatore upland lies with gradual slope towards interior which rises along the Cauvery up to 457m in the west. Southern region extends up to the foot of western ghats comprising Vagai and Tamberaparani basins. However, continuity of the eastern ghats is broken by the central Cauvery basin

The Moyar gash separates Mysore Plateau and Nilgiris. The elevation of Mysore plateau and ghats is more or less same around Dharampuri and Krishnagiri districts. The western and eastern ghats join each other in Nilgiris district with a gap near Palghat. In the south of this gap are Annamalai hills, in east Pallani hills and in west Scrdamoni and varushnd hills. The ghats have a slope direction of NNW-SSE varying to NW-SE towards east. Tamilnad hills comprising the Javadis, the Shevaroyes, the Kalrayans and Pachamalais are between the north-eastern plain between Palar and Cauvery rivers. Mysore Plateau lies in the north west of Tamilnad hills. The region in and around Coimbatore upland is dotted with small hillocks. In the south, Vagai and Tambarparani are the major basins with east directional slope. Vagai valley separates Madurai hills from Varushnad and Andipatti ranges. Physiographically, Tamil Nadu can be differentiated into four regions distributed from coastal plains to high mountains which are as follows:

1.Coastal Plain: The region includes Pulicat lake to Kanyakumari, Chinglepet, part of Villupuram, Cuddalore, Vellore, Thiruvernammalai Tiruchirapalli, Thanjavur, parts of Tiruchirapalli, Pudukkottai, Ramnathapurani, Tirunelveli, Kanyakumari which is situated 77 m above msl. Soils of this region are mostly alluvial, marine and Aeolian deposits.

2. Central Plateau: This region extends between Eastern and Western ghats area at an elevation ranging 150-160m above m.s.l, between Nilgiri and Annamalai hills except Palghat, between Cauvery and Palghat gap and the Plateau rises from 120-180 m along river reaching up to 360-460 m in West. Soils of this region are mostly derived from granite and gneissic rocks. Rivers Bhavani, Noyal and Amaravathi originate from Western ghats and flow across the Plateau.

3. Western Ghats: It represents the highest Mountains of the State, a compact area of 2,950 km² with a summit level of 1,830 to 2,440 m rising with extreme abruptness on all sides. The other groups of southern Palghat contain Annamalai highest Peak of the Peninsula, Palani hill over the river Vaigai, Cardamom hill and Cut represent the Western Ghats.

4. Eastern Ghats: It comprises a line of hills, the Javadis, Shevaroyes, Kalrayans, Pachamalais and Kollirnalais, between the Polar and Cauvery rivers, tails of Cuddapah and Nagari hill fall in this region. The Eastern ghats rise steep above the Plateau level to 1100-1600 m in the Javadis and to 1,525-1650 m in the Shevaroyes

Geology:

In Tamil Nadu four major rock types namely Gneisses, Charnokites, Granites and undifferentiated crystalline rocks are found. Undifferentiated rocks cover nearly 70-80% of the state extending from north up to south in east ward direction. Next major rock type is Gneisses covering nearly 10-15% of the state. North of Palar river, gneissic formation is granitoid in character giving rise to rounded hills and characteristic granitic topography. Whereas in areas south of Palar, these are micaceous, hornblendic. Charnockites are extensively found in the region south of Palar forming Javadis, Shevaroyes and most of Nilgiris.

Crystalline limestone of fine quality is observed as outcrops on the ridges of Madukkarani. Hornblende schist, amphibolite and hematite quartzite with bands of limestone and chloritic schists are found in the north-western part of Vellore and Thiruvernammalai, Archean (Dharwarian) exposures in Tamilnadu are represented by Kyanite, quartz and schist of Satyamangalam and magnetite-hematite and quartz schists of Kanjamalai Hills (Salem). Alluvial formations spread over the eastern upland along river courses. All mountainous ranges are representative of fault scrap mountains. Coastal zones contain sedimentary limestone, clay, laterites, heavy mineral sands and silica sands. The hill ranges are sporadically capped with laterites and bauxites of residual nature. Gypsum and phosphatic nodules occur as sedimentary veins in rocks of the cretaceous age. Gypsum of secondary replacement occurs in some of the areas adjoining the foothills of the Western Ghats. Lignite occurs as sedimentary beds of tertiary age. The Black Granite and other hard rocks are amenable for high polish. These granites occur in most of the districts except the coastal area.

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Drainage:

Eastern tilt of the Peninsula and uplift of the western ghats causes the upland drainage pattern. Four rivers namely Cauvery, Vagai, Tambarparni and Palar forms major drainage systems. Cauvery is the major perennial river. In the upland region all rivers except Ponnani, Periyar, Kodayar and Pazhayar flow from west to east.

Natural Vegetation:

Vegetative cover in Nilgiris is very thick and rainfall of an area determines the growth and density of the vegetation. There is no forest cover on upland region and the common plants grown therein are coconut, acacia, palmyra, mango, banyan, jack, Longifolia, peepal, wattle, acacia etc. In Periyar district extensive area is under forests. The regions covered by Bhavani, Gopichettipalyam Uttamapalyam, Peryakulam, Mettupalyam and Coimbatore also have vast areas under forests.

Soils:

The soils of Tamil Nadu comprise four major soil groups eg. Black soils(12%), Red soils (61%), Laterite soils (3%) and Alluvial soils (24%). The distribution of the different soil types in different districts of Tamil Nadu are as follows:

Type of Soil	Areas
Red Loam	Parts of Kancheepuram, Cuddalore, Salem, Dharmapuri, Coimbatore, Tiruchirappalli, Thanjavur, Ramanathapuram, Madurai, Tirunelveli, Sivagangai, Thoothukudi, Virudhunagar, Dindigul and The Nilgiris Districts.
Laterite Soil	Parts of The Nilgiris District
Black Soil	Parts of Kancheepuram, Cuddalore, Vellore, Thiruvannamalai, Salem, Dharmapuri, Madurai, Ramanathapuram, Tirunelveli, Sivagangai, Thoothukudi, The Nilgiris, Virudhunagar and Dindigul Districts.
Sandy Coastal alluvium	On the Coasts in the districts of Ramanathapuram, Thanjavur, Nagapattinam, Cuddalore, Kancheepuram and Kanyakumari
Red Sandy Soil	Small Patches in the districts of Coimbatore and The Nilgiris.

Climate:

The climate of Tamil Nadu is tropical controlled by relief, location and proximity to the sea. In the state, the summers are not too hot nor winters are so cold. In Tamil Nadu the rainfall can be classified as advancing monsoon season, i.e., SW monsoon with southwest winds (June to September), retreating monsoon season, i.e., NE monsoon with North Eastern winds (Oct to Jan), winter rains (January to February) and summer rains (March to May). South west monsoon, Arabian sea and Palghat gap chisels the climate on the western side of the state whereas Bay of Bengal and retreating monsoon influence the climate in the upland of the eastern part of Tamil Nadu. In Tamil Nadu, rainfall quantum due to South West monsoon increases in east to west direction. Even though rainfall is wide spread, most of the rainfall occurs during October-November in the upland region covering eastern Tamil Nadu. The area around Coimbatore and Madurai receives more rainfall in October from retreating monsoon (Oct –Feb), but Nilgiris, Salem, North Arcot receive more rainfall from advancing monsoon. Furthermore post monsoon rain (North East) and cyclonic depressions also bring considerable rains. Annual average rainfall in the state is 945 mm. Occurrence of drought is very frequent in some parts of Tamil Nadu. In upland retreating monsoon has relatively more impact. Higher temperature during March-September causes relatively lesser contribution from SW monsoon than NE monsoon when the temperatures are low. Highest mean monthly maximum zone comprises the region around Madurai and Tiruchirappalli district. Occurrences of drought in certain parts of the Tamil Nadu is quite frequent. Highest mean monthly temperature zone comprises the region around Madurai and Trichurapalli districts and lowest temperature zone are in Nilgiris and Annamalai Hills. In Tamilnadu mid February to mid June are the hottest months and mid December to mid February are the coldest. Tamil Nadu state is divided into seven agro-climatic zones. The details of the areas covered by each zone are given in the next page.

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SL No.	Zone	Districts/ Taluk
1	North Eastern Zone	Kancheepuram, Thiruvallur, Cuddalore, Villupuram, Vellore, Thiruvannamalai, Ariyalur, Perambalur in Perambalur district
2	North Western Zone	Dharampuri, Krishnagiri excluding hill areas, Salem, Namakkal district excluding Thiruchengode, Perambalur district
3	Western Zone	Erode and Coimbatore district, Tiruchengode taluk of Nammakal, Karur taluk of Karur district, Southern part of Dindigul district Periyar and Coimbatore district, Tiruchengode, Taluk of Salem, Karur Taluk of Tiruchirappalli and Northern part of Madurai.
4	Cauvery Delta Zone	Tanjavur, Thiruvarur, Naagapattinam, Musiri, Lalgudi, Thuraiyur taluks of Tiruchirappalli, Kulithalai Taluks of Karur district, Aranthangi taluk of Pudukottai, Chidambaram and Kattumannar koil taluks of Cuddalore district
5	Southern Zone	RamanathapuramShivagangai, Virudhunagar, Tuticorin and Tuticorin districts, Nattam taluk of Dindigul district, Melur, Thirumangalam, Madurai North and South taluks of Madurai districts and Pudukottai district., Melur, Tirumangalam, Madurai North and South, Pudukkottai district.
6	High Rainfall Zone	Kanyakumari
7	High Altitude and Hilly Zone	Nilgiris district, Shevroys of Salem district, Elagiri-Javachi of Nilgiri district, Kollimalai, Pachdi Malai, Annamalais of Coimbatore district, Palnis of Dindigal district and Podhezai Malai.

Agriculture:

Agriculture continues to be the most predominant sector of the State economy, as 70% of the population is engaged in Agriculture and allied activities for their livelihood. The State has as an area of 1.3 Lakh sq.km with a gross cropped area of around 63 L.Ha.. The Government's policy and objectives have been to ensure stability in agricultural production and to increase the agricultural production in a sustainable manner to meet the food requirement of growing population and also to meet the raw material needs of agro based industries, thereby providing employment opportunities to the rural population.

Tamil Nadu has all along been one of the states with a creditable performance in agricultural production with the farmers relatively more responsive and receptive to changing technologies and market forces. The major food crops grown in the state include rice, jowar, ragi, bajra, maize and pulses. Cotton, sugarcane, coconut, tea and coffee are also grown and considered as cash crops. Some farmer produce horticultural Products like bananas and mangoes.

Paddy is grown in large excess because rice is the main staple food of the state. There are three crops based on duration. The first one is the 'Kuruvali' (the short term crop) with duration of three and a half to four months from June to July to Oct - Nov. The second crop is called the 'Thaladi' that grown in 5 to 6 months Oct - Nov to Feb - March. Third is 'Samba' and has a duration of almost 6 months from Aug to January. The major source of irrigation is the rivers, tanks and wells.

Forests:

Out of the total geographical area of the state 17.59% area falls under forests. This comes 2.95% of the total country area. Tamilnadu has an area of 19,388km² reserved forests, Protected forests has 2,183 km² And un classed forests occupies 1306km²

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Methodology for Delineation and Codification:

The development of land and water resources on a sustained basis without deterioration and with constant increase in productivity is the main stay of mankind. The “Watershed or hydrological unit is considered scientific and appropriate base for necessary surveys and investigations for assessment of natural resources and subsequent planning and implementation of various development approaches. Watershed approach is more rational because land and water resources have optimum interaction and synergetic effect.

Watershed is a natural hydrologic entity that covers a specific aerial expanse of land surface from where the rainfall/run-off water flows through a particular point. It's a general phenomenon governed by the topography of the terrain. Based on the size the hydrological unit is termed As Water Resource Region, Basin, Catchment, Sub-catchment, Watershed, Sub-watershed and Micro-watershed.

Big river basins of the country are well recognized with respective geographical extent. The country has been distinctly delineated into 6 Water Resource Regions by Dr. A.N. Khosla of Central Water Commission in 1949. Soil and Landuse Survey of India initiated work on delineation and codification of watersheds in India at national level on 1:1m scale leading to the publication of Watershed Atlas of India in 1990. As per this Watershed Atlas, Kerala is covered by 4 and 5 Water Resource Region. The region 4 covers all rivers draining in Bay of Bengal except of the Ganges and Brahmaputra drainage. The region 5 covers all rivers draining to Arabian sea except of Indus drainage.

The delineation and codification is done through following criteria. The delineation is carried out from down-stream to upward considering a river system as a discrete system. The next river system should be taken for delineation after completion of the previous one. The codification should be done from left to right banks following alpha-numeric system

Stages of delineation and codification:

The delineation has been done in 5 stages starting with Water Resource Regions and their subsequent division in Basins, Catchments, Sub-catchments and Watershed on 1: 1 m scale. Subsequently two stage delineation starting subwatershed and micro watershed has been done on 1: 50000 scale. Each stage of delineation is described herein below:

State One - Water Resource Regions (denoted by Arabic Numbers) for example 1,2,3

1. Indus drainage
2. Ganges drainage
3. Brahmaputra drainage
4. All drainage flowing in Bay of Bengal except Sl. No. 2 & 3.
5. All drainage flowing into Arabian sea except at Sl.No. 1
6. Western Rajasthan mostly ephemeral drainage.

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Stage Two – Basin – Each WRR has been divided into basins which constitute big individual rivers. They are denoted by Capital English alphabets suffixed to WRR code for example A,B,C.. Thus the basin will be denoted as 5A,4B....etc. for Tamilnadu

Stage Three - Catchments: Each basin has been further divided into a number of catchments which mainly pertain to main tributaries or a group of contiguous small tributaries or individual stream. They are denoted by Arabic number suffixed to Basin Code for example 1,2,3..... thus catchments will be expressed as 5A1, 4A2,4B3.....etc.

Stage Four : Subcatchments : The Sub-catchments are further subdivided into a number of sub-catchments which are mainly smaller tributaries or streams. They are denoted by capital English alphabets suffixed to catchment code for example A,B,C..... Expressing the subcatchment as 5A1A, 4B3F.....etc.

Stage Five : Watersheds – Each subcatchment has been divided into a number of watersheds which are the smallest hydrological unit delineated in 1: 1 m Watershed Atlas of India in the macro level category. They are denoted by Arabic numbers suffixed to sub-catchment code for example 1,2,3 and watershed will be symbolized as 5A1A1,4B3F8.....etc

Stage – Six –Subwatersheds: This delineation and codification is transferred in 1: 50,000 Survey of India topomaps for further delineation at micro level. The watersheds are subdivided in subwatersheds which are either the banks of small tributaries or discreet streamlet. They are denoted by small English alphabets suffixed to code of watershed. However, the use of e,i,o and l alphabets are avoided. Thus the subwatershed will be expressed as, 4B2C1a, 5A1A1a...etc

Stage Seven: Microwatersheds: The sub-watersheds are further divided to the smallest micro-level hydrological unit i.e. micro-watershed which are part of small streams or streamlets. They are denoted by Arabic numbers but restricted to 9 only and suffixed to sub-watersheds code. This completes the delineation and codification at micro-level. Thus the micro-watershed will be coded as 5A1A1a1, 4B2C1a1 ...etc.

Thus the micro-watershed code **5A1A1a1** will represent water resource region 5, basin 5A, catchment 5A1, sub-catchment5A1A, watershed 5A1A1, sub-watershed 5A1A1a.

Digital Database Generation:

All this codified maps upto microwatershed level (Toposheet wise) were scanned and digitized using GIS software. The area of microwatersheds has been deduced out of digitized database.