Socio-Ecological Characterisation of the Project Landscape

Introduction

River Moyar originates in the Nilgiris of the Western Ghats, flowing West to East along the Tamilnadu and Karnataka State border. Originating near the hill town of Gudalur (11°51'43.30"N; 76°53'53.30"E) in Nilgiris, the river courses down through the Moyar gorge; meanders through dry forest plains before draining in to the Bhavanisagar reservoir (11°29'N; 77°03'E) .It is one of the largest rivers in the Nilgiris with a total length of about 85- 90 km. The three major tributaries of River Moyar are: Kedrahalla, Sigur River and Kahanhalla while Sandynallah, Naduvattam, Melkodmund and Lone Valley streams are the minor tributaries.

River Moyar has the distinction of running its course through the forests of the Western Ghats, on a rainfall gradient of about 5000 mm at the Nilgiris to Bhavanisagar where the annual rainfall is just 500-600 mm. This steep descent renders the region a unique character; supporting not just a diversity of habitats and species but also interesting human settlements and traditions.

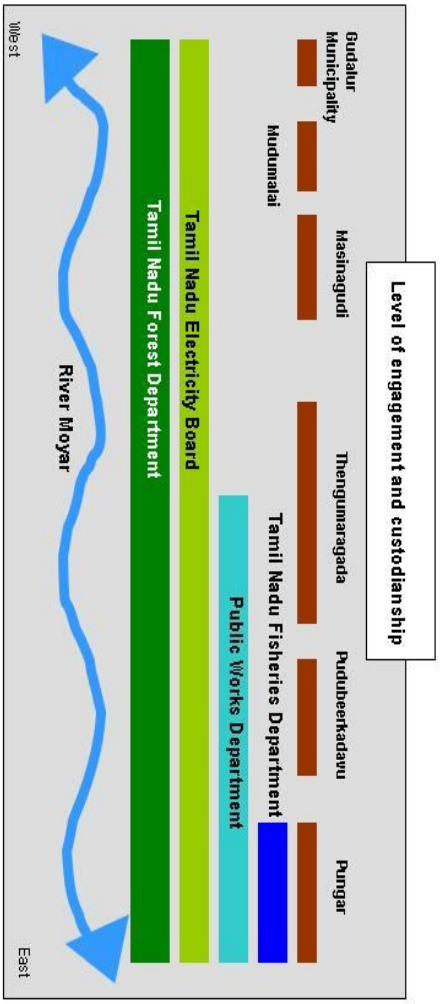
Despite this, River Moyar receives little or no attention for any conservation action. This was possibly the most significant finding of the characterization process, followed by the fact that a number of organizations/government departments that are mandated to utilize and plan for the protection of the river function with little or no horizontal integration. More disappointing is the fact that the interventions are rather limited in terms of a vision, and at best can be described as ad-hoc.

Stakeholders	Nature of stake
Tamil Nadu Forest Department	Protected Area Management (including WLS, Tiger Reserves) and Reserved Forests; focus on forests and wildlife, no specific action plan for riverine systems or riparian forests, although some of the riverine wildlife protected by the Wildlife Act.
Tamil Nadu Electricity Board	Hydro-electric projects (PUSHEP and MUSHEP). Classified plans only for the use of water to generate hydroelectric power. No formal system to engage in joint planning. Relationship with the TNFD restricted to obtaining permissions
Tamil Nadu Public Works Department	In charge of the Bhavanisagar dam at the tail end of River Moyar. No direct link with other departments
Tamil Nadu Fisheries Department	Mandated to oversee inland fisheries operations at the Bhavanisagar dam; focus on productivity. No direct link with other departments.
Tamil Nadu Pollution Control Board	Mandated to monitor pollution levels in the river; no known presence
TWAD/DoE	Mandated to monitor aspects of recharge and drainage as well as management, no known presence
TN Revenue Department	Negligible presence since much of the area is vested with the TNFD
Panchayats	Mandated to engage in micro planning; no prior attempts

Political and Administrative settings

River Moyar borders the states of Tamilnadu and Karnataka, wherein it flows through three districts (Nilgiri and Erode district of Tamilnadu and Chamrajnagar District of Karnataka). The utilization and management of river though rests largely with the state of Tamil Nadu.

Administrative jurisdication along the river is with five panchayats and one municipality. The point of origin is vested with the Gudalur municipality, although the actual site is within a reserved forest. The river course within the municipality is rather minimal; although reports from the field suggest that any pollution that River Moyar is subjected to occurs only at this stretch due to discharge of effluents from a meat processing factory that is located very close to the river bank. The Panchayats that are located along the river course (West to East) are as follows: Mudumalai, Masinagudi, Thengumarahada, Pudhupeer Kadavu and Pungar. The following schematic diagram



represents the primary stakeholders and their level of engagement with River Moyar.

Hydroelectric Projects and their impact on the Landscape and River Moyar

Critical to the characterization process is the impact of Hydro-electric power projects in the Nilgiris, which have a distinct bearing not only on the river course and the river basin through dams and associated power houses, but also due to river course manipulation and the subsequent linkages that have been forged.

Pykara is one of the highest of south Indian streams originating in the Mukurti peak at an altitude of around 2400m ASL. It is the biggest stream in the Nilgiris Plateau. The stream flows over a number of cascades and waterfalls that it provides a drop of about 1000m before it reaches the Pykara Dam at Glenmorgan. Downstream, Pykara joins the River Moyar and eventually River Cauvery through its tributary, the River Bhavani.

The Pykara Hydroelectric Project Scheme was the first hydroelectric project that the state of Tamil Nadu (erstwhile Madras) launched and successfully implemented. The Project that was formally sanctioned during the British rule in 1929 was meant to generate and supply electricity for the industries in Coimbatore. Situated in the Nilgiris Plateau, the Pykara HP stands out as the highest in Asia and continue to be amongst the highest of hydroelectric projects in the world (source: Pell Frischmann Group and TNEB).

The Pykara Ultimate Stage Hydroelectric Project (PUSHEP) that was completed during the beginning of the 21st century was formally inaugurated in September 2005. The power generation capacity of PUSHEP is 150 MW.

Temporal and Spatial spread

The Pykara HP has been implemented in stages over a period of 75 years; PUSHEP being the final one. The spadework for the Project started in 1932. The first power-generating units were small with a capacity of 6.5 MW. Three such units were installed in the powerhouse located at Glenmorgan taking advantage of the run-of-river water alone. In order to enhance the available flow, two regulating storages were added.

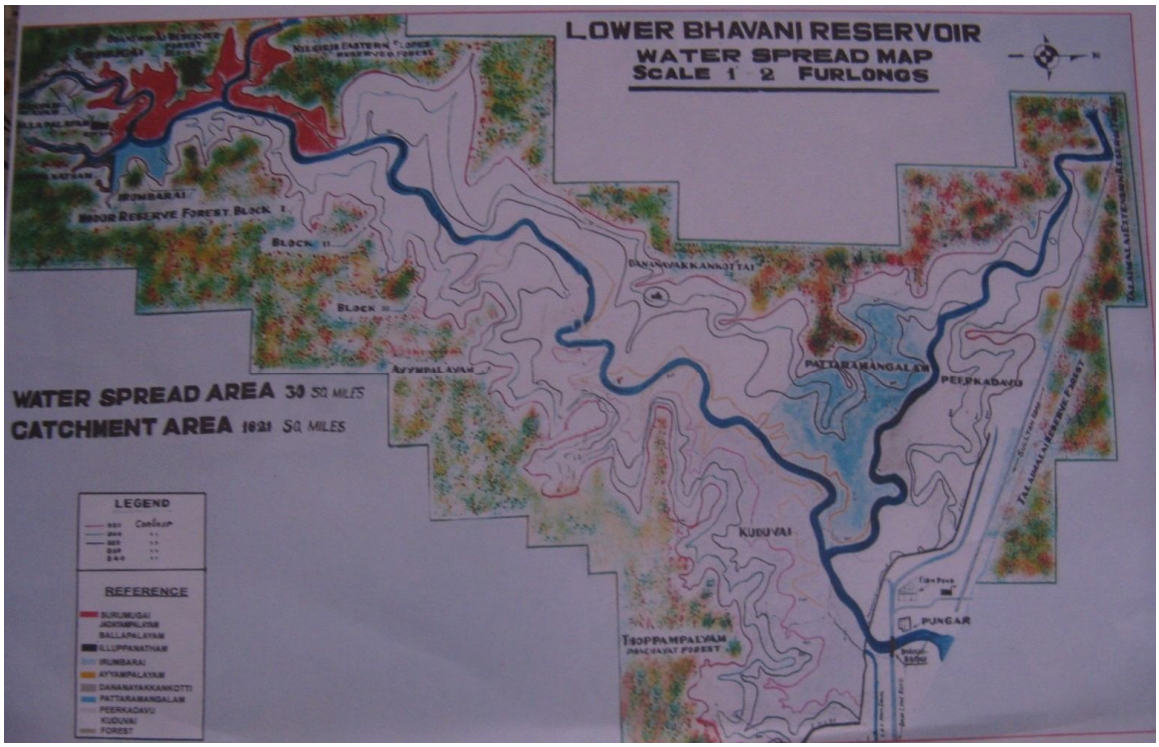
These storages were located at Mukurti (upstream) and Pykara (downstream). The additional flow thus achieved enabled the installation of more power generation units. Subsequently, another storage dam was built across the Sandynallah stream. This reservoir was built to regulate and divert flows from a catchment of 44.03km2into the Pykara Dam. The network of reservoirs thus

built helped achieve the set target of generating 70 MW of electricity. In 1955, the Nilgiris Plateau experienced yet another major transformation due to the Kundah Hydroelectric Scheme. The Kundah HS led to the creation of Avalanche Dam (372m long; 57.66m high) and Emerald Dam (328.6m long; 65.72m high) around Portimund within the Kundah basin. A 733.77m long horseshoe-shaped tunnel that had the capacity to discharge 900 cusecs of water connected the two dams. The Avalanche and Emerald streams were tributaries that directly fed Pykara before the dams were constructed.Two other dams were constructed across the tributaries of Pykara in 1965; Parson's Valley Dam (14.5km2) and Portimund Dam (10.6km2). These dams enhanced the volume of water that got diverted into the Kundah basin. The Naduvattam Diversion Project completed in 1976 harnessed water from the 12.82km2 Naduvattam basin that lies to the west of Pykara basin. In order to augment further the power generation capacity of the Pykara HP, water was diverted from the 12.95km2 Lone Valley and Melkodmund stream in the Nilgiris Plateau; both streams flowed between Pykara and Sandynallah. The huge volume of water thus diverted into the Pykara Dam necessitated the enlargement of the fore bay. The enlargement of the Pykara fore bay was completed in 1978-79.

During the 1990s when the Pykara HP was in its final stage of implementation (PUSHEP) it had a well-established network of reservoirs that harnessed water from a catchment fed by Pykara, Sandynallah, Naduvattam, Melkodmund and Lone Valley streams (tributaries of River Moyar). The catchment has provided the gross storage necessary for making PUSHEP operational and generating the additional 150MW of electricity that was envisaged).

During 1946-52, the Moyar Hydroelectric Scheme was implemented. The Scheme was implemented using the tail water of the Pykara HP. The project is located at a distance of 16km downhill of the Pykara (Glenmorgan) power station. The Moyar HS also benefits by the water that is diverted from the Maravakandy Dam (located north-east of Masinagudi) through a flume channel. At Maravakandy there is a mini-hydroelectric scheme capable of producing 2.6 MW of power (Tyagi, 1995). The Maravakandy-Moyar flume channel is 6.81km long and 10.86m wide. The Moyar Ultimate Stage Hydroelectric Project (MUSHEP) that was proposed in 1995-1996 had envisaged the widening of the flume channel by another 2m. The channel that is around 2m deep had 19 bridges across it; 3 wide (5-11m), 16 narrow (1-5m) and 3 underground passages. The various hydroelectric projects that were implemented since 1932 in the Nilgiris Plateau together established a 53km network of tunnels (INO, 2007).

The Bhavanisagar Dam and Reservoir into which River Moyar is drained is also known as the Lower Bhavani Dam. It is the second largest dam in the state of Tamil Nadu after Mettur, and also ranks as one of the biggest earthen dams of India. The construction of this dam was commissioned in the year 1948 and completed during 1955. Standing at a height of 32 m, the capacity of the dam is 32.8 tmc. The water spread area is 48.28 sq km, while the catchment area for the reservoir is 2608.746 sq. km.



Map of the Bhavanisagar Dam and Reservoir (restricted): project team was allowed to take a photograph after much persuasion

Wildlife Corridors with specific reference to River Moyar in the Landscape

It is widely believed that one of the major consequences of the Hydro-electric projects has been the creation of Wildlife Corridors. Daniels et al contend that hydroelectric projects have directly impacted not less than 150km2 in the landscape (Daniels et al ….) The details are as follows: (Sivaganesan et al, undated)

1. **Moyar Valley-Eastern Ghats**: Located at the junction of Eastern Ghats and Western Ghats; extends between Thengumaragada and Kallampalayam; 350-400m ASL; 12km long with an average width of 3.5km; scrub and deciduous forests Links Bannari RF of Satyamangalam Forest

Division and Kallar of Coimbatore Forest Division; elephants use the corridor; other important wildlife includes the Blackbuck.

2.**Susilkuttai-Bannari** Located in the northern part of Erode district bounded in the north by Karnataka; extends between Moyar tail end and Bannari beat of Kallar; 9km in long with a width of 0.5-3.0km; scrub and deciduous forests. Links Moyar Valley and other protected areas within the Biosphere Reserve; elephants use the corridor; good population of Blackbuck present.

3.**Kallampalayam-Uppupallam** Located in the foothills of the eastern slopes of Nilgiris; extends between Moyar Valley and the banks of Bhavanisagar Reservoir; 9km long with a width of 0.2-4km; thorn and deciduous forests Links the Eastern Ghats with the Coimbatore Forest Division; dominated by the invasive Prosopis juliflora; elephants migrate frequently.

4.**Moyar-Avarahalla** Located in the north-eastern part of Mudumalai WLS; bounded by Moyar road and Sigur RF; 9km long with a width of 25-100m; thorn and deciduous forests. Also known as the 'MoyarAvarahalla roadside corridor' runs parallel to the Singara flume channel; links Sigur Plateau and Mudumalai. Important for elephants/other wild mammals

National Parks and Nature Reserves Located along River Moyar

Except for the tail end of the river, where it joins the Bhavanisagar Dam, River Moyar from West to East flows through Gudalur Forest Division, Mudumalai Tiger Reserve and Wildlife Sanctuary, Nilgiris North Forest Division and the Sathyamangalam Wildlife Sanctuary with intermittent patches of Revenue ownership under various forms. The Bandipur Tiger Reserve in Karnataka also has a peripheral presence along the river course.

Climate

There are obvious differences in the local climate across the river basin, since the point of origin is at an altitude of 1300 meters above MSL while the eastern tail end is at 350 meters above MSL. It is hence but natural that the rainfall gradient varies from 400 – 5000 mm East to West, receiving rainfall from both South-west and North-East monsoon. This entails that the landscape supports varied vegetation types including Tropical Dry Deciduous Forest, Tropical Moist Deciduous Forest, and Semi-Evergreen Forest (Champion and Seth 1968, Suresh *et al.* 1996) on the upper reaches. The eastern stern side of the river receives rainfall mostly from the north-east monsoon between September and November. The annual rainfall is at about 400mm as the area falls in the rain shadow with vegetation of Tropical Dry Thorn Forest. Along the mid stream, a good stretch of riparian forest is present.

Land-Use, Soil and Forest Cover

A major portion of the landscape is under forest cover (60%), followed by small parts of area under plantation and agriculture. Tea, coffee and pepper are the major plantation crops along the river basin especially on the West. The eastern side of the river is characterized by rainfed-river based agriculture that is intermediate in nature (subsistence with intermittent commercial crops).

Soil

Red Loam and Black soil are the major soil types found along the river basin, red loam soil is composed of sand, clay, silt and organic matter and its porosity allows high moisture retention and air circulation rendering the soil fertile. Black soils have high clay content, highly moist retentive and poor in phosphorous, nitrogen and organic matter: it is highly suitable for cotton cultivation.

Human Presence in the Landscape

The landscape is home to a significant number of indigenous communities; whose historical presence is referred to in texts dating to the Sangam Period (3 Century BC to 3 Century AD). It is in manuscripts of recent history, notably those belonging to the Chera dynasty of the Tamil Kingdoms that the landscape was home to some of early indigenous communities notably Kurumbas. Records of the East India Company reiterate this fact and in certain sections pertaining to creating of Company forests, extol the role of the Kurumba tribes in wildlife management.

Contrary to what is popularly believed, the landscape on the westward part of the river was quite dynamic, with changing patterns of colonization and land use. Many early migrants to the landscape such as the Moundadan Chettys, Wyanadan Chettys and the Badagas colonized the upper and mid reaches of the river. The Eastern end remained closed until the advent of the Hydroelectric projects. One of the major drivers of a change in livelihoods in the landscape has been the manipulation of River Moyar. As hydroelectric projects were established and the river course manipulated, settled agriculture in an intensive form was ushered in. This is not to state that there was no agriculture in the past; what the hydroelectric projects facilitated was the multi-cropping seasons as opposed to rainfed single crop, subsistence cropping giving way to a more intermediate form of cropping with horticulture and plantation crops, intensive tea, coffee and pepper plantations along higher grounds, mixed cropping being replaced with mono-cropping, and the most significant : cultivation of water loving crops such as bananas and creation of recent settlements. The earlier pastoral and hunter-gatherer livelihoods were forced into curtailment, the indigenous communities were located in Padis (settlements), forcing them to work as wage

labourers or migrant labour. One of the most telling aspects of the social dynamics in the landscape is the manner in which indigenous tribal communities have been marginalized. The following table summaries some of key socio-economic characteristics of the landscape:

Name of the village	Panchayat/ Taluk/ District	Endogamous Groups/Caste Groups	Land ownership	No. of households	Dependency on River Moyar	Dominant crops	Major NTFP extracted	Presence of human-animal conflict	Sacred sites near the River/Customary-Cultural use
Susilkottai	Pungar /Sakthi (Tk), Erode(Dt)	Valayar (MuthuRajan, MBC)	Lands owned only by the Tribals/other lands under use belong to the Public Works Department	170	Agriculture – largely paddy and other cereals on the flood plain. Fishing at Bhavanisagar Dam. Drinking water	Cereals, Minor millets, Bananas	*Solanum torvum*	Intense	Pechiamman, Nagavalli, kottaimariamman temples on the river bank; dedicated site for the crematorium on the northern bank
Gulithuraipatti - Nandhipuram	Pungar /Sakthi (Tk), Erode(Dt)	Hindu Irular	Lands owned by the tribals (Tribal Settlment/Forest Dwellers)	15	Household uses; Irrigation for subsistence agriculture and for rearing cattle	Vegetables an Flowers; Minor Millets, Spices and Pulses	*Albizzia amara, Solanum torvum, Tamarindus indicus*	Moderate	
Boothi Kuppam	Pudubeerkadavu /Sakthi (Tk), Erode(Dt)	Valayar (MuthuRajan, MBC)	Lands owned by the tribals, leased to other castes, also cultivation in open lands	100	For agriculture, Boat transport, Fishing, Drinking water,	Banana, Vegetables,Minor millets	Firewood, Neem seed, *Solanum torvum*	Moderate	Sornamariyamman temple is there near river, they are using this temple in some season and burial
Uppupallam	Pudubeerkadavu /Sakthi (Tk), Erode(Dt)	Adivasi Irular/ST	Tribal Settlment/Forest Dwellers)	16	No direct use of the River: Have to. Cross 5km across the dam to reach Susilkuttai	Vegetables :Beans variety; egg-plant; lady's finger	*Sapindus trifoliatus, Solanum torvum*, Phoenix, Neem seeds	None	Solakara marimman temple near the dam; burial ground on the banks

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Allimoyar	Thengumarahada/ Kothagiri (Tk), Nilgiri(Dt)	Adivasi Irular/ST	Owned by ST, Tribal settlement/forest dwellers	70	Cattle rearing. Maavakadavu [anaikatti pallam, erumakadavu] is used for agriculture	Horticultural crops notably flowers cereals, mulberry, paddy	Sapindus trifoliatus, Solanum torvum, Phoenix, Tamarind, Albizzia amara, Phyllanthus, Terminalia chebula and honey	Wild boar	Burial sites and sacred temple of Mariamman at Moyar bank
Thengumarahada [Erstwhile Gethapatti]	Thengumarahada/ Kothagiri (Tk), Nilgiri(Dt)	BC, ST. Adidravidar, Badugas, Lingaythukar ar, nandikoudar, vettavagoundar	Tenancy farmers of the Badagas of Kotagiri for a 99 year period. Badagas granted the lease by the British for growing food crops	800	Cattle rearing; drinking, washing, transportation, fishing. Koucal river is used for Agriculture	Flowers,Banana, Bittergourd, Turmeric, Paddy, other vegetables	No	Wild boar	Burial site and a temple for Vinayak (Elephant God) on the River Bank
Kallampalayam - Pallatheru	Thengumarahada/ Kothagiri (Tk), Nilgiri(Dt)	Hindu Irular	Tribal settlement/forest dwellers	43	Boating; Drinking and bathing	Paddy, Flowers and Pulses	, Sapindus trifoliatus, Solanum torvum, Phoenix, Tamarind, Albizzia amara, Phyllanthus, Zizipus	Wild boars breaching into agricultural lands; seldom Elephants	Sinnor and Thonnai Mariamman temple; Boat driving

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Pudhukaadu	Thengumarahadaa/ Kothagiri (Tk), Nilgiri(Dt)	Adivasi Irular/ST	Leased	50	Cattle rearing, washing., agriculture, traditional boatmen	Banana, Paddy, Horticulture	Sundai, Phoenix, Kaatuvalli kilangu, soapnuts	Leopard hunts goats; wild boar on agri fields	Rearing cattle
Doddamoyar	Masinagudi / Udagamandalam/NIlgiri	Adivasi Irular	None	6	Fishing by hook – five species most commonly caught. Cross the river on a rope bridge. Also collect crabs and Cyprus sedge for making mats, also collect water for drinking and other household purposes.		Extensive collection of local greens such Manatakkali, mullukeerai, ponnankanni, mukkaratai; Also Phyllanthus, Syzigium, , Elanthai, Dioscorea tubes etc. Only for subsistence	Low	Thoddamariamman temple. No sacred groves now
Moyar	Masinagudi/Udhagamandalam/Nilgiri	Kurubagoundars, Othiyagoudar ,Adivasis, Adidravidar, Vanniar	Forest lands under lease/houses on patta	800	Fishing by hook – five species most commonly caught. Cross the river on a rope bridge. Also collect crabs and Cyprus sedge for making mats, also collect water for drinking and other household purposes. For irrigation and domestic use as well.	Vegetables; millets, pulses and oilseeds	Greens for domestic food and Phyllanthus, Sapindus and Sygizium fruits for trade. Also collect myrobalans. as NTFP	Moderate	Kaliamman, Boothanathamariamman , kittienkattai temples

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Masinagudi	Masinagudi/Udhagamandalam/Nilgiri	Gowdar; Vellalar; Kurubar; Adivasi Irular; Adi Dravidar, Vanniyar, etc	Yes	2000	Agriculture and domestic drinking purpose	Turmeric, Pappaya, vegetables, Ragi, millets	Myrobalans, Honey, Sapindus and Phyllanthus	Most intense	This river is a gift from God, without this the whole district would incur difficulties; also the river provides water for wildlife
Kaargudi	Mudumalai/Gudalur/Nilgiri	Adivasi Kurumbar	Forest lands	15	Fishing by hook , also collect Crabs		Cyperus, Vitex, Greens, honey, jamun, guava for domestic purpose	No	Mariamman, sanibhavan temples. Sacred grove in Thorapalli
Teppakadu Teak padi	Mudumalai/Gudalur/Nilgiri	Adivasi Kurumbars, kaatu naikkars	Own house on Forest land	20	Fishing by hook; boats made of bamboo was used once, but not now		Crab, Cyperus, Vitex, Greens, honey, jamun, guava for domestic purpose	No	Scared river for life, Bommadevan temple; also burial site

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Teppakadu light padi	Mudumalai/Gudalur/Nilgiri	Adivasi Kurumbars	Own house on Forest land	85	Fishing by hook		Crab, Cyprus, Guava, Mango, Jamun Myrobalans, Honey, Greens	NO	Kargudi mariamman temple Burial
Teppakadu camp padi	Mudumalai/Gudalur/Nilgiri	Betta Kurumbars, Naikkars	Own house on Forest land	82	Fishing by hook		Crab, Cyprus, Guava, Mango, Jamun, Grewia and tubers	No	Bommade van sivan temple