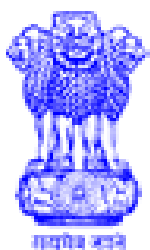SUSTAINABLE REGIONAL PLANNING FRAMEWORK
for

puducherry, viluppuram, auroville & cuddalore

Final Report

February 2012

Acknowledgements

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Appendices

Vision

"The Puducherry-Viluppuram-Auroville-Cuddalore (PVAC) Sustainable Regional Planning Framework will establish a way forward for our unique and diverse communities to grow together as a single entity whilst promoting prosperity for all sections of society, enriching our quality of life, our culture, our heritage and our environment. It aims to be a model for the evolution of a new paradigm for development that is holistic, inclusive and balanced; and hinges upon making responsible choices in our communities today without diminishing our quality of life in the future."
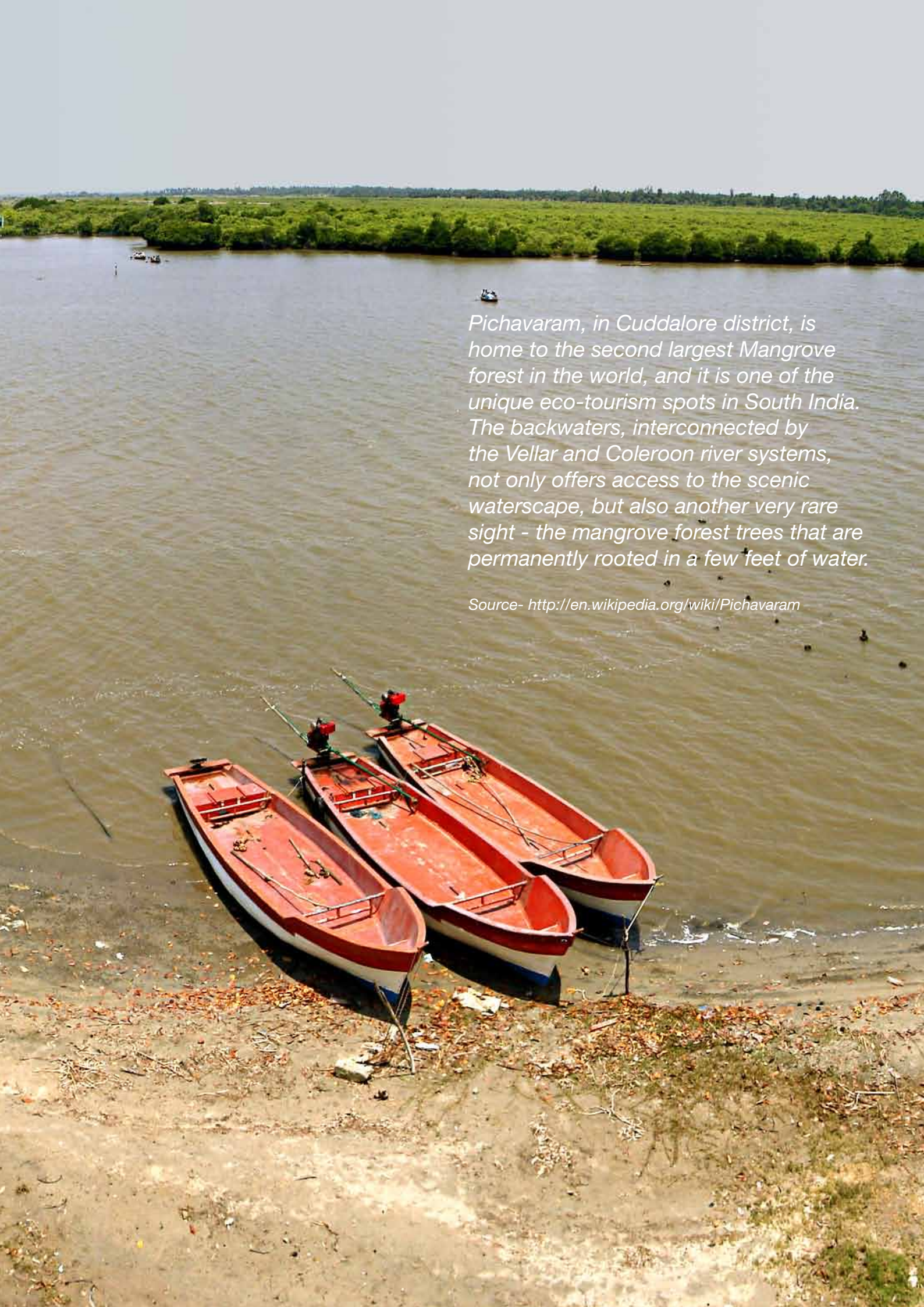
Pichavaram, in Cuddalore district, is home to the second largest Mangrove forest in the world, and it is one of the unique eco-tourism spots in South India. The backwaters, interconnected by the Vellar and Coleroon river systems, not only offers access to the scenic waterscape, but also another very rare sight - the mangrove forest trees that are permanently rooted in a few feet of water.

Source- http://en.wikipedia.org/wiki/Pichavaram

1.0 Overview

In 2030, 60 percent of the global population — or five billion people — will live in urban areas. India's urban population grew from 290 million in 2001 to 377 million in 2011 (McKinsey 2010, Census 2011). According to the McKinsey's report (2010) India will have 590 million (40 percent of the total population) people living in the cities by 2030, which is twice of United States Population today.

Our cities are expanding and their peripheries are engulfing the surrounding rural areas into the metropolitan boundaries. The metropolitan cities with a population of over 1 million have already increased from 35 in 2001 to 50 in 2011, and this number would continue to increase in the future. Tamil Nadu, Gujarat, Maharashtra, Karnataka and Punjab are expected to have over 50% of their population living in the urban areas by 2030. The ever increasing migration into cities is causing tremendous pressure on urban basic services and infrastructure. There is enough evidence to show that our forthcoming generations will need to overcome extreme challenges posed by population growth, migration, congestion, diminishing natural resources, energy crisis and food insecurity.

On the other hand, about 70% of India's population lives in rural areas but have access to only 30% of the national wealth. With growing urbanization this share is rapidly diminishing. This divide is also the cause for the massive migration from the rural to the urban that we are now witnessing. The current policies and pattern of investments are resulting in an urban-rural divide and a deterioration of both. While mega-cities are becoming unmanageable and unlivable because of over expansion and development, rural towns and villages are languishing due to lack of investments and opportunities for economic growth. Even after 50 years since independence the situation in rural India has not changed much- lack of livelihood opportunities, high levels of illiteracy, inadequate health care and extremely limited access to social services continue to exist.

While India's current development model has created a stronger economy driven by industrialization, it has not been entirely successful when viewed from the parameters of balanced urban-rural growth, inclusive communities, or equitable distribution of resources. In other words, the foundation of the present development model is industrialization driven primarily by competition, profit making and a desire for high living standards. This has resulted in indiscriminate over exploitation of natural resources and a rapid degradation of our environment. In India, the problem is being compounded by a glaring deficiency of scientific planning approaches. The result is what we are witnessing in India today; a lopsided economic growth accompanied with a rapid deterioration of environment and quality of life.

"India cannot afford to get its urban strategy wrong, but it cannot get it right without bringing about a fundamental shift in the mindset which separates rural from the urban." (HPEC.2011. XXI)

It has become increasingly important to bridge the gap between demand and service delivery in terms of its infrastructure provision whilst empowering citizens and ensuring their participation in the process of governance and decision-making. While doing so, efforts also need to be directed at protecting the natural environment. However, sustainability cannot be achieved without understanding the local places and scales where the human life actually occurs. The local environment, history and community aspirations together define the 'spaces' that people occupy. Any action directed towards achieving sustainability needs to acknowledge this intrinsic connection that exists between the society and their environment; and define a spatial framework in which 'people live as rooted, active, participating members of a reasonably scaled, naturally bounded, ecologically defined "place".' (Kaliveli Bio-region Development Framework: Design Retreat. 2012)'

Such an integrated approach will ensure a people-centred development, or sustainable human development, which has been gaining increasing acceptance over the last 10 years. It emphasizes that development should be broad-based and bottom-up, redistributive and just, empowering and environmentally sustainable; seeking to meet the needs of the present generation without compromising the ability of future generations to meet their own needs (WCED 1987).

Redirecting investments away from mega cities and building a strong economy base in rural areas will reverse migration flows, benefiting both. The future of the country lies in creating a more balanced and harmonious pattern of human settlements through an urban-rural continuum; urban cities having the serene and beautiful quality of life of the rural; and the rural with the entire infrastructure required for a decent and secure quality of life.

Globally and nationally there is a recognised need for such a new form of approach to development. However, there is lack of clarity in the conceptualisation of such an approach. Devising specific initiatives, their components and strategies, particularly those related to community mobilization, are a bigger task at hand. The decision makers and the civil society is awaiting a new framework for development which could pave way for future initiatives from its example. (Kaliveli Bio-region Development Framework: Design Retreat. 2012)'

Puducherry, Auroville and the surrounding Tamil Nadu districts are an ideal laboratory for this experiment to evolve a new paradigm for development. A regional plan for this area could evolve a new paradigm for development. The region is large enough to contain a substantial mix of economic activities, yet small enough so that relatively few changes to the natural and economic landscapes can produce observable trends. The experience gained from such an endeavour could motivate and encourage similar integrated development projects in other regions, giving a new direction to India's growth, one that is sustainable and harmonious.
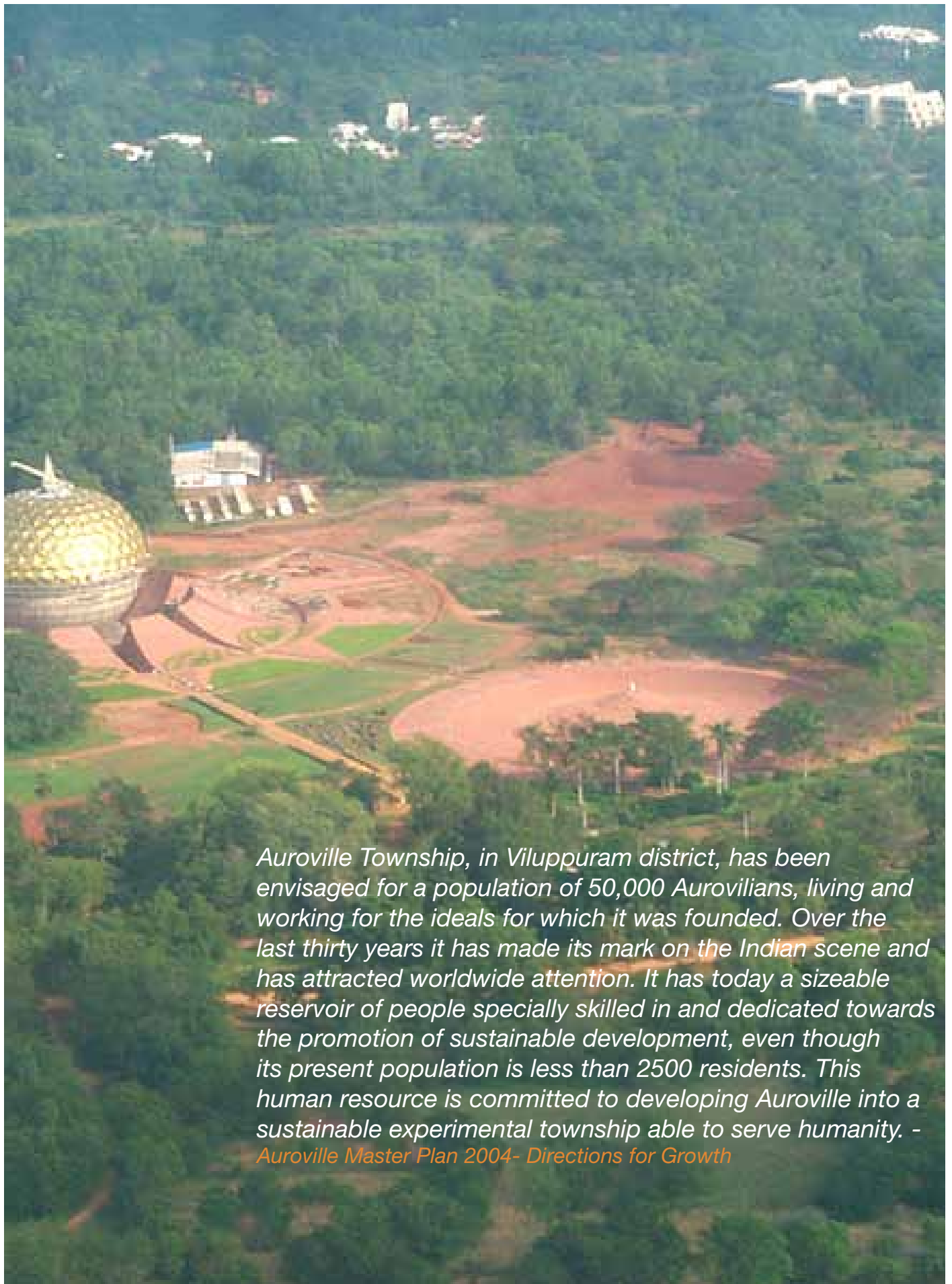
Auroville Township, in Viluppuram district, has been envisaged for a population of 50,000 Aurovilians, living and working for the ideals for which it was founded. Over the last thirty years it has made its mark on the Indian scene and has attracted worldwide attention. It has today a sizeable reservoir of people specially skilled in and dedicated towards the promotion of sustainable development, even though its present population is less than 2500 residents. This human resource is committed to developing Auroville into a sustainable experimental township able to serve humanity. - Auroville Master Plan 2004- Directions for Growth

Government Initiatives

In view of this growing divide between the urban & rural and mass migration of rural population to urban areas the Government of India initiated the idea of Regional Plans. According to the policy "In any comprehensive plan of development it is axiomatic that the special needs of the less developed areas should receive due attention. The pattern of investment must be so devised as to lead to balanced regional development."

The Government of India, through its 73rd and 74th constitutional Amendment Acts of 1992; and the JNNURM programme have already recognized the need to strengthen India's urban local bodies (ULBs) as local self-government with clear functions, independent financial resources, and autonomy to take decisions on investment and service delivery. ULBs also need to be made accountable to the citizens. However, the progress in implementing reforms under JNNURM has been slow. Most ULBs continue to look for Government subsidies and very few reforms in governance have been achieved. The local level governments displayed a lack of capacity to raise their share of funding for the approved projects. The government of India has proposed a New improved Jawaharlal Nehru Urban Renewal Mission (NIJNNURM), based on the experiences of the JNNURM, which focuses on capacity building and supporting urban reforms within a programme approach. (HPEC, 2011; McKinsey Report. 2010)

In view of the increased urbanization, the 74th Amendment has also indicated the need for integrated planning. Articles 243ZD and 243ZE specifies the creation of a Committee for District Planning in each district, and a Committee for Metropolitan Planning in every metropolitan area . Some of the issues like water management, environmental conservation, sharing physical and natural resources, often extend beyond one administrative boundary and require shared understanding and collaborative responses. A participatory process needs to be initiated to decide on the investment policies and project priorities. *(Implementation of the 74th Constitutional Amendment, JNNURM)*

"Regional Planning is the conscious direction and collective integration of all those activities which rest upon the use of the earth as site, as resource, structure".

- Lewis Mumford.
The Culture of Cities. - Harcourt, Brace and World, Inc. New York, 1938

CASE STUDY:
Kollam Integrated District Development Plan, Kerala

The Kollam District Planning Committee (DPC) is one of the first DPCs to consolidate Panchayat / Municipality plans in the District and to prepare a Draft Development Plan for the District as a whole. The preparation of Plans is at two levels in the project – one at the Gram Panchayat / Municipality level, a Local Development Plan (LDP) and at the District level, an Integrated District Development Plan (IDDP). The methodology adopted is a combination of top-down, grass root-up approach. Both IDDP and LDPs are prepared based on Spatial Planning Approach. (Insert flowchart of the preparation of LDP & IDDP). The data collection and analysis are done at the local level. The draft of the regional plan i.e. IDDP is prepared first considering the suggestions and the results of local level data of the LSGs in the district as well. Afterwards, the draft LDPs are prepared considering the draft IDDP as an umbrella plan. Both IDDP and LDPs are then modified and finalized in a consultative manner.

Source: General information on Integrated District Development/ Local Development Plans, Department of Town and Country Planning, Government of Kerala (http://www.townplanning.kerala. gov.in/Pages/iddp_gen.htm

PLAN	
A perspective plan, or a development plan, or an annual plan of a metropolitan area, district or a local planning area	
PERSPECTIVE PLAN	
A long term (20-25 years) plan providing the goals, policies, strategies and general programmes of spatio-economic development of a state, a metropolitan area, a district or a local planning area	
DEVELOPMENT PLAN	
A comprehensive plan of a local planning area covering the whole area or a part thereof, conceived within the framework of the perspective plan providing medium-term (five years) policies, programmes and detailed proposals for socio-economic and spatial development of such area indicating the manner in which the use of land and development therein shall be carried out	
DISTRICT DEVELOPMENT PLAN	
A five year regional plan of socio-economic and spatial development of a district incorporating both physical and fiscal proposals of the development plans of various municipal bodies and panchayats located in the district	
METROPOLITAN AREA DEVELOPMENT PLAN	
A five year regional plan of socio-economic and spatial development of a metropolitan area conceived within the framework of its approved perspective plan	

Source:
Model Urban and Regional Planning and Development Law, Ministry of Urban Affairs & Employment, New Delhi

Provision of Urban Amenities in Rural Areas (PURA)

Provision of Urban Amenities in Rural Areas (PURA), was launched in the year 2003 by Dr. Abdul Kalam, as an attempt to bridge the service delivery gaps and address the lack of economic investment, and the poor quality of life in the rural sector. There are wide gaps in the availability and accessibility to social and physical infrastructure in urban and rural areas. These factors lead to migration from rural to urban areas. PURA attempts to provide four crucial connections: physical connectivity, electronic connectivity, knowledge connectivity leading to economic connectivity of rural areas.

'PURA is envisaged as a self-sustainable and viable model of service delivery to be managed through an implementation framework between local people, public authorities and the private sector.' The Government support would include finding the management structure that would develop, maintain, the rural infrastructure provided. The governments would empower this management and provide the initial economic support needed. (Ministry of Rural Development)

Puducherry- Viluppuram- Auroville- Cuddalore Region

Puducherry and the surrounding districts of Cuddalore and Viluppuram including Auroville span a total area of roughly 2,500 sq.kms. and constitute an extremely distinct region rich in environmental resources, ecological biodiversity and cultural heritage thus, trivializing the lines that mark the administrative boundaries that divide them. Within this region are four major urban centres- Puducherry, Cuddalore, Viluppuram and Tindivanam and over 500 villages. If unplanned, rapid urbanization of these towns will result in depletion of environmental resources in favour of economic gains and unsettle the urban-rural balance.

The Region has one large city in the form of Puducherry (population of Puducherry city -0.24 million; Puducherry District-0.95 million as per 2011 Census) and four smaller towns: Cuddalore town to the south (population of Cuddalore city 0.17 million; Cuddalore District-0.26 million as per 2011 Census), Viluppuram to the west (Viluppuram City-95,000 as per 2001 Census; Viluppuram District-0.35 million as per 2011 Census), Marakkanam to the north (population of 19,000 as per 2001 Census) and Tindivanam to the northwest (population 68,000 as per 2001 Census). Interspersed between the aforementioned urban areas are large tracts of rural areas where agriculture is the primary livelihood activity.

From a development perspective, Puducherry has over 68% of the population living in the urban areas, while the surrounding areas of Viluppuram and Cuddalore districts in Tamil Nadu are predominantly rural in nature. Puducherry district is experiencing substantial population and economic growth, and this trend is expected to continue growing at a rapid pace. Cuddalore and Viluppuram districts, on the other hand, have also witnessed a substantial increase in population although the urban cores of these districts remain underdeveloped because of minimal investment in infrastructure.

At the ecosystem level, the wetlands of Puducherry and the surrounding districts of Viluppuram (including Auroville) and Cuddalore in Tamil Nadu constitute a distinct ecological bio-region. The topographically higher wetlands drain into lower wetlands till one reaches the coastal areas rich in bio-diversity. The whole region is part of an integrated natural ecosystem: along the coast are the beaches, sand-dunes, estuaries, forests and mangroves. The natural backwaters and wetlands, along the sand dunes, arrest the water coming down the Deccan plateau through waterways, swales, and rivers. These backwaters play recharge the coastal aquifers, thus providing good ground water and also arresting any salt water intrusion that may occur from the seaside.
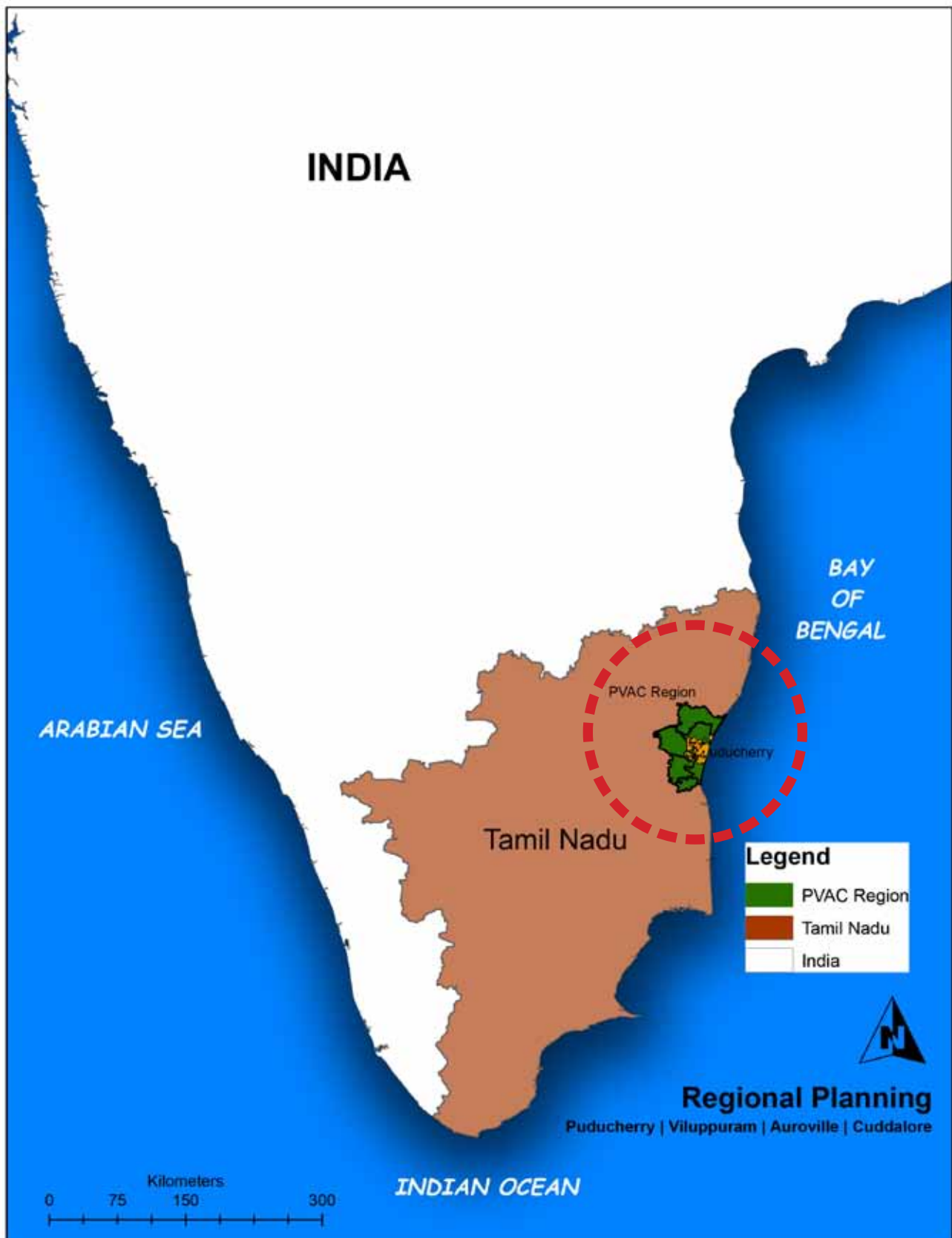
Location of the Puducherry- Viluppuram- Auroville- Cuddalore Region in India

It is clear now that in case a well articulated regional planning approach and integrated growth management framework is not put in place in Puducherry and its neighbouring Tamil Nadu districts immediately, rapid urbanization and haphazard growth will lead to land under agriculture being usurped for other urban activities. This will have a disastrous effect on the livelihoods of the people that make up this region as well as on the water systems of the area leading to increased runoff, deterioration of water quality and significantly reduced re-charging of aquifer. The intent is to combine the strengths and resources of each sub-region and manage the growth in a way that benefits the entire region and not just the major urban centre of Puducherry.

Sharing the region's resources more equitably is the only way that we can build a more sustainable and inclusive regional economy that supports real and long-term growth. It is now absolutely necessary to forge a new understanding that embraces our collective values for safeguarding the environment and our natural resources. The land, forests, water bodies, coastal areas, built heritage, local values, practices and traditions that abound in this region must be treated as a collective resource that have been handed down to us and that we must in turn hand down to our future generations. We must ensure that our chosen path for growth is prosperous without diminishing the quality of our lives in the future. How much we consume today will determine how much we have left for tomorrow. The choice is really ours to make at this point regarding how we want to grow.

Study Area Boundary

The study area boundary for the first phase of this regional planning effort has been roughly identified as the area bounded by Marakkanam and the Kaliveli Tank (Vanur and Tindivanam taluks of Viluppuram District) on the north, Coromandel Coast on the east and Perumal Lake (Cuddalore, Panruti and Kurinjipadi taluks in Cuddalore District) on the south. On the west, the region includes the Puducherry Urban Area and areas within the Viluppuram taluk of Viluppuram District. Taking into consideration the administrative boundaries, prominent natural features (specifically the water bodies and topography), and presence of major growth centres (population and employment linkages), a 40 kilometer radius around Puducherry city was further delineated as the boundary used for data collection and analysis purposes.

Regional Planning Boundary
Puducherry | Viluppuram | Auroville | Cuddalore

Scope of the Puducherry- Viluppuram- Auroville- Cuddalore Regional Plan Framework

In September 2010, INTACH Puducherry and PondyCAN, with funding assistance from ADEME have embarked upon an initiative to develop a regional plan for the Puducherry- Viluppuram-Auroville-Cuddalore region. The Puducherry- Viluppuram- Auroville- Cuddalore (PVAC) Sustainable Regional Planning Framework is an initiative to establish an integrated inter-state growth strategy for Puducherry and its neighbouring districts in the state of Tamil Nadu- Viluppuram and Cuddalore. The impetus for this citizen-driven effort came from the realization that in case an integrated growth management framework is not put in place in Puducherry and its neighbouring Tamil Nadu districts immediately, rapid urbanization and haphazard growth will lead to deleterious impacts on communities over the next 20 years. It is the first effort of its kind in the region and focuses on promoting a paradigm shift from conventional planning models to a more integrated sustainable participatory planning model at the ecosystem level, and not just administrative boundaries.

The primary outcome of this project was envisioned to prepare the outline or the framework for a Regional Plan and not the plan itself. With the preparation of this document, the goal is to evince interest from citizens, local bodies and governments to support the preparation and implementation of a comprehensive Inter-State Regional Plan.

Any successful planning effort not only needs to have the endorsement of the governing bodies but also the support of the citizens. The Regional Planning Framework is intended to engage with the citizens and provide a forum for expressing their needs and aspirations for the region and incorporating those into future regional, district,and local plans. The Framework aims to:
- Document the present growth patterns in terms of demography, socio-economic growth, food and agriculture, mobility, energy, water, air quality, education, health, governance and the overall quality of life
- Develop a coherent vision for the region that embraces a sustainable development trajectory resulting in a good quality of life for all with a socio-economic and governance fabric that is based on equity, inclusion, participation and collective responsibility and inspired by the values of harmony, goodwill, discipline and truth;
- Present a preliminary outline of an action plan for the realization of the vision for the region that forms the base for a comprehensive regional plan in subsequent phases;
- Compile a GIS database for the region that contains information about the natural, social and cultural features and that contains thematic information on the thematic areas such as land use, water resources, education, health, energy, mobility, economy, and other features.
- Formulate a methodology for conducting field surveys and conducting participatory planning exercises to elicit people's aspirations and understand

Project History

Although the idea of preparing a regional plan has been around for over 10 years, it was not able to progress due to lack of funding opportunities. The grant from ADEME was instrumental in taking the dialogue further and initiating a formalized planning process.

1986	September	Ministry of Urban Development (MOUD) write to Puducherry and Tamil Nadu Government to establish a working group and initiate Regional Planning Process
2005	January	MOUD requests to set up a Joint Regional Planning Working Group. Coordination between the states encouraged
2008	March	Puducherry Town and Country Planning (TCP), INTACH and PondyCAN meet to discuss the regional plan
2009	May	Consultation meet for "Water Management through Integrated Planning and Regional Collaboration" with TCP, INTACH, PondyCAN and L'Avenir
	July	Consultation meet for the "Integrated Development Plan for Puducherry-Auroville-Viluppuram-Cuddalore" attended by officials from both the Puducherry and Tamil Nadu governments

their needs at the local level;

- Preliminary recommendations for a few sectors- land use, transportation, water, and energy that will serve as a model for a sustainable development of the region;
- Identify potential projects that can be implemented while the regional plan is being prepared to demonstrate the feasibility and scalability of some of the key elements of the plan framework.

Planning Process

The Regional Planning Framework provides general direction and broad guidelines for addressing priority issues in the region and to ensure that planning decisions do not compromise long-term planning needs. The effort is a citizen-led process with support provided by the government of Puducherry, the district collectors of Cuddalore and Viluppuram, Auroville Town Development Council, and various area institutions.

The following phases outline the planning process adopted to prepare this Regional Planning Framework:

Data Compilation and GIS Mapping
Since the initiative included multiple administrative districts and departments, easy access to data and compilation of information at the regional level has been a challenging task. The first step in the process involved compilation of data from various sources such as the Puducherry Town and Country Planning Department, local Public Works Departments, Regional Transportation offices, and other governmental agencies. Online research and collection of reports from previous planning reports was then undertaken.

Regional Planning Framework Process
Puducherry–Viluppuram–Auroville–Cuddalore Region

PLANNING PROCESS

A — DATA COMPILATION/ ANALYSIS

1 PLANNING CONTEXT
- PLANNING CONTEXT
- PRIOR DEVELOPMENT PLANS

2 REGIONAL CONTEXT
- GIS
- ECONOMICS
- DEMOGRAPHY
- NATURAL ENVIRONMENT
- LAND USE

3 COMMUNITY ENGAGEMENT
- WORKSHOPS
  - LAND USE
  - TRANSPORTATION
  - WATER
  - ENERGY
  - ENVIRONMENT AND DISASTER MANAGEMENT
  - GOVERNANCE
- INTERVIEWS
- SURVEYS
  - TRANSPORTATION
  - WATER
  - ENERGY
  - VISION

IDENTIFYING KEY ISSUES

B — FORMULATING VISION

GOALS AND OBJECTIVES

1 LAND USE
2 TRANSPORTATION
3 WATER
4 ENERGY

PRELIMINARY RECOMMEN- DATIONS

C — FRAMEWORK FOR THE REGIONAL PLAN

D — IMPLEMENTATION APPROACH

- ORGANIZATIONAL FRAMEWORK
- INTERGOVERNMENTAL COORDINATION
- NEXT STEPS
- ADVOCACY AND COMMUNITY OUTREACH

Following the secondary data collection, an extensive GIS database creation exercise was initiated. This included developing base data pertaining to physical features, hydrology, administrative boundaries, transportation networks, land cover, and other contextual information in a Geographic Information System database. An extensive GIS mapping exercise was started to visually represent the natural, social, cultural, and development features of the region. The mapping exercise was instrumental in gaining a better understanding of the region's growth patterns and analyzing trends at a macro-level.

Community Participation
Public involvement has been an important component of the planning process undertaken during the preparation of this Regional Planning Framework. The purpose of this first phase of the community participation initiative was to obtain insight into the issues and concerns of stakeholders representing the civil society, government representatives and elected officials.

Field Visits and Stakeholder Interviews
Interviews were conducted through the field visits and the surveys to increase awareness about the need for regional planning and also provide an opportunity for the citizens to identify their vision and aspirations for their respective communities and for the region as a whole. Additionally, stakeholder interviews were also conducted by the team as part of this planning process. The field visits and interviews were document as videos and summarized in Appendix A.

Community Surveys
Theme based surveys, were conducted to understand the key issues under each of the following three themes- transportation, water and energy. Appendix B contains a brief summary of the results obtained in these community surveys. Over 2,500 citizens were surveyed on various issues during the course of the planning process.

Community Participation

Interviews	**Formal Interviews** With Government/ NGOs. **Informal Interviews** Local citizens / local leaders/ citizen groups/ NGOs
Theme Based Workshops	**Water** Opportunities for integrated water management across Puducherry and Tamil Nadu **At the sub-region level** Cuddalore Viluppuram Auroville
Surveys	**Vision Survey** To identify the issues and aspirations of the citizens **Water** Domestic water supply/use Ousteri lake survey **Energy** Energy use pattern in consumers and vendors **Transportation** Origin-Destination survey Forecasting
Field Visits	To communicate with the citizens and understand their expectations and aspirations for the region.

Theme-based Workshops

A series of theme based workshops with citizens, elected representatives, non-governmental organizations, and resource persons from the region were conducted in Puducherry, Viluppuram, Cuddalore and Auroville. These workshops gave an opportunity to engage the invited participants in discussing the concept of regional planning and to help educate government officials of the two states of the need for collaborative planning. The workshops also provided a platform to initiate a dialogue between members of the civil society and government officials and elected representatives from the states of Puducherry and Tamil Nadu. The outreach efforts attracted more than 300 participants in the four workshops conducted during this process. The feedback received from the participants informed the various issues and preliminary recommendations reflected in this plan. Appendix B contains a summary of the feedback received during these workshops.

Of the proposed 8 workshops, the following activities were undertaken as part of the regional planning process:

- 2 stakeholder workshops in Puducherry
- 1 stakeholder workshop in Cuddalore; 1 workshop with government departments and NGO groups from Cuddalore
- 2 workshops in Viluppuram Workshop in Cuddalore was combined with workshop
- Several focus group meetings were facilitated between INTACH, PondyCAN and regional NGO groups including REAL, DHAN Foundation, CEAD, French Institute of Puducherry.

Regional Planning Framework Documentation

The GIS mapping and the stakeholder/ citizen feedback established the baseline for identifying the key issues, challenges, and preliminary recommendations presented in this Regional Planning Framework document. The Framework is organized into four main themes- Land Use, Transportation, Water, and Energy. It also includes a section on the implementation strategies and the way forward in translating the regional vision into reality.

Key Challenges faced by our Region

The purpose of the Regional Planning Framework is to build on the region's assets, identify its challenges and opportunities, and develop a road map that will help guide the region's growth in a sustainable and equitable manner. Over the coming years, the PVAC Region faces many challenges that can only be addressed through a regional planning approach. Key challenges are presented below related to various systems that need to be integrated in building complete communities.

land

While Puducherry suffers a tremendous strain on its urban infrastructure and quality of life because of uncontrolled and unplanned expansion and excessive development cramped into a limited land area, the immediate vicinity in both Cuddalore and Viluppuram districts have vast tracts of land languishing from paucity of investment. Other critical concerns related to land use include: unplanned sprawling growth, lack of enforcement, loss in agricultural land, and minimal forest cover and recreation areas.

mobility

Urban sprawl and haphazard development directly influence regional travel patterns and mobility networks. The region is characterized by limited sustainable transportation choices that provide connectivity between the urban centres, towns, and rural areas. Traffic congestion, lack of dedicated pedestrian/ bicycle facilities, safety, poor quality bus service, absence of a regional airport, and multiple port developments are some of the other major concerns related to efficient movement of people and goods.

food security

A significant portion of area under cultivation in the region is rapidly being converted into non-agricultural uses. In Puducherry alone, it is predicted that in another two decades most of its territory will be urban with no agriculture left. Also, the productivity of the current agricultural land in the region is poor owing to unsustainable practices, lack of sufficient infrastructure and loss of agricultural labourers. The challenge is to protect the agricultural land base and to encourage its active use for food production.

water

Water security is very essential to the sustainability of any region. Appropriate management of water will not only ensure water availability for all. In the region, water tables are rapidly declining and its quality deteriorating, with saline intrusion affecting aquifers along the entire coastal region. Crucial, irreplaceable water bodies continue to be threatened by industrial and residential expansion.

environment

Natural resources are under severe strain because neither their use, nor plans for their protection, conservation, and augmentation are coordinated among the stakeholders within the region. Loss of forest cover has further led to soil erosion, disappearing biodiversity and poor groundwater recharge from the rains. Coastal mismanagement has already destroyed beaches and fishing villages throughout the region, and continues to threaten the remaining areas. Given the disaster wrought by the tsunami in Tamil Nadu in the recent past (December 2004) and cyclone Thane (December 2011) to the coastal areas of the region, preservation and restoration of the beaches of the bio-region and forests need to be given high priority. Waste generated through excessive consumption habits and a lack of appropriate recycling practices in the region has further exacerbated issues related to environmental degradation.

energy efficiency

Studies suggest that by 2030, the world may need to spend more than 200 billion euros a year on measures such as building flood defences, transporting water for agriculture and rebuilding infrastructure affected by climate change. The costs of adapting to climate change will be enormous (IIED, 2009, as cited in UN Habitat. 2011). It is crucial to integrate energy efficient practices in every aspect to reduce the ecological footprint, reduce high energy consumption, control over exploitation of natural resources and reduce the green house gas emissions.

infrastructure

One of the biggest challenges faced in the region is the accessibility to physical and social infrastructure, especially in the rural areas. The problem is two fold: due to this inaccessibility to both physical and social infrastructure in rural areas, there is migration towards the urban areas thereby adding tremendous stress on the existing infrastructure. This has resulted in haphazard growth that is not correlated with the infrastructure carrying capacity of the communities.

livelihoods

Puducherry has one of highest per capita income levels in the nation and it is ironically surrounding by some of the poorest districts of Tamil Nadu. From a macro-level perspective, the region's economic disparities and imbalances are a reflection of contemporary India's growth-characterized by statistics such as country with "one of the highest GDP growth rates but simultaneously India also ranked 94th out of 118 countries in the Global Hunger Index". Changing trends in agriculture, household level food security, migration, viability of non-farm economy, and proliferation of unsustainable development models such as SEZs need attention if the vision of sustainability is to be achieved in our region.

heritage

The region is extremely rich with architectural and cultural heritage that dates back to hundreds and thousands of years. Temples that belong to the Pallava and Chola period alongwith buildings reminiscent from the region's colonial architecture are scattered throughout the region. However, heritage preservation efforts are concentrated only in Puducherry, and more specifically in the Boulevard Town. Rural and urban heritage sites, cultural practices and local traditions in the entire region are under threat to development and economic pressures warranting an urgent need for a comprehensive heritage preservation strategy with government support.

governance

While our region's units of government are numerous, in order for the concept of integrated planning to materialize, there should be more collaboration between governmental agencies at all levels. At the same time, the participation of the community is a crucial part of any democracy. Both government and the citizens need to enabled and empowered to make any governance work.

2.0 Regional Context

Puducherry and the adjoining districts of Viluppuram and Cuddalore are very closely connected to each other through natural resources (water, ecosystems, coastline), climate, historical links, culture, religion, language, tourism, trade/business, population and transportation. Documentation and developing an understanding of our regional assets that define this tightly knit connection is an important first step in the planning process. In order to turn our vision for the future into reality, we need to look at where we stand today and establish targets accordingly to realize the vision.

Administrative Context

The region cuts across the two states –Tamil Nadu and the Union Territory of Puducherry. Puducherry U.T. extends over a total area of 479 sq. kms. and comprises of four districts, Karaikal, Puducherry, Yanam and Mahe. For the purposes of this regional planning effort, of the four districts in the U.T. only Puducherry district has been included as part of the study area boundary.

The bulk of Puducherry district is an irregular stretch of land consisting of Puducherry & Oulgaret municipalities and the commune panchayats of Ariankuppam, Villianur, Nettapakkam, Mannadipet and Bahour. This district is non-contiguous and is scattered in 11 enclaves within Tamil Nadu. This unique administrative boundary makes it crucial to understand the dynamics within the district and its relationship with the intermittent Tamil Nadu region. The total area of Puducherry district and its enclaves is 290 sq.kms.

Puducherry District boundaries
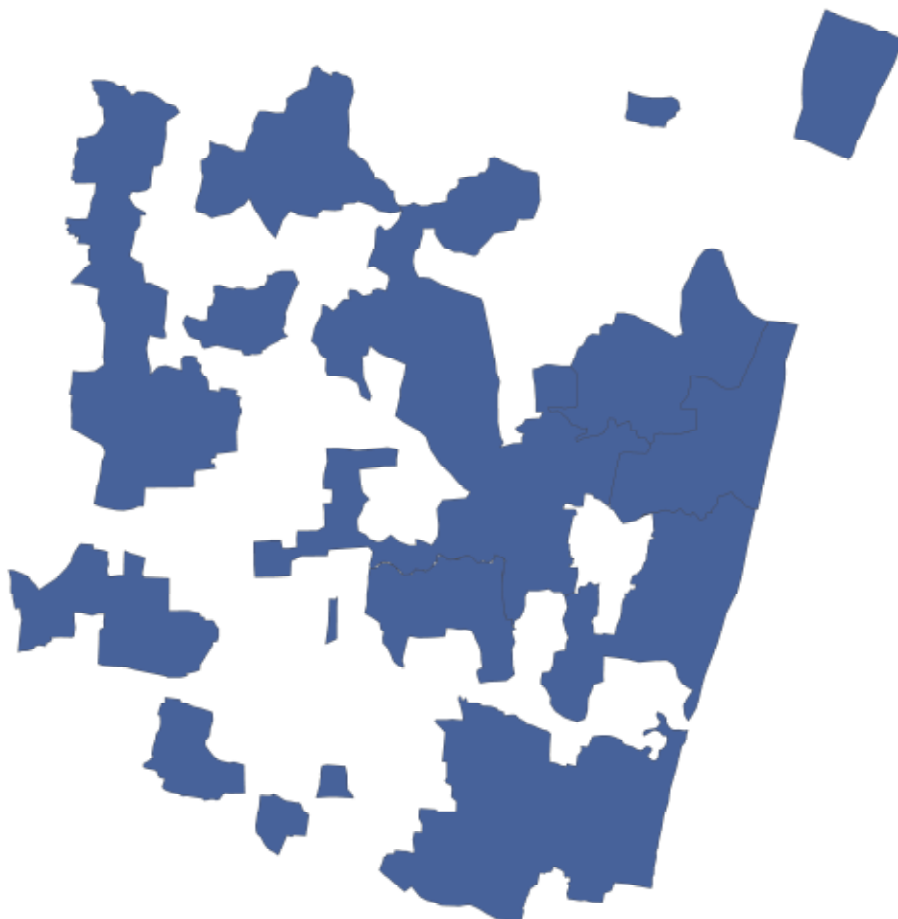
Viluppuram District boundaries

Gingee

Tindivanam

Vanur

Sankarapuram

Tirukkoyilur

Viluppuram

Ulundurpettai

Kallakkurichi

Taluks within the
Regional Boundary
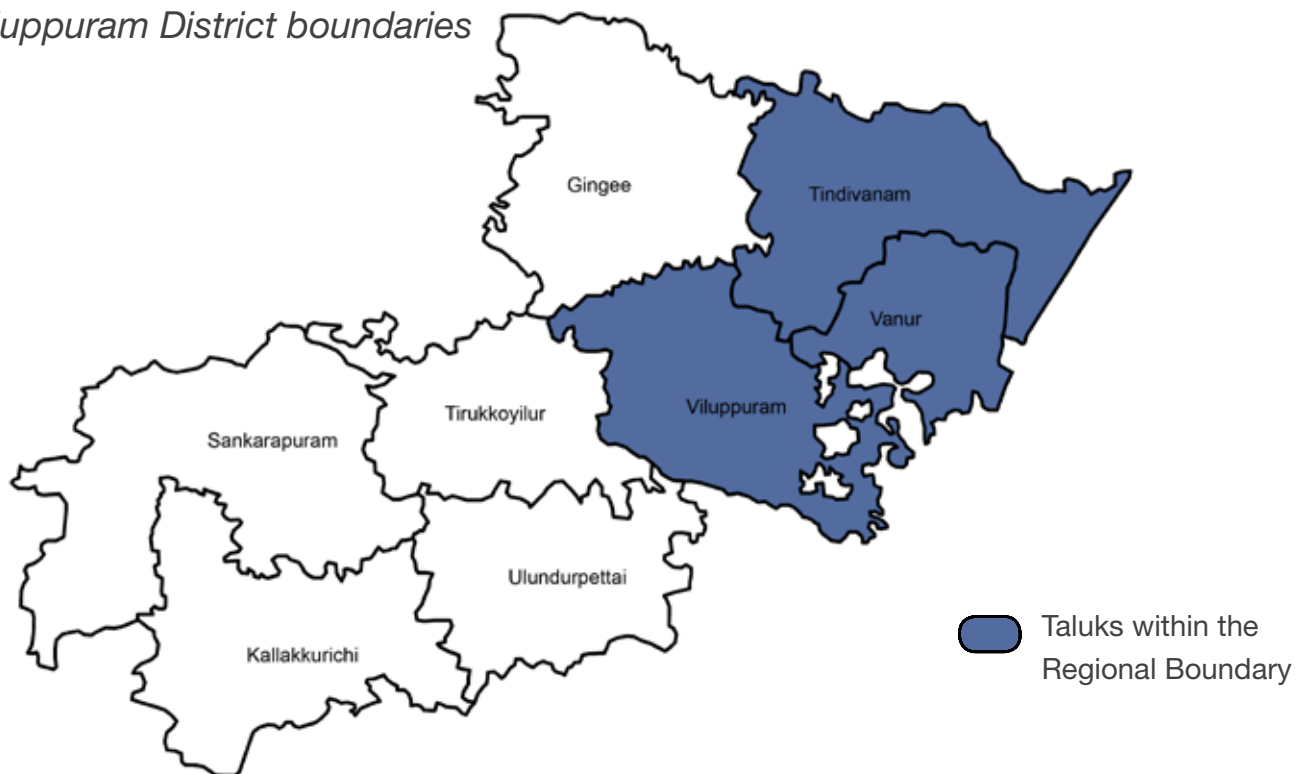
Cuddalore District boundaries

Cuddalore

Viluppuram

Virudhachalam

Kurinjipadi

Tittakudi

Chidambaram

Kattumannarkoil

Taluks within the
Regional Boundary
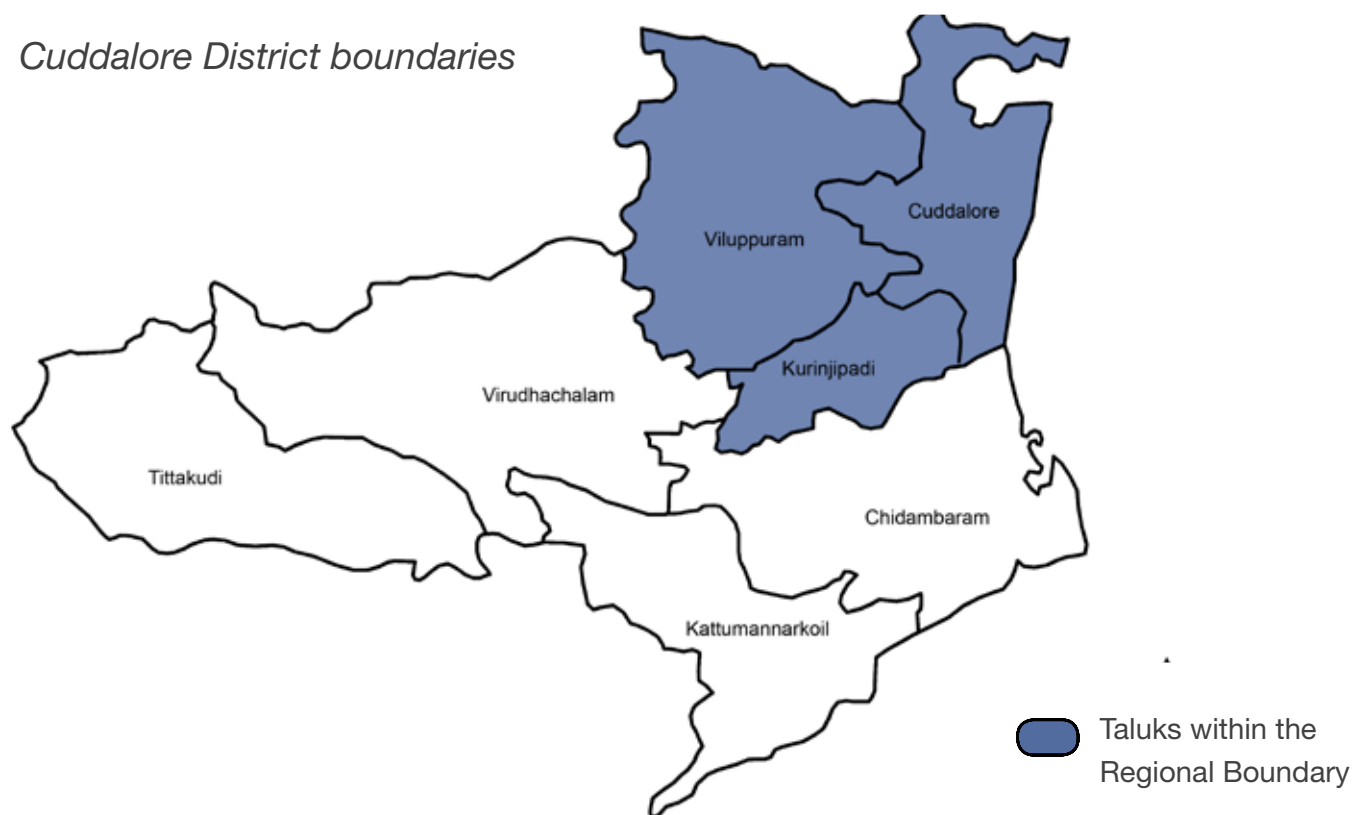
Snapshot of the three districts in the PVAC Region

PUDUCHERRY DISTRICT

Population (2011)	946,600 or 0.95 million
Area	293 sq. km
Density (2011)	3231 persons per sq.km
Population Growth (2001-2011)	28.73%
Urban/ Rural Ratio (2011)	654,392/ 292,208
Municipalities	2
No. of Villages	
No. of Communes	5

VILUPPURAM DISTRICT

Population (2011)	3,463,284 or 3.46 million
Area	7185 sq km.
Density (2011)	482 persons per sq.km
Population Growth (2001-2011)	16.99%
Urban/ Rural Ratio (2011)	509,876/ 2,953,408
Municipalities	3
No. of Town Panchayat Unions	15
No. of Village Panchayats	1104
No. of Revenue Villages	1409

CUDDALORE DISTRICT

Population (2011)	2,600,880 or 2.6 million
Area	3678 sq. km
Density (2011)	707 persons per sq.km
Population Growth (2001-2011)	13.80%
Urban/ Rural Ratio (2011)	882,631/ 1,718,249
Municipalities	5
No. of Panchayat Unions	13
No. of Town Panchayats	16
Village Panchayats	681

2001 Population Distribution:PVAC Region

TAMIL NADU
6,24,05,679

CUDDALORE DISTRICT
22,85,395

VANUR
TALUK
1,66,737

MARAKKANAM
95,455

TINDIVANAM
TALUK
4,13,141

TINDIVANAM
MUNICIPALITY
67,737

VILUPPURAM TALUK
5,05,869

VILUPPURAM
MUNICIPALITY
95,455

VILUPPURAM DISTRICT
29,60,373

KURUNJIPADI
TOWN PANCHAYAT
23,883

PANRUTI
TALUK
2,39,241

PANRUTI
MUNICIPALITY
55,346

CUDDALORE TALUK
5,05,869

CUDDALORE
MUNICIPALITY
1,58,634

PUDUCHERRY
UNION TERRITORY
9,74,345

PUDUCHERRY
DISTRICT
7,35,332

ARIANKUPPAM
URBAN
23,193

VILLIANUR
URBAN
44,194

OULGARET
MUNICIPALITY
2,17,707

PUDUCHERRY
MUNICIPALITY
2,20,865

TINDIVANAM
Tindivanam

VANUR

VILUPPURAM

Auroville

Viluppuram

Puducherry

PUDUCHERRY

BAY
OF
BENGAL

Panruti

Cuddalore

CUDDALORE

PANRUTI

KURINJIPADI

0   5   10   20km

Regional Context
Puducherry | Viluppuram | Auroville | Cuddalore

Puducherry is interspersed by districts in the state of Tamil Nadu-Viluppuram (the Taluks of Viluppuram, Vanur and Tindivanam) to the north and north-west; and the district of Cuddalore (the Taluks of Cuddalore, Kurinjipadi and Panruti), to the south and south West.

Cuddalore District covers an area of 3,678 sq.kms. including 5 municipalities, 13 panchayat unions, 16 town panchayats, and 682 village panchayats. Chidambaram, Cuddalore, Kattumannarkoil, Kurinjipadi, Panruti, Titakudi, Vridachalam are the seven taluks within the District. Cuddalore municipality, the headquarters of Cuddalore taluk and district, covers an area of 27.69 sq. kms and is divided into 45 wards.

Viluppuram district is the 23rd district of the Tamil Nadu state. It has been formed by isolating the erstwhile composite South Arcot district with Viluppuram as its head quarters. The district, sprawling over an area of nearly 8,000 Sq. kms, is administratively divided into four revenue divisions, eight revenue taluks, 54 revenue firkas and 1490 revenue villages. There are three municipalities,15 town panchayats, 22 panchayat unions and 1104 village panchayats in this district. Sankarapuram, Gingee, Kallakurichi, Tindivanam, Viluppuram, Thirukoilur, Ulunderpet, and Vanur are the taluks within the district. Viluppuram, Tindivanam, and Vanur taluks were included as part of the 'planning region' for the purposes of this study.

The township of Auroville, located in Vanur taluk, is also an integral component of this regional planning framework. The Auroville Foundation Act, passed by the Indian Parliament in 1988, is one of the key milestones in the development of Auroville. It provides statutory support for preparation of a Master Plan for Auroville to ensure orderly development of the township, which is planned to occupy a circular area of 2000 ha, of which about 850 ha are presently owned by the Auroville Foundation. Auroville's development has been closely related to that of the surrounding villages. There are 13 such villages in the immediate vicinity of Auroville. Auroville's immediate influence, in terms of socio-economic development and natural resource management, is expected to extend over this entire region. The Auroville Universal Township Master Plan, Perspective 2025 is a unique example gazetted by the Ministry of Urban Development, where, policies and strategies have been identified to ensure a planned and sustainable growth of the township and its surrounding villages.

Taken as a single entity, including the major growth centres of Puducherry, Cuddalore, Tindivanam and Viluppuram that are located within a 40 kilometres radius of each other, the region encompasses a total area of approximately 2,500 sq.kms.

Demographic Profile

Our region has experienced significant demographic changes in the last decade and is expected to continue to witness similar or more of these changes in the coming decades. Historically, population growth had been concentrated in the existing town centres; however, in the last decade there has been a significant increase in population centres emerging along the transportation corridors. The following section discusses some of the salient features of the PVAC region's demographic composition.

Population

According to the 2001 Census data, the entire districts of Puducherry, Viluppuram and Cuddalore have a population of approximately 59.8 lakhs (5.98 million). This has increased to nearly 7 million according to the 2011 Census provisional data. For the purposes of the regional planning effort, selected taluks in the two Tamil Nadu districts and Puducherry region.

In 2001, the study area accommodated a total population of **2.9 million**. At the district and taluk level, in 2001 the population of Puducherry district was 0.74 million; the two taluks in Cuddalore accounted for 1.04 million; the three taluks in Viluppuram were 1.1 million. If the 2011 provisional data for Puducherry district is used, and the population increase of the districts is used to roughly estimate the decadal growth in the taluks (14% for Cuddalore and 17% for Viluppuram), we will have an estimated 2011 population of **4.6 million** in the PVAC region.

The region has one large city in the form of Puducherry (population of Puducherry city -0.24 million; Puducherry District-0.95 million as per 2011 Census) and four smaller towns: Cuddalore town to the south (population of Cuddalore city 0.17 million; Cuddalore District-0.26 million as per 2011 Census), Viluppuram to the west (Viluppuram City-95,000 as per 2001 Census; Viluppuram District-0.35 million as per 2011 Census), Marakkanam to the north (population of 19,000 as per 2001 Census) and Tindivanam to the northwest (population 68,000 as per 2001 Census).
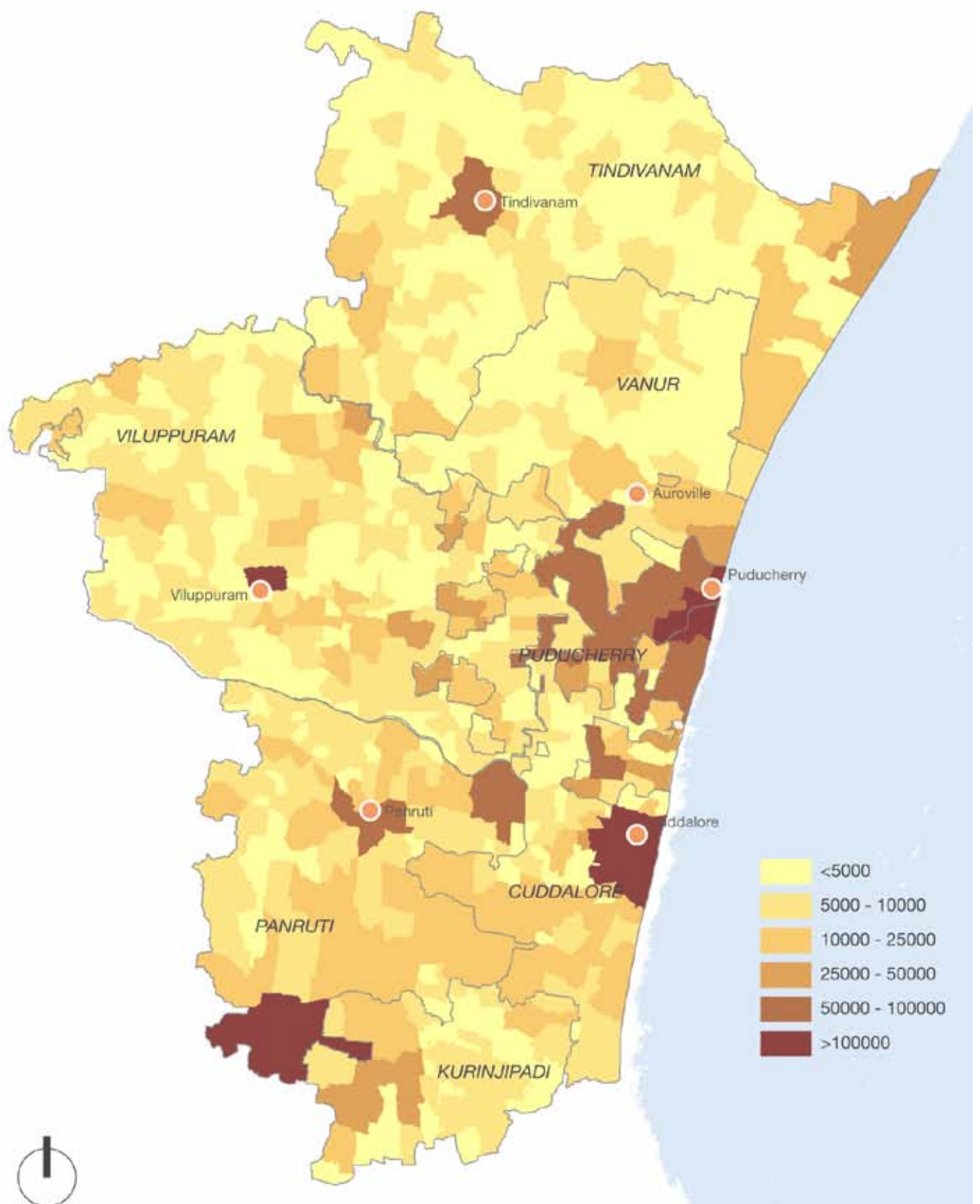
Population Distribution (2001)
Puducherry | Viluppuram | Auroville | Cuddalore

Legend:
- <5000
- 5000 - 10000
- 10000 - 25000
- 25000 - 50000
- 50000 - 100000
- >100000

Population Density

Puducherry district and Cuddalore Taluk are the most densely populated areas in the region. The population density in Puducherry District was 2534 persons/ sq.km in the year 2001, and this figure has now increased to 3231 persons/ sq. km (Census 2001, Census 2011). Over the last 3 decades the density of the population has doubled in Puducherry, indicating a concentrated development accompanied by high stress on the existing infrastructure in the area. In comparison, Cuddalore district's population density has increased from 621 persons/ sq.km in 2001 to 701 persons/ sq. km in 2011. In 2001, Cuddalore town population density was at 5723 persons/ sq.km (Census 2001, Census 2011)

Vanur and Tindivanam are sparsely populated in comparison to the other areas in the region with a population density of 362 persons/ sq.km and 414 persons/square km respectively (Census 2001)

Migration

Migration to the urban centres from the surrounding states has been significant over the last two decades. For example, approximately 100,000 people migrated into Puducherry in the year 2001. 87.4% of these inter-state migrants were from the state of Tamil Nadu. (Census 2001)

Social security system and opportunities for alternative livelihood systems in Puducherry is another strong motivator for in-migration into the state. The establishment and development of industries during 1971- 1981, also accelerated the decadal growth and migration rates in the District of Puducherry (Planning Commission, 2010).

The rural population of the region has been decreasing at a steady rate since 1981, indicating a large scale migration of unskilled and skilled labour to the urban areas. Puducherry has over 69% of the population living in the urban areas. Cuddalore and Panruti taluks in the Cuddalore District have approximately 45% of the population residing in urban areas. (Census 2001). The surrounding areas of Viluppuram and Cuddalore regions are predominantly rural in nature in comparison to Puducherry. Viluppuram, Tindivanam and Vanur taluks have nearly 80% of the population living in the rural areas. (Census 2001)
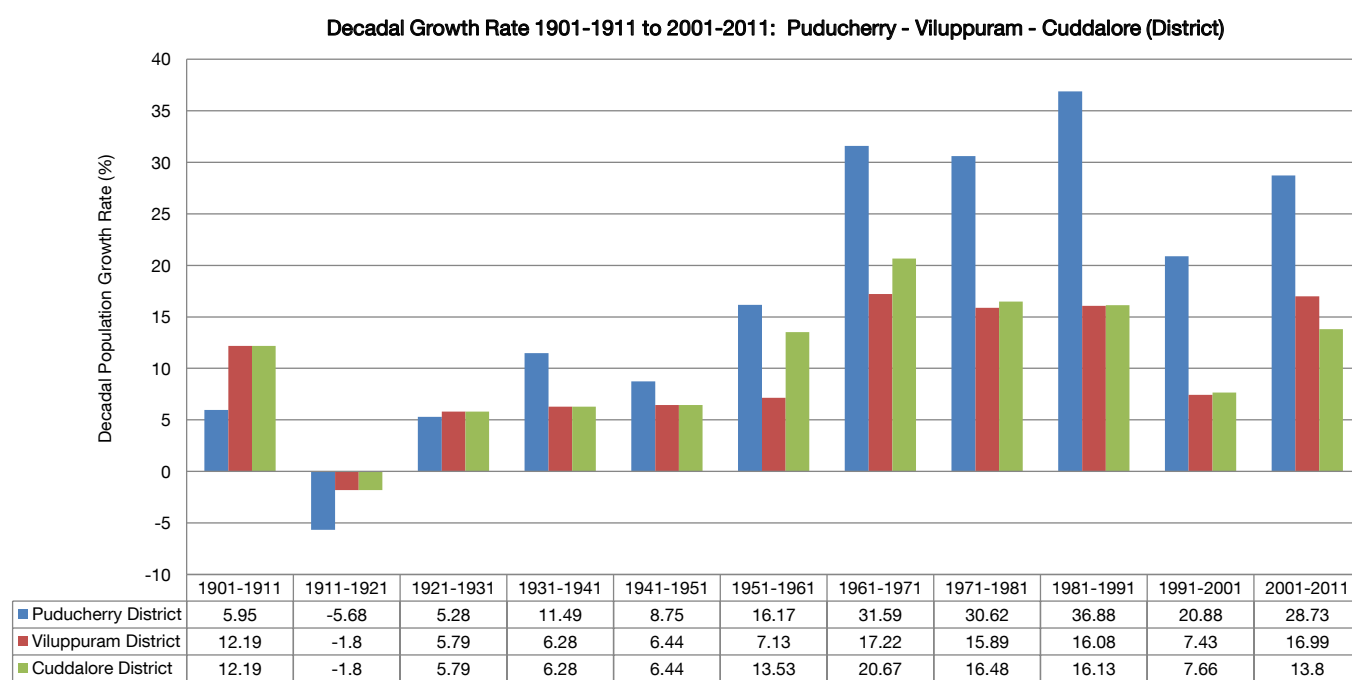
Within Viluppuram District, the percentage of urban population increased by two times from 7.5 per cent in 1991 to 14.4 per cent in the year 2001. This could be attributed to migration from rural areas due to better opportunities for livelihood, education and marriage (Viluppuram District Agriculture Plan. 2008)

Growth Trends

Population projections for Puducherry as reported in the 2007 City Development Plan, indicate that the growth trends will stabilize over the next decade. Puducherry region has witnessed a rapid growth of population in the past three decades. Especially during the decade 1981-91, the State witnessed a growth rate of 33.6 percent and Puducherry district grew at a rate 36.8 percent per annum. The growth rate of the Puducherry District was at 28.73 percent for the years 2001-2011.

Cuddalore and Viluppuram's growth rate was significant (16 percent) between the years 1981-91. After which the growth rate declined to approximately 7 percent. During the last decade (2001-2011) the growth rate has risen back to 16.99 and 13.8 percent for Viluppuram and Cuddalore District respectively. (Census 2001, Census 2011)

Decadal Growth Rate 1901-1911 to 2001-2011: Puducherry - Viluppuram - Cuddalore (District)

	1901-1911	1911-1921	1921-1931	1931-1941	1941-1951	1951-1961	1961-1971	1971-1981	1981-1991	1991-2001	2001-2011
Puducherry District	5.95	-5.68	5.28	11.49	8.75	16.17	31.59	30.62	36.88	20.88	28.73
Viluppuram District	12.19	-1.8	5.79	6.28	6.44	7.13	17.22	15.89	16.08	7.43	16.99
Cuddalore District	12.19	-1.8	5.79	6.28	6.44	13.53	20.67	16.48	16.13	7.66	13.8

Temple at Perimukkal
Image Credit: Joss, Pitchandikulam, Auroville

Cultural Heritage

Puducherry, along with the Viluppuram and Cuddalore districts of Tamil Nadu, share a common history and culture. Historically, the entire region including Puducherry, Viluppuram and Cuddalore was under the Pallava, Chola, Pandya empires, and later under the Vijayanagara Empire in the 14th- 15th century before falling under the reign of the Islamic rule. Later in the 1600s, during the colonial period, Puducherry was under the French rule and the surrounding region comprised of the South Arcot district of the British rule.

Prior to becoming part of the republic of India, for about 200 years Puducherry was under the French rule and had trade connections with a few European countries. But before that it was still an ancient Indian city called Vedapuri that traces its origin to Saint Agasthya, the revered sage of the south. The excavations near Puducherry reveal that a Roman settlement trading post existed here, 2000 years ago. It was also the site of many battles between the British and the French. The French and Italian also had trade connections with Cuddalore and other coastal towns in Tamil Nadu. The fishing communities all along the coast have common deities and festivals (such as Masi Magam) that are directly linked to the sea and seashore. This culture and religious practices along the coastlines should be preserved and the beaches should be saved from going to resorts and other such developments.

Annual Temple Car Festival at Oondiapet
Image Credit: Joss, Pitchandikulam, Auroville

Arcot, from the former district name of South Arcot, finds it reference in the puranas, this district is described as part of Sri Rama Khetra. Historic evidence available from Madras district gazetteers published in 1962 reveals that the name 'Arcot' derived from Tamil 'Aaru kadu' i.e. six forests which was said to be the abode of six rishis. This district in Tamil called 'Thondai Nadu' and in particular 'Nadu Naadu '. It has a speciality ' Saandror udaithu' i.e. great and elite personalities possession of the district such as the saivaite pathmakers Thirunaukkarasu and Sundarar. Maikaudar, one of the eighteen siddhas, was born in this district. This district is proud of possessing as birth place of Vallalar Ramalingar. Ovvaiyar, the Tamil poetess gave in marriage angavai, sangavai; the daughters of pari the vallal in Tirukoilur to the king Deiviekan. The famous temple of Sri Natarajan, the dancing Shiva is situated in this district (Cuddalore).

South Arcot District Tourist Map
Puducherry | Viluppuram | Auroville | Cuddalore

The Sri Aurobindo Ashram located in the heart of Puducherry city, is directly connected through its devotees, friends of Ashram, etc. to the rest of India and the world, particularly to the states of West Bengal (Sri Aurobindo's birth state) and Gujarat (where he lived and worked before coming to Puducherry in April 1910). His spiritual counterpart Mira Alfassa also known as the Mother, was from France and she carried on the work until she left her body in 1973. Because of the Mother and Puducherry being formerly under French rule, there is still a very strong virtual connection with France and other European countries.

Auroville Universal Township – located just about 10 kms away from Puducherry in Tamil Nadu Auroville was started by the Mother in February 1968. It was endorsed by UNESCO and the Government of India as a special project and it currently has about 2100 residents from about 40 countries. Auroville, which in the Mother's words "wants to be a universal town where men and women of all countries are able to live in peace and progressive harmony above all creeds, all politics and all nationalities. The purpose of Auroville is to realise human unity.", will eventually have about 50,000 residents with Matrimandir as its soul in the centre of Auroville. Auroville through its residents and Auroville International (AVI) 8 Centres and 16 liaison offices (total 24 countries) is very well connected to the world.

Historical Timeline of the Region

1500s	1521	The Portuguese returned to trade in textiles
1600s	1674	The Dutch and the Danes set up textile trade Puducherry Fort: French established a settlement. Francois Martin acquired land from the Muslim Governor, to set up Fort Puducherry. The Fort housed the commercial buildings and was laid on a grid iron pattern, with the church and the market at the centre.
	1693	The Dutch occupied the fort and it was later restored to French in 1697 Cuddalore: British established settlements and business establishments in Cuddalore, and it was the capital to all the South Indian British territories until 1758. Fort St. David was built and used for military operations.
1700s	1758 1746	Fort St. David attacked by the French, and the operational power shifted to Fort St.George, Madras The British lost Fort St. George in Madras to Dupleix, and retaliated by capturing. Puducherry in 1761 and razing the town to the ground, sparing only a few structures. However the Treaty of Paris returned Puducherry to the French.
1800s	1801	South Arcot was handed over to the British
	1865	Water supply scheme for the town was inaugurated in Puducherry
	1866	Cuddalore Town constituted as a Municipality. Cuddalore Old Town (OT) and Cuddalore New Town (NT) came into existence
	1878	Railway Company started the work of laying lines in Puducherry and in one year the railway line to Viluppuram was completed.
	1887	Indo-China Bank was given rights to provide Telegraphic Network in Puducherry
	1898	Anglo-French Textiles was started in Puducherry
1900s	1921	Bus stand completed in Puducherry
	1938	Protected water supply started in Cuddalore
	1954	Puducherry, Kaikaral, Mahe, Yanam merged with the Indian Union de facto on Nov 1st
	1962	A project for the comprehensive development plan for Puducherry Urban Area was approved and this job was entrusted with the Town and Country Planning Organization (TCPO), New Delhi.
	1968	Auroville: On 28th February, 5,000 people assembled near the banyan tree at the centre of the future township for an inauguration ceremony attended by representatives of 124 nations, including all the States of India. This was the beginning of the ideal township devoted to an experiment in human unity.
	1971	Puducherry Unit of Town and Country Planning was started and began the preparation of the comprehensive plan.
	1993	Cuddalore and Viluppuram districts were formed in 1993 by splitting the former "South Arcot" district

But before the Auroville and Sri Aurobindo Ashram connection within India and the rest of the world the fishermen from the coast of this region have had their traditional fishermen network. They were connected all the way to their fishermen networks as far down south as Kerala. This connection still exists. Cuddalore, Viluppuram and Puducherry share an inherent physical, biological, and ecological relationship. Often times, the development initiatives overlook these inherent links, and do not relate to the cultural, social or environmental context of the bio-region. The pressure of development, is transforming the communities while slowly erasing the cultural heritage in the communities.

Bioregionalism is needed to build a sustainable future. 'This concept acknowledges the local environment, history, and community aspirations. It relies on safe and renewable sources of food and energy. It ensures employment by supplying a rich diversity of services within the community, by recycling our resources, and by exchanging prudent surpluses with other regions.' (Kaliveli Bio-region Development Framework,2012.)

Traditional water lifting system, Koonimedu
Image Credit: Joss, Pitchandikulam, Auroville

Major Regional Cultural Heritage Landmarks

Beaches and Water Fronts	Leisure
• Puducherry Beach • Auro Beach • Chunnambar Beach and Water Sports Complex • Kalapet Beach • Silver Beach, Cuddalore	Puducherry • Promenade • Botanical Garden Viluppuram • Kalrayan Hills • Tiruvakarai Fossil Wood park Cuddalore • Pichavaram Mangrove Forests
Religious Tourism	**Heritage**
Puducherry: • Manakulavinayagar Temple • Vedapuriswar Temple • Sri Varadaraja Temple • Sri Gokilambal Temple • Sacred Heart of Jesus • Eglise De Notre Da La Immaculate Conception • Eglise De Notre Dame Des Agnes • Eglise de Notre Dame De Lourdes **Viluppuram:** • Tiruvakarai Vakrakaliamman Temple • Anniyur Ramanatheeswarar temple • Sendamangalam Abath hayeswarar Temple • Parikkal Narashimar Temple • Viluppuram Anjaneyar temple **Cuddalore:** • Sri Natarajan Temple • Padaleeswarar temple • Thiruvandheepuram Devanatha swamy temple • Thiruvandhepuram Haiyakrever temple **Tindivanam:** • Murugan Temple **Vanur:** • Siva Temple • Bruvaragaswami Temple	Historical buildings and streets in and around Boulevard Town, statues and monuments Gingee Fort, Viluppuram Fort St. David, Cuddalore
Others	**Handicrafts**
Aurobindo Ashram, Puducherry Auroville Township	Terracotta and Hand Made paper industry Hand loom weaving in Kurunjipadi

Economic Context

Cuddalore and Viluppuram districts were formed in 1993 by splitting the former "South Arcot" district. Both districts are primarily rural in character and economic composition- Viluppuram (85% rural) and Cuddalore (67%). The primary occupation inland is agriculture and plantation (cashew & casuarinas) and artisan fishing along the 80 kms coast, except a few fishing harbours where trawlers are used. Viluppuram district is considered an industrially backward district and has four sugar mills and a number of modern rice mills as the major industries.

The main activity of the Cuddalore town is trading of jewels, groceries and fish products. Currently, the town's economy revolves around the activities of 30 industries in SIPCOT, an industrial estate on the outskirts of the town on the Cuddalore-Chidambaram road.

Over the last decade, the contribution of the primary sector (agriculture, forestry and fishing) to Puducherry's economy has significantly declined. Within the secondary sector (manufacturing industries, electricity, power, water supply), the manufacturing sector is the major contributor. The exponential growth in this sector indicates that the economy of Puducherry is shifting from agricultural activities to non-agricultural activities.
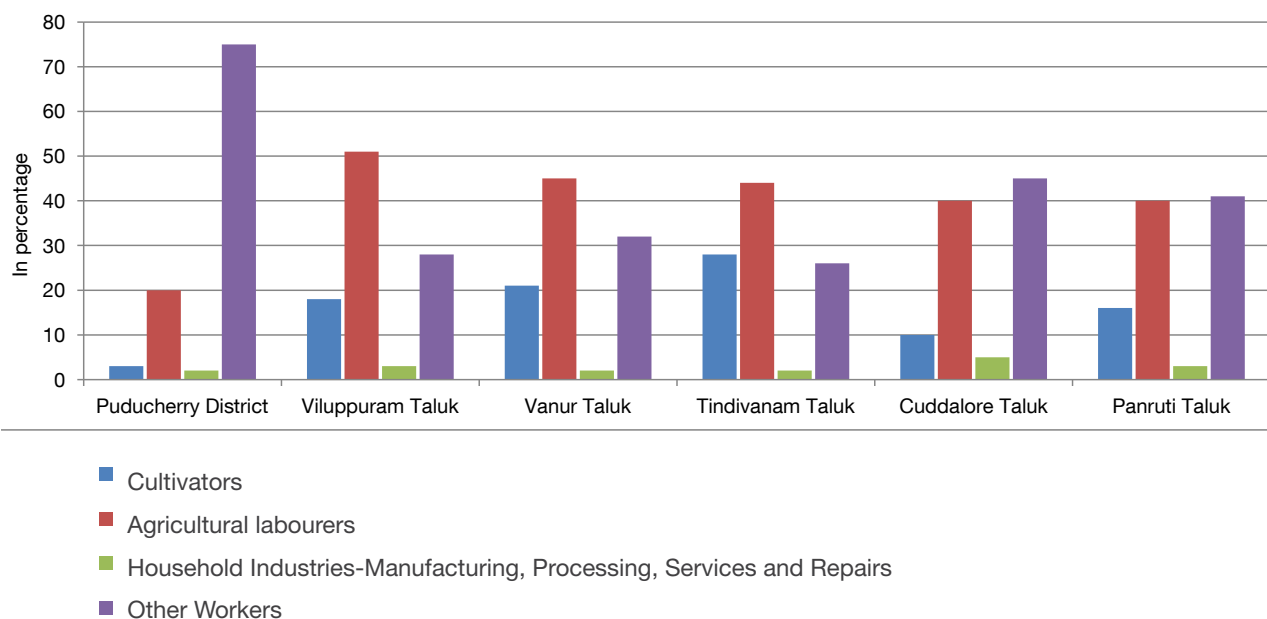
Ports

Puducherry Port is a minor port located in between the major ports of Chennai and Tuticorin. For the last 15 years the cargo handled at the port was rice, wheat, molasses, cement, sugar , flurospar, palmolein, timber. It could only lighterage operations, which are not functional throughout the year. The government is exploring the possibility of developing the port's capacity to make it operational all year around through private sector participation. Cuddalore Port, one of the first natural ports, is situated at the confluence of the rivers Uppanar and Paravanar. The port imports neat harbour like Timber, Potatoes, Sugar. Timber arrives from Burma and is sent to Puducherry; Potatoes/ sugar arrive from Karnataka. The port has recently been renovated to handle all types of cargo. (www.tnmaritime.com)

Industries and Incentives

As in 2005, there were approximately 7537 industrial units in Puducherry, exhibiting an increase by nearly two times the number of industrial units registered in 1990-91. The Industrial policy document, 1997 identified agro processing including marine products, Electronics & Software Development, Leather products & Footwear, Light engineering including auto components and Textiles including garments as thrust area-sectors. Puducherry, until recently, attracted several industries to the area through provision of incentives, concessions and tax holidays. However, after these incentives expired in 2011 several industries have shut down or are in the process of downscaling and searching opportunities in other areas. The government is in the process of finalising its draft industrial policies, and these will enforce stringent regulation on pollution or high resource (water and energy) consuming large industries. (The Hindu. March 2012)

Distribution of Main Workers (%) in 2001: Puducherry - Viluppuram - Cuddalore

Legend:
- Cultivators
- Agricultural labourers
- Household Industries-Manufacturing, Processing, Services and Repairs
- Other Workers

Agricultural Economy

In Puducherry, the absolute area under cultivation has declined from 38,592 hectares in 2001 to around 34,682 hectares in 2008. There has been a corresponding increase in area put to non-agricultural use by around 3,000 hectares since 2001 and in fallow land by around 1,000 hectares. (Source: Puducherry Vision 2025, CII)

Out of the total land area of 7.22 lakh hectares, an extent of 3.31 lakh hectares (45.8 percent) is utilised for cultivation. The waste land (Categories 3&5) available in the district is 67056 ha. Vast stretches of waste land are formed in Gingee, Kallakurichi, Marakkanam and Vanur Blocks. Sizable area remains as current fallow (12 percent of the geographical area).

Image Credit: Joss, Pitchandikulam, Auroville

Tourism Economy

The PVAC region has tremendous potential to strengthen its tourism economy. Developing a regional eco-tourism strategy in a sustainable way will create a win-win situation for the entire region without compromising the natural resources. Following are the various tourism sectors that have the potential of forming a strong cluster.

Legend:

- ● Growth Centres
- Religious attractors
- ✳ Cultural/ Heritage attractors
- ▲ Educational attractors
- ✚ Medical facility attractors
- ○ Leisure/ Amenity attractors
- Transit attractors
- Industrial attractors

Regional Tourist Map
Puducherry | Viluppuram | Auroville | Cuddalore
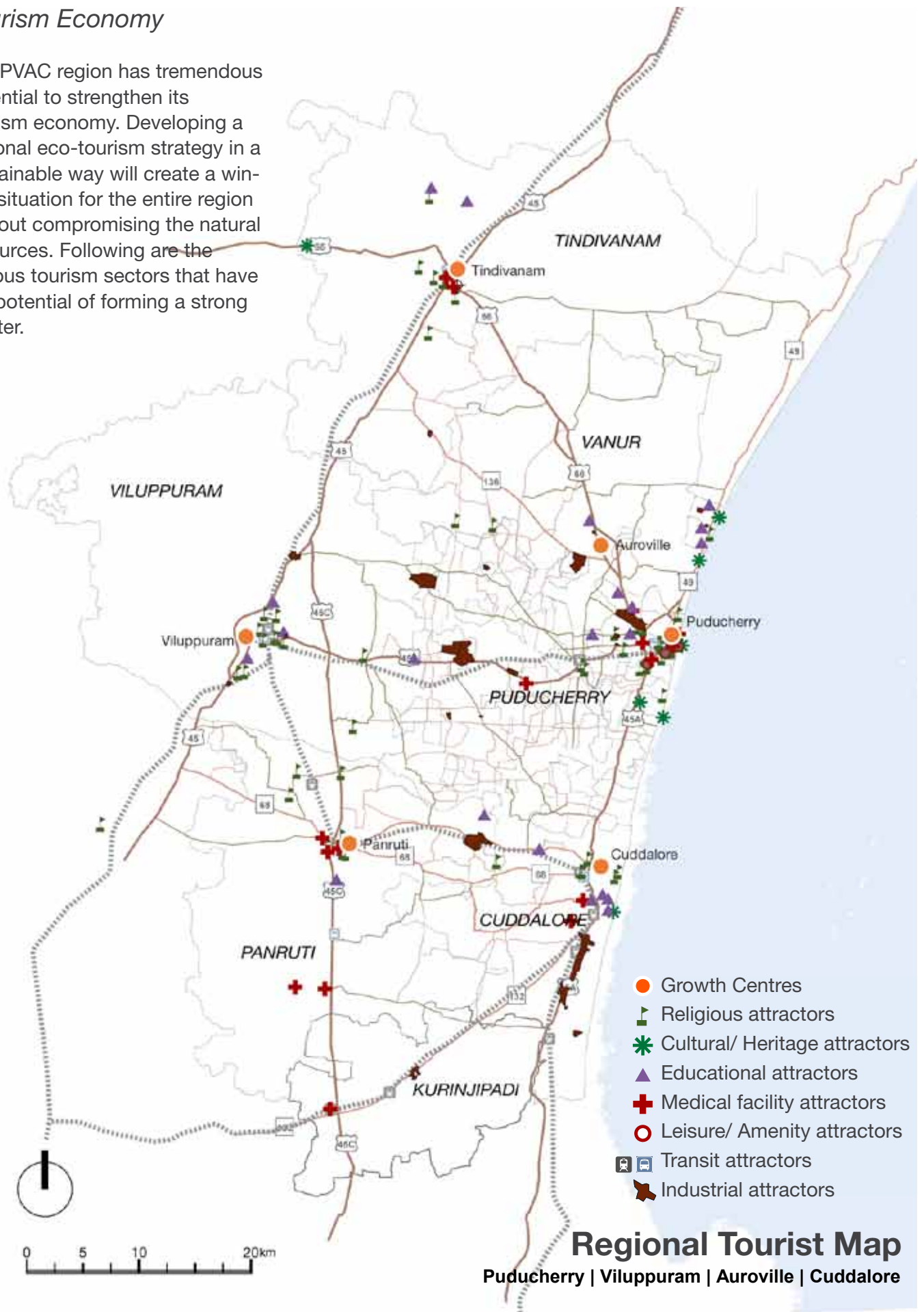
Spiritual and Religious tourism

The region boasts of many temples and ashrams, some very well known that attracts tourists from India and around the world. Chidambaram and Tiruvannaamalai's shaiva temples date back to the Chola period. Chidambaram, located to the south of Cuddalore town, is famous for its Nataraja temple . Tiruvannaamalai's Annamalaiya Temple, is located in Viluppuram District near Tindivanam. Both the temples are representative of the rich cultural and architectural heritage in the region. Tiruvannaamalai is also home to the Ramana Maharshi Ashram, whose teachings and principles have brought followers from across the globe. Aurobindo Ashram and Auroville are the other major spiritual destinations in the region.

Nataraj Temple, Chidambram, Cuddalore District

Waterways

The 80 kms long coastline of the region has some beautiful sand dunes, backwaters, estuaries and mangroves. Most of it is fairly undisturbed and has a great potential for sustainable tourism along these beaches and ecosystems. Ariyankuppam, located 7 kms to the south of Puducherry, was an ancient major port where trading took place with the Romans. A few kilometers off from this area is Chunnambar, which is popular for its beach and the water related recreation activities. The beaches along Cuddalore, Auroville and the water front of the Goubert Avenue in Puducherry, is a weekend destination for both local and national tourists.

Nature / Trails

There are some undisturbed patches of native forests/sacred groves and some beautiful canyons and hills where hiking trails and nature walks could be planned. The green corridors and conserved green areas from the water management analysis could be potential trails and recreation cycle paths. Pitchandikulam forest was established in 1973 as one of the pioneering Auroville green belt communities. Kaluvely,is the second largest brackish water lake in India, is located in Viluppuram, The watershed supports a rich ecosystem comprising of several species of plants and animals.. Pichavaram in Cuddalore, is a mangrove forest offers opportunities for eco-tourism. Together, these rich natural resources can be brought together with a greenway while providing opportunities of recreation for the citizens of the region. The great number of natural lakes, wetlands and irrigation tanks attract a number of birds during the winter/rainy season. Kaliveli tank in the north is a very popular destinations among the bird watchers and it also fulfills the criteria for a "Ramsar Site" and was few years ago categorized as wetland of national importance by Ministry of Environment & Forests.

Heritage /Archaeology

There are cultural heritage and archaeological sites in this region dating back to ancient burial grounds, ancient Jain sites, and Italian civilization archaeological site.

Heritage Tourism
Rural and urban heritage tourism destinations is the main source of tourism traffic in the region. Boulevard Town in Puducherry, Auroville in Viluppuram district, and Tranquebar in Nagapattinam district are some of the key tourist destinations in the region. Arikamedu, an ancient Roman trade centre is 4 Kms. south of Puducherry on the right bank of Ariyankuppam river. It has a long history that dates back to the second century B.C. The port town was inhabited by Romans, Cholas and French.

Excavation in progress in Arikamedu in 1947. Source: The Hindu Archives
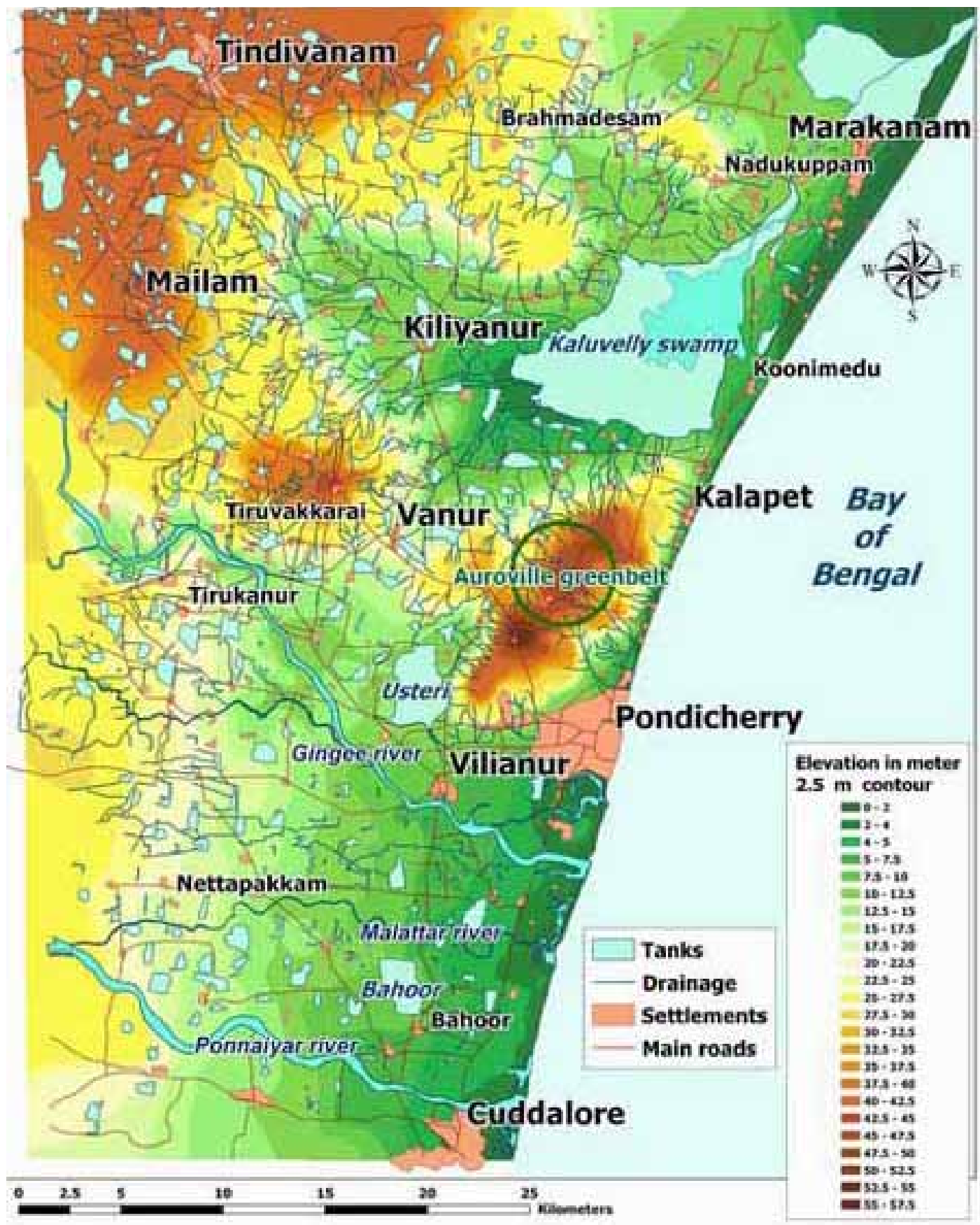
Elevation and hydrography of the PVAC region
Source- Auroville Water Harvest- Centre for Water Resource Management

Topography

The region is located on a coastal plain with semi arid climate. Puducherry region is at an elevation of about 15 meters above sea level, intersected by the deltaic channels of River Gingee and Pennaiyar and other streams forming the two main drainage basins, interspersed with lakes and tanks. To the north-west of Puducherry town is the Red hills or Gorimedu, which are low hills of a height of 30 meters. River gingee crosses the region from the north west to south east. Penniyar river cuts along east-west, through the southern part of the region dividing Puducherry and Cuddalore. Viluppuram is also a flat land with the kalrayan hills and Gingee as the only undulating terrain. Auroville is located in the ridge between two main high points of 60 meters above sea level.

Flora and forest cover

The forest cover in the Puducherry Union Territory is insignificant. Currently, the only existing patch of forest is the vegetation available in Swadeshi Cotton Mills Campus. A sizable portion of which was cleared for the construction of District Court building. Mangrove vegetation is seen to some extent in the estuaries and along the sides of Ariyankuppam river. (Adapted from: http://www.pon.nic.in/citizen/science/ppcc-new/ppcc/chapter8.pdf).

Pichavaram, in Cuddalore, is the second largest mangrove forest. The backwaters, interconnected by the Vellar and Coleroon river systems, offer abundant scope for water sports such as rowing, kayaking and canoeing. The Pichavaram forest offers waterscape and backwater cruises and also the unique mangrove forest trees that are permanently rooted in a few feet of water.

The forests in the Viluppuram district is divided into three regions- the coastal regions, the lateritic region and the inland plains region. Kaliveli is an old mangrove forest rich with flora and fauns, has been degraded over a period, of time. Some parts of Kaliveli tank in Vanur and Tindivanam District is proposed for Kaliveli Bird Sanctuary, under section 18(1) of The Wild life Protection Act 1972, and it is currently being prepared by the government. It will be rooted through the District Collector, Viluppuram for onward transmission through the proper channel to the Tamil Nadu Government for notification.

TDEF

CELASTRACEAE Cassine glauca (Rottb.) Kuntze

Synonyms:

Tamil names: கண்ணீர் மரம், கண்ணேர மரம்
Phonetic: Kanneer Maram, Kannera Maram

List sites   Show Distribut

Plant Profile

- Medium sized tree to 10 meters; evergreen; rough bark; thornless.
- Mature specimens are more often found in remnants that are less disturbed, however found in degraded areas in a modified form.
- Growing in a wide variety of situations; found on all soil types.
- General frequency: occasionally found within the range.
- Plant use: Root is used for snake bites and swellings. Wood is useful for cabinet work, combs and picture frames

buds   flowers   new growth   habit   leaf   trunk

Planting and Propagation

Planting requirements: Can be planted in the sun, although can tolerate the half shade; some aftercare is helpful; reasonable soil required for it to grow
Seed treatment: soak for 12hrs

General

Habit: Tree	Woody: Yes	indigenous	evergreen
Thorns:	Latex: Absent		

Leaf

Leaf: Simple	Leaf arrangement: Opposite	Leaf aromatic: No
Leaf(let) length: 9.5 cm	Leaf(let) width: 5 cm	

Flower

Flower (dominant) colour: green	Flower aromatic: no	Flower size: 0.8 cm
Flowering season	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	

Fruit

Fruit colour (when ripe): white	Fruit type: Drupe	Fruit size: 1 cm
Fruiting season	Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	

Tropical Dry Evergreen Website information developed by Auroville Botanists
Image Credit: Joss, Pitchandikulam, Auroville

Auroville Afforestation Programme

Auroville plateau was a forest areas around 200 years ago, and it underwent slow transformation to accommodate the development activities. As the towns expanded, more trees were cut down and the timber was used for export. This was further accelerated when the British allocated plots to anyone who would clear the land and cultivate it for a year. Most of this was left fallow during the monsoons. The remainder of 2000 mature neem trees in the area were deforested to make timber in the mid-fifties. The once lush green forest transformed into an area of red earth scattered with gullies and ravines, which were carved out by the monsoon floods. Every year, the top soil erosion continued to get washed away into the Bay of Bengal.

Legend
— GreenCorridor
     5M Planning Contours
▬▬ Interior Boundry
☐ Auroville Limit
...... Drainage
■ Canyons
■ 10 Meter Hydrologic Buffer
■ AVF Farms
■ AVF Woodland
■ AVF Tree Farms and Orchards
■ AVF Land

Patches - Corridors
Buffers - Stepping Stones
"Data is only approximate - Must be Field Checked for Accuracy"

1:20,000
Meters
0   375   750   1,500   2,250   3,000
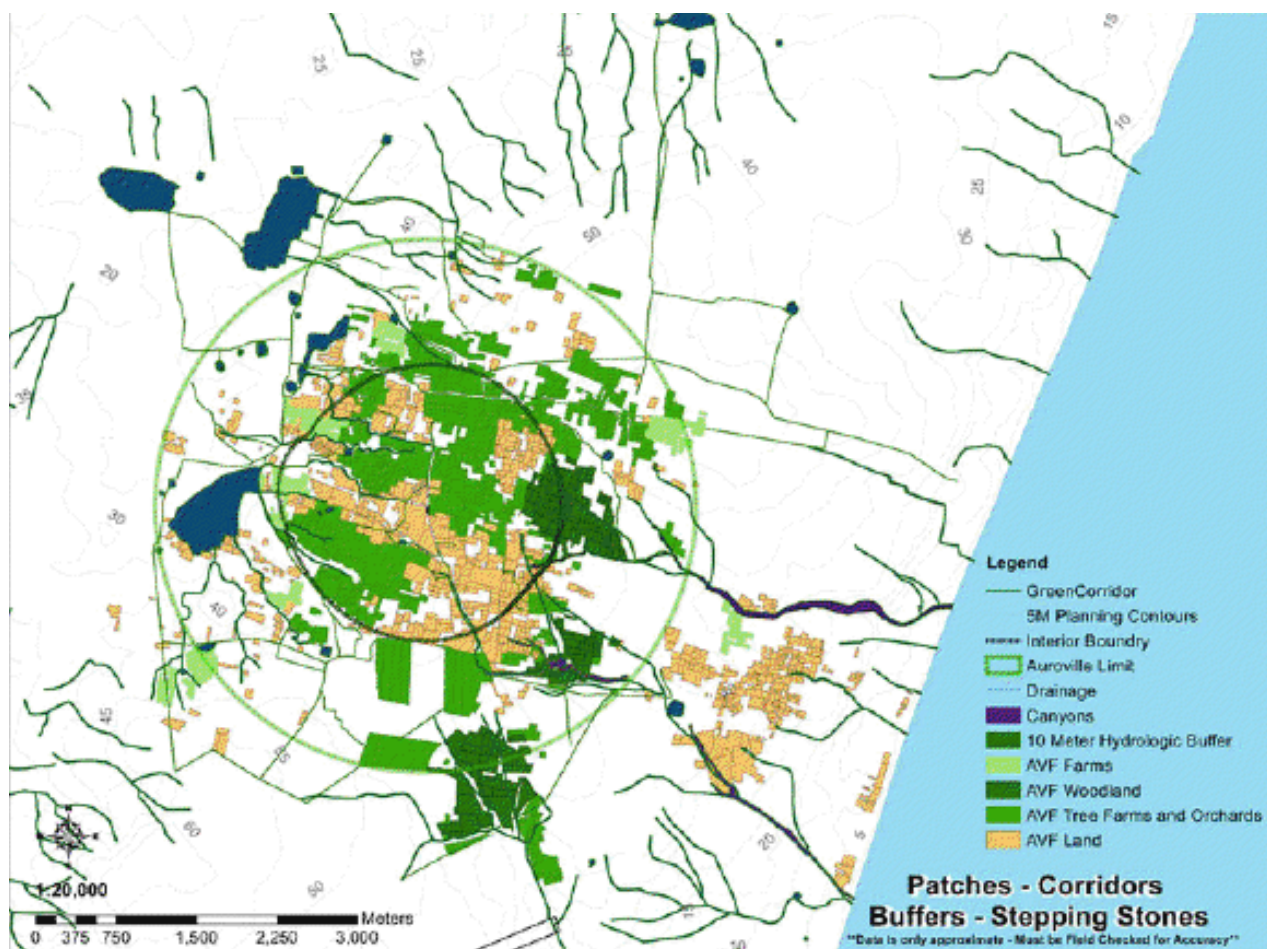
Auroville Green Belt Master Plan

The Auroville Green Belt Master Plan, currently under preparation, is an expansion of the Auroville Township Master Plan intended to look at the needs of the Green Belt and Auroville.

Recognizing that Auroville is but one player in the larger question of preserving and protecting the water sources of the bioregion, the green belt plan focuses on identifying and clarifying the roles that it will play in this effort. As Auroville lies at the head of many of the water flows that serve to replenish the Kaliveli aquifer, the Green Belt plan begins with the critical effort to protect these flows and to ensure that as much of the rainfall of the region is recaptured as possible through various means of diversion, storage and groundwater recharge.

Under this plan, the green belt is defined by its functions rather than by its physical dimensions. Tree planting, agriculture and the construction of water retention and diversion facilities are combined with limitations on permitted land uses, prohibitions against large scale building, and educational programmes to serve this purpose. While the focus is on the land inside the planning area of the Auroville Township, projects and recommendations are also suggested for the management of critical areas inside adjoining jurisdictions. This should permit a more complete treatment of those watercourses that lie partially within Auroville. The plan also makes recommendations on methods of extending the network of protections into other critical areas within the bio-region.

Coastal Management

The region has a coastal stretch of about 80 kms covering the states of Tamil Nadu and Puducherry. A small but significant portion of the local economy (both in Puducherry and Tamil Nadu) is dependent on the coastal resources through inland and marine fishing.

Infrastructure needs to be developed and additional measures need to be taken to protect the area from future natural disasters. The coastal resources including the habitats are being threatened by pollution especially from land based sources, development activities such as ports and dam, tourism, deforestation, natural disasters, over fishing and destructive fishing practices.

Puducherry has lost about 25 percent (1500 km) of its beaches to the hidden impacts of development along the coast. Since the mid-late 1990s, the erosion of the region's coast has been severe. This has been attributed to the construction of the harbour which has obstructed the natural movement of the sand and water.   The government agencies decided to shield the beach with large rocks, build a seawall, and construct several groins to protect the town. As a result of the use of hard coastal protection measures up to 10 km of beaches to the north of the harbour have completely been lost and signs of coastal erosion can be seen up to a distance of about 30 km.
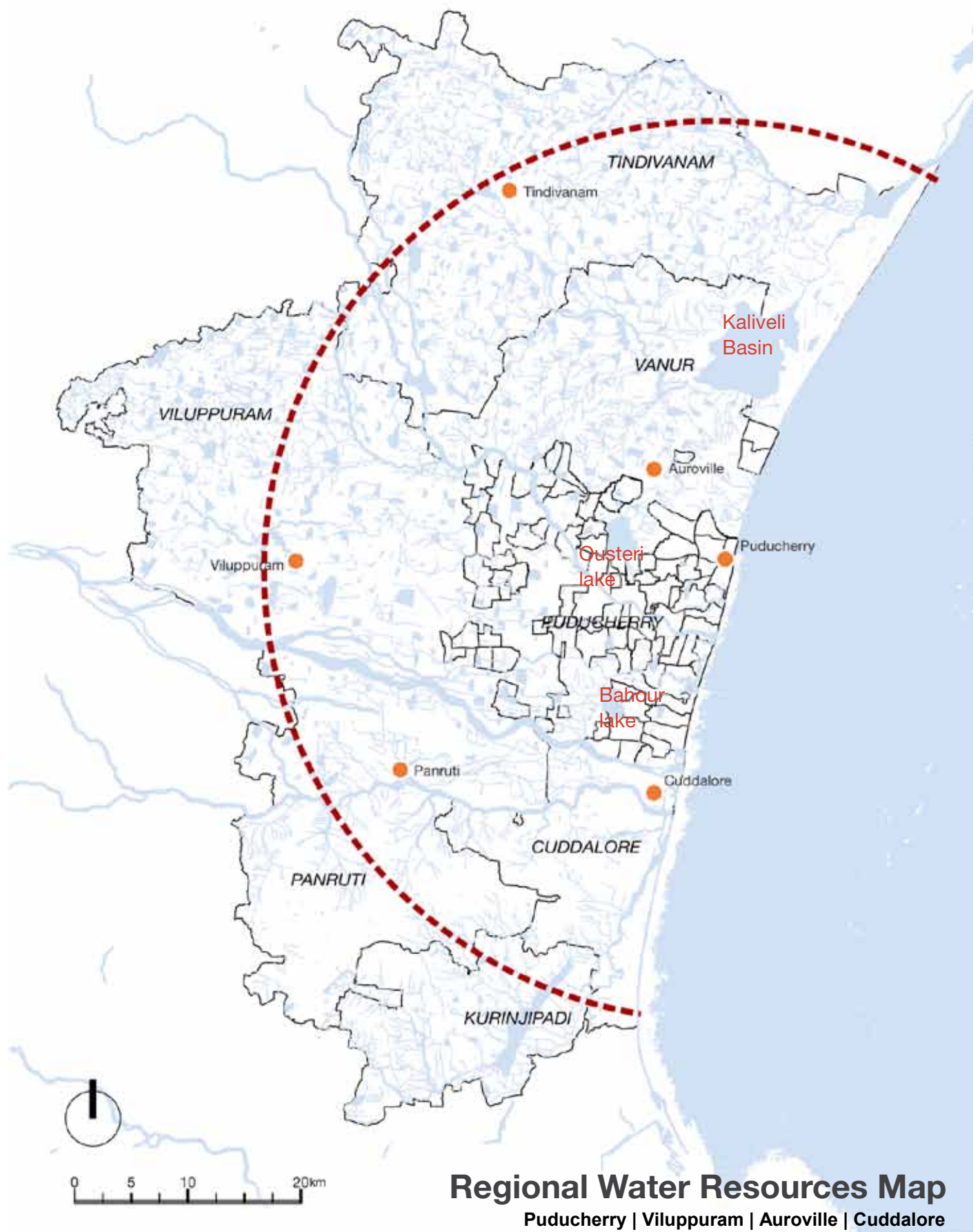
It is estimated that the erosion is advancing northwards at a rate of about 500 meters a year. The erosion of this coast has resulted in the loss of beaches including 200 acres of coastal land and environment. Most importantly, erosion has destroyed the homes of poor traditional fishing families who live next to the sea. A government report states that about 35,000 fishing families are vulnerable to inundation from the sea. This land loss has severely affected their livelihoods as they use the beach space for all their activities. It has also caused saltwater intrusion into their aquifers, leading to shortage of drinking water.

Water Resources

The region is dependent on the monsoon rains for irrigating the lands, filling the ponds and other purposes, as there are no perennial rivers. An efficient tank system was designed 1500 years ago to provide enough water for the area. They recharged the ground water and were the sole source for drinking and irrigation. They guaranteed a decent crop, and sometimes even two crops a year. The tanks were all interlinked with each other so that surplus water could over flow from each tank to the other thus allowing for distribution of water over a larger area and less scope for wastage.

TINDIVANAM

Tindivanam

VANUR

Kaliveli
Basin

Auroville

VILUPPURAM

Puducherry

Ousteri
lake

Viluppuram

PUDUCHERRY

Bahour
lake

Cuddalore

Panruti

CUDDALORE

PANRUTI

KURINJIPADI

0   5   10   20km

Regional Water Resources Map
Puducherry | Viluppuram | Auroville | Cuddalore

Currently, the ground water has reduced as it is extracted excessively, especially along the coast. The rate of extraction is much higher than the rate of recharge, making the practice unsustainable. In Tamil Nadu about 90% of the available surface water and 60% of the ground water is used for consumption. In Puducherry, the ground water extraction has reached the "over exploited" category. This increases the intrusion of salt water into the aquifers. The water quality is also depleting due to the industrial waste disposal in the water bodies. Several water bodies have been encroached by construction activities which are insensitive to the natural course of water.

Kaliveli Wetland

The Kaliveli Bio-region, is a seasonal wetland with a salinity gradient from fresh to brackish water. It includes diverse landforms such as the coast, dunes and charnockite hillocks. It supports several species of flora and fauna. It is also an important stop on the migratory flyway and is a breeding ground for many species of water birds.. The plateau supports the last vestiges of the Tropical Dry Evergreen Forest. The Kaliveli tank and the Yedayanthittu estuary are situated about 20 km north of Puducherry along the coast towards Marakkanam in the Viluppuram district of Tamil Nadu. Broadly speaking, three wetland ecosystems exist in the area: the floodplain, the mangroves and

GIS mapping of the Kaliveli Catchment,with the involvement of school students and womens groups, Source: Joss, Pitchandikulam, Auroville

the estuary. The Kaliveli Basin covering an area of 1500 sq. km. is a catchment area representative of this system. It is linked with chains of irrigation tanks connected along feeding channels extending over the entire length and width of the watershed and finally ending in Kaliveli wetland.

Cuddalore Watershed

The watershed in Cuddalore is delineated into catchment, which are constituted by a single major river or by a group of small rivers or a major tributary of a major river. The two major catchment areas cover Cauvery to Amaravathy; and Vellar and Gadilam rivers. These catchment areas are further divided into sub catchment areas and watersheds.

Tank Rehabilitation Project in Puducherry

This project was initiated in 1999 with the aid from the European Union. It is coordinated by the Project Management Unit of the Public Works Department, Government of Puducherry with the Water Harvest, Auroville, and included the participation of all the stakeholders. The activities include, social mobilization, rehabilitation of tanks, village ponds, check damns, minor damns and engineering support towards designing check dams, minor dams, artificial recharge structures, etc. (http://www.auroville.org/environment/harvest/harvest_th.htm)

Cuddalore water pollution issue

The villages around the SIPCOT area are continuously dealing with effluents from the industrial area, which has affected the lives of the people and the environment. The people have experienced health issues. In addition to air and soil pollution, the water table has also been affected. This has lowered farm production and reduced the fish catch. The citizens has complained of the poor quality of water and its subsequent effect on their livelihoods. They also stated that they purchase water as all the available potable water is contaminated. (http://www.sipcotcuddalore.com/News_Frontline_TheHindu_040605.html)

Auroville Water Harvest

Auroville Water Harvest: Center for Water Resource Management is a non-profit organization working with an objective to address the sea water intrusion and to promote integrated water management with people's participation.

Energy

Power generation

Due to the structural reform process in the 90s, most Indian States have seen a structural reform of the electricity delivery system into a publicly owned Holding company, comprising of a generating company (GENCO), a distribution company (DISCOM) and a transmission company (TRANSCO). The main aim for this was to increase the efficiency of the existing system, reduce costs of delivery and increase electrification.

This streamlining has not yet occurred for the Union territory of Puducherry. The Puducherry Electricity Department (PED) was in charge of distribution and transmission of electricity before the start of the reforms and therefore under section 14 of the electricity act 2003 it is considered to be a deemed licensee. The settlements in Tamil Nadu draw their main supply of energy from the Tamil Nadu Electricity Board (TNEB) through the 110/22 kV sub-stations. Several load-centre sub-stations are located around the township to step down the voltage from 22 kV to 415 V and supply 3-phase electricity through low-tension distribution lines to the end users.

JERC

The Joint Electricity Regulatory Commission (JERC) is constituted under the section 83 of the Electricity Act. The JERC functions like all the other regulatory commissions with the addition that is caters to the union territories except (Delhi and the state of Goa). In 2008 it was given the added responsibility of looking at the state of Goa and renamed the joint electricity regulatory commission of the state of Goa and Union Territories.

Puducherry Power Corporation Limited

The Puducherry Power Corporation Limited (PPCL) was incorporated in 1993 under the Government of Puducherry to erect and run a combined cycle gas turbine (CCGT) power plant in Karaikal.

Renewable Energy Agency of Puducherry (REAP)

The Renewable Energy Agency of Puducherry is the State Nodal Agency for MNRE and the State designated Agency for the Bureau of Energy Efficiency. Traditionally REAP has not been a strong implementing agency and is currently in the process of developing a renewable energy policy for the UT of Puducherry.

High Energy Consumption

The demand for electricity in the state of Puducherry is increasing steadily (2,614 million kWh in 2007-08 to 3,146 million kWh in 2011-12 (planned). Apart from the limited power generated and supplied by Puducherry Power Corp. Ltd. (PPCL), representing less than 8% of the electricity consumed, the remaining electricity is purchased from Central generating Stations (CGS), TNEB and KSEB. More than 3/4th of the electricity is obtained from CGS. The total cost of electricity purchased has also been increasing as well (5,069 million Rs in 2007-08 to 7,820 million Rs in 2011-12 (planned). The average unit cost of electricity purchased was Rs2.58 in 2010-11, with the lowest price being that of TNEB (Rs 1.99) and the highest being that of KSEB (Rs 3.61).

JERC, under the Electricity Act 2003 has the power to set a minimum renewable energy purchase obligation for each respective state. Therefore an additional aspect to be taken into account for the PED is the total renewable energy component in the energy supply-mix as specified by the Joint Electricity Regulatory Commission (JERC). The JERC has asked the PED to procure 2% of its total consumption from Renewable energy sources in the year 2010-2011, of which 0.3% must necessarily be solar power. Similarly this Renewable component rises to 3% in the year 2011-2012 of which 0.4% is the solar component.

Renewable Energy: The Auroville Experience

Auroville is one of the pioneers in the design and use of renewable energy systems, and it has been extensively involved in its research and implementation. Auroville is recognised in India as a 'testing' centre for a wide variety of renewable energy technologies.

Solar Energy
In the early eighties, one of the first solar panels was set up in Auroville. Today over 150 houses are powered by the photovoltaic cells. Over 50 houses use solar power along with the state grid connections. " The total standalone photovoltaic energy capacity of Auroville is more than 15% of the total photovoltaic capacity in India. "

Solar power has been used for lighting streets, homes, pumping water for drinking water and for irrigation, heating water for domestic purposes, and food processing. Other solar applications developed are solar curing chambers for ferrocement prefabricated elements and solar concentrators.

Energy from wind:
Windmills have been designed and used for pumping water in Auroville. The AV55 wind mills can be used to pump water from as deep as 100 m as well as for low-lift high-volume output from open wells. Auroville uses over 30 mills for pumping water. (http://www.auroville.org/research/ren_energy/wind_energy.htm)

Energy from Biowaste:
Auroville centre for Scientific Research has significantly contributed to the design and manufacturing bio gas plants. Their innovative modular prefabricated ferrocement biogas system is suitably designed for small scale farm operations and producing biogas in the range of 2 to 4 m3 a day.

Transportation

The PVAC region is currently served by a network of National and State Highways. Regional transit is limited to the rail network and bus services operated by the Tamil Nadu State Transport Corporation, the Puducherry Road Transport Corporation and other private operators. Modes of regional commute are currently limited to personal vehicles (two-wheelers, bicycles and cars), bus service (public and private) and the informal sector (autos, mini-buses and shared autos). Also there is poor connectivity to many monuments and destinations of cultural and heritage significance in the region which results in a loss for the tourism economy of the region.
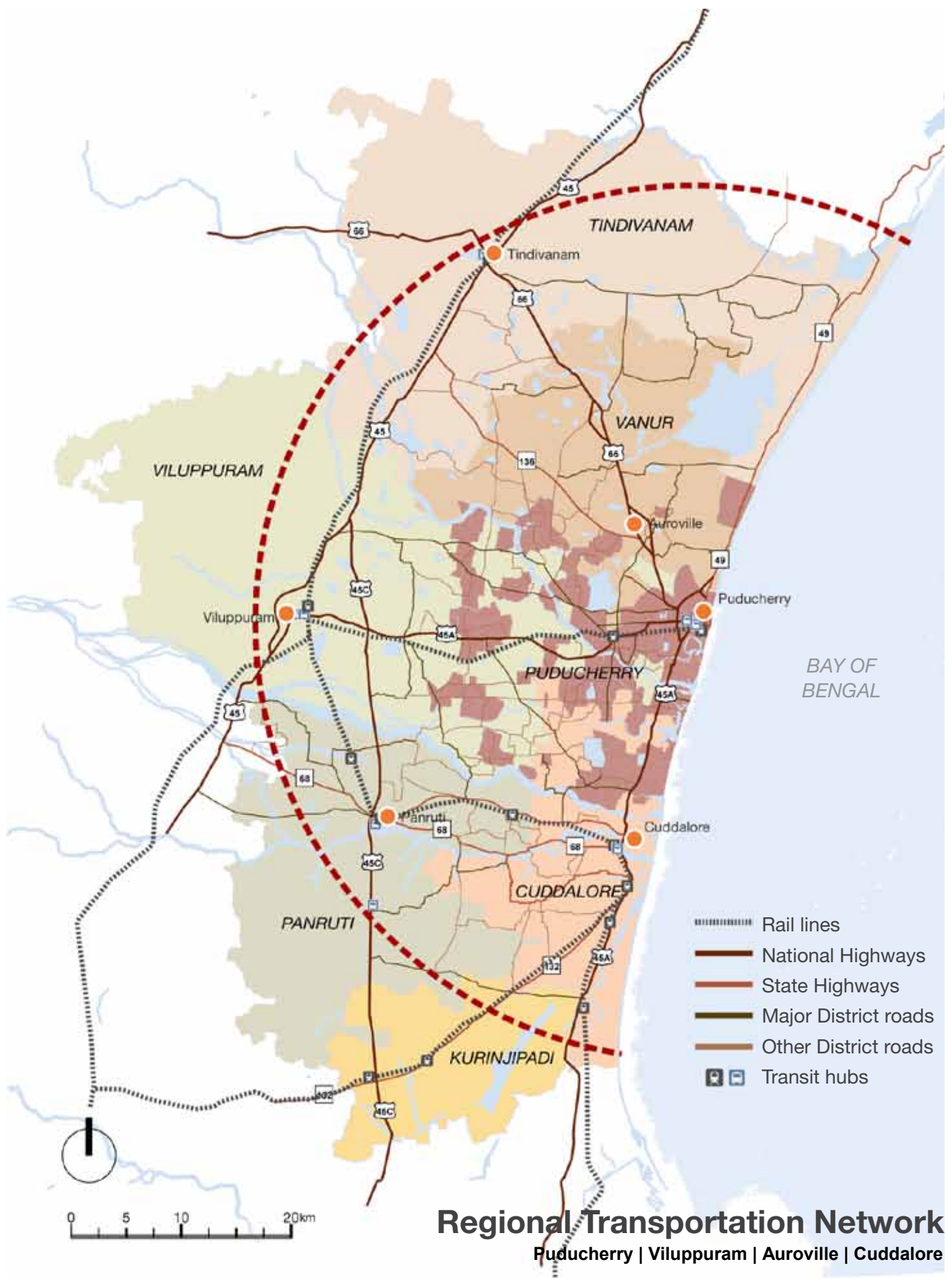
In Puducherry, two-wheelers constitute 42% of traffic, followed by cyclist at 26%, cars at 12% and para-transit at 13%. Rail service between the regional town centres is infrequent and represents an underutilized potential for the region's connectivity. The region's congestion level, number of private vehicles and travel times are increasing steadily and with the projected growth trends, this situation is expected to worsen.

Higher-order transit services that connect each of the growth centres to one another are almost entirely lacking. At the local level, the pedestrian environment continues to be neglected and pedestrians are forced to share space on the carriageway leading to unsafe conditions. Detailed audits are needed for better assessment of transportation options and needs for the region.

Additionally, the different modes of transportation networks that are prevalent in the PVAC region exist in isolation from one another. Providing convenient multi-modal transfer facilities and improving the overall management and quality of the transportation systems will help to optimize the mobility patterns across the region.

Existing trends related to modes of transportation

From the origin destination survey conducted as part of the study for this report, it was evident that the respondents rely on multiple modes of transportation to reach their destinations. Usually it is a combination of cycling, walking, sharing a ride, or using an auto or rickshaw to reach the bus stop. In the year 2005, about 40 percent of the Puducherry City's population walked, 15 percent used cycles and 30 percent used two wheelers. The public transportation use was a mere 7%. (MoUD. 2008) This could be attributed to the necessity to make multiple bus transfers to reach one's destination.

TINDIVANAM

VILUPPURAM

VANUR

PUDUCHERRY

BAY OF
BENGAL

PANRUTI

CUDDALORE

KURINJIPADI

Tindivanam

Auroville

Viluppuram

Puducherry

Panruti

Cuddalore

	Rail lines
	National Highways
	State Highways
	Major District roads
	Other District roads
	Transit hubs

0 5 10 20km

Regional Transportation Network
Puducherry | Viluppuram | Auroville | Cuddalore

From the transportation survey conducted, the following observations were made-

- In the low income segment (of the total respondents surveyed), 25% walk and another 25% cycle to work. This could be partly attributed to the short distances to work.
- Buses are also a preferred mode of transport for commuting to work in this segment accounting for 17%. However, more than 25% recently shifted to the use of a two-wheeler.
- The high income segment tended to travel longer distances to commute to work. Walking, cycling and bus to work contribute for around 10% each.
- Walking and cycling to work is not prevalent among middle and high income groups. This could be partly driven by longer distances to work.
- More than 75% of total number of households surveyed who own a cycle use it daily. However, more than 37% households do not own a cycle.
- Two-wheelers are a common mode of transport within the region with 75% of the respondent households owning atleast one two-wheeler while only 13% of the households own a car.
- 62% of high income households own a car out of which 33% of the car owners use it daily and more than 44% use it less than once a week.

Rail

With respect to rail links, Viluppuram is the biggest railway junction in the region. Viluppuram serves as the distribution point of rail traffic from Chennai with many trains passing through it as they access towns and cities further south in Tamil Nadu. It is connected to Chennai via the Chennai – Trichy railway line, which is currently being converted from meter gauge to board gauge. Viluppuram also has lines connecting to Tindivanam to the North, Cuddalore Port extending up till Tiruchirapalli Junction to the South. Puducherry is linked to Viluppuram through Broad Gauge.

Though there is a rail link connecting Villuppuram and Puducherry and also Panruti and Cuddalore, the trains are infrequent trains. However, Viluppuram and Tindivanam function as important transportation nodes given their road and rail accessibility. Inspite of this, the quality and service within the region is poor.

Roadways

The East Coast Road (or State Highway 49) is a two-lane highway, running north-south along the coast and connecting Chennai to Cuddalore via Puducherry. This driveway connects several historic and recreational places of interests. NH 66 originates from Puducherry, connecting it with Bangalore via Tindivanam.

NH 45A forms an East - West connection in the region and connects Viluppuram to Puducherry and turns south along the Coast through Cuddalore until it merges with NH 67 at Nagapattinam. NH 45C originates from Vikravandi near Viluppuram and connects to Thanjavur through Panruti. NH 45 is another important four lane highway connecting Chennai to Trichy via Tindivanam and Viluppuram and is one of the busiest highways in the region. SH 136, SH 68 and SH 132 are the other State Highways that form alternative links between the National Highways. The missing link in the region is the lack of direct road connectivity between Puducherry and Panruti which implies longer travel times between the two centres.

Viluppuram town is located close to the intersections of NH 45 with NH 45A and 45C; and Tindivanam is located at the intersection of NH 45 and NH 66. This proximity to major highway intersections, gives them tremendous potential to develop as future transit hubs if leveraged in the right direction. Even today as it stands, these intersections which double up as transit stops also function as hubs for small and informal businesses thereby contributing to the local economy of these towns.

However, the highway design and construction is unable to support the movement of both freight and people resulting in high traffic density along ECR and the NH 45. The design is also limited in terms of providing a choice of transport modes that can be accommodated on these highways. The land use developments along these highways are unregulated and access to such developments are not designed appropriately leading to added load and congestion on these roadways. In Viluppuram and Panruti, the State Highways are narrow and the buildings are constructed all the way until the edge of the carriageway making it unsafe for both pedestrians and vehicles. In Cuddalore, the poor condition of roads has resulted in pollution, poor air quality and health issues from dust from the broken carriageways. Inadequate signage is also a cause for concern with respect to safety on the roads.

Highway designs need to be revisited in sections where they cross existing towns and villages and also need to accommodate all modes of transport. This picture shows a conflict between different modes.

Typical large residential development along highways in the region

Public Transportation

Public transportation has a higher carrying capacity than any private vehicle. Lack of designated bus lanes and other systems that optimize mobility encourages the use of private transportation. Bus services operated by the Tamil Nadu State Transport Corporation, the Puducherry Road Transport Corporation and other private operators have only so much of a reach and in some cases are not frequent enough to function as a preferred mode of travel. Also, the management of these bus services is poor thereby giving it an image of being a poor man's mode of travel. Viluppuram and Tindivanam in particular reported a lack of public transportation operating locally and that this gap was being filled by para-transit modes and privately operated mini-buses.

At the local level, public transportation is not a popular choice of commute for work, especially among the middle and high income groups. From the survey conducted in the PVAC region, it was observed that only 70 percent of the respondents use public transportation, out of which only 34 percent use it on a daily basis. The usage seems to be higher among the lower income users.

PHOTO: V. VINOTH

For the City of Puducherry, the MoUD study from 2008 identified the city bus supply index at 8.62 for, the year 2005. This indicates that there were only 8.62 buses (both public and private) provided per one lakh population. This is a very unbalanced ratio, especially given the high density of population and high percentage of growth rate within the Puducherry urban area.

On the other hand, the city ranked 2.12 in the public transportation index, in 2005. This indicates that the city had relatively high access to public transportation in comparison to some of the other cities in India. The service accessibility index (% of work trips accessible in 15 minutes) was 85.68 in 2005. Given the small scale of the city, the length of the trip to access public transportation is usually smaller in comparison to the larger metropolitan cities. This is consistent with the transportation survey, where it was observed that 63% of the respondents walk to a public transport stop whereas 13% take a motorcycle to get to a public transport station.

Para-transit

Para-transit is typically used when there is unavailability of public or private transportation. It is used for shorter commute trips, especially when the regular mode of transportation fails. It is usually availed for temporary/ emergency travel needs. In Puducherry City, there were 2017 Intermediary Public Transport (auto rickshaws) in 2005, which was 397 IPT/ lakh of population. However this mode of transportation becomes a permanent mode of travel, when the demand of public transportation remains unsatisfied as has been the case in all the four growth centres in the PVAC region. The disadvantage associated with para-transit is that the routes and fares are not regularized as a result of which on some occasions they tend to be exploitative of their passengers. One way to address this problem is to regularize and establish service level benchmarks for para-transit so that it can begin to function as a legitimate mode of transport that is capable of closing the gaps that are left by bus services. In such a case, para-transit will function as a feeder service to high speed transit networks.

Para-transit is the only mode of transport available for local travel in some towns

Walking and cycling

In 2005, the walkability index for Puducherry was low (0.37) (MoUD.2008). This index is computed with a combination of the length of the footpaths and the public opinion regarding the pedestrian facilities. The low index value indicates that the pedestrian facilities were either absent or the quality of the existing facilities was poor. Given the limited road widths and the high traffic and congestion, walking or cycling becomes an unsafe option.

Through the field visits conducted in the region, it was observed that the pedestrian spaces were neglected and the roads are increasingly being designed for the motorized vehicle users. Also that policies continue to provide hidden subsidies to private transit modes and investment too is centred on providing more road space to motorized vehicles.

Lack of pedestrian facilities forces pedestrians to share space with motorized vehicles leading to unsafe conditions

Airways

The only airport that serves the entire PVAC region is the airport in Puducherry. This too is mainly used for charter flights with no national or private carriers. There however exists a proposal for an airport to be built at Lawspet which is north of Puducherry city. The general perception with respect to the PVAC region is that the location of this airport can only serve Puducherry and Auroville while the rest of the region will still not avail the benefits of an having an airport to serve them. Also that this proposed location is not very far from the Chennai airport too. An airport located south of Puducherry and north of Cuddalore was suggested during the public consultation workshops as one that would be ideal to serve the entire region.

Freight

Currently highways in the region carry both people and freight. This is not viable on the long run and there is a need to identify dedicated freight corridors for the region that offer connectivity between the ports and railway stations for more efficient movement of goods. This is especially pertinent in view of the fact that new ports are being developed in and around the region and there will be excess load on the existing highway network from the additional cargo that is bound to come in. Having dedicated freight corridors also ensure faster and more efficient movement of goods and contribute to the regional economy.

Waterways

Public transportation via waterways is an unexplored potential along the coastline providing an additional mode of transport between the coastal towns and villages and could be used to offset some of the traffic volume along the East Coast Road.

Lack of options in areas of higher social need

There are many people in the PVAC who cannot afford to own a private mode of transport and many more who stretch their available resources to do so. As energy costs increase, the potential for social exclusion grows, as more people are unable to afford to participate in activities due to the high cost of travel. Access to frequent, fast and affordable transit is therefore crucial for equity and social cohesion. Additionally, in some parts, connectivity to the rural areas is virtually non-existent. The transportation system needs to improve the mobility options for people in these areas, connecting at-risk, vulnerable and disadvantaged communities to the jobs, social services, and health care facilities which can improve people's lives.
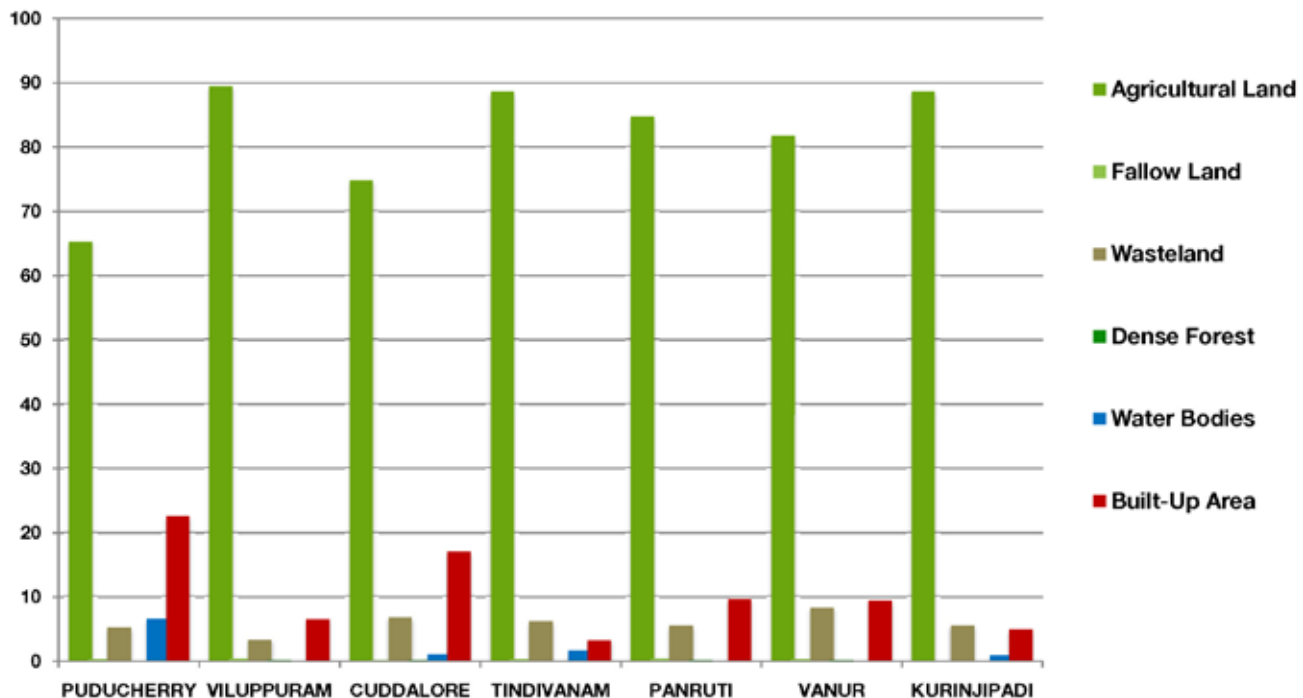
Protecting agricultural land and natural forest cover

As the PVAC region grows, it becomes all the more imperative to protect our natural areas and agricultural lands. The PVAC region is endowed with over 50% of its land cover under agricultural crop lands and natural forest areas. Given that development follows transportation infrastructure, the transportation system plays a critical role in shaping growth and development, and will therefore be an important part of efforts to protect these lands.
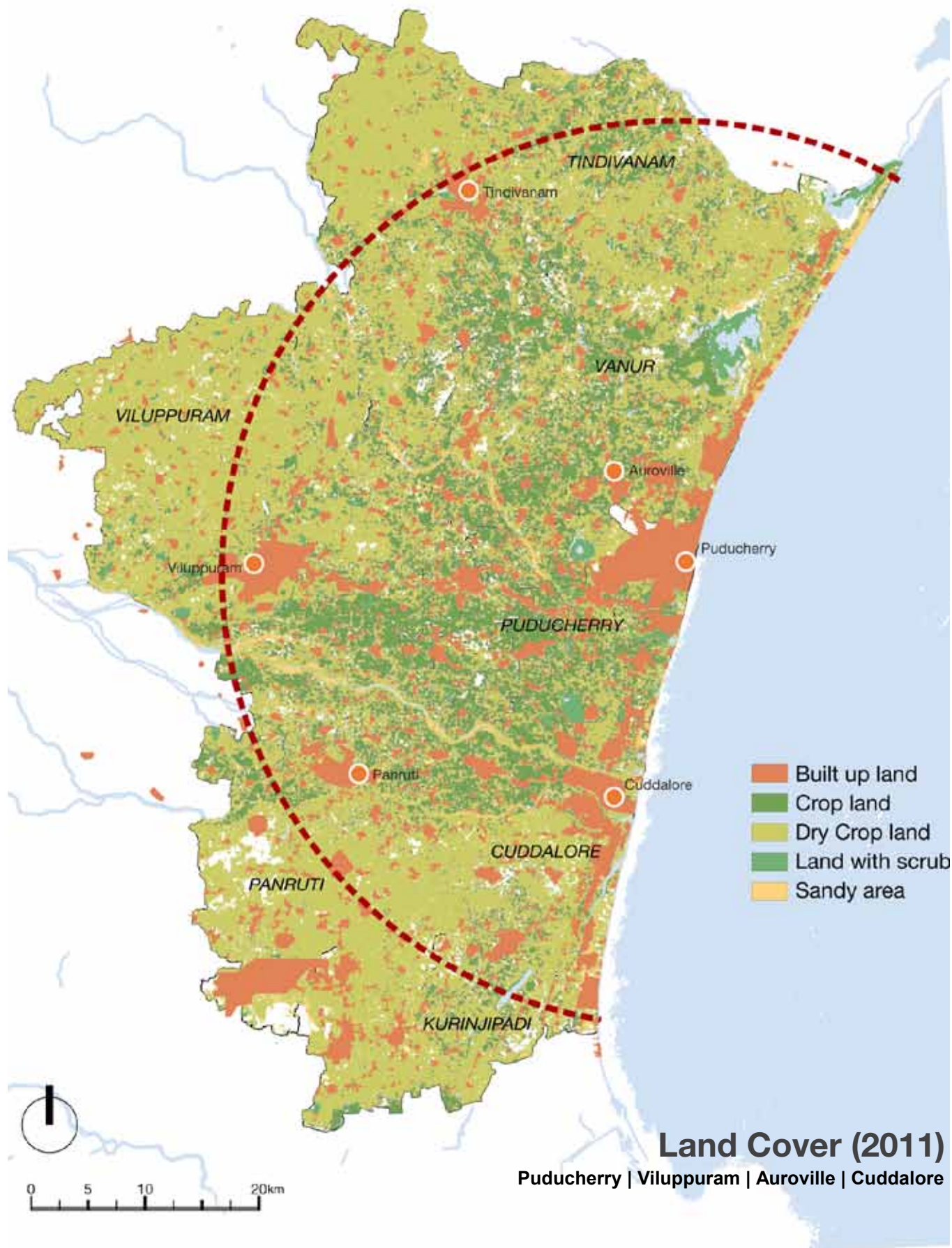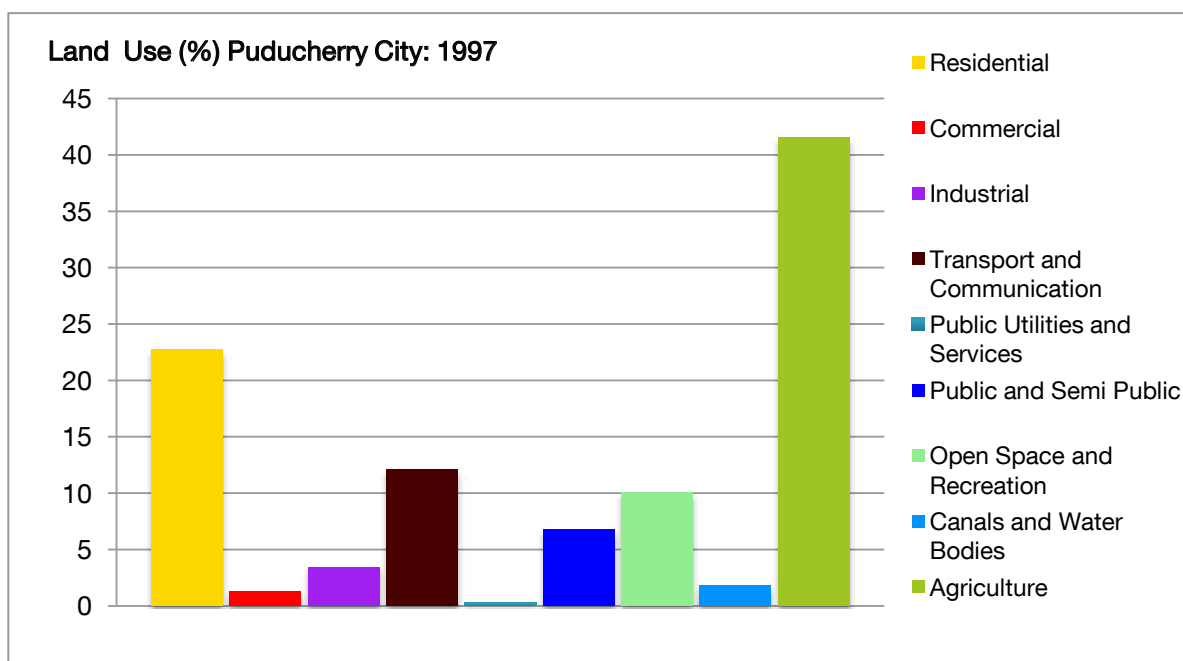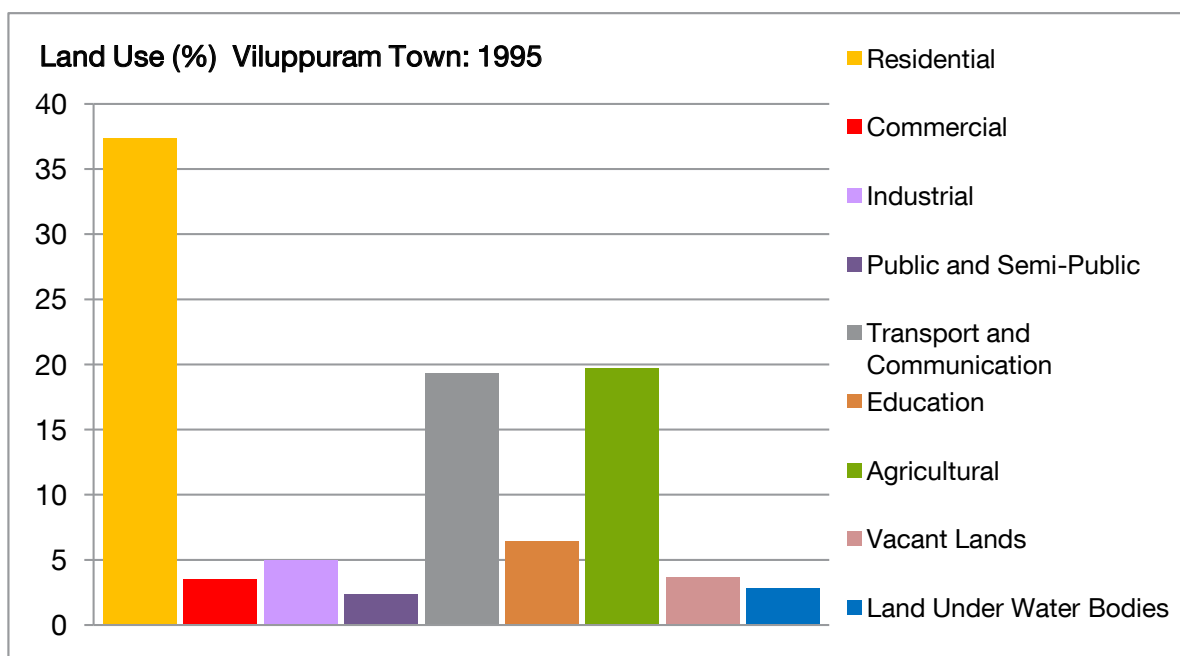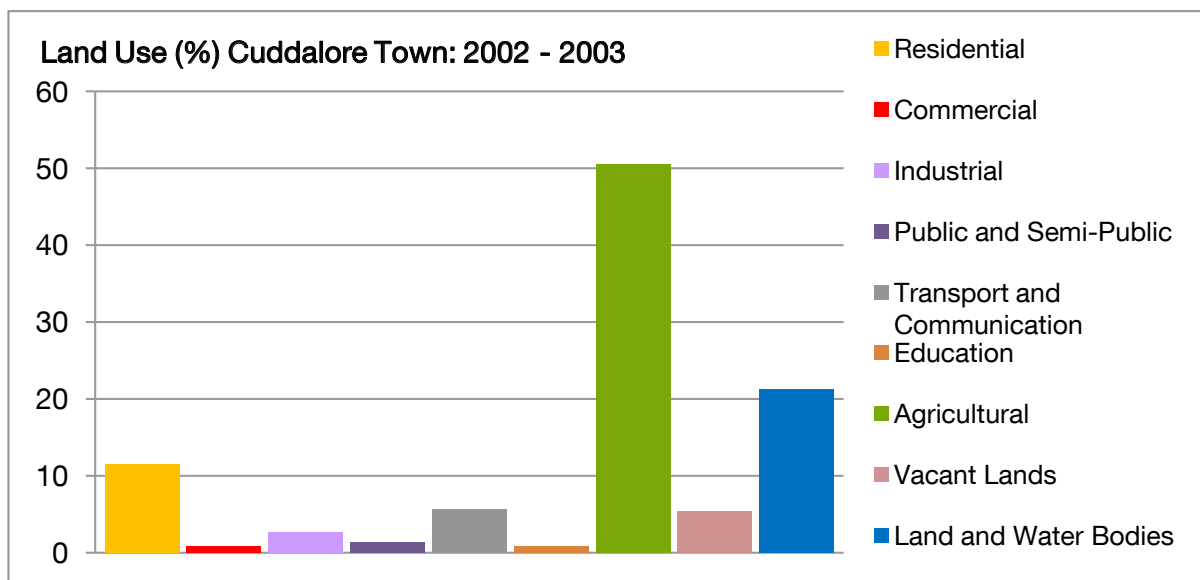
Land Cover

The persistent growth of the urban expansion of Puducherry on one side and the Chennai suburbs on the other has placed much pressure on the ecosystem resulting in several threats to the region. One of the key limitations as it relates to analyzing the land use and land cover change is the limited data availability and access to information in the public domain. Identification of historic and current land use consumption trends through GIS mapping as part of this study were instrumental in understanding growth patterns at the regional level. Field visits were conducted by the team to understand community perceptions related to these changes in development and collect anecdotal information on its impact on the overall quality of life.

Percentage distribution of regional land cover - Year 2000

Land Cover (2011)
Puducherry | Viluppuram | Auroville | Cuddalore

Legend:
- Built up land
- Crop land
- Dry Crop land
- Land with scrub
- Sandy area

Map labels: TINDIVANAM, VANUR, VILUPPURAM, PUDUCHERRY, CUDDALORE, PANRUTI, KURINJIPADI

Town markers: Tindivanam, Auroville, Puducherry, Viluppuram, Panruti, Cuddalore

Scale: 0 — 5 — 10 — 20km

Land Use (%) Cuddalore Town: 2002 - 2003

Legend:
- Residential
- Commercial
- Industrial
- Public and Semi-Public
- Transport and Communication
- Education
- Agricultural
- Vacant Lands
- Land and Water Bodies

Land Use (%) Viluppuram Town: 1995

Legend:
- Residential
- Commercial
- Industrial
- Public and Semi-Public
- Transport and Communication
- Education
- Agricultural
- Vacant Lands
- Land Under Water Bodies

Land Use (%) Puducherry City: 1997

Legend:
- Residential
- Commercial
- Industrial
- Transport and Communication
- Public Utilities and Services
- Public and Semi Public
- Open Space and Recreation
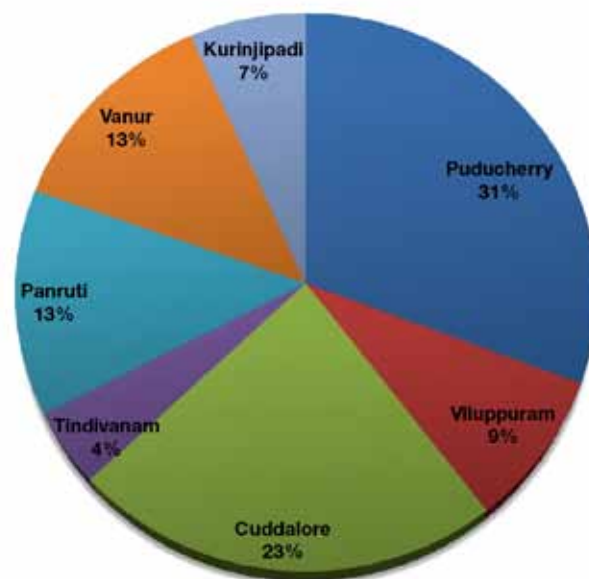- Canals and Water Bodies
- Agriculture

Built-up Land

A preliminary visual analysis of the regional land cover changes between 2001 and 2011 was conducted during the planning process using satellite images and GIS data. The analysis revealed that at the region has witnessed a significant loss of agricultural land in exchange for expansion of built-up areas. As illustrated in the diagrams on page 80-81, the proliferation of built-up areas in what is termed as "suburban sprawl" – characterized by dispersed, low-density and automobile-dependent development. It also magnifies the problem of spatial mismatch in the region as it relates to presence of existing infrastructure (employment centres, educational institutions, and physical infrastructure) and carrying capacities of the settlements.

The maps on the following pages show that in 2001, the development activities were concentrated only in the major town centres. However, in 2011, it was observed that several small clusters are now haphazardly dispersed across the region, with a significant concentration of new settlements along the East Coast Road.
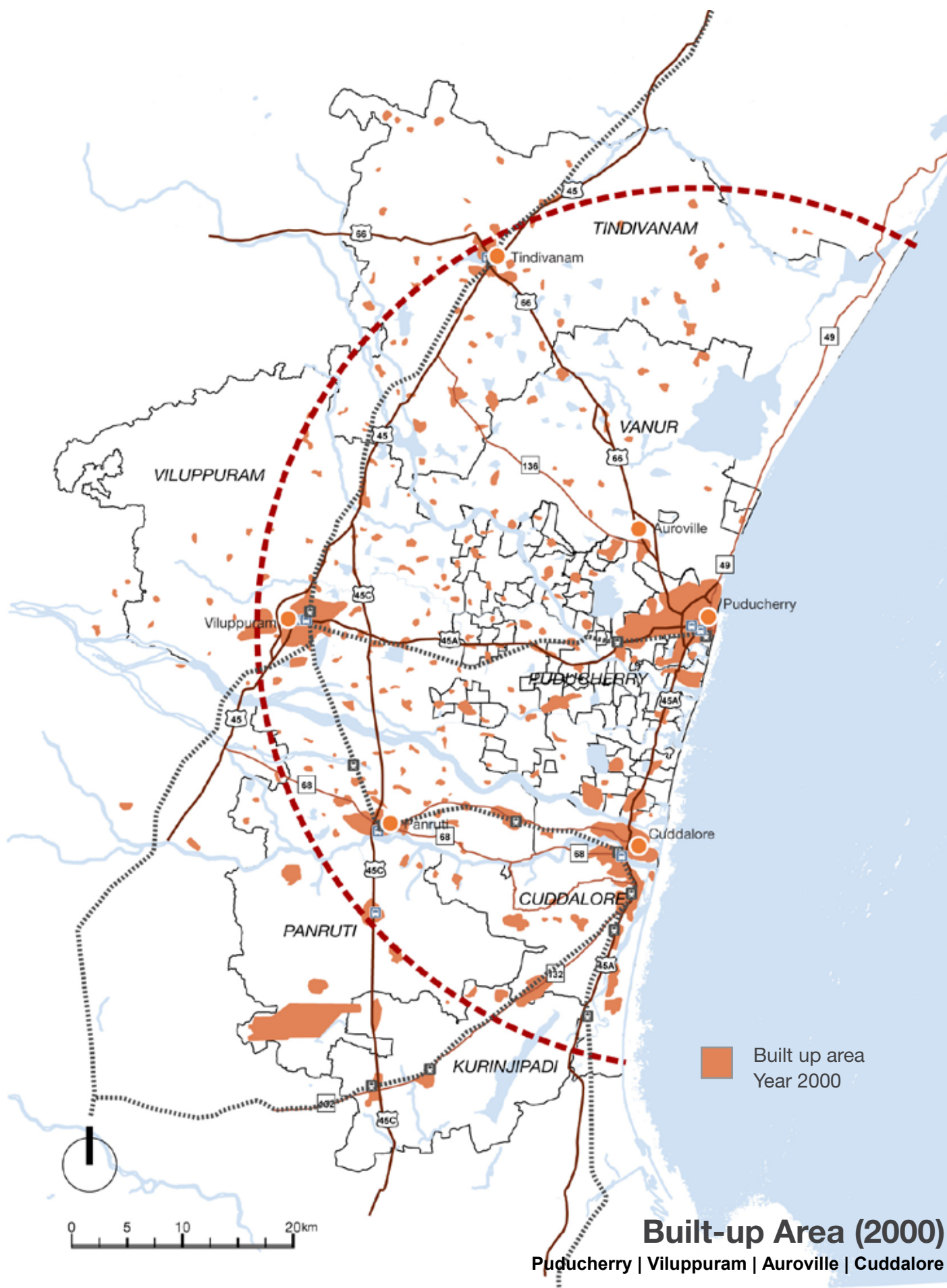
There is a glaring disparity between the proportions of developed lands between the major town centers as well. For example, nearly 70% of the total area in Puducherry was categorized as developed. In comparison, only 17% of Cuddalore town is developed.
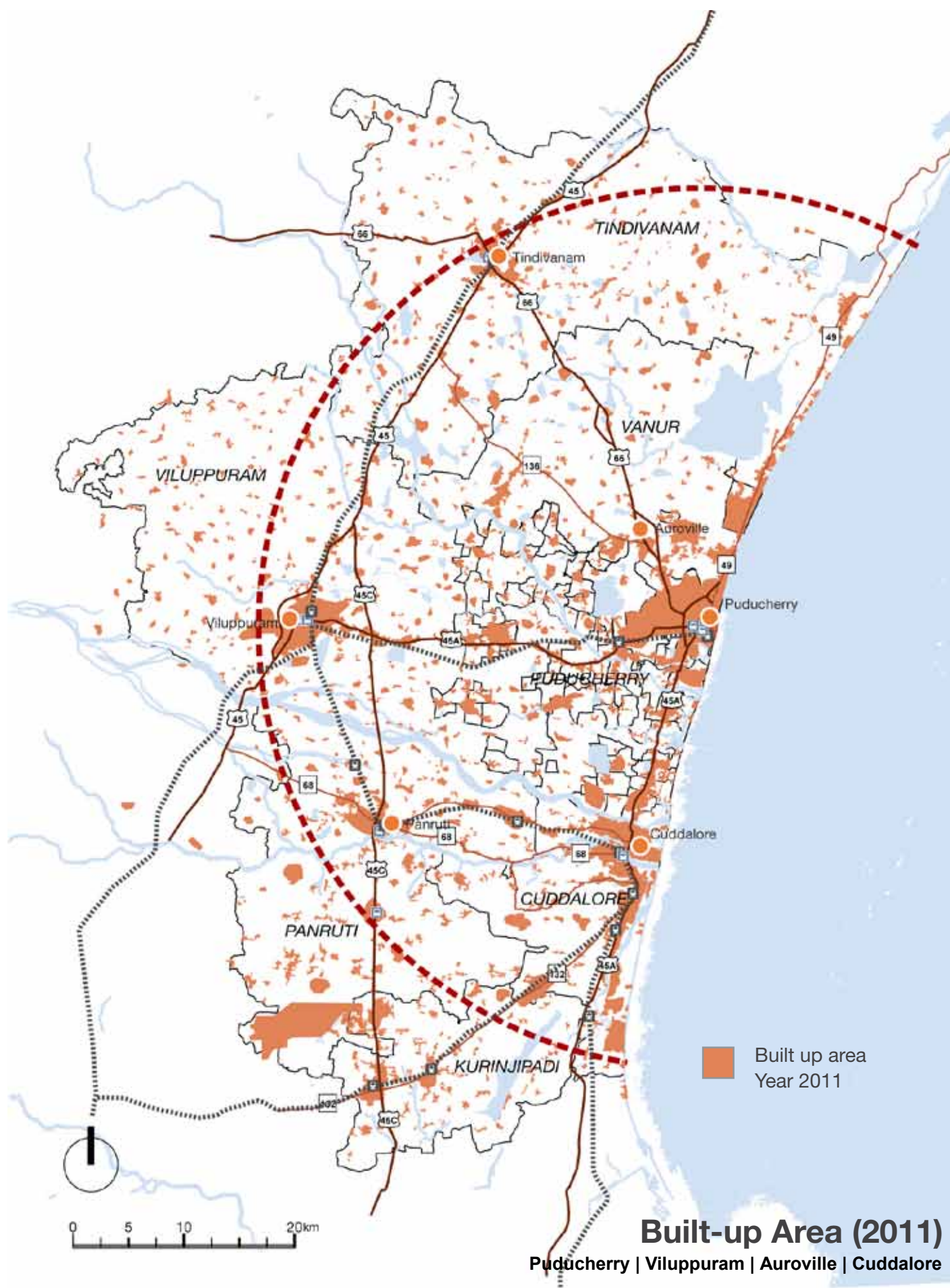

Percentage distribution of land under development- Year 2000

Built up area
Year 2000

Built-up Area (2000)
Puducherry | Viluppuram | Auroville | Cuddalore

TINDIVANAM

VILUPPURAM

VANUR

Tindivanam

Auroville

Puducherry

PUDUCHERRY

Viluppuram

Panruti

Cuddalore

PANRUTI

CUDDALORE

KURINJIPADI

0 5 10 20km

Built up area
Year 2011

Built-up Area (2011)
Puducherry | Viluppuram | Auroville | Cuddalore

TINDIVANAM

Tindivanam

VANUR

VILUPPURAM

Auroville

Viluppuram

Puducherry

PUDUCHERRY

Panruti

Cuddalore

PANRUTI

CUDDALORE

KURINJIPADI
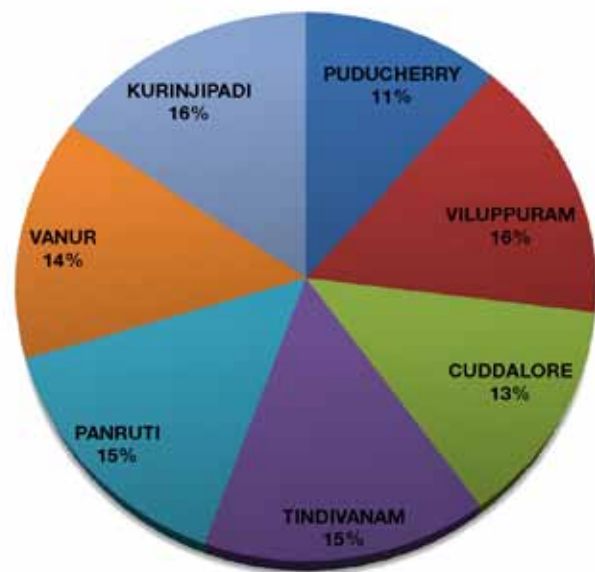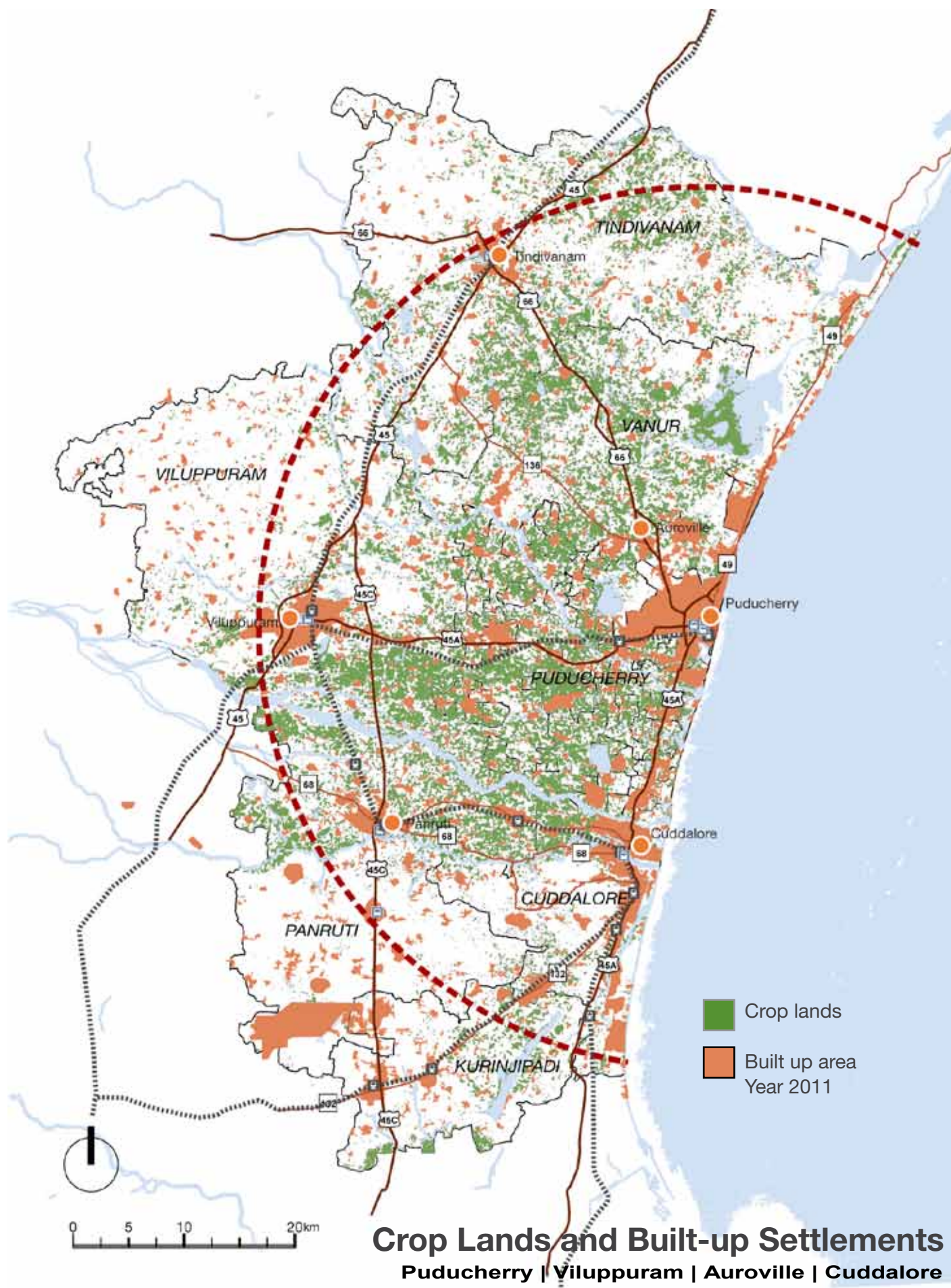
0   5   10   20km

Agriculture

Agriculture is the predominant land use activity in the region accounting for over 50% of the total land cover in 2011. However, when the land cover change is analyzed over the last two decades, it is clear that this growth is not actually related to densification of existing urban centres but primarily due to conversion of agricultural land into developed land. For example, in the period between 1990 and 2007, Puducherry district witnessed a 30% increase in "land put to non-agricultural uses" (Season & Crop Report 2008-09 published by the Department of Economics & Statistics, Puducherry and Public Works Department, Puducherry). During the same time period, the total cropped area decreased by 12% in Puducherry. In Viluppuram, the land under agriculture reduced by 4 percent, where the land under non-agricultural uses increased by 12 percent between the years 2005-2006 and 2006-2007.

Percentage distribution of land under agriculture-Year 2000

VILUPPURAM

TINDIVANAM

VANUR

PUDUCHERRY

Tindivanam

Auroville

Puducherry

Viluppuram

Panruti

Cuddalore

PANRUTI

CUDDALORE

KURINJIPADI

Crop lands

Built up area
Year 2011

0   5   10   20km

Crop Lands and Built-up Settlements
Puducherry | Viluppuram | Auroville | Cuddalore

Social Infrastructure

The region when analyzed as a single entity exhibits a significant concentration of social infrastructure and services- health facilities, educational opportunities, skills development centres and social security networks. However, majority of these facilities are located in Puducherry district and is one of the primary reasons for migration from rural to urban areas.

Puducherry is known for its education and medical institutions. There are 1,215 schools in the Union Territory. The Union Territory has one central university and 11 medical and allied colleges. It has one of the largest super-specialty government hospitals (JIPMER) in India and other specialized health care facilities such as the Aravind Eye Hospital and Pondicherry Institute of Medical Sciences. The Sri Aurobindo Ashram also has several facilities in the Boulevard town that cater to the health, education and other social service needs of the citizens.

Cuddalore and Viluppuram lack the basic social infrastructure facilities in terms of higher education and health-care services. However, Annamalai University at Chidambaram i.e. 50 kms away from the town caters to the education needs of the town. The municipality does not run any of the education facilities and are maintained by Government and Private agencies. However, the municipality maintains the reading centres and libraries spread across the town.

The Health Department of the municipality carry out preliminary health activities. It also maintains a maternity hospital near the Thirupapuliyur railway station. The health centres conduct health camps and provides facilities with respect to disease prevention, nutrition, medical care, women's activities and medical supplies.

Major Educational Institutions
Puducherry
• Puducherry Engineering College. • Puducherry University. • Jawaharlal Institute of Post-Graduate Medical Education & Research (JIPMER) • Mahatma Gandhi Medical College and Research Institute • Puducherry Institute of Medical Sciences
Cuddalore
• Krishnaswamy College of Engineering & Technology, Cuddalore • St. Joseph's College of Arts and Science (Autonomous), Cuddalore • Padalesuwarar Polytechnic College, Cuddalore • Mahalakshmi College of Hotel Management and Catering Technology
Viluppuram
• Sacred Heart Convent, East Puducherry Road, Viluppuram • Sri Ramakrishna Vidhyalaya Metric. HSS, Viluppuram. • AKT Academy, Kallakurichi. • A.K.T. Memorial College of Engineering and Technology, Kallakurichi • Dr. Paul's Engineering College, Vanur.

Major Medical Facilities
Puducherry
• Indira Gandhi Govt. General Hospital & Post Graduate Institute • Maternity Hospital • Govt. Hospital for Chest Diseases • Mahatma Gandhi Leprosy Hospital • ESI Hospital
Cuddalore
• Government Hospitals • Krishna Hospital • Kannan Hospital • Siva Sakthi Nursing Home
Viluppuram
• Governement Hospital • ES Hospital • Aswini Hospital

Auroville outreach units along with several groups in Puducherry and Tamil Nadu have come together in a synergetic manner in aiming at the Kaluvelley bio-regional development plan. Environmental Education and Awareness building in the Kaliveli bio-region has been part of the Auroville engagement in the region for long. Such initiatives include organic farming efforts in the Vanur block of Viluppuram district that are being propagated through the efforts of Auroville Harvest and Palmyra and many innovative environmental education programmes being implemented by Pitchandikulam in the Marakkanam block of the Viluppuram district.

Sustainable Enterprises in the Auroville Bio-region (SEDAB) is a joint effort by several Auroville based units that aims to create several enterprises in the spheres of natural resource based enterprises, eco-friendly cottage enterprises and waste material based cottage enterprises in the bio-region through existing community based groups (SHGs) and organizations in the region. This project is being funded under the Special SGSY scheme of the Government of India, Ministry of Rural Development (MRD). AV Farm groups, Pitchandikulam, Palmyra, AV Water Harvest, and others have independently been promoting several aspects of sustainable agriculture in the bio-region for long, a five year development plan has been made for the AV Farm group that will integrate all such efforts and the same is being pursued. Palmyra has proposed an independent sustainable agriculture based programme to the Ministry of Rural Development (MRD).

Auroville Village Action Group (AVAG)

The AVAG was started by Aurovilians, villagers and social workers, to build relation between communities by encouraging them to organize their lives, children's education and their villages. The village groups have rebuilt schools, run evening classes for young students, mended streets, repaired street taps, and helped raise the standard of collective living in some 50 villages around Auroville. These were done with the participation of the community members, including women and young people. The primary focus of AVAG is currently on women's empowerment and microfinance. Their other initiatives include, development of the dalit communities and developing strategies for sustainable community organization.

Pudhu Vaazhvu Project

Pudhu Vaazhvu project covers 15 districts, 70 blocks and 2432 panchayats in Tamil Nadu. The objective is to empower the poor by improving their livelihoods and reducing poverty by:
Developing, strengthening pro-poor local institutions at the village level.
Building the skills and capacities of the poor.
Enhancing their livelihoods by financing demand driven sub project investments.

The Project adopts community driven development approach involving village communities at every stage of project implementation. The Project activities aim at social mobilisation of the poor and the marginalised. The projects focus on livelihood promotion of target population, after strengthening the community organization through capacity building.

Nadukkuppam Environment education Center with solar powered sewage treatment system.
Image Credit: Joss, Pitchandikulam, Auroville

3.0 Regional Vision and Guiding Principles

The Puducherry- Viluppuram-Auroville- Cuddalore (PVAC) Regional Planning Framework is the region's first truly comprehensive planning initiative that includes multiple jurisdictions. Discussions regarding regional planning for Puducherry and Auroville have been ongoing at various levels, mostly driven by citizen groups, since 2006. These discussions attracted participation from concerned citizens, area institutions and government representatives from Puducherry, Tamil Nadu, and the Central Government, but the conversations were generally centered on Puducherry. However, what was unique in this planning framework was the success of the outreach efforts in engaging the support of the Tamil Nadu government officials and District Collectorates of Cuddalore and Viluppuram.

The planning process includes numerous opportunities for the public also to get involved in sharing their opinions about the region's current state and vision for a sustainable future. Building on prior local visioning efforts such as the Puducherry 2025 Vision Plan, the vision statements

were drafted by the INTACH and PondyCAN team. Community visions were then collected via surveys, interviews with key government officials, and focus group meetings. This chapter includes photographs of the PVAC region taken by the INTACH and PondyCAN team combined with quotes from residents and decision-makers of the region.

"The vision for Tamil Nadu for 2023 is to become India's most prosperous and progressive state with no poverty, and where its people enjoy all the basic services of a modern society and live in harmonious engagement with the environment and with the rest of the world."
- Vision Tamil Nadu 2023, Strategic Plan for Infrastructure Development in Tamil Nadu, Government of Tamil Nadu, March 2012

"By 2025, Puducherry will be an international destination for higher education, learning, and research; a best-in-class wellness, spiritual, and eco-tourism destination; a hub for high-end services and industries enabled by high-quality infrastructure, connectivity, and responsive governance; duly preserving its environment and heritage, and thereby emerging as a model, value-based society".
- Puducherry Vision 2025, CII and Sriram Charitable Trust

"We need a comprehensive plan that aims to promote economic, social and cultural development at the same time preserving and enhancing the natural and cultural resources of the region"
- Lata Iyer. Auroville Resident and PondyCAN Member

Building on the shared values of our region expressed in this vision, the Puducherry-Viluppuram-Auroville-Cuddalore Regional Planning Framework aims to:

"Establish a way forward for our unique and diverse communities to grow together as a single entity whilst promoting prosperity for all sections of society, enriching the quality of life, our culture, our heritage and our environment. It aims to be a model for the evolution of a new paradigm for development that is holistic, inclusive and balanced; and is hinged upon making responsible choices in our communities today without diminishing the quality of our life in the future."

Guiding Principles

The Puducherry- Viluppuram- Auroville- Cuddalore (PVAC) Regional Planning Framework is intended to serve as a guideline for promoting the harmonious development of our region's cities, towns, villages, and communities into the future. The Regional Planning Framework describes our desired vision to our assets- the land, forests, water bodies, coastal areas, built heritage, local values, practices and traditions- as a collective resource that have been handed down to us and that we must in turn hand down to our future generations. We must ensure that our chosen path for growth is prosperous without diminishing the quality of our lives in the future. How much we consume today will determine how much we have left for tomorrow.

In charting our region's advent into the next two decades, the following 7 guiding principles were established to direct growth towards creating a future that integrates the three pillars of sustainable development- economy vitality, social equity and ecologic integrity. These principles reflect the values and concerns of the community described by the residents and stakeholders during the series of surveys, interviews, workshops and focus group meetings conducted as part of the planning process.

1 ***Adopt a value-based integrated development model***

The region has the potential to develop a seamless continuum of self-sustaining urban and rural communities with distinct identities built on each community's system of values and its long-standing relationship with the physical, social, cultural, economic and spiritual environment, to achieve a high quality of life for all. The intent is to search for new development models that connect people with their place of living, working, and recreation.

2 ***Protect and enhance the region's natural environment***

Nurturing a healthy ecosystem at the bio-regional level will be given high priority in order to mitigate the negative consequences of local and global environmental impacts- including climate change and disasters- so that we are better geared in the future.

3 ***Encourage responsible resource consumption and strive to achieve high energy efficiency***

Executing a stakeholder driven regional energy resource planning process that will provide citizens with appropriate incentives and access to advanced technologies to adopt a lifestyle that minimizes excessive resource consumption and sensitizes the community on energy savings, recycling and renewable energy production and consumption aspects.

4 ***Develop an integrated multi-modal transportation system***

Through strategic investments that reflect regional priorities and carrying capacities of existing communities, the region will have a broad range of integrated transportation choices that are designed to provide convenient, clean, affordable, and safe linkages to well-defined regional destinations for all.

5 ***Manage and conserve the region's water resources through collaborative watershed based planning***

Restoration and protection of the water quality and ecological integrity will be pivotal in achieving sustainable development across the region. Future development- especially agriculture and industry- which may consume most of the water should be based on water availability, in case of water shortage less water intensive crops and less water intensive and industries should be promoted.

6 ***Strengthen the region's agricultural economy***

To address the decline of land based livelihoods, food insecurity and biodiversity loss from conversion of natural ecosystems, the region's agricultural resources will be reintegrated back into the local economy and the overall land use mix.

7 ***Develop a robust regional economy***

Building upon the principles of collaboration and cooperation as opposed to promoting competing interests and profit-driven decisions, the region will support an economic base that is based on the strengths of each community within the region. There will be high interdependence between the region's economic clusters such that the different activity centres- city, town, or village- complement each other. Intergovernmental coordination across political boundaries will be instrumental in marketing the region as a single entity to potential investors.

8 ***Instill a sense of community pride and active citizen participation***

In the next two decades, the region will provide residents with opportunities to be proud of their achievements and instill a sense of ownership in preserving and enhancing their quality of life. If as a region we are collectively able to do this, then we would have addressed the local issue of liveability through a new paradigm for development. The right choices can make all the difference — and that difference will last for decades.

The regional planning framework's preliminary analysis and recommendations are organized within four key themes- Land Use, Transportation, Water, and Energy. The analysis and recommendations presented in the following chapters reflect the vision, opportunities, challenges, and ideas shared by the community residents and stakeholder groups.

Each theme begins with an overview section with relevant community perceptions identified. This is followed by a brief discussion of the key challenges faced by the region as a whole and specific challenges related to issues in selected growth centres and rural areas. Suggested recommendations have been extracted from the feedback received during the working group sessions and previous planning efforts and projects that have been completed in the area. It should be noted that these recommendations are not meant to be exhaustive and should be further analyzed during subsequent phases. Recommendations are also accompanied by relevant case studies that could serve as a model in the search for a new development for our region. Finally, as mentioned above only four key themes have been discussed in detail in this report. Other integral themes such as Environment, Economy, Demography, Physical and Social Infrastructure, and Livelihoods will be addressed as part of ongoing efforts at various local, sub-regional, district or regional level as funding opportunities arise in the future.
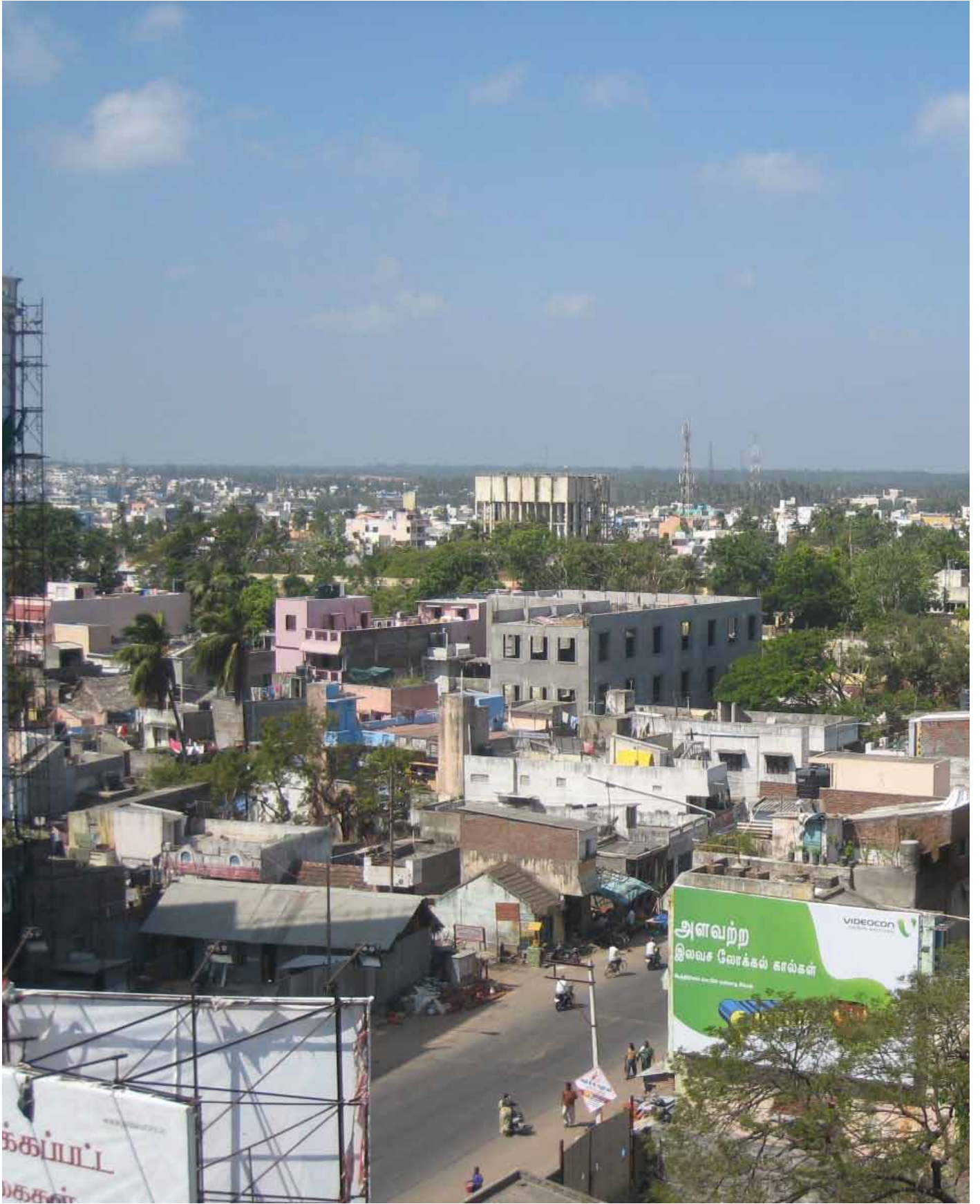
4.0 Land Use

Land is one of the most valuable but scarce natural resources that forms an integral part of the ecological fabric. It is a resource that represents the physical manifestation of human aspirations, activities and consumption behaviour. This resource is further constrained by multiple factors- environmental (soil, topography, water, climate, vegetation); political (ownership, boundaries); economic (development, population growth, productivity); social (livelihoods, religion, lifestyle).

This theme addresses the optimal utilization of land and its relationship with these diverse factors in achieving a sustainable development model. Achieving a high quality of life in terms of livability for all current and future residents is one of the primary goals of the PVAC Regional Planning Framework.

Current land use development patterns and decisions in the PVAC region are primarily economically driven, with limited or no consideration for ecological and social equity factors. In the last two decades, the PVAC region has witnessed an increase in new settlements burgeoning in the peri-urban and rural areas along the transportation corridors. This is partially driven by a simultaneous increase in the region's population.

During this time, much development occurred unevenly, resulting in an imbalance between where jobs are located and where people live. Other factors such as housing affordability, increased demand for cheaper land by industrial and institutional uses, and growing trends of developing gated communities catering to changing lifestyles of consumers have exacerbated the disparities in the region. As a result, a fragmented landscape has emerged in the region that is not accompanied by a simultaneous upgrading of the surrounding community's infrastructure capacity. This has a direct impact on the individual's quality of life (increased commuting time, reduced health and wellness) and the environment (deteriorating air quality, increase in carbon footprint, urban heat island effect, increase in waste generated).

Community Perceptions

Loss of agricultural land
• Inadequate agricultural facilities to sustain the agricultural activities
• Shift from agriculture to small scale businesses. Conversion of land agricultural uses to other uses

Encroachment on the natural ecosystem
• Over wetlands and water bodies, and the natural course of the canals
• Untreated industrial waste dumped in land and water

Environmental Issues
• Increased Sand Mining activities
• Low maintenance of the public beaches
• Lack of proper waste disposal strategies, both solid and liquid waste
• Industrial Pollution

Tourism
• Tourism is under developed
• Potential of Cuddalore, Viluppuram and other heritage structures remains unexplored

Enforcement, Regulation, Policies
• Master Plans need revision
• Need for stringent regulations to prevent conversion of designated land uses
• Protection of environmentally sensitive areas, in addition to the natural features

The intent of this study was to compile, analyze and document the land use changes and development patterns prevalent in the region. Through public consultations and visual analysis of historic land cover changes, several issues and opportunities were identified. Finally, one of the primary goals of the land use theme is to review established growth management models and test the application of these models in the Puducherry- Viluppuram- Auroville- Cuddalore region.

Land Use and Carrying Capacity

In Puducherry and Oulgaret Area,about 90 percent of the population is covered by the water supply network. In Puducherry city, only about 30 percent of the total population and about 28 percent of the city area is covered by the sewer system. The newer residential development is dependent on the septic tanks for waste water disposal. This water is ultimately drained into the soak pits or natural drains in the city, leading to poor hygienic conditions. (Wilbur Smith. 2007) The current infrastructure is unable to satisfy the needs of the existing population. With migration and rapid population growth, the stress on the existing infrastructure system is further increased.

It is now clear that in order to bridge the gap between urban and rural communities in our region and to limit migration of human capital from our rural areas, rural empowerment, decentralized planning and provision of adequate infrastructure is necessary. On the other hand, if we desire to maintain a decent quality of life in our urban growth centres, it is crucial that individuals and policy-makers first consider the regional implications of their choices. Second, an integrated carrying-capacity based development planning policy needs to be adopted and enforced at both the national and local levels. This type of development acknowledges the dependency on the ecosystem while respecting its limitations. The urban and rural areas need to perceived as a single continuous ecosystem in order to maintain the continuum and ensure the quality of life in both areas.

Provision of parks, playgrounds and public recreational spaces have been a low priority in the region. According to the Puducherry CDP(2007), only about 8% of the total Puducherry urban area was dedicated to the community's recreational needs. In Cuddalore(town) and Viluppuram (town), this designated recreational space is less than 2 percent of the total area. Tindivanam's (town) recreational uses are limited to cinema halls, wedding halls and hotels. Both Panruti and Tindivanam have negligible amount of recreational facilities for its citizens. Contemporary planning trends advocate reserving a minimum of 30% of recreational and public open space for urban areas.

"Carrying-capacity of a region, comprising its supportive and assimilative capacities, is defined as the ability to produce desired outputs from a constrained resource base to achieve a higher and more equitable quality of life. while maintaining: desired environmental quality, and ecological health."
Carrying-capacity as a basis for sustainable development- A case study of National Capital Region in India, P. Khanna*, P. Ram Babu, M. Suju George National Environmental Engineering Research Institute

In Puducherry city, only 30% of the total population and about 28% of the city area is covered by the sewer system
- Puducherry CDP (2007), Wilbur Smith

Land Use and Livelihood Opportunities

As discussed in the Regional Context section, the PVAC region landscape still retains a healthy mix of urban and rural agricultural areas. However, as shown in the land cover trend analysis, the agricultural lands are converting into non-agricultural uses at a rapid pace. In Puducherry District, the agricultural land reduced by 6.1 percent, while the land under non-agricultural uses increased by 7.6 percent in the period between 1995-96 to 1999-2000; and 2000-2001 to 2002-03. In Viluppuram District, the agricultural land use decreased by 3.6 percent, while the area under non-agricultural uses increased by 12.9 percent between the periods 2005-2006 and 2006-2007. The decline in agricultural uses has accelerated issues related to food scarcity in both urban and rural areas.

This has resulted in loss of land livelihoods for the rural population and resulted in large-scale migration to urban areas, such as Puducherry, Cuddalore, Viluppuram, and Tindivanam in search of employment opportunities and better social services. However, these urban centres have not been consciously planned to accommodate the growing influx of migrants from the surrounding rural areas. This results in a mismatch between land use allocation and available infrastructure service levels, thereby exerting pressure on the already aging and succumbing infrastructure, which in turn contributes to proliferation of slums and a glaring increase in urban poverty. Densification of urban areas is a solution to consume less land by building vertically; however it will be effective only if it is supported by coordinated investments in upgrading the carrying capacity of the existing infrastructure or locating densities where the capacities are sufficient.

Salt Works at Marakkanam
Image Credit: Joss, Pitchandikulam, Auroville

Land Use and Energy

It is now a well accepted fact that in order to exert less pressure on energy production, urban areas need to cut down on consumption and make behavioural changes. Minimizing energy use at the individual and community level will ultimately have a significant impact on the amount of energy produced in the long-term. Land use decisions and built environment design have a direct impact on the energy consumption behaviour and production of greenhouse gases. While energy demand, consumption, conservation and achieving energy efficiency are dependent on several factors- such as market forces, low tariffs, power generation policies at the national and state level- it is one of the most important indicators to measure sustainable development at the local level.

The Puducherry-Viluppuram-Auroville-Cuddalore region is blessed with abundant sunshine and wind, however, there is not a concerted effort at a regional or local level yet to capitalize on these resources to promote and develop renewable energy sources.

Some of the other key challenges in the PVAC region that contribute to the amount of greenhouse gas emissions as a result of inefficient land use development patterns include
• sprawl development leading to excessive transport energy consumption, more fuel consumption and larger carbon footprint leading to deforestation and urban heat island effect;
• inadequate infrastructure planning and rural development programmes in rural areas; high natural resource consumption and waste generation;
• and inefficiencies in building designs and between different land use sectors (industrial, residential, commercial, transportation) leading to high energy demand and consumption. In 2010-11, the industry sector accounts for more than 60% of all the electricity sold in Puducherry alone (Heavy industries have a share of 42%). The domestic sector accounts for 23.6% of all the electricity sold, followed by the commercial customers with a share of 6.4%.

Promoting compact communities with higher densities in the region's growth centres (Puducherry city, Cuddalore town, Viluppuram town, Tindivanam town), only when supported with adequate infrastructure services could be one of the solutions at the urban level to address the energy crisis issues. However, this needs to be supported by policies at the both the regional and local levels including: efficient transportation systems, preservation of open spaces and productive agricultural lands, setting renewable energy targets, bringing market transformation for energy efficiency appliances, and incorporating green building regulations in local zoning codes. Increasing general awareness about sustainable lifestyles among the residents, especially the urban rich, will also be a key factor in changing the energy demand.

Janmarg BRTS, Ahmedabad
Source- ITDP

Land Use and Transportation

It is now established that there is a strong correlation between transportation and land use patterns. However, as evident in most urban areas in both developed and developing economies, planning for transportation infrastructure has been focussed on automobiles even though the overall share of people using personal vehicles is significantly lower . From the surveys conducted in the PVAC region, it was observed that only about 13 percent of the respondents own a car and only a third of this, use it daily. Public transportation is not a popular choice of commute for work, about 60 percent of the respondents from the survey use a motorcycle to get to work. In Puducherry city alone, only 7% use public transportation, 40%of the population walk and about 15% cycle.

Repeatedly, unplanned decisions by local authorities in the region such as locating higher education institutions or employment centres on productive lands away from urban centres (along Cuddalore-Puducherry Road or ECR) or allowing construction of gated townships in the middle of agricultural areas have resulted in a disinvestment in public transportation systems and pedestrian infrastructure in city centres.

Public transportation is not a popular choice of commute for work- about 60% of the respondents surveyed use a motorcycle to get to work. In Puducherry city alone, only 7% use public transportation, 40% walk and about 15% cycle.

Case Study: RUrbanism

The concept of 'Sustainable RUrbanism' for Goa 2100, was introduced as part of the project proposal of the International Competition of Sustainable Urban Systems Design held by the International Gas Union and the National Organizing Committee of the 22nd World Gas Conference. (Proposals for SUSD. 2003. p. 012)

RUrbanism is a 100 year development strategy for the region of Greater Panjim, that is experiencing the negative impacts of sprawl, migration and poverty. Several smaller sustainable nuclei are developed away from the core. These nuclei are interlinked to their surrounding ecosystems and its people and culture; and networked to other viable urban cells to form a living and developing tissues.

RUrbanism nuclei:
- are efficient, adaptive and low-stress infrastructure.
- are developed based on resource availability with pedestrian mobility and a shared neighbourhood cultural identity
- are semi-open with well-defined physical and governance boundaries
- prevent uncontrolled growth but allowing replication
- can support a population of 10,000 to 30,000
- are a contributor to the whole
- reduce dependency on the rural environment
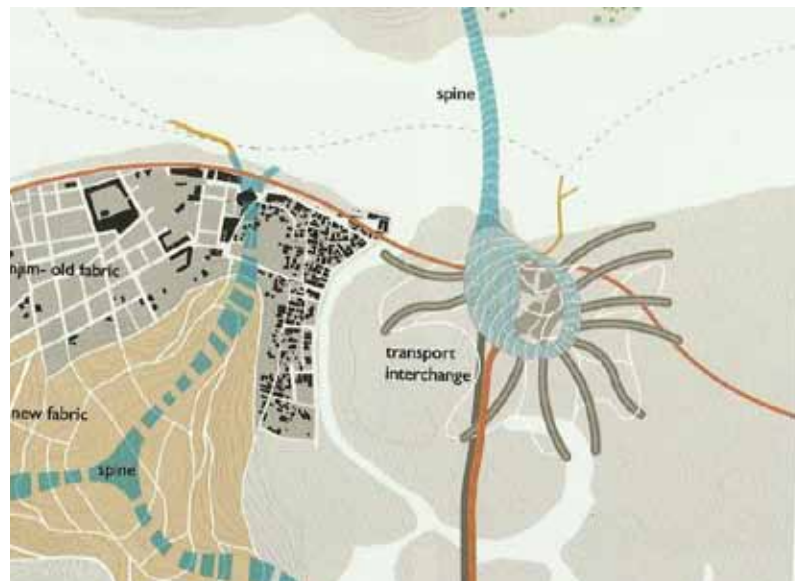
'RUrbanism is the central challenge of sustainable urbanism in India. This new urbanism values human time and meaningful work, reduces poverty and deprivation, redefines consumption and shrinks ecological footprints- by balancing relationships between natural, physical, financial and human capital in a way that frees human time to create economic wealth, well-being and culture.'(p.202)

Source: Proposals for the International Competition of Sustainable Urban system Design (SUSD)- Report of the International Gas Union Special Project. 22nd World Gas Conference Tokyo 2003

## Case Study: Smart Growth/ New Urbanism

"Smart growth development practices support national environmental goals by preserving open spaces and parkland and protecting critical habitat; improving transportation choices, including walking, bicycling, and transit, which reduces emissions from automobiles; promoting brown field redevelopment; and reducing impervious cover, which improves water quality."

The 10 principles of Smart Growth as identified by the EPA are:
1. Mix land uses
2. Take advantage of compact building design
3. Create housing opportunities and choices for a range of household types, family size and incomes
4. Create Walkable neighbourhoods
5. Foster distinctive, attractive communities with a strong sense of place
6. Preserve open space, farmland, natural beauty, and critical environmental areas
7. Reinvest in and strengthen existing communities and achieve more balanced regional development
8. Provide a variety of transportation choices
9. Make development decisions predictable, fair and cost-effective
10. Encourage citizen and stakeholder participation in development decisions
Source: <http://www.newurbanism.org/newurbanism/smartgrowth.html>
Smart Growth is a land use and transportation model that promotes sustainable development. According to the Environmental Protection Agency (EPA),
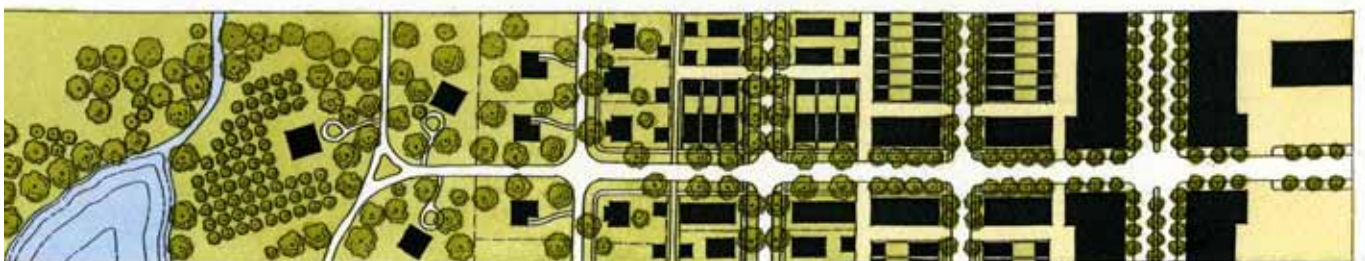
An idealized New Urbanist transect as proposed by the Center for Applied Transect Studies
Source- http://www.transect.org/index.html

Case Study: Transect-based Model

The transect model developed by Andres Duany and DPZ (Duany Plater-Zyberk & Company), is a categorization system that organizes all elements of the urban environment on a scale from rural to urban. The Rural- Urban Transect is divided in six Transect Zones, which vary by the level and intensity of their physical and social character, providing immersive contexts from rural to urban. One of the principles of Transect-based planning is that certain forms and elements belong in certain environments. The Transect is evident in two ways. Zones and communities (1) exist as characteristic places on the Transect and (2) they evolve along the Transect over time. This is a growth process analogous to succession in natural environments.

The six zones are:
*   T-1 Natural Zone: unsuited for settlement due to topography, hydrology or vegetation.
*   T-2 Rural Zone : sparsely settled lands in open or cultivated state.
*   T-3 Sub-Urban Zone: consists of low density residential areas, adjacent to higher zones that some mixed use.
*   T-4 General Urban Zone: consists of a mixed use but primarily residential urban fabric.
*   T-5 Urban Center Zone: consists of higher density mixed use buildings that accommodate retail, offices, rowhouses and apartments.
*   T-6 Urban Core Zone: consists of the highest density and height, with the greatest variety of uses, and civic buildings of regional importance. Typically only large towns and cities have an Urban Core Zone.

Special District: consist of areas with buildings that by their Function, Disposition, or Configuration cannot, or should not, conform to one or more of the six normative Transect Zones

This transect model can be applied to the zoning maps, to regulate development in a sustainable fashion while keeping the continuum and maintaining the character of the urban and rural areas.

Source- Smart Code V 9.2 <http://www.transect.org/codes.html>; < http://bettercities.net/article/transect-applied-regional-plans >

A TYPICAL RURAL-URBAN TRANSECT, WITH TRANSECT ZONES

Land Use and Environment

The PVAC region is losing wetlands, water bodies and forest areas due to the insensitive built up area encroachment over these areas. Currently, Puducherry Urban Area has no record of dense forests (Wilbur Smith. 2007) with the exception of the Swadeshi mills complex. In Viluppuram district the total area under forests is less than 10 percent. Overall, the area under forests is depleting. Lack of effective enforcement mechanisms has resulted in this unchecked encroachment over environmentally sensitive lands. The existing regulations have failed to control the exploitation of ground water resources for industrial uses. Also the industrial activities have resulted in environmental pollution. The Pichavaram forest in Cuddalore district and Pitchandikulam reserve in Auroville are the major forest reserves in the region.

In the SIPCOT industrial area (Cuddalore), over 20,000 people from over 20 villages are affected by the toxic chemical compounds that are manufactured or released into the environment . The citizens have complained of health related issues due to the contamination of the water, air and soil. The effluents have also contaminated the river bodies and depleted marine life. The industries have drastically reduced the ground water levels, which in turn has altered the cropping patterns and its productivity. As a result, the farmer's livelihood is affected due to low income generated. The industrial development has repercussions on the ecosystem, due to the lack of stringent regulation on its operation, management and waste disposal. (http://www.sipcotcuddalore.com/News_Frontline_TheHindu_040605.html)

At the domestic level, waste water is drained out in the open lands or in the drains. The solid waste is also disposed on open/ vacant lands. In Puducherry city, only 30 percentage of the total area is covered by the sewerage system.

The land use activities in the watershed disrupt the natural movement of water. These changes may include increased surface run off, decreased infiltration in the groundwater and increased movement of pollutants in the water. A Water shed based planning is required to prioritize the protection, management and the shared use of the water resources without altering the watershed through development activities.

Proposed Growth Management Model

Based on the feedback received during the workshops and review of case studies of various regional growth models around the world, the framework includes a conceptual development model to manage future growth in the PVAC region. The model includes the preliminary application of three key concepts- Urban Growth Boundary, Complete Communities, and Rural Ecosystem Greenbelts.
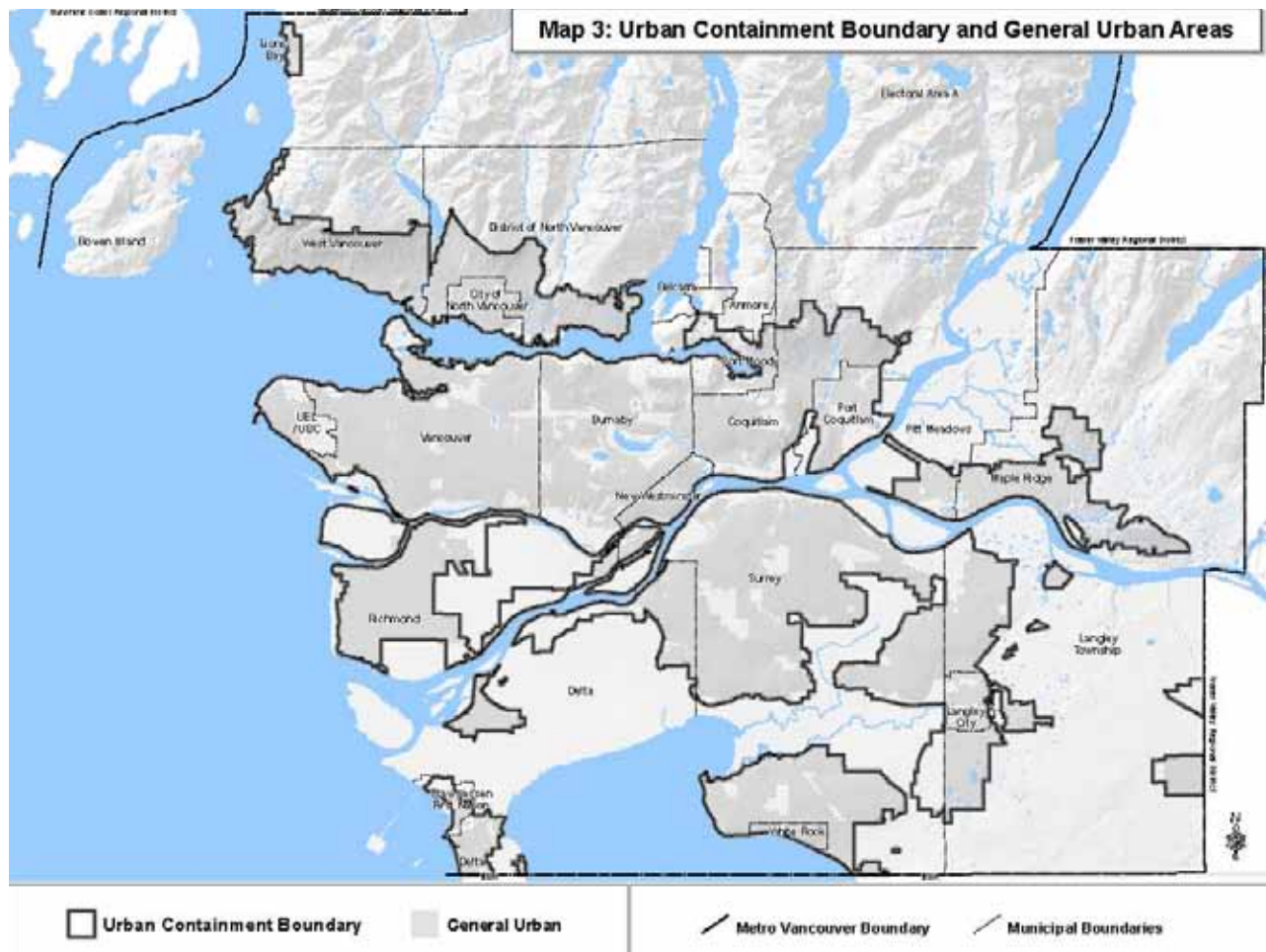
Urban Growth Boundary

Urban Growth boundary, or UGB, is a concept that has its roots in the Portland metropolitan region in Oregon, United States. The concept essentially involves demarcating a boundary around an existing growth centre to curtail unplanned or uncontrolled conversion of agricultural lands and open spaces by developers in search of cheaper land. The boundary delineation is based on factors such as available agricultural lands and vacant land, existing and proposed infrastructure capacities, population growth projections, other environmental and economic factors. It should be noted that these boundaries are not permanent and need to be regularly redefined in coordination with the local master plans and development plans of individual property owners. Limiting urban development in a compact footprint will promote integrated land use- transportation- infrastructure planning and strengthen land livelihoods for the surrounding rural areas.

Within the PVAC region, a similar exercise should be initiated around the major growth centres of Tindivanam, Viluppuram, Panruti, Cuddalore, Puducherry, and Auroville. While Auroville is not a town or growth centre, it's interaction with the immediate bio-region and villages through the planned greenbelt, and the vision to design a city for 50,000 residents provide a unique laboratory to test this concept at the local level within a controlled regulatory environment. A pilot project is underway with the Auroville Town Development Council (TDC) to conduct a land use growth study for the immediate area surrounding Auroville, encompassing an area of approximately 50 sq.kms. A preliminary analysis of existing land cover in the region, through GIS remote sensing data, indicates that a range of 100 sq.kms. (for smaller growth centres such as Tindivanam and Panruti) to about 200 sq. kms. (for larger centres such as Puducherry and Cuddalore) could serve as an optimal growth area that should be for further research. These regional centres need to be connected with efficient inter-city transportation connections to make the concept of growth boundaries successful. Disadvantages of the urban growth boundary model include high property values in the growth centres due to shortage of land.

Urban Containment Boundary

Urban Containment Boundary is a strategy for addressing one of Metro Vancouver's primary goals of creating a Compact Urban Development as part of their Regional Growth Strategy for 2040. It is an attempt to delineate urban and non-urban areas to prevent sprawling urban development to consume the natural landscape, necessitate costly and inefficient urban infrastructure and adds to the global problems of greenhouse gases, peak oil and climate change. It is crucial to ensure structured growth within these boundaries and that the urban centres are well served by transit and road network. Several such urban centers in the region collectively make an important contribution to providing locations for employment and convenient access to shops and services close to home.

Source: Metro Vancouver. 2010 <www.metrovancouver.org>

Map 3: Urban Containment Boundary and General Urban Areas

Compact Growth Centres modelled on the "Complete Communities" concept

The concept of designating an urban growth boundary relies heavily on the success of developing compact "complete communities" that support higher densities for a diverse mix of uses with adequate infrastructure, easily accessed through multimodal transportation facilities.

"Complete communities are walkable, mixed use, transit-oriented communities where people can: find an appropriate place to live at all stages of their lives, earn a living, access the services they need, and enjoy social, cultural, educational and recreational pursuits." (Metro Vancouver 2040, Shaping Our Future, September 30, 2010).

Unlike urban areas in the west, most Indian cities have traditionally been designed as mixed-use communities with residential and commercial uses located in close proximity to each other. However, what lacks is the supporting infrastructure and public amenities necessary to support the densities. Complete communities are designed to provide a mixed-use pedestrian-oriented environment within a typical 2000 feet walking distance from a transportation node. Each growth centre identified in this planning framework has a unique role to play in the overall development of the regional vision, and this needs to be defined working collaboratively with the larger community. For example, Tindivanam and Viluppuram towns are important transit junctions within the larger region; therefore, future development within these centres could potentially be focussed around transportation oriented development patterns. On the other hand, Cuddalore town is emerging as an important regional industrial centre with a concentration of industries, small port, and large tracts of undeveloped land in close proximity to serene beaches. Puducherry, as the major urban centre in the region, assumes the role of an international tourist destination that has the potential to set a precedent in setting the trend for other small towns and cities in India as a model that successfully integrates heritage-based sustainable development with a strong social infrastructure system.
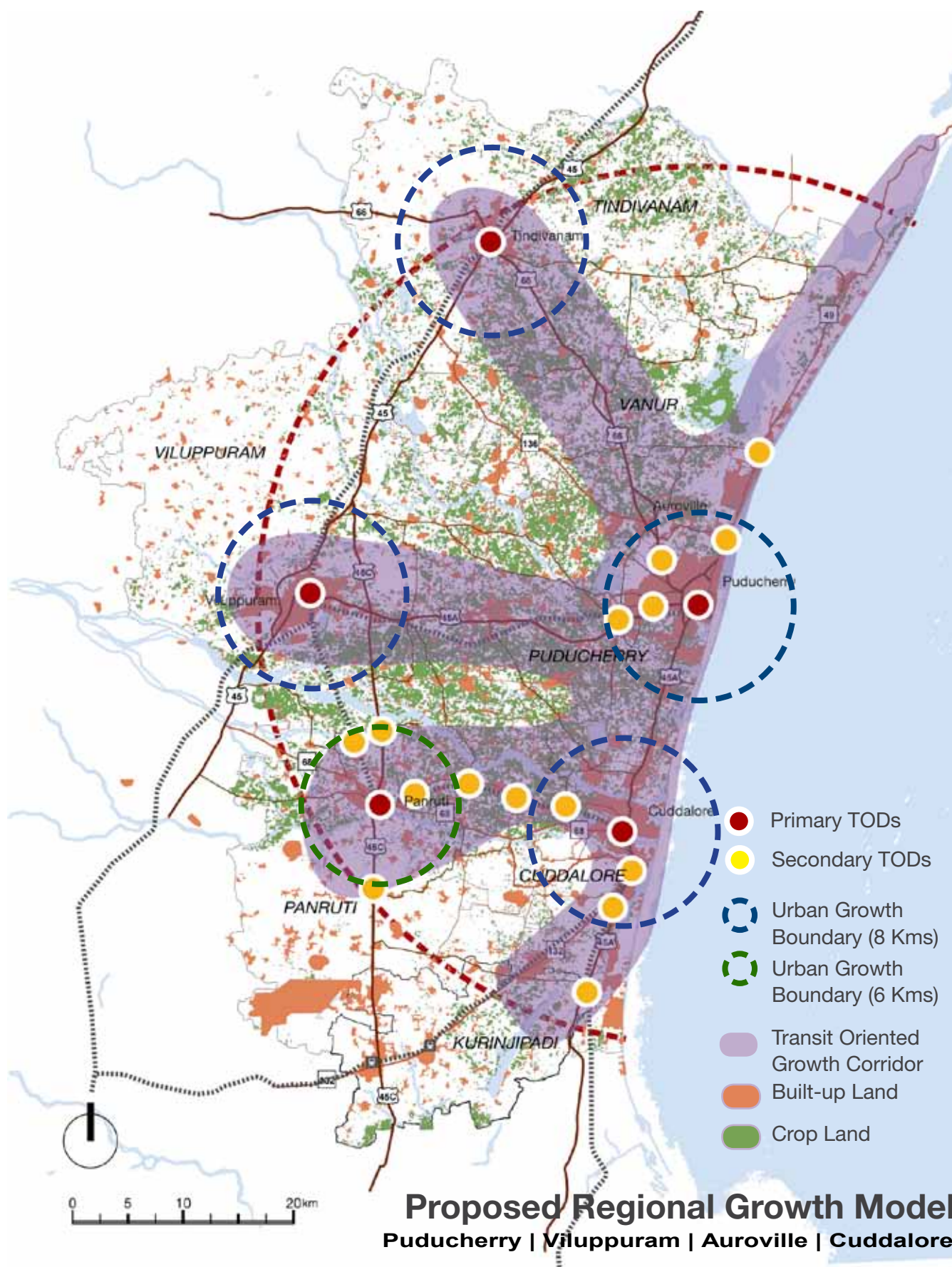
Juan Amarillo in Bogota, Colombia is a 35 km long greenway which was opted over the proposal to create 8 lane highway along an existing creek. The greenway connects peripheral economically weaker areas to the city with good barrier free designs. It also extends into the rural hinterlands as a leisure trail for nature lovers. Source- Institute for Transportation and Development Policy

Integrated Rural Ecosystem Greenways

As a buffer to the development and human activities, between the designated urban growth boundaries, connecting greenbelt areas may be identified that serve as buffers and linkages between the growth centres. These greenbelts will serve as the "lungs" of the region serving multiple functions: protecting the region's bio-diversity; preserving the region's threatened wetlands, water bodies; serving as research laboratories for promoting sustainable agricultural practices; developing much-needed recreational facilities for the region; reimagining the role of culture and tradition within the rural fabric; and operating as carriers of best practices in green infrastructure systems. Working with governmental entities and landowners, public land ownership within these rural greenbelts will be encouraged to provide greater public access and implement environmental management best practices. The character of these greenway systems should be flexible depending on the existing villages and settlements it transects. Mechanisms such as Transfer of Development Rights and Conservation easements are some of the strategies that could be used to implement these greenbelt systems that will protect the development of farmland and forest uses in rural areas.

Proposed Regional Growth Model
Puducherry | Viluppuram | Auroville | Cuddalore

Legend:
- Primary TODs
- Secondary TODs
- Urban Growth Boundary (8 Kms)
- Urban Growth Boundary (6 Kms)
- Transit Oriented Growth Corridor
- Built-up Land
- Crop Land

0 5 10 20km

Land Use and Governance

The PVAC Regional Planning Framework process is the first attempt to integrate the various government sectors that function in isolation from each other. Land use decisions are primarily driven at the local level by political leaders, elected officials, government departments, private developers, and individuals. Developing a coordinated regional land use development decision-making support mechanism should encourage local authorities to consider regional implications in their choices. The foundation of developing sustainable communities is the local master plans (district, municipality, and village levels), building bye-laws, and trained decision-makers supported by a team of professional urban planners. It is important that intensive public consultations are conducted at a regular basis to arrive at solutions that are citizen-driven and not through a top-down process. Local land use planning should be formulated with concerned departments relating to transportation, water, agriculture, tourism, power and renewable energy, environment.

Puducherry
- Non-Contiguous land
- Government owns only 2% of land in the city
- Rapid Urbanization adding pressure on the existing infrastructure
- Saturation/ Unavailability of land for further development
- Bahour lake unused for recreational purposes
- Congestion due to poor urban planning
- Challenges in preserving environmentally sensitive areas
- Issues of preserving and maintaining heritage areas

Viluppuram
- Lack of strict enforcement of building regulations
- Over 70% of the Viluppuram Municipality is earmarked for development
- Residential developments along the access road to Viluppuram

Cuddalore
- Fisheries and production of sea products along the Cuddalore Coast remains undeveloped
- Currently only 17 percent of the land is under use in the Cuddalore Municipality.
- The physical gap between the Old Town and New Town is rapidly developing and filling up in a
- haphazard manner.
- Cuddalore Port: No policies for port development although it has the potential to create more
- employment opportunities.

Tindivanam
- No designated bus station resulting in traffic jams and congestion
- Insufficient infrastructure developments

Goals

- Maintain urban-rural continuum to reduce regional disparities
- Promote integrated carrying-capacity based development planning, especially within an environmental context
- Address negative impacts of urban sprawl at the regional and bio-regional level
- Redevelop existing growth centres with integrated land use and transportation policies
- Strengthen rural livelihoods in the region by identifying unique assets of the diverse rural areas and providing adequate infrastructure facilities
- Promote intergovernmental and interdepartmental coordination and capacity building of decision- makers and government staff at the local level
- Strive to create an ongoing programme for training, advocacy and community outreach efforts

Preliminary Recommendations

Policy and Enforcement

- Work with the Ministry of Urban Development (GOI), and the Tamil Nadu and Puducherry state governments to jointly appoint a regional planning steering group to continue with further research into the conceptual recommendations identified during this process
- Update Master Plans at town and panchayat level to regulate growth in alignment with the region's vision
- Emphasize the role of local planning authorities to improve enforcement of regulations.
- Prepare annual assessments of the region's growth needs, working in close collaboration with decision makers and trained urban planners
- Develop benchmarks and set targets based on evaluation of existing conditions to measure success
- Create policies that require infrastructure and environmental impact assessment for all new developments in the region
- Encourage public-private partnerships to ensure provision of basic amenities such as quality education and infrastructure

Physical Interventions

1. Research and explore alternative regional land use development alternatives to improve the quality of life at both the rural and urban levels. Some strategies that need further research include:
   - Establish an Urban Growth Boundary around the major growth centres with respect to the region's productive agricultural lands and major employment centres
   - Delineate regional greenway buffer systems that are designed as recreational corridors as well as carriers of green infrastructure
   - Identify growth centres at district levels and developing redevelopment master plans in collaboration with local planning authorities
   - Prepare integrated rural integrated development plans at the bio-region level
   - Implement pilot projects to test the applicability of the Ministry of Rural Development's PURA scheme (Provision Urban Amenities for Rural Areas)
   - Initiate future development scenario modelling exercises

2. Develop a consolidated regional GIS database to enable researchers, local authorities, and citizens to access information, conduct, and disseminate realistic programmes and priorities
3. Conduct detailed existing land use surveys at the village level employing participatory mapping exercises and training for women, school children, youth, and other interested individuals
4. Capitalise on the region's tourism potential to accelerate infrastructure development projects, in collaboration with the private sector
5. Identify key pilot projects and implement these projects to accelerate the momentum generated by this process. Some of the immediate land use related pilot project ideas that were discussed during the stakeholder workshops include:
   - Regional Natural Resources Significance Mapping
   - Regional Tourism Strategy
   - Auroville Bio-Region Integrated Land Use Strategy
   - Cuddalore Town Centre Redevelopment Master Plan
   - Cuddalore District Heritage Revitalization Strategy
   - Kaliveli Bio-region Development Framework

Awareness and Community Participation

1. Engage citizens at the neighbourhood and village level to develop local area functional plans
2. Conduct training programmes for government and non-government staff for visioning, community participation, plan formulation, mapping and employing sustainable development practices in the various development sectors
3. Work with citizens, regional industries and administrators to create a regional task force, similar to the experience of the Bangalore Agenda Task Force. The intent is to collaborate to identify, formulate and implement short-term projects that instill a sense of confidence and pride in the area residents
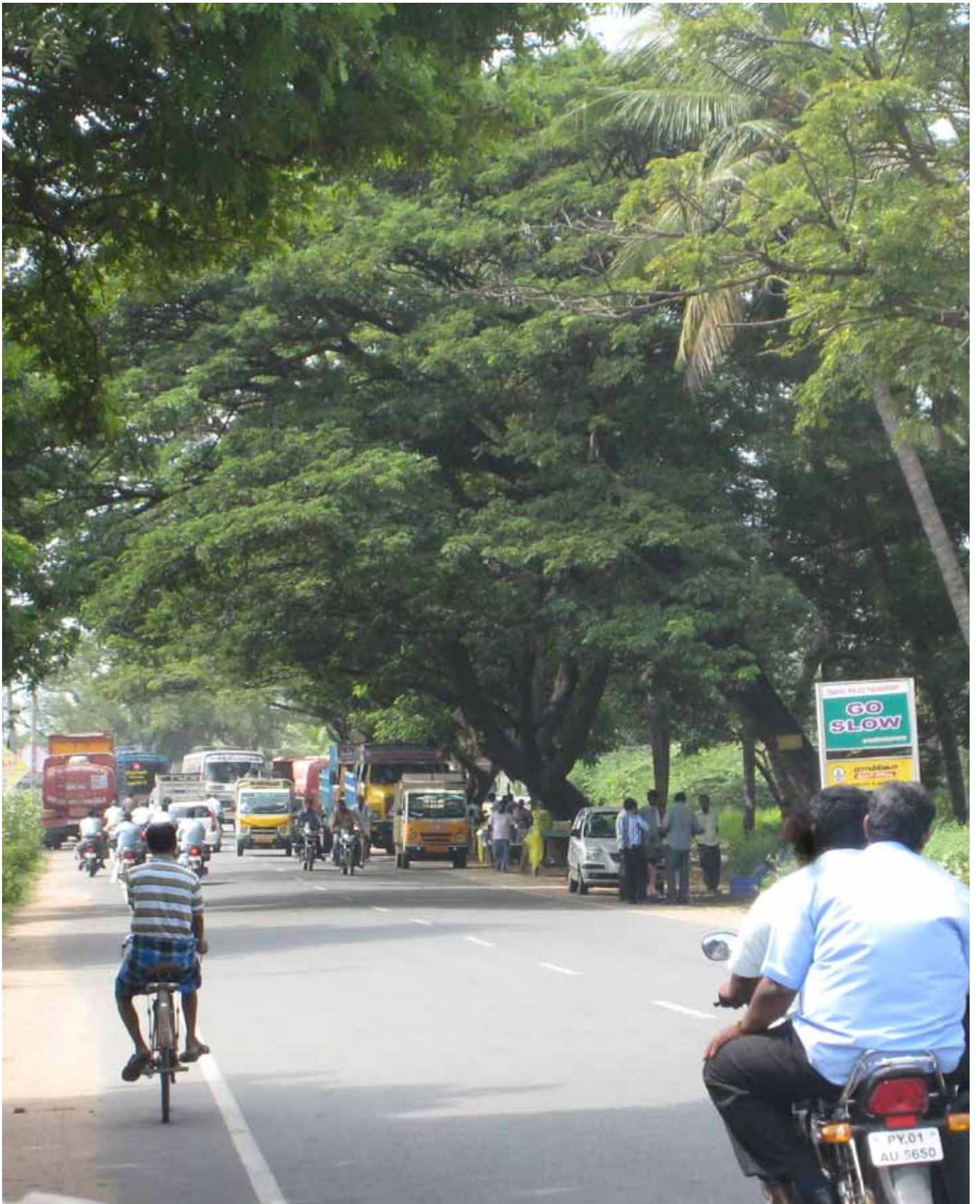
5.0 Transportation

Transportation systems shape a region's growth and prosperity by supporting development. Optimized mobility accelerates economic development, brings in additional investments and influences the range, location of activities and goods and services that are available for consumption.

The Puducherry- Viluppuram- Auroville- Cuddalore region stands at a crossroad in its history and development with the potential to become a prime region that offers its people immense benefits in the form of jobs, opportunities and a superior quality of life. For this opportunity to become a reality, the PVAC region will have to identify transportation strategies and must demonstrate a commitment to maintain and expand its transportation choices in a sustainable manner. Infrastructure investments in this sector should be guided by the ideal of ensuring the highest returns not just in financial terms but also in terms of an improved quality of life for its entire people.

Most indicators of quality of life such as education, health care and standard of living improve as cities grow and become prosperous. Ironically, mobility is one indicator that can deteriorate with prosperity depending on the collective mobility choices. This is because as cities grow, the mobility needs of its people grow. Inadequate options for comfortable and high speed transportation lead to an increase in the dependency on personal vehicles. This increase in private vehicles, while improving individual comfort and mobility, only increases congestion and pollution, thereby diminishing the quality of life on the long run.

The transportation strategies must therefore focus on our key transportation needs-
- handling increasing travel demand
- optimizing the speed, safety, reliability and comfort across various modes
- managing the flow of goods across the region and
- increase the ease of accessibility to all sections of the population while consuming less energy and contributing to a clean environment.

Transportation and Livelihoods

The unequal distribution of amenities and employment opportunities across the PVAC region results in increased travel between the growth centres and particularly to and from Puducherry. Additionally, low-density development spread horizontally along the national and state highways in the PVAC region tends to increase commute distances which directly affect the livelihoods of people in terms of the increased cost of travel.

There are other hidden costs included as well such as travel time cost and congestion cost. Travel time is one of the largest costs of transportation, and travel time savings are often the primary justification for transportation infrastructure improvements. Studies indicate that travel time costs tend to be higher when driving under congested conditions or for passengers on crowded public transport and lower for a comfortable passenger. Also, travel time costs per minute tend to increase for longer commutes (more than about 20 minutes). Walking and cycling can have positive values under pleasant conditions but under unpleasant conditions such as when moving along a busy highway or waiting for a bus in an area that is chaotic and unsafe, the time spent walking, cycling and waiting for transportation costs two or three times higher than the time spent travelling itself. Likewise, congestion costs consist of the incremental delay, stress, vehicle operating costs and pollution that results from each additional vehicle added to the traffic stream.

The combination of large travel distances and fewer, efficient transportation choices, makes the overall transportation costs high and accessibility to social infrastructure, jobs and other social needs within the region difficult. Prioritizing high speed transit and dedicated facilities for cycling and walking can shrink the commute distances and bring down the overall transportation costs in the PVAC region. The provision of such transportation facilities also addresses another dimension of the transportation and livelihoods debate which is the informal economy that thrives in and around transit nodes specifically in Viluppuram and Tindivanam. Upgrading the transportation facilities to multi-modal mobility hubs will ensure a better environment for both the local businesses and vendors as well as the shoppers who can now choose to pick up their daily needs during their commute time as opposed to making an additional trip for the same. This is bound to improve the livelihoods of the people of the region by fostering a more robust local economy centred around multi-modal mobility hubs.
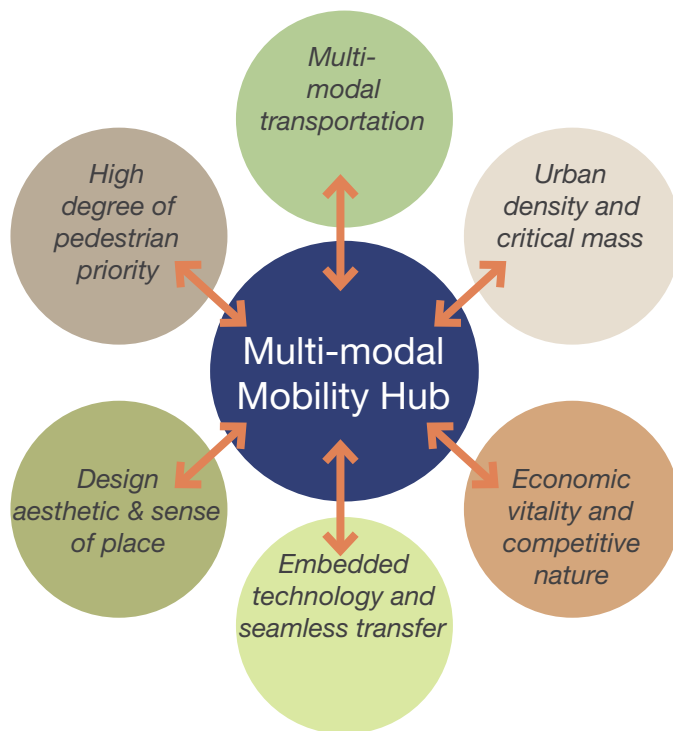
Multi-modal mobility hubs

A multi-modal mobility hub is a place of connectivity, where different modes of movement, from walking to high speed rail, come together seamlessly. It is a place in the city where there is an attractive, intensive concentration of employment, living, shopping and leisure activity around a transit interchange. A mobility hub is easily accessible for those who begin or end their trip on foot or bicycles. It is a place where the passenger is a coveted consumer, with choices about how he or she moves around the city.

Transportation and Land Use

The transportation plans should promote an urban form that best suits the geographical constraints of its location and also supports the key social and economic activities of its residents
-MoUD, 2008

Densely populated regions, if planned appropriately, have smaller carbon footprints per person than less dense areas, which tend to involve higher travel times and thereby higher consumption of energy. Such low density areas also work against investment in more sustainable transportation system because the density of these areas will not match the transit capacity. In addition to not being well-suited to transit, low-density development also consumes a lot of land as it tends to spread itself horizontally. The land use developments in the PVAC region too show a similar trend. Therefore it is essential to match the density of the existing developments to the capacity of transportation systems and vice versa in order to achieve a more balanced transportation system which is essential to the sustainable use of land in the region.

More specifically, development along the East Coast road needs to be controlled to allow only low-intensity, environmentally-friendly development for various reasons including the fact that the ground water levels along the coast cannot meet up to the demand created by such increasing development. New development can be located along The NH45 can be explored instead as a new corridor for development by upgrading it to accommodate high speed transportation systems such as Electric Multiple Units (EMU) or the Bus Rapid Transit (BRT) system.

The Electric Multiple Unit (EMU) is a multiple unit train consisting of self-propelled carriages, using electricity as the motive power. EMUs have been employed as part of the commuter rail system operating in Chennai since 1931 to connect the suburbs of Chennai to its centre. The total system spans around 900 km and has spurred rapid and dense development along the rail corridor.

Typical development that comes up abutting National and State Highways

BRT can be defined as a high quality bus based rapid transit system that delivers fast, comfortable and cost-effective mobility through the provision of segregated right-of way infrastructure, frequency of service and effective marketing with consumer service. The Janmarg BRT system that was launched in Ahmedabad, Gujarat in 2009 is a successful model that demonstrates transit oriented development centred around the BRT stations. Such models of development reduce travel time and congestion significantly and also lead to increase in property values from better urban form coupled with amenities within a 2km radius.

'The right to have access to every building in the city by private motor car in an age when everyone possesses such a vehicle is actually the right to destroy the city'
Lewis Mumford, Historian, 1895-1990

LONDON, UK
Paddington Basin is one example of how major railway stations have been redeveloped as opportunity areas for higher densification and a wider mix of uses.

Image source: Changing Course in Urban Transport- An Illustrated Guide by Robin Hickman, Paul Fremer, Manfred Breithaupt, Sharad Saxena; Asian Development Bank, Deutsche Gesellschaft für Internationale Zusammenarbeit, 2011

Transportation and Energy consumption

The current trend of increasing private vehicle users indicates higher energy consumption patterns per person. This results in higher green house gas emissions as well as noise and air pollution. This considerably decreases the quality of air we breathe and in turn affects the health of the people.

A survey that was conducted as part of the study for this report observed that if the fuel cost was doubled, 45% people will look for more fuel efficient vehicles and 27% people will switch to public transport. 10% said they will walk and cycle more. However, not many will switch to smaller vehicles (3%), or move closer to work or share a ride if the fuel cost doubles. The study also identify that the electric scooters and vehicles have not gained popularity within the region as yet.

Green house gases contribute to climate change and its effects, such as drought, floods, rising sea levels and more frequent incidents of extreme weather. Such climatic instability, in turn interferes with day-to-day operations. Transforming how we travel within the PVAC region needs to be acknowledged as part of the solution to curbing climate change.

The costs of fuelling private vehicles will also become increasingly unsustainable. Regions that are centred on private vehicles will be more adversely affected by rising fuel costs than those with more balanced transportation systems. Providing more energy efficient mobility choices also reduces our dependency on non-renewable sources of energy.

Transportation and Public Health

The World Health Organization predicts that there will be 2.3 billion overweight adults in the world by 2015 and more than 700 million of them will be obese. Our travel choices contribute to our susceptibility to this major health risk. One study found that each hour spent in a car on a daily basis is associated with a six per cent increase in the likelihood of obesity. In contrast, every kilometre walked per day was associated with a 4.8 per cent reduction in the likelihood of obesity.
Emissions from motor vehicles also have impacts on respiratory, cardiovascular and skin related ailments.

In the interest of ensuring health benefits to the people of the PVAC region it is therefore essential to create awareness and advocate walking and cycling as more healthier choices for mobility. More importantly prioritizing pedestrian and cycling facilities in the infrastructure budgets and upgrading these facilities will make them a more desirable choice for the people of the PVAC region. Achieving this will indeed help to set a precedent for other regional planning efforts to follow in the country.

SEVILLE, SPAIN
The city illustrates how sustainable modes can be supported by a compact urban structure. Many people live and work in the center, with excellent conditions for walking, cycling, and public transport.

Source: Changing Course in Urban Transport- An Illustrated Guide by Robin Hickman, Paul Fremer, Manfred Breithaupt, Sharad Saxena; Asian Development Bank, Deutsche Gesellschaft für Internationale Zusammenarbeit, 2011

Transportation and Governance

The Ministry of Urban Development (2008), has identified that transportation networks work better when there is a seamless travel between the different systems. This allows better connectivity between road, rail, waterways and airways across the region, and reduces the time of travel and improves efficient movement within a larger region. This needs coordination between the various government bodies in charge of the transportation development, both within the state and in-between the states. In addition to this the land use developments need to be coordinated at a regional level to support this seamless transportation network. A regional transportation plan, which is consistent with the needs of the society, needs to be reflected at both the local and regional level plans.

Three primary tools that, if made mandatory through statutory process, can help achieve these goals within the PVAC region are-

Comprehensive Mobility plan (CMP)

A Comprehensive Mobility plan is a long term strategic document which provides the vision and goals to achieve the desirable mobility pattern for the city's populace in a sustainable and cost effective manner.

The National Urban Transport Policy (NUTP) calls for ensuring safe, affordable, fast, comfortable, reliable and sustainable mobility to any urban population. It seeks to incorporate urban transportation needs at the urban planning stage rather than being a consequential requirement. It also advocates the integration of land use and transport planning in cities to minimise travel distances as well as the increased use of public transport and non-motorised modes for travel.

In other words, the NUTP advocates a multi-pronged approach woven around-
• Integrated land use and transport planning,
• Equitable allocation of road space with priority to pedestrians and cyclists
• Priority to use of public transport as well as intermediate public transport/ para-transit
• Quality & pricing of public transport and para-transit
• Smooth movement of freight traffic
• Use of cleaner technology
• Parking management

- Changing behaviour and travel habits
- Innovative financing mechanism
- Public Private Partnerships and enlisting public cooperation

The NUTP recommends that Comprehensive Mobility plans be prepared for all urban areas towards its cause, the main features of which include-
- To optimise mobility of people and goods rather than vehicles
- To improve and promote public transport system
- To focus on non-motorised vehicles and pedestrians
- To act an effective platform for integrating land use and transport planning

Comprehensive Mobility plans are to take cognizance of existing plans and studies such as City Development plans, master plan and transport studies.

Regional Non-motorized transit (NMT) Framework plans

A Regional Non-motorized transit (NMT) framework plan is a long-range, multi-jurisdictional plan which envisions a network of trails and greenways across the PVAC region meant exclusively for pedestrians and cyclists. The plan will include conceptual alignments for trails and greenways along the many streams and water bodies that abound in the region.

The plan will be used extensively by local governments, trail users and environmental agencies/ organizations as a framework and guide for making connections between towns and cities in the PVAC region and as a consideration in major infrastructure investment decisions.

Station Area plans

Station Area Plans is a local area planning tool which should be used for implementation of spatial plans and transport networks around public transport stations.

Each station area plan may cover a walking distance of 400 m radius or an administrative unit. Like the Town Planning Scheme mechanism, the Station Area plans should be a statutory provision to define:

• Land use changes
• Circulation and connectivity improvements in street network
• Mandatory provision of affordable housing
• Supportive parking policies

The Local body planning cells in the PVAC region should work on creating station area plans around its transit nodes. Each station area should be defined and mapped based on the stipulated radius of 400m walking distance from the station exit. Under this programme, guidelines should be set for development around all station areas. Decisions about the permitted land uses and densities should be made based on the specific needs of each station area in each growth centre.

The components of the Station Area Plan should address the following-
•   Maximize ridership through appropriate development
•   Generate meaningful community involvement
•   Design streets for all users
•   Create opportunities for affordable and accessible living
•   Make great public spaces
•   Manage parking effectively
•   Capture the value of transit for financing infrastructure and affordable housing
•   Maximize neighbourhood and station connectivity
•   Ensure proper implementation
•   Evaluate efficiency

The Station Area plan also includes the design of all public transport nodes/ mobility hubs and their seamless interface with the immediate vicinity with particular focus on pedestrian and cyclist facilities. The respective public transport agency will be responsible for design of station areas.

Goals for Transportion

- *Accessibility*

  Maximize mobility and access to opportunities for all residents of the region

- *Place making*

  Creating high quality public realms in existing towns and cities through an integrated approach to transportation and land use planning

- *Public health*

  Facilitate healthy active living by promoting and expanding sustainable transportation choices

- *Safety and security*

  Improving safety and security for all modes of transportation with special emphasis on pedestrians and cyclists

- *Quality control*

  Ensure reliability and high quality of the transportation network

- *Economy*

  Shift towards a movement based economy

- *Environment*

  Protect the region's natural resources by integrating transportation and land use planning to achieve cohesive, compact and sustainable models of development

- *Climate change and energy use*

  Decrease the dependency on non-renewable sources of energy by reducing travel demand as well as the promotion of technology that works on alternate sources of energy

Proposed Transportation Model

Transit Oriented Development
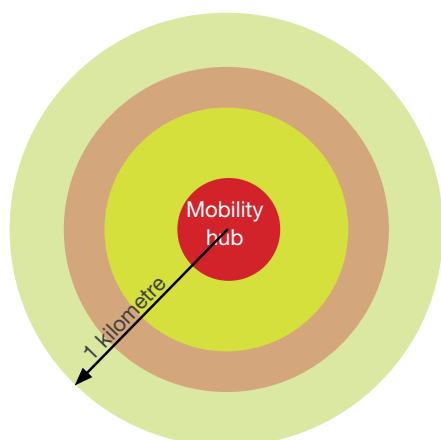
Land use and transportation are integral aspects and tools of development and form the backbone for growth of a region. In other words, the growth and success of a region is governed by the policies and attitudes related to each of these aspects.

Learning from the mistakes committed by many American cities in being car-oriented and proliferating unsustainable urban sprawl and in light of planning for a sustainable future it is imperative to move towards an economy based on movement systems.
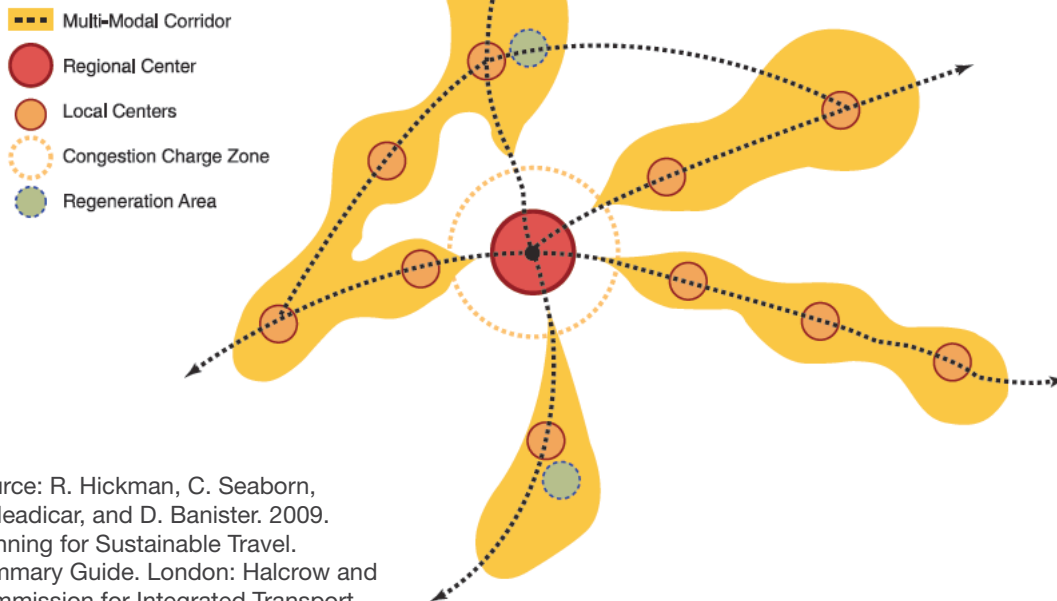
It is therefore imperative for the PVAC region to make a paradigm shift towards planning its transportation model. The corresponding land use policies also need to be modified to permit growth that is concentrated around mobility hubs and transportation corridors to help maintain and increase the base of users in the future. Such developments are termed 'Transit Oriented Development' or TOD.

Paradigm shift from existing transit hubs to new multi-modal hubs that support transit oriented development

Characteristics	Existing transport nodes	Proposed multi-modal mobility hubs
	Low-density	Medium- and high-density
	Single uses	Mixed-use
	Separated uses	Integrated uses
	Low employment	High employment
	Low critical mass	High critical mass
	Wide arterial roads	Network of streets
	Large parking lots	Strategic parking structures
	Little weather protection	Weather moderation
	Disabled unfriendly	Accessible
	Discourages walking	Pedestrian-friendly
	Discourages cycling	Bike-friendly
	No additional services/institutions in node	Shops and services located within hub
	No information	Real-time information
	Single mode	Multi-modal

Focusing Development along the Major Transit Corridors, and near Interchanges

Multi-Modal Corridor

Regional Center

Local Centers

Congestion Charge Zone

Regeneration Area

Source: R. Hickman, C. Seaborn, P. Headicar, and D. Banister. 2009. Planning for Sustainable Travel. Summary Guide. London: Halcrow and Commission for Integrated Transport.

Transit-oriented development (TOD) is a planning and real estate product that packages mass rapid transit with higher density mixed use development in close proximity to each other. Bringing the daily functions of life closer to transportation hubs is a means to reduce private vehicle use and land consumption throughout the entire region. In the case of planning new developments, the ideal practice would be to concentrate the bulk of the development in and around the transport hub.

Fundamental characteristics of TODs include
    a. Compact mixed use development with multiple options of transportation
    b. Dedicated lanes for pedestrians and bicyclists are given the highest priority.
    c. A train station is usually the centre of the development of a city/ town. A variety of mixed uses are provided within a 10 minute walking radius of the train station.
    d. Collector support transit systems including trolleys, streetcars, light rail, and buses, etc, along with the core transit system allows better public transportation accessibility to the public.
    e. Variations in urban form as distance from the transit node increases
    f. Reduced amounts of parking for personal vehicles

In the case of already established urban centres such as Viluppuram and Tindivanam, locating hubs near or at already developed sites and especially sites that hold larger densities of people, e.g. offices, shopping malls, cinema halls etc. is ideal for promoting TODs.

Viluppuram town is located close to the intersections of NH 45 with 45A, and 45C. It is also the biggest railway junction in the region. Viluppuram serves as the distribution point of rail traffic from Chennai. Within the town, the bus station is located within a 3 kilometre radius from the railway station. A Station Area plan will ensure that Viluppuram emerges as a model TOD Centre.

Similarly, the Tindivanam town is located is located at the intersection of NH 45 and NH 66. It is strategically located on all the major roadways, making it an important junction. Although Tindivanam is yet to have a formal bus terminus facility, the current practice is for buses to stop along the highway and within a walking distance from the railway station.

Benefits of Transit oriented development (TOD)

Benefits to transit users	• Reduced commute distances • More destinations near transit stations • Better walking conditions • Increased vibrancy and security near transit stations
Benefits to society	• Optimized mobility • Increased public safety resulting from high-density, mixed-use development in a pedestrian-friendly environment, creating vibrant and lively neighbourhoods • Increased household disposable income as a result of reduced reliance on personal automobiles and therefore decreased transportation costs • Conservation of open space made possible by focusing development in high density, established urban centers • Increased land available for public space, as a result of compact, high density development • Economic development opportunities provided by mixed-use urban centers based around transit • Increased tax base for local governments, as a result of the TOD attracting commercial and retail activity • Affordable housing, made more financially feasible due to zoning for higher-density residential use • Increased diversity of housing choices within a region in a mixed-use environment. • Reduced traffic related problems • Reduced public infrastructure and service costs • Increased quality of life and community liveability

It is recommended that locating the proposed new bus terminus within walking distance of the railway station and also providing a high quality pedestrian environment connecting the two facilities will help to create a multi-modal transit hub which can eventually function as a TOD Centre.

In the case of Cuddalore too, the new town area is well poised to be a TOD centre owing to the proximity of the train station and the bus terminus. Improving access to the port town from the new town will ensure equitable distibution of uses and foster a better local economy with increased real estate value. The port town itself too has the potential to be a TOD centred around its own railway station.

It might seem that Puducherry lags behind without a major rail station in this regard. However, it will be worth exploring less expensive transportation systems for Puducherry such as the BRTS for both local and regional connectivity. In such a case, Puducherry's TOD model will be centred around the BRT stations.

In other words, all the growth centres within the PVAC region have tremendous potential to develop and function as key TOD centres that provide accessibility to and from other towns and cities in the region.

In addition to the above, the following aspects will need to be dealt with to ensure successful implementation of the TOD model of development–

Land use and Zoning
Where this is not possible, land use policies should reflect this move by either re-zoning existing land or by introducing 'incentive zoning' for developers to build such uses near the mobility hubs. Incentive zoning is a method to entice private developers to contribute to the urban development of the city in line with the goals of the public agencies in cases where public funding is limited for such developments. The private developer could get incentives in terms of easy and inexpensive grant of approvals, lower property tax rates, subsidies in utilities etc.
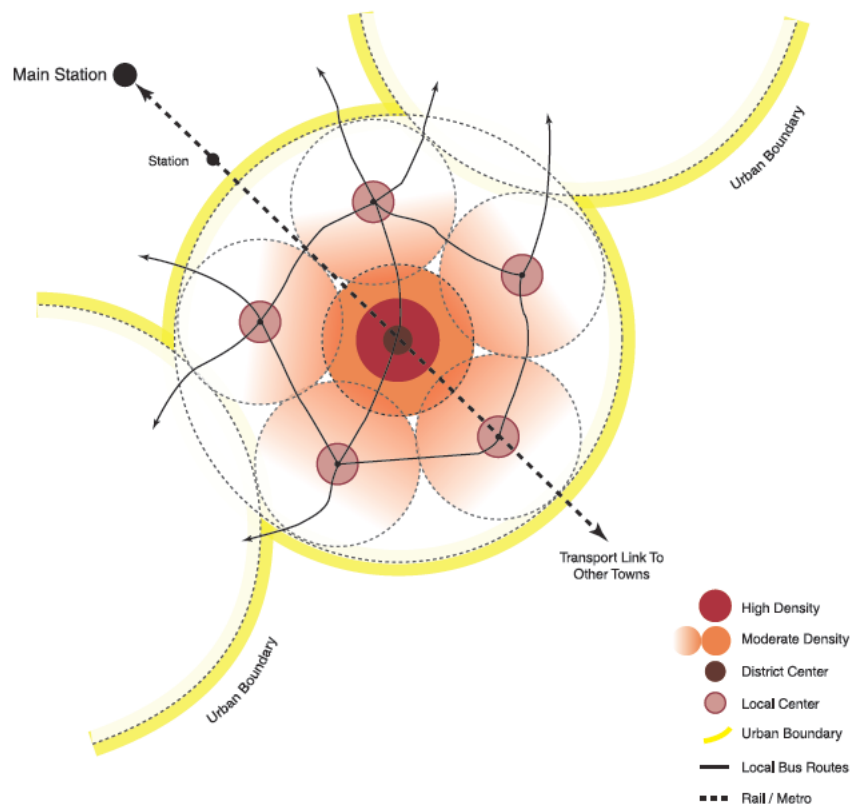
Density
To address the density aspect of TODs, the floor space index (FSI) allowances need to be revised along the mobility corridors to allow for more dense development along them. This in turn will indeed have to be supplemented by an upgrade of urban infrastructure systems such as water supply and drainage along these corridors.

In other words, a shift towards concentrating and compacting urban development measures along these corridors is in line to achieve a more sustainable development pattern as well as to channel public funds towards a more holistic scheme for better returns in the future.
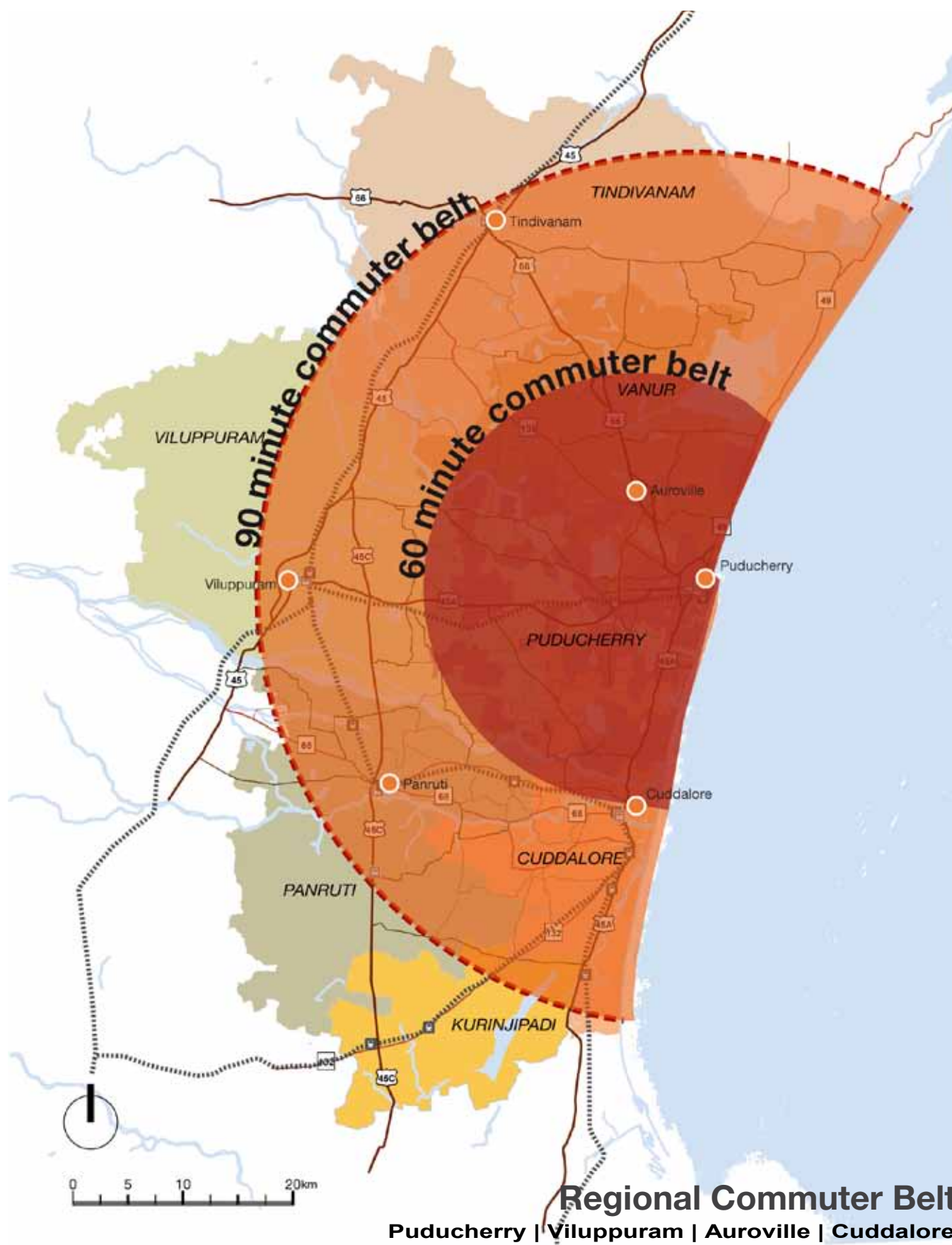
Clustering Density around the Transit Network

Source: R. Rogers. 1997. Cities for a Small Planet. London: Faber

Main Station

Station

Urban Boundary

Transport Link To Other Towns

Urban Boundary

- High Density
- Moderate Density
- District Center
- Local Center
- Urban Boundary
- Local Bus Routes
- Rail / Metro

Well-Linked and Permeable New Development

Source: R. Hickman, C. Seaborn, P. Headicar, and D. Banister. 2009. Planning for Sustainable Travel. Summary Guide. London: Halcrow and Commission for Integrated Transport.

- Mixed Use Development
- Major Employment Site
- Open Space
- Bus Station
- Car Park
- Cycle Park
- Pedestrian / Cycle Links
- Major Road
- Local Road
- Rail / Metro Station
- New Rail / Rail Station

Regional Commuter Belt
Puducherry | Viluppuram | Auroville | Cuddalore

Pedestrian environment

Streetscape improvement initiatives need to be undertaken as part of a long-term and coordinated effort towards a better public realm in the city. The improvements should be worked out with a view to highlighting the benefits of walking both to the individuals and the environment. Coaxing people to walk in the city can only be achieved by addressing the comfort and safety factor involved.

Providing dedicated pedestrian paths cutting across blocks to cut down walking distance or footbridges along water bodies or routes through parks can make walking an appealing option for commute. Also, in order to tackle the discomfort associated with high temperatures as we face in the PVAC region, it will be wise to provide shaded walkways made possible by planting trees or putting up well-designed canopies.

Parking

A policy on parking is also pivotal to the success of this model of development. While parking provision near mobility hubs is acceptable to enable moving from single occupancy to sustainable multi-modal transport, in general a policy for reduced parking spaces elsewhere in the city will help promote the larger vision. If absolutely required, such parking should be priced at premium rates to discourage the use of private vehicle use while also totally eliminating it.
Incentives should be introduced for using alternatives to single occupancy private cars such as differential charging depending on the number of passengers in the vehicle. The design and management of parking facilities must also reflect the new mobility as well as 'safe design'. Priority should be given to high-occupancy vehicles, energy-efficient vehicles, and car-share companies – all in advance of single-occupancy cars.

Randstad Model

The Randstad Holland (formerly known as the Randstad or Deltametropolis) is conceptualised as a single, coherent urban network – the largest of the country. The network is further divided into three economic core areas (the 'North-wing', the 'South-wing' and the 'Utrecht region') and, right in the middle of those, the 'Green Heart'.

The Randstad Holland is the economic, social, political and cultural heart of the Netherlands. It is valued for its diversity of functions, profiles and landscapes, and it's dispersed, polycentric spatial structure is celebrated as a feature that sets the region apart from many other European metropolises. The government's main objective for the Randstad is to strengthen its international competitive position.

The main strategy proposed is to make better use of the economic, cultural and spatial diversity that is inherent to the region and to allow the region to cater for its own growth and development (instead of guiding growth to other parts of the country).

Source- Excerpts from POLYNET Action 3.1 "The Randstad: Analysis of policy documents & policy focus groups." Institute of Community Studies/The Young Foundation & Polynet Partners, 2005
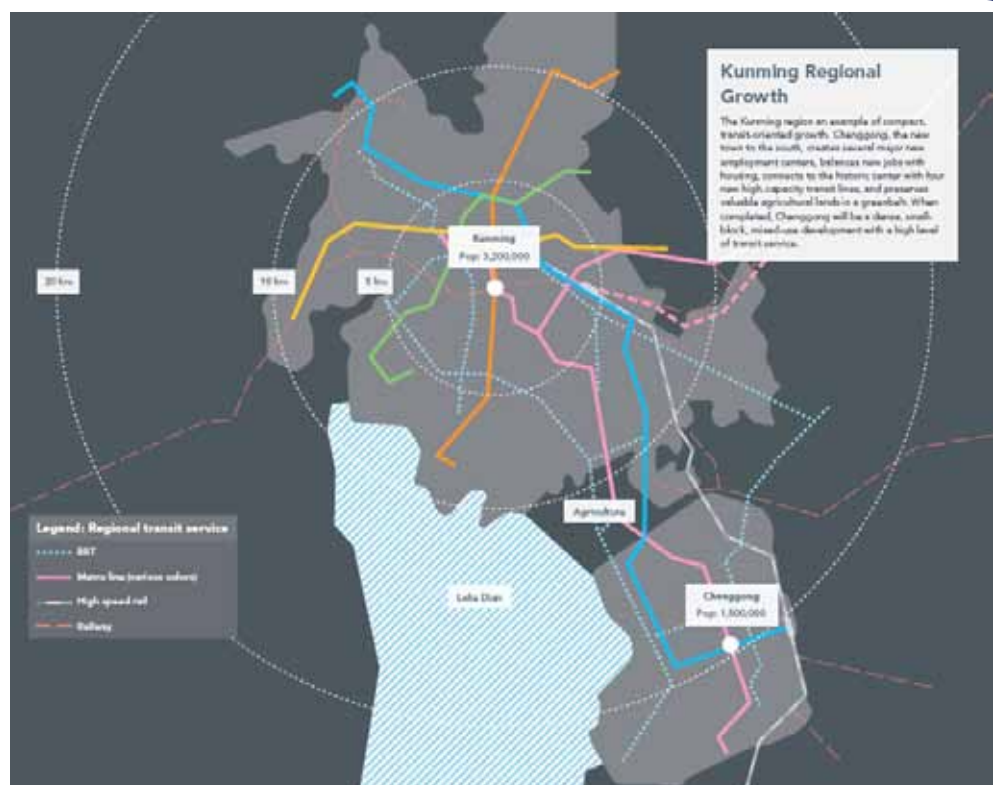
5 Finger Concept- Copenhagen, Denmark

Copenhagen's regional framework–the 5 Fingers concept –was originally conceived in the 1940s.The 5 Finger concept continues to shape regional form as this image from the recent regional plan demonstrates. Under the guidance of a regional planning body, urban areas are confined to linear corridors that are linked by transit and extend like fingers from the central core. Green wedges protected from urban development fills in the space between the urban corridors.

5 FINGER PLAN 1947

5 FINGER PLAN 2003

source: Greater Copenhagen Authority Transport Plan 2003
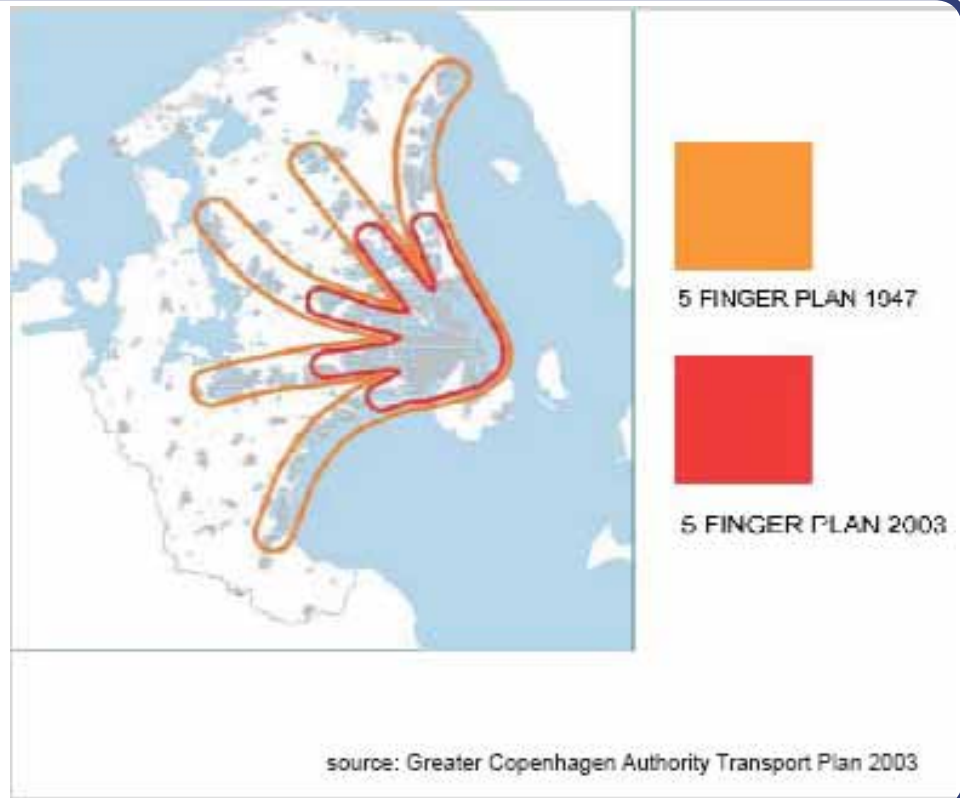
Kunming Regional Plan, Chenggong

The Kunming region an example of compact, transit-oriented growth. Chenggong, the new town to the south, creates several major new employment centers, balances new jobs with housing, connects to the historic center with four new high-capacity transit lines, and preserves valuable agricultural lands in a greenbelt. When completed, Chenggong will be a dense, small block, mixed-use development with a high level of transit service.

Source: "Planning Cities for People: A Guide to Prosperous, Low-Carbon Urbanization" http://www.climateworks.org/news/item/sustainable-urban-planning-a-blueprint-for-model-chinese-cities

Transportation performance measures

Performance measures can help to incorporate the goals of the transportation framework for the region into transportation decision-making. The recommended performance measures for the PVAC region are:

• *Transit Accessibility*
Measures the ability of people to reach destinations using public transportation

• *Bicycle and Pedestrian Mode Share*
Measures the proportion of trips taken by bicycle and walking mode

• *Vehicle kilometres travelled (VKT) per capita*
Measures the amount of vehicle activity normalized by population

• *Carbon Intensity*
Measures the amount of carbon dioxide (CO2) emitted from transportation per person

• *Mixed Land Uses*
Measures the proportion of residents living in locations with mixed land uses

• *Transportation Affordability*
Measures the cost of transportation relative to income

• *Benefits by Income Group*
Measures transportation plan benefits by income group

• *Land Consumption*
Measures the amount of land consumed by new transportation infrastructure and/or new development served by new transportation infrastructure

• *Bicycle and Pedestrian Level of Service*
Measures the quality of service from the perspective of a bicyclist or pedestrian includng safety in specific locations

• *Average Vehicle Occupancy*
Measures the ratio of passengers to vehicles on the roadway (the average number of people in each vehicle)

• *Transit Productivity*
Measures the average number of riders on transit vehicles

Preliminary Recommendations

Policy and Enforcement

- Introduce mechanisms to enhance coordination among the governments
- Propose policies to regulate development along environmentally sensitive corridors such as the East Coast Road
- Make policy changes that incentivize a shift from being car-centric to more public transport driven mobility by adopting Transit Oriented Development (TOD) as a preferred model of development
- Make it mandatory to create and implement 'Comprehensive Mobility Plans' across the region in order to achieve better integration of land use and transportation through planning
- Make it mandatory to create and implement 'Station area plans' for all existing and proposed public transport systems
- Introduce subsidies and incentives for the use of electric vehicles and alternate renewable sources of energy

Physical Interventions

Roadways
- Improve design of highways and their connectivity to towns and settlements
- Any new highways should have dedicated cycling and pedestrian pathways on them
- The quality of road/highway must change when it passes through a town or village
- Develop ECR as a scenic driveway with opportunities to access the beaches along the stretch

Rail and bus
- Provide high speed transit to connect all the growth centres in the PVAC region such as rail links, BRT or LRT to reduce travel time. EMUs such as the ones that connect the suburbs of Chennai to its centre should also be considered
- There is a need for more frequent train service and more compartments in existing trains that operate in the region
- Increase the number of buses and introduce service level benchmarks to ensure performance of the existing bus system
- Provide dedicated transit service for fisherman to transport their catch quickly and efficiently which will in turn improve their livelihoods
- The Punyasthala Express train with connects Bhuvaneshwar and Rameshwaram does not stop at the Chidambaram station inspite of crossing through it. Chidamabaram itself is designated as one of the 5 primary abodes of Lord Shiva that draw a substantial number

- of tourists throughout the year and it would be beneficial for the economy of the region if a train stop were introduced

Walking and cycling
- Improve access to transit by providing high quality and seamless pedestrian and cycling facilities to connect to transit nodes. Safe and shaded parking areas for cycles should also be provided at all transit nodes.
- Promoting walking and cycling across the region by providing pedestrian and cycling facilities or Bicycle expressways
- Provide a regional greenway network along streams, water bodies and wooded areas which can serve both as mobility corridors as well as recreational corridors

Waterways
- Introduce a regional waterway connection connecting Chennai-Puducherry-Cuddalore and other places along the coast.
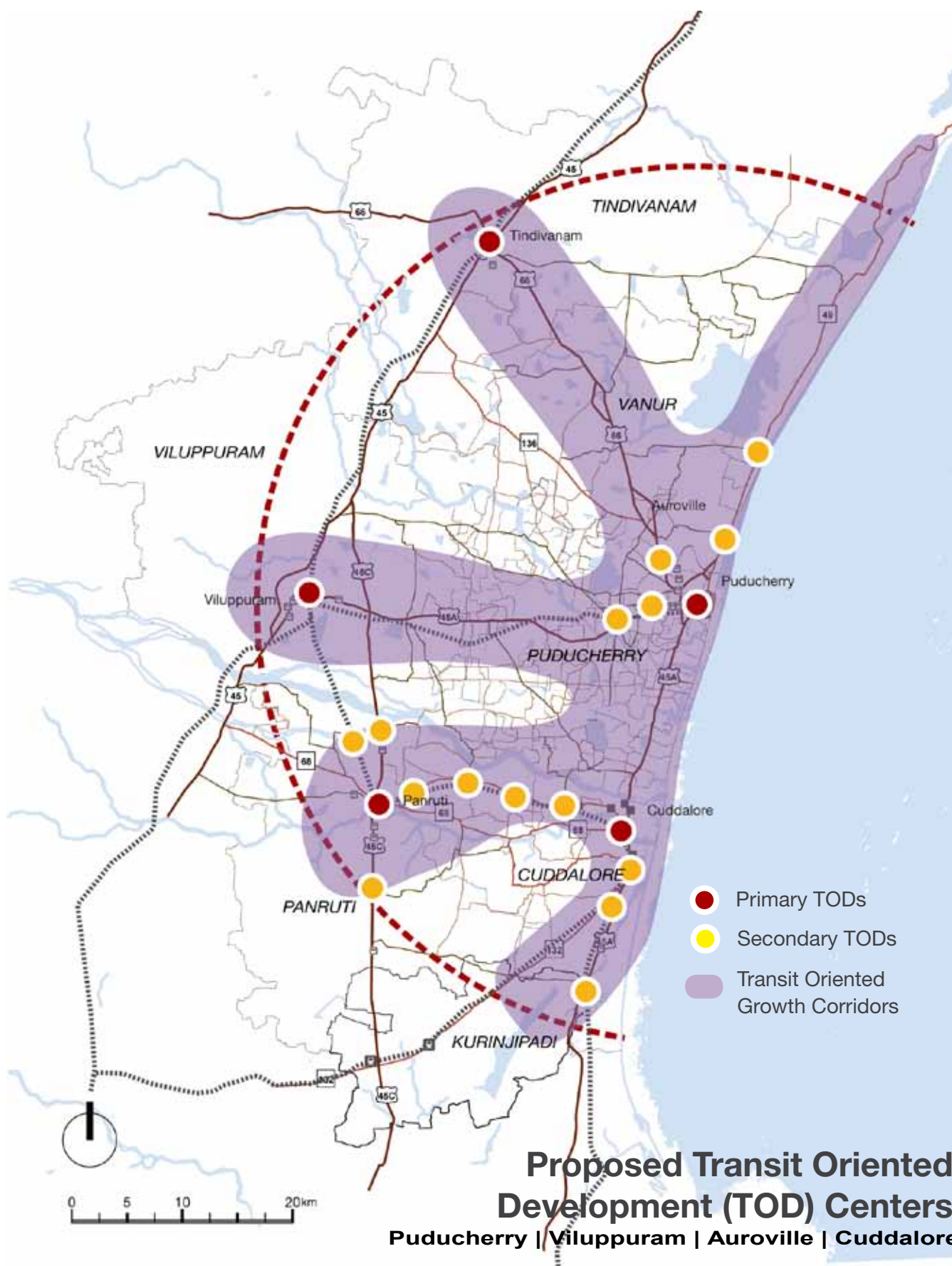
Freight
- Separate freight access for better economic development. For instance, a separate freight corridor connecting ports of Karikal, Cuddalore, Cheyyur and Chennai

Airways
- Explore possibilities of relocating the airport South of Puducherry for better regional connectivity

Awareness and Community Participation

Advocacy and awareness building at local levels and across media types required to sensitize the people towards the need for better quality and sustainable modes of transport as opposed to being a region dependent on private modes of transport

Proposed Transit Oriented Development (TOD) Centers
Puducherry | Viluppuram | Auroville | Cuddalore

Legend:
- ● Primary TODs
- ● Secondary TODs
- Transit Oriented Growth Corridors

0 5 10 20km

Juan Amarillo in Bogota, Colombia is a 35 km long greenway which was opted over the proposal to create 8 lane highway along an existing creek. The greenway connects peripheral economically weaker areas to the city with good barrier free designs. It also extends into the rural hinterlands as a leisure trail for nature lovers.
Source- Institute for Transportation and Development Policy
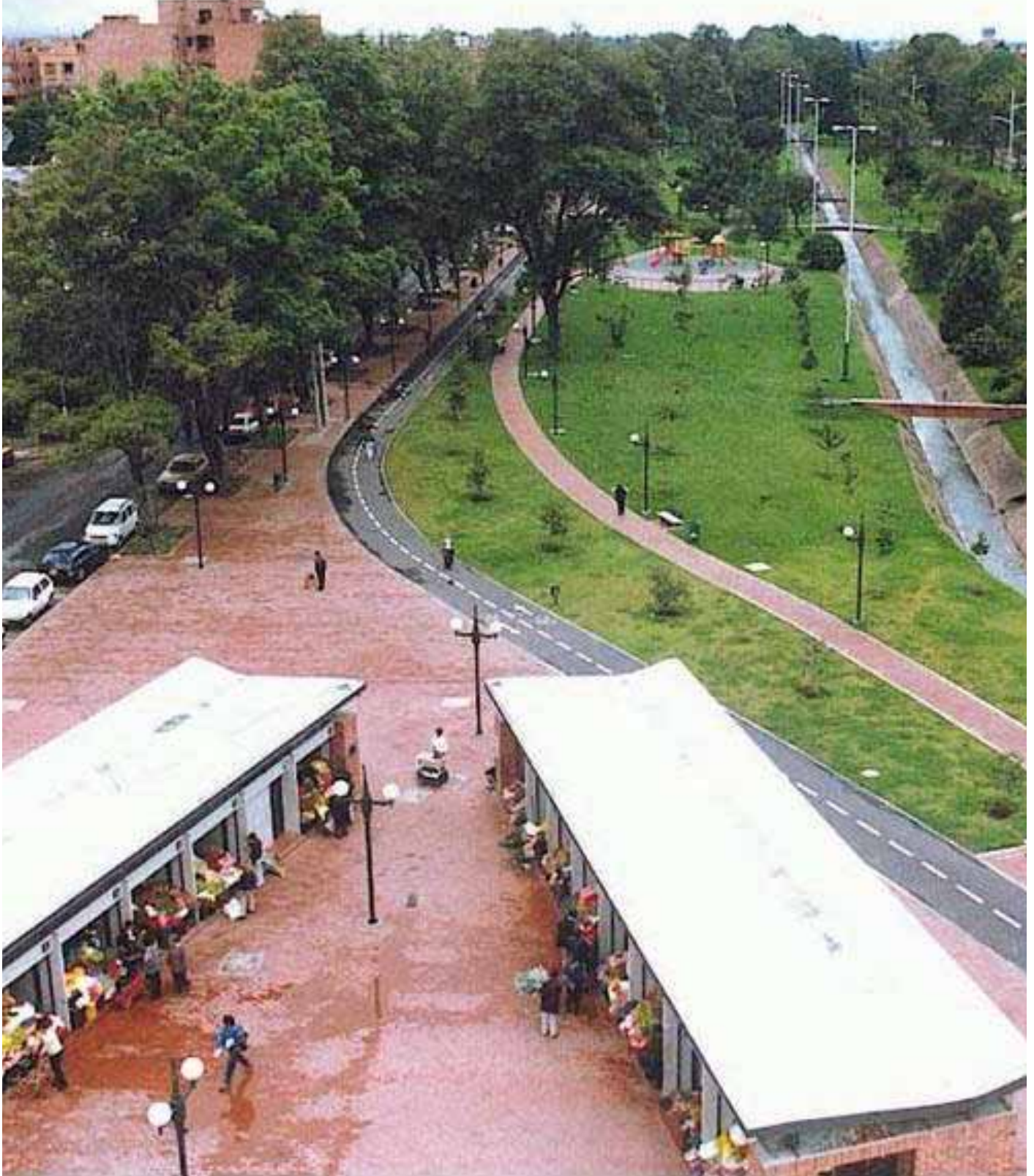
6.0 Water

Puducherry region is a flat land of average elevation of about 15 metres above sea-level, intersected by the deltaic channels of River Gingee, Ponnaiyar and other streams forming the two main drainage basins, interspersed with lagoons, lakes and tanks.

River Gingee crosses the region diagonally from northwest to southeast. Ponnaiyar forms the southern border. The alluvial delta of Ponnaiyar is only a few metres above the sea. To the northwest of these hills are a section of fossiliferous limestone formations of the Cretacian age. To the south of this area is situated the alluvial tract of Varahanadi (Gingee) and to the north is the recent alluvium.

Excessive Exploitation of Ground Water Resources
- Imbalance in demand and supply of ground water recharge
- Excessive pumping leading to imbalance in pressure
- Horizontal and vertical extraction of ground water due to competition and scarcity

Unsustainable Farming and Irrigation Practices
- Lack of awareness in selection of crops
- Skepticism and lack of unity among farmers to adopt alternate technologies
- Peer pressure among farmers to farm the same crops as successful farmers

Industrial Pollution
- Effluent dumping from industries pollutes water
- Health issues like skin diseases, cancer, asthma, due to the untreated toxic dump in the local water bodies
- Local people buy potable water for their daily use

Sand Mining
- Sand mining in coastal area induces the shallow aquifer salinity

Inaccessible or Inadequate Water Supply
- Water bodies encroached for development
- inequitable distribution of water

Fragmented Water Management at both state and local level

Geology

The geological formations in the region are of two main types:

1. Hard Rock: Hard rock systems occur in the eastern part of the region (Charnockite in Fig. 6.1) and are old formations of the Archean geological age (older than 2,500 million year). Groundwater flows in the fissures or the fractures in this system.

2. Sedimentary Rocks: They are of schematically three more recent geological ages. The oldest are from the Mesozoic/Cretaceous age (older than 65 million year, Vanur sandstone, Ottai claystone, Thuruvai limestone, refer graphic on following page), followed by formations of the Tertiary age (older than 5 million year, Kadapperikuppam limestone, Manaveli siltstone and Cuddalore sandstone, refer graphic on following page) and of the Quaternary age (before 1 million year, Alluvium, composed of fluvial and marine deposits). The groundwater flows in joints or intergranular pores in sedimentary rocks.

Climate

Hot and tropical maritime type of climate characterized by small daily range of temperature, humid weather and moderate rainfall.
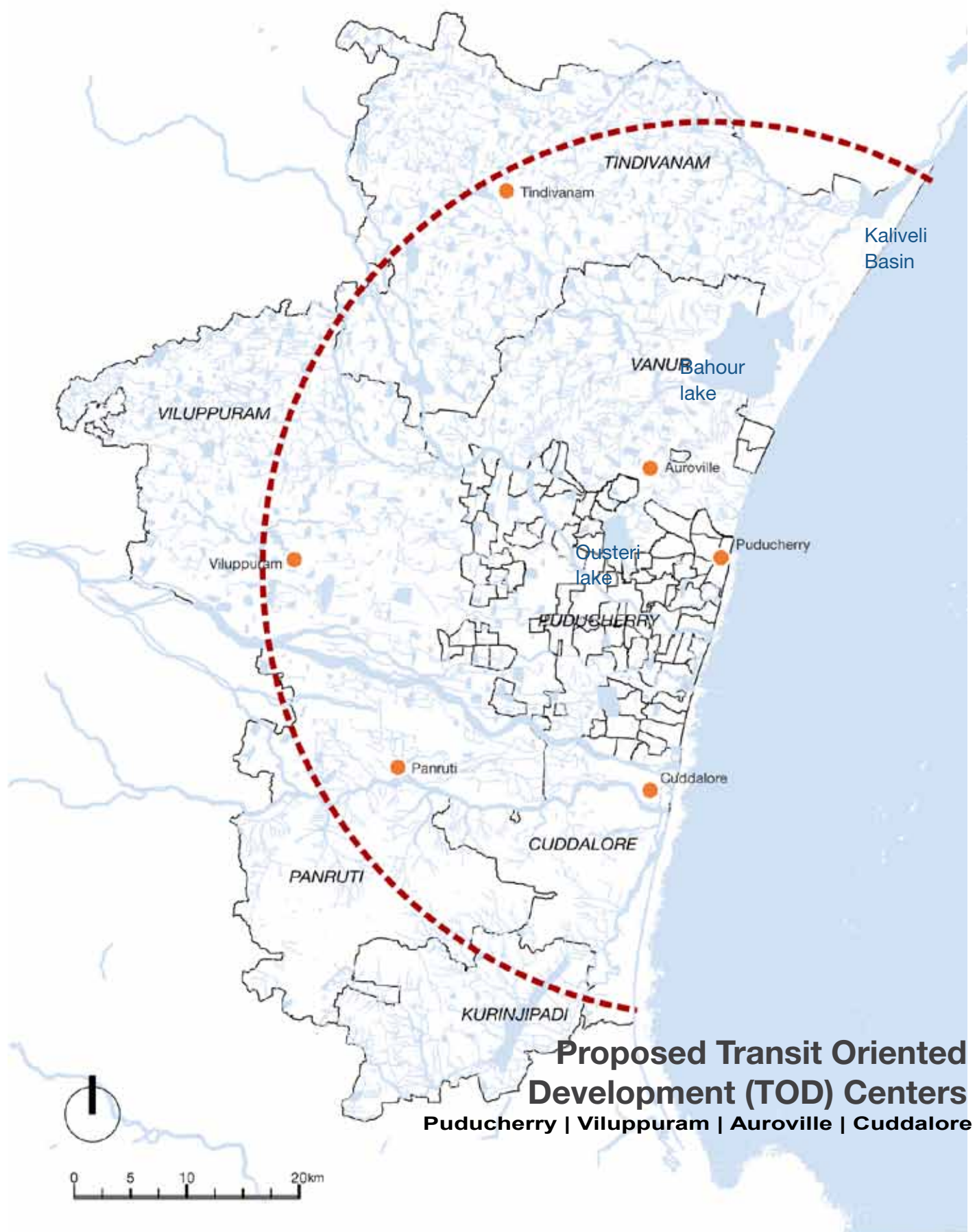Summer: March to June
South West Monsson: June to September
North East Monsoon: October to November
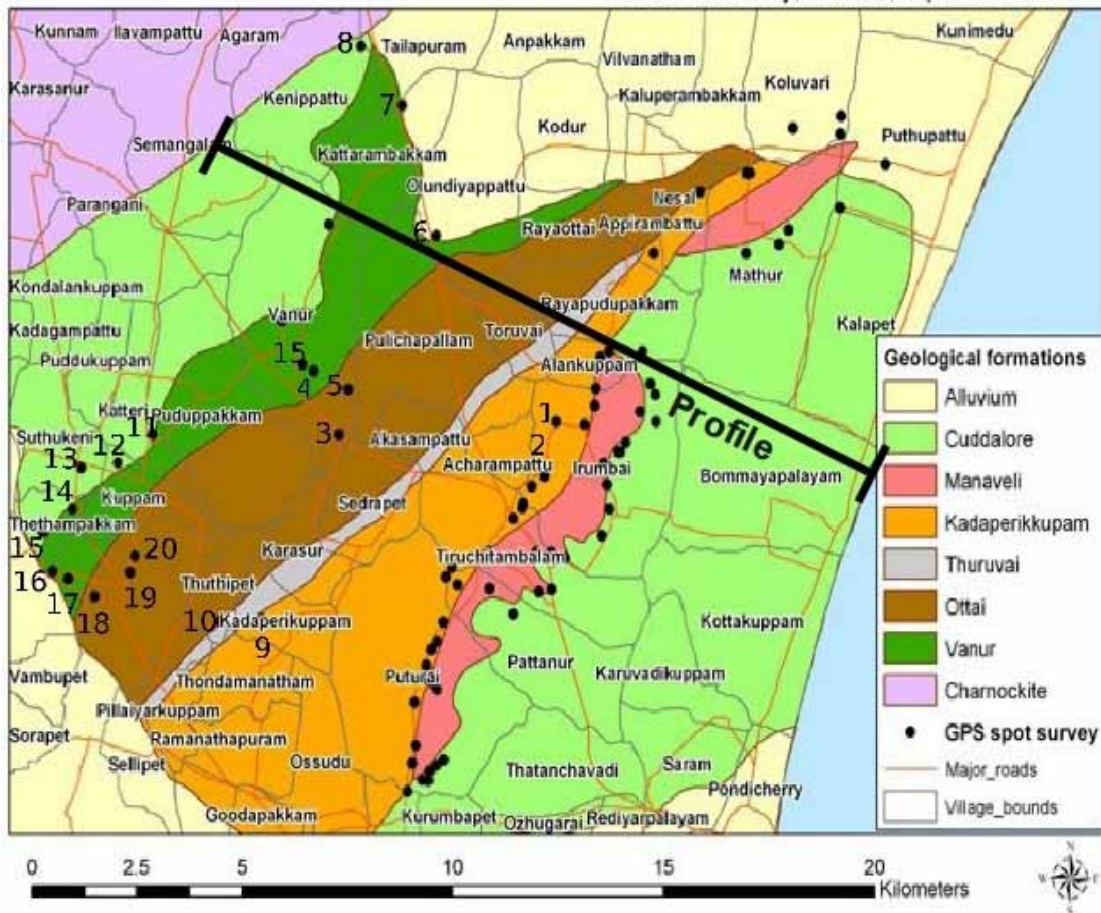Winter Season: December to February

Rainfall

Average Rainfall is 127 cm, of this about 50 per cent is recorded during October – November.

TINDIVANAM

Tindivanam

Kaliveli Basin

VILUPPURAM

VANUR

Bahour lake

Auroville

Ousteri lake

Puducherry

Viluppuram

PUDUCHERRY

Panruti

Cuddalore

CUDDALORE

PANRUTI

KURINJIPADI

Proposed Transit Oriented Development (TOD) Centers
Puducherry | Viluppuram | Auroville | Cuddalore
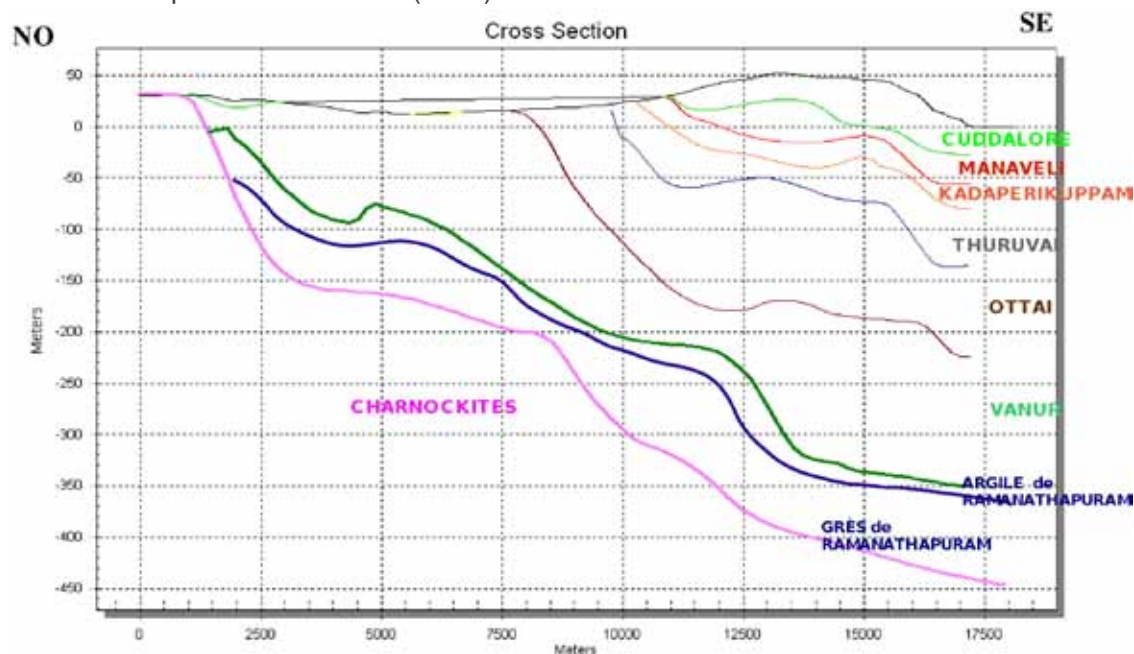
0   5   10   20km

Data source : Geological map , GSI, CGWB , 1984
GPS Field survey, Harvest, september 2004

Source: Adapted from Vincent (2007)

Section of the profile identified in the geological map. Source: From Vincent (2007)

Water Availability

1. Surface systems: rivers and tanks / ponds

The rivers flowing in the region are non perennial. Also, a large set of ponds / tanks have been neglected since the mid-80's; and instead groundwater has been utilized.

2. Ground Water Systems

Groundwater is currently the predominant source of water in the region as the rivers are not perennial. It is extracted predominantly from dugwells in hard-rocks formations and tubewells in sedimentary contexts. The formations the most advantageous in term of groundwater exploitation are the Alluvium and the Cuddalore sandstone, followed by the Vanur sandstone.

The geological map and its corresponding profile on the previous page, illustrates the complex distribution of the geological formations. The pattern visible at the soil surface or few meters below changes with depth, as illustrated in the figure below.

• Three aquifers : Cuddalore aquifer, Manaveli aquifers,Vanur aquifers.
• The depth of these aquifers varies in the region as illustrated in the graphic on the previous page
• There are some flows occurring across the aquifers, i.e., vertical percolation of water, though this flow is function of the intrinsic formation. The figure below shows the interactions between the different aquifers systems. Eventually, the groundwater systems are a very complex as it flows are tri-dimensional.
• Groundwater recharge (from rainfall, rivers, ponds, tanks) occurring at the soil surface do not flow only in the vertical direction, but follows predominantly along the geological formation. Hence the groundwater recharge occurring in one location may benefit another location. This illustrates the necessity for a Regional Planning for management of groundwater.
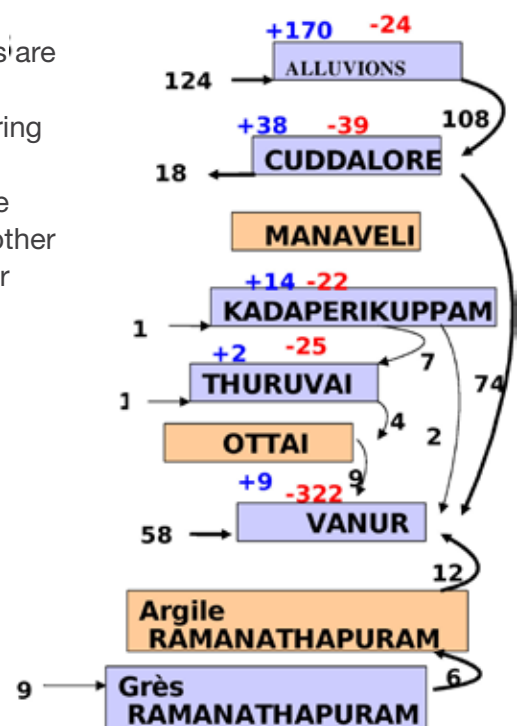
Source: Adapted from Vincent (2007)

Ground Water Levels

From the year 2000 to 2005:
• There was a fall in Ground Water levels for all the 3 aquifer systems

From 2005 to 2010:
• The pace of the fall seems to have reduced in the Tertiary aquifer (Cuddalore sandstone), or even the levels appeared to have
• raised a little for the alluvial system ,
• This may indicate a reduction in the total amount of groundwater
• extracted for irrigation due to urbanisation, as predicted by
• Reddy (1999) but the overall trend is still alarming.

Spatial pattern:
• The levels tend to be shallower near the coast (around 6 m.b.g.l), in the Cuddalore and Alluvial systems, and deeper towards the east of the district, in the centre to the east (with depth of about 30 m.b.g.l. or more

Particular locations:
• The ground water levels are relatively shallower near the coast due to the restriction on tubewells. But according to Reddy (1999) the levels were even more shallow in the 80's, making a natural barrier against sea water. Currently the pressure of the aquifer system bordering the sea has weakened.
• Due to the industries, there is high depression in Mettupalayam (30 m.b.g.l. or more in the Cuddalore system)
• Due to the sugarcane areas and the presence of the Puducherry Cooperative Sugar Mills, probably there is higher depression in Lingareddipalayam, around Sorapet (30 m.b.g.l. or more in the
• Alluvial and Vanur systems) (Reddy, 1999).

Piezometric level in Cuddalore aquifer in July - 2003
2 meters interval contour map with reference to Mean Sea Level
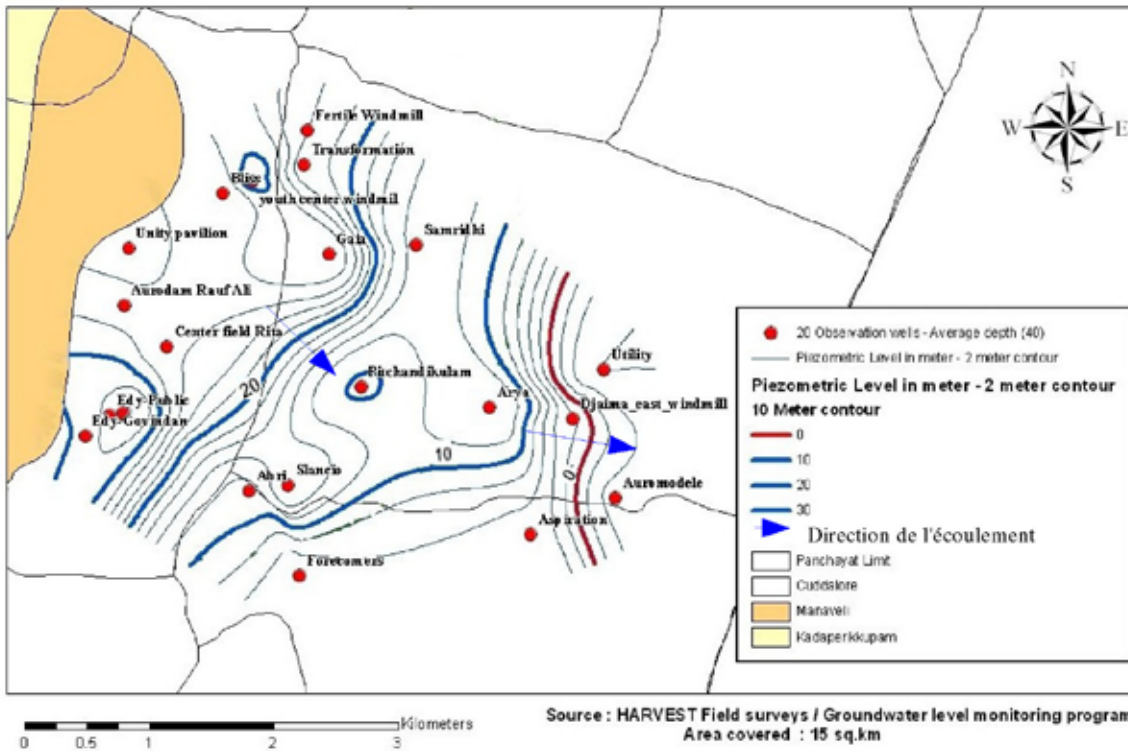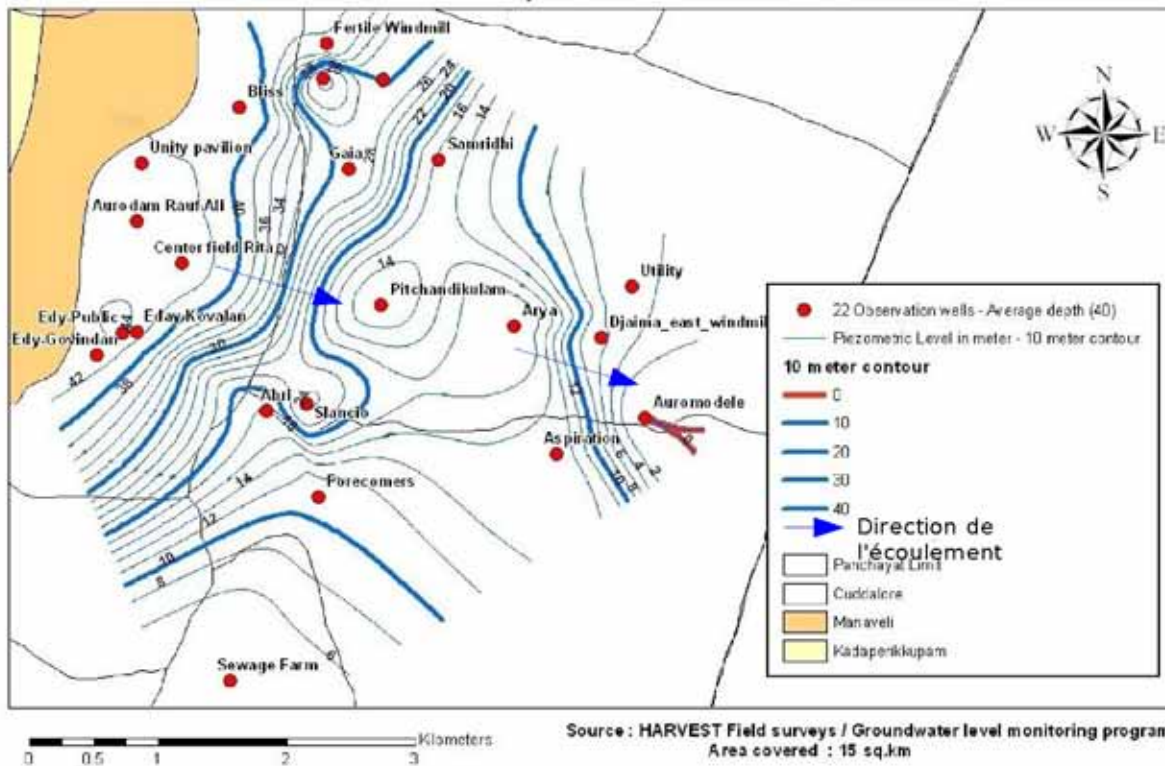
Cuddalore Aquifer in January 2003

Piezometric level in Cuddalore aquifer in January 2003
2 meters interval contour map with reference to Mean Sea Level
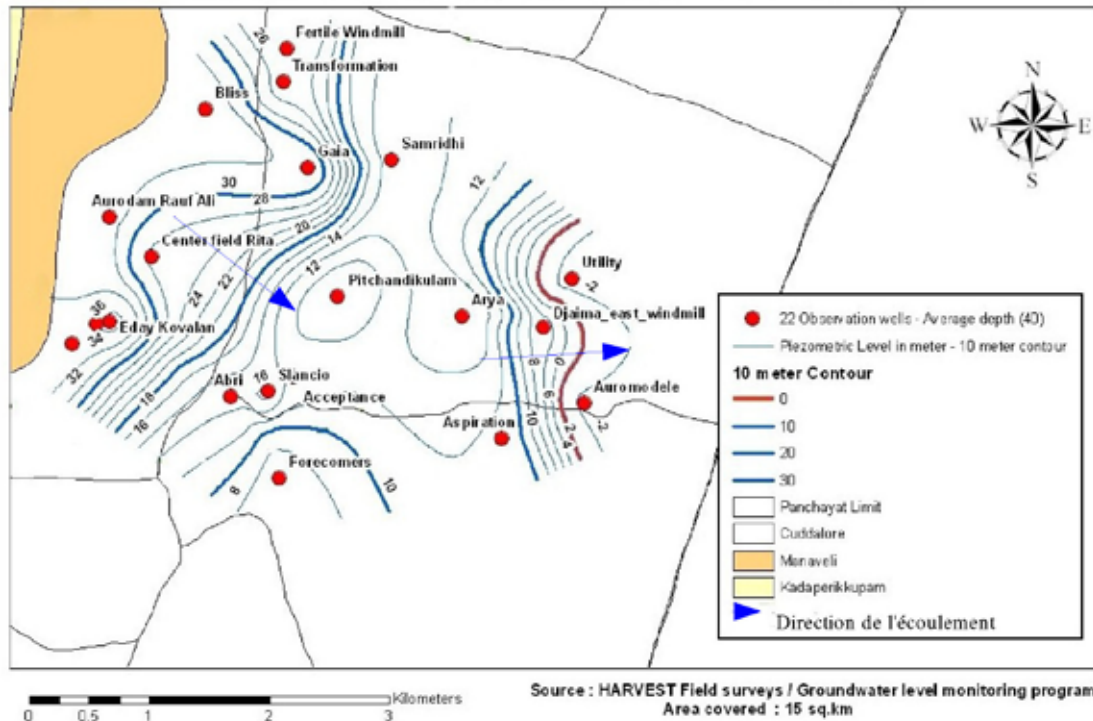
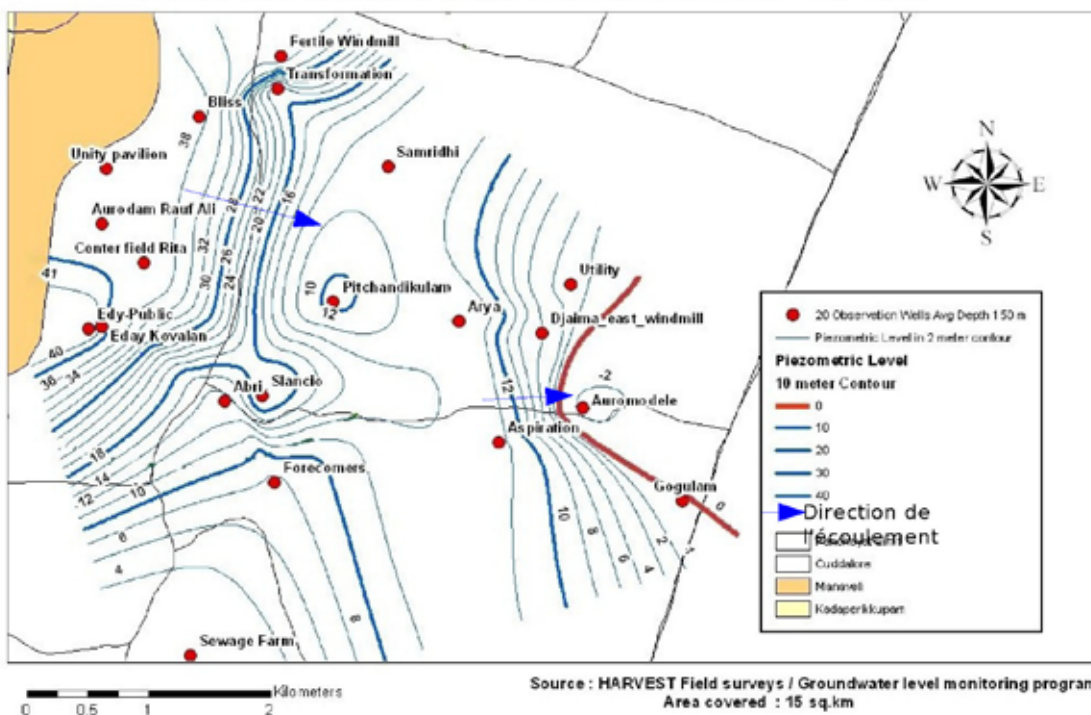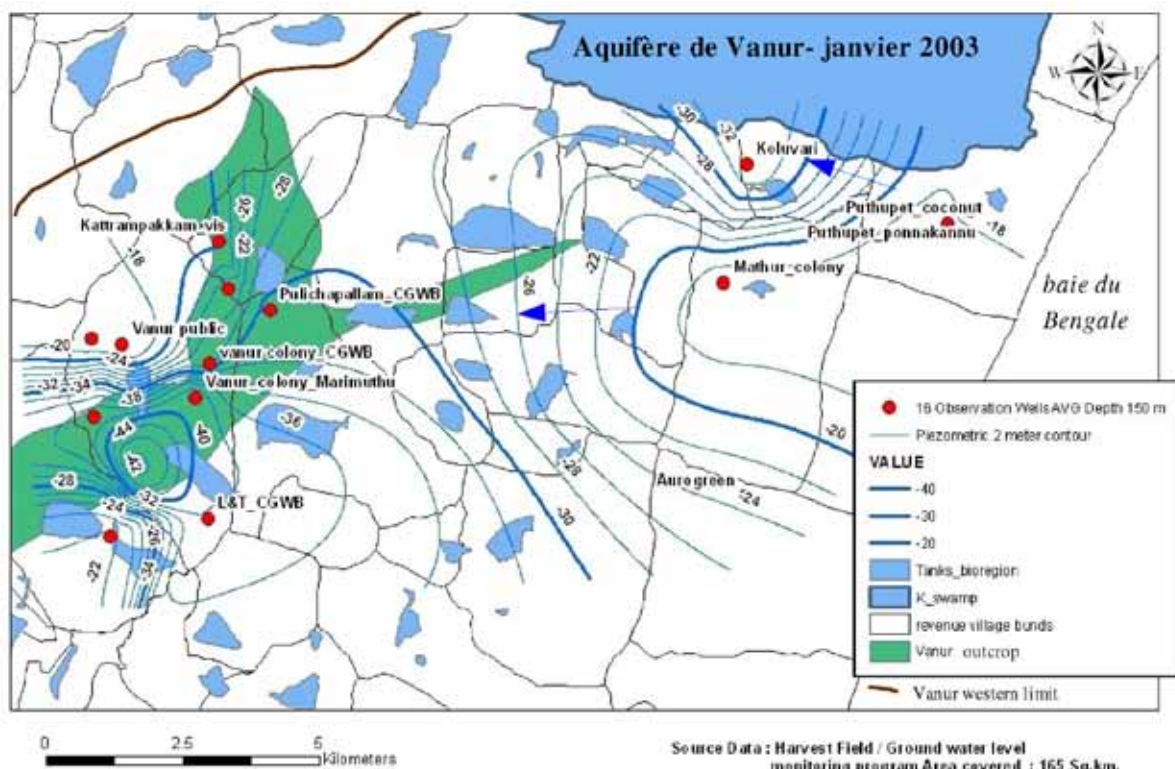Cuddalore Aquifer in July 2003
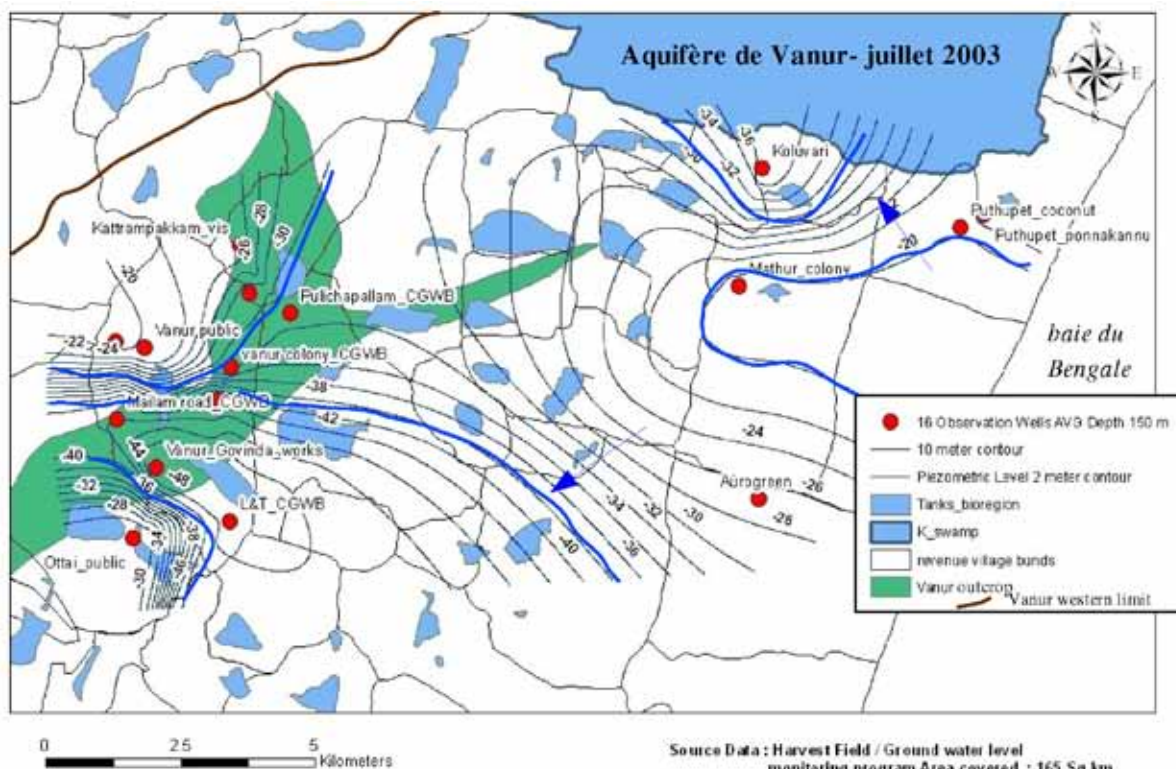
Cuddalore Aquifer in January 2006
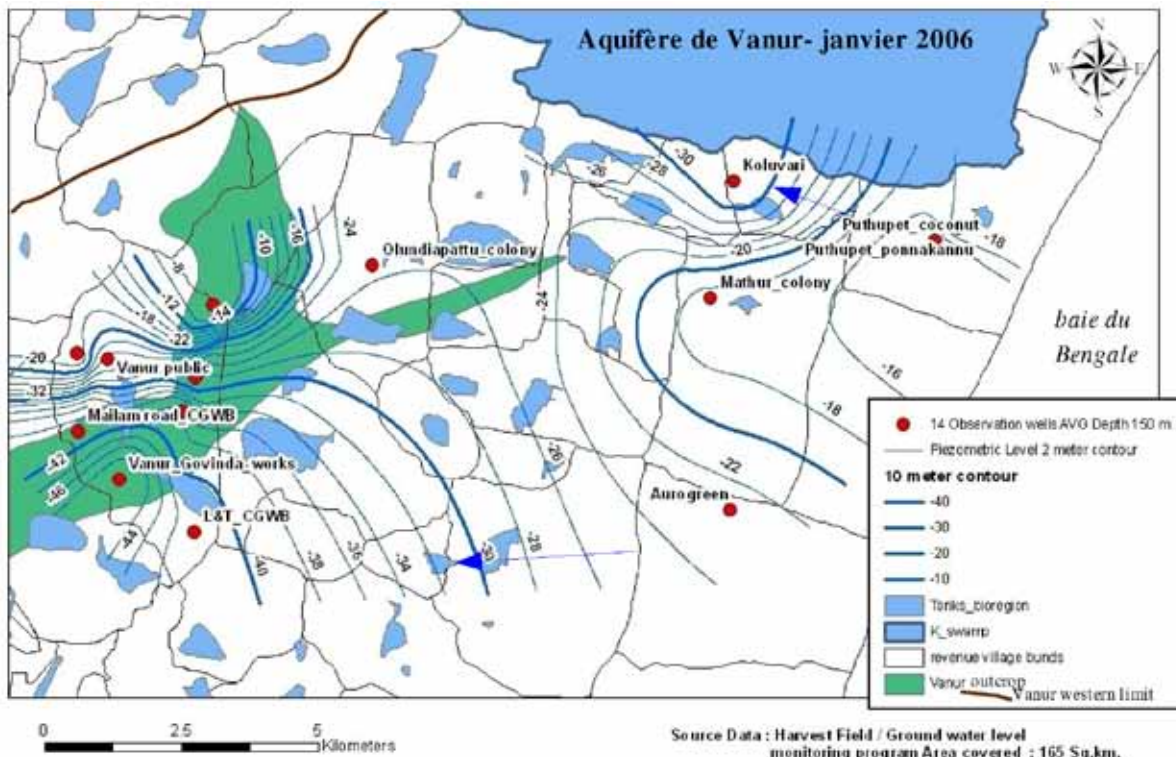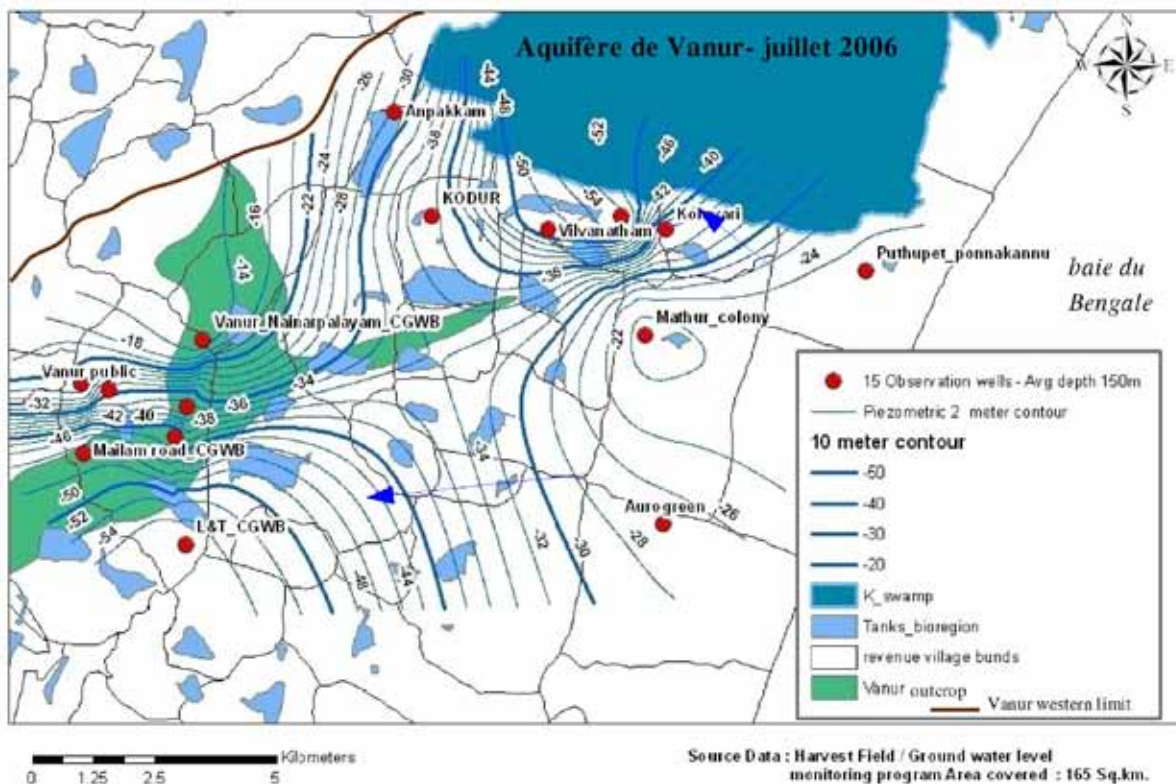

Cuddalore Aquifer in July 2006

Vanur Aquifer in January 2003

Vanur Aquifer in July 2003

Vanur Aquifer in January 2006

Vanur Aquifer in July 2006

High percentage of Ground Water Budget

Ground Water Budget is the rate of ground water exploitation, it compares the amount of available groundwater with the amount extracted.

Ground Water Budget according to different sources in the PVAC Region

Ground Water Budget according to the Central Groundwater Board for Cuddalore and Viluppuram districts

Spatial Unit	Date	Ground-water	Uses							Balance	Source
		Available for uses	Irrigation			Domestic and Irrigation		Total			
		Mm^3/year	Mm^3/year	% of column 3		Mm^3/year	% of column 3	Mm^3/year	% of column 3	Mm^3/year	
Cuddalore district	2004	1,565	1,071	68%		37	2%	1108	71%	457	CGWB (2009a)
Viluppuram district	2004	1,696	1,834	108%		55	3%	1889	111%	-193	CGWB (2009b)

*Maximum possible, after rehabilitation of all tanks in Puducherry District

Spatial Unit	Date	Available water resource			
		Surface	Groundwater		Total
		Rivers and tanks	Recharge	Available for uses	
		Mm^3/year	Mm^3/year	Mm^3/year	Mm^3/year
Puducherry district	Not precised, most probably 2000	35	164	140 (85%)	174
Puducherry district	1998	35	177 (15% of rainfall)	150 (85%)	185
	2025	75*	177 (15% of rainfall)	150 (85%)	225
Puducherry district	1998	-	177 (15% of rainfall)	150 (85%)	150
Kalluvely basin, Puducherry district, eatern part of Viluppuram and northern part of Cuddalore districts	2003	-	196	Not precised	196
			w Alluvium: 148		w Alluvium: 148
			w Cuddalore sandstone: 25		w Cuddalore sandstone: 25
			w Kadaperikuppam calcareous sandstone: 9		w Kadaperikuppam calcareous sandstone: 9
			w Thuruvai calcareous sandstone: 9		w Thuruvai calcareous sandstone: 9
			w Vanur sandstone: 5	-	w Vanur sandstone: 5
Kalluvely basin down to river Gingee	1997 - 2001	-	117	112	112
			w Tertiary (Cuddalore, Manaveli, Kadapperikupam): 27	w Tertiary (Cuddalore, Manaveli, Kadapperikupam): 19	w Tertiary (Cuddalore, Manaveli, Kadapperikupam): 19
			w Cretaceous (Ottai, Vanur, Ramanathapuram): 90	w Cretaceous (Ottai, Vanur, Ramanathapuram): 93	w Cretaceous (Ottai, Vanur, Ramanathapuram): 93

Spatial Unit	Date	Uses								Balance	Source
		Irrigation		Domestic		Industries		Total			
		Mm³/ year	% of column 6	Mm³/ year	% of column 6		% of column 6	Mm³/ year	% of column 6	Mm³/year	
Puducherry district	Not precised, most probably 2000	174	100%	35	20%	7	4%	216	124%	-42	Veerappan and Vaid-yanathan (2008)
Puducherry district	1998	174	94%	35	19%	7	4%	216	117%	-31	Reddy (1999)
	2025	157	70%	81	36%	10	4%	248	110%	-23	
Puducherry district	1998	134	89%	28	19%	8	5%	170	113%	-20	DA (1999)
Kalluvely basin, Pu-ducherry district, eatern part of Vilup-puram and northern part of Cuddalore districts	2003	Not precised						203	104%	-7	Vincent (2007)
								w Al-luvium: 13	w Al-luvium: 9%	w Alluvi-um: 135	
								w Cud-dalore sand-stone: 36	w Cud-dalore sand-stone: 144%	w Cud-dalore sand-stone: 11	
								w Kada-perik-uppam calcar-eous sand-stone: 22	w Kada-perik-uppam calcar-eous sand-stone: 244%	w Kada-perikup-pam cal-careous sand-stone: -13	
								w Thuru-vai calcar-eous sand-stone: 27	w Thuru-vai calcar-eous sand-stone: 300%	w Thuru-vai cal-careous sand-stone: -18	
								w Vanur sand-stone: 105	w Vanur sand-stone: 2100%	w Vanur sand-stone: -100	

In Puducherry, the ground water budget is over 100%, which indicates an over exploitation of the existing resources. There are two ways to replenish the ground water budget:

Supply-side: increase the groundwater recharge

There have been a lot of works to increase the supply through artificial groundwater structures, such as restorations of tanks, installations of ponds, roof-top rainwater harvesting and infiltration etc. This approach is popular and the easiest as it's predominantly based on technical solutions.

The study shows that natural context of the region is favourable as rainwater infiltration in the soil is quite homogenous in the region and the infiltration rate is considered to be relatively high due to high permeable sub-soils. However scientific evidences on its benefits are lacking.

Demand-side: reduce the amount of groundwater extraction

This predominantly relies on social, economical and institutional dimensions. The amount of water extracted for irrigation is the predominant term. Reddy (1999) states that the share of water for irrigation will reduce in 2025, though will remain the predominant uses. The table on the previous page (for Puducherry) shows that the water budget will stay negative even if all the tanks of the district are rehabilitated. It appears therefore urgent to reduce the amount of groundwater extracted for irrigation.

Key issues related to water

Kaliveli Water Shed

(includes Marakkanam, Tindivanam, Auroville, Northern part of Puducherry District)
As identified by Auroville Centre for Scientific Research and Auroville Water Service – Harvest

1. Lack of appropriate watershed management
2. Need of appropriate institutional tools
3. Need of Ground Water research in the area
4. Inadequate public awareness
5. Non-availability of water
6. Pollution and Over exploitation of ground water
7. Excessive irrigation
8. Poor storage of Ground Water
9. Encroachment over tanks
10. Unexpanded growth of unauthorized shrimp farming

Puducherry

1. Lack of holistic and inter disciplinary approach of water related problems. Currently, the water supply, monitoring and management of water resources (both ground and surface water) are fragmented among multiple departments within each state
2. Poorly regulated exploitation of groundwater
3. Improper maintenance of water resources, infrastructures and encroachment of surface water bodies(like the Kanakan lake)
4. Deterioration of groundwater quality due to sea water intrusion and mixing with water from deeper formations, due to over-exploitation of groundwater and dumping of wastes by industries which pollutes the percolating rainwater
5. Reduced ground water levels due to
6. Imbalance in demand and supply of ground water recharge
7. Horizontal and vertical extraction of ground water due to competition and scarcity
8. Excessive pumping leading to imbalance in pressure
9. Lack of public awareness on the overall scarcity and economic value of water
10. Most residential units let out their greywater into the open land
11. Lack of awareness in selection of crops based on economic value
12. Skepticism and lack of unity among farmers to adopt alternate technologies
13. Farmers incentivized towards the same crops by industries demand e.g. sugarcane
14. Poor Quality supply or low water pressure in Kuruchikuppam, Vaithikuppam, Karuvadikuppam and Kuruvinathem Village
15. In Bahour Village, sewage water is mixed in the agricultural canal

Cuddalore

1.	Water Pollution due to untreated waste dump from the industries. As a result potable water is purchased.
2.	Issue with the quality of the water; it has high EC, PH value, etc.
3.	Sewerage and solid waste is mixing with the water and causing pollution
4.	Effluent from the sugar mill at Nellikuppam is causing water pollution
5.	The use of heavy duty pumps for filling the overhead pump extracts more ground water than needed

Viluppuram

1.	Inadequate supply of water at the domestic level. The per capita supply is 54 (L/cap/day) in Viluppuram Municipality, where as Puducherry receives 110 (L/cap/day)

Goals

- Improve collaborative water management in the region
- Encourage sustainable water usage for farming
- Contain urban water demand: public awareness in the urban context

Regional Water Management Models

Auroville Water Harvest

Auroville Water Harvest is a non profit organization working in the area of Viluppuram District, Tamil Nadu since 1996 to combat sea water intrusion and to promote integrated water management with people's participation. The following are some of the projects undertaken by the organization

1. Tank Rehabilitation Project-Puducherry

This project was initiated in 1999 with the aid from the European Union. It is coordinated by the Project Management Unit of the Public Works Department, Government of Puducherry, It included the participation of all the stakeholders (Ayacut farmers, non ayacut farmers, farmers with their own bore wells, landless agricultural labours, scheduled caste people in the colony, women and youth groups, and other general users of the tank) throughout the process.

The successful implementation of the tank rehabilitation works and the sustainable management of the system lie in the effective mobilization of the whole community. In order to create awareness on the management of water resources and to make the people to get involved in the project, Community Organisers are employed through the NGOs. In 2007, 11 Community Organisers and one Nodal Officer were deployed by Harvest to carry out Social mobilization in 40 tank villages. Harvest conducted GPS topographic surveying in tanks, channels and ayacut areas for TRPP. Surveys were conducted in the Puducherry district and the adjacent Tamil Nadu area.

Rehabilitated Tank
Source: Auroville Water Harvest, 2007

## 2. Kaliveli and Puducherry Sedimentary Coastal Basin, a UNESCO HELP Programme

(Excerpts from: http://www.auroville.org/environment/harvest/harvest_gw.htm)

This is a large pilot programme undertaken to create a framework for successful sustainable water management in the Kaliveli and Puducherry Sedimentary Coastal Basin. The main objectives are:

• To understand present circumstances from a hydrological and socio-economical point of view
• To quantify the fresh water resources and their time evolution in order to prevent salinisation in the aquifers
• To define methodologies of system evaluation that could be applied and extended to other sedimentary basins
• and to find good arguments to promote the introduction of water management rules/laws

3. APFAMGS Project (Andhra Pradesh Farmer Managed Groundwater Systems Project)

This project specifically focuses on the demand side management of water though awareness creation and empowering the farmers to manage their own water resources. APFAMGS attempts at getting back to the tradition methods of water management. It demands a new approach to governance itself - a participatory form of governance rather than a top down bureaucratic one - a culture of providing services, howsoever poor and abysmal they maybe rather than one of empowering people to develop their own water resources. It covers about 500 villages in seven drought prone districts of Andhra Pradesh viz., Anantapur, Chittoor, Cuddapah, Kurnool, Mahbubnagar, Nalgonda and Prakasam.
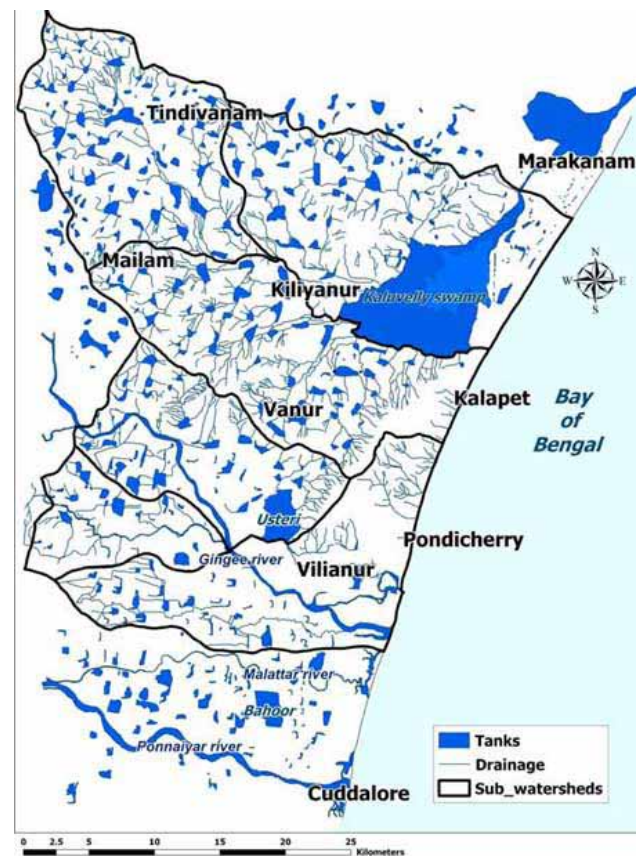
Hydrological network of the 1400 km 2 project area
Source: http://www.auroville.org/environment/harvest/harvest_gw.htm

A City Saving Water, Zaragoza, Spain

"In 1997, the "Zaragoza, the water-saving city" project was initiated in Spain aiming to promote a new water-saving consciousness through a more efficient water management. The project emphasized the importance of simple technological changes to achieve a sizable reduction in water consumption. Partnership arrangements and agreements were made with over 2,450 establishments involving 92,000 people. 168 educational establishments, 428 teachers and 70,000 students are directly participating in the campaign's Educational Programme. People were educated on simple lifestyle changes that could reduce their consumption, such as fixing all water leaks, turning the tap off while shaving, reusing grey water and so on. All in all 1.17 billion m³ of water were saved in one year through changes in people's habits and new technologies

The programme was implemented through the following phases:
* Phase 1: 'Small steps, big solutions' – A widespread awareness-raising campaign to reduce water consumption within homes, public buildings and commercial activity through behavioural change and water saving technology.
* Phase 2: '50 good practices' – The implementation of 50 examples of water efficient technologies and practices in parks, gardens, public buildings and industry to demonstrate performance, overcome resistance and encourage uptake on a wider scale throughout the city.
* Phase 3: 'School for efficient water use' – The dissemination of pocket guides among the city's major water consuming sectors describing the good water saving practices identified in Phase 2 of the programme.
* Phase 4: '100,000 commitments' – The invitation of citizens and businesses to make online public commitments to save water with the aim of recording 100,000 such commitments in time for the International Expo "Water and Sustainable \ Development" which opened in Zaragoza in June 2008.

Extracted from Sustainable Urban Energy: A Sourcebook for Asia UN HABITAT, 2011, ICLEI, .2011 <http://www.switchtraining.eu/fileadmin/template/projects/ switch_training/files/Case_studies/Zaragoza_Case_study_preview.pdf>

Preliminary Recommendations

Physical interventions

1. Construct bed dams below each road bridge over water nallas
2. Capacity motors to be used for filling overhead tanks at the
3. domestic level.
4. Series of check dams need to be built every 10 to 15 kms to increase rain water harvesting. Feeder canals connected to check dams will fill up of tanks/ ponds/ water bodies. This will also stop reverse sea water intrusion
5. Increase the tree cover
6. Pichavaram, Perumal Eri, Veeranam Eri to be developed as tourist attraction
7. Ponneri and Veeraaman to be developed. This will increase the water holding capacity of the tanks and will also reduce the flooding of water
8. Sustainable Farming
9. Creating farm pond in low lying areas
10. Rehabilitation of tanks and ponds based on cascaded approach for better water shed management
11. Build channels for natural irrigation of fields during rainy season from eris as opposed to usage of motor to pump water
12. Creating dead storage in existing tanks and ponds
13. Measuring rainfall for planning crops based on water availability for efficient irrigation.

Policy and Enforcement

1. Establish solar power based desalination plants
2. Minimum charge on electricity or introduce a cap on the number of electricity units and water consumed per year
3. Introduce ground water metering
4. Incentivize co-operative farming
5. In dry lands, there is need for standards specifying a percentage of land for creating irrigation ponds
6. Enforcement for creating percolation ponds near a bore well/ open well to recharge ground water
7. Restrict use of bore wells to one season
8. Self-regulations within farmers associations
9. Introduction of 15% green area of total plot size in building
10. Bye-laws to restore water at individual house level.
11. Subsidizing the water harvesting equipments and compulsory

12. Provision of rain water harvesting for individual house
13. Create and sanction semi-governmental organisation with the mission to create efficient water management awareness
14. Development Bank and government to provide loan facility for promoting new farm ponds to the farmers for their land, to ensure rain water harvesting and crop cultivation, fish rearing
15. Encourage non-paddy crops during summer to save water
16. Promote organic farming for water saving techniques
17. Create rain water harvesting alongwith percolation pits in urban habitats
18. Encourage regular de-siltation of village ponds
19. Water Management
20. All tanks to be managed (rehabilitation, operation and maintenance) should be exclusively done by the Water User Association (WUA) only. WUAs need to be given more powers
21. All encroachments less than 100 acres to be evicted and restored to its full capacity
22. Approved sand quarry sites need to be monitored
23. When roads are designed highways should work in close coordination with PWD
24. Drainage options to be designed properly at the time of road design; barrages need to be planned
25. Bridges over rivers need to be constructed by PWD, instead of the Highway Department, as they have a better knowledge about the flow rates.
26. Farmers should be allowed to use the tank silt, as this will increase the live storage of the tanks and increase the soil fertility of the lakes.
27. Solid waste dumping and diverting household/ municipal sewage to the canals should be prevented
28. Sewerage from Sugar Mill(Nellikuppam) to be taken out through lined (including bottom) channels and then dispersed.
29. Separate act required for protection of agricultural land in line with the "Waterways Protection Act 2008"
30. Decentralized way of planning needs to be adopted. All the departments should work in close coordination
31. Need to develop the rail link from Chennai to Cuddalore via Puducherry, as this would reduce water bodies being used up for road construction.
32. Waste water from Industries:
33. Should be treated and let into the sea or backwater or canals
34. They should be reused by the industry and will encourage them to treat their effluent efficiently

35. Pricing:
- Price of water to be proportionated with income
- Pricing should not be an open door for privatisation / profit making. Industries should be charged heavily for excessive ground water extraction. This would encourage them to reuse their waste water

36. Technological Contribution:
- Technologies at individual or household level: water saving devices, water economical appliances, waste water treatment for individual houses or apartments should be mandated
- Introduce 24 hour supply of domestic water, which actually reduces the total amount of domestic water supplied, as less water is wasted during the individual storing process.
- Two pipeline systems should supply the domestic water: if the per capita consumption is 130 L/cap/day, a minor part needs actually to be potable (around 10 L/cap/day).
- One pipeline system should convey potable water: used for drinking and cooking.
- Another pipeline should supply clean but not potable water: used for domestic purposes such as bathing, toilet, house cleaning etc.

Advocacy and awareness of best practices

1. Creating awareness through school curriculum
2. Dissemination of better technologies for irrigation such as drip irrigation
3. Awareness on benefits of co-operative farming
4. Soil texture and structure based irrigation calendar
5. Need for consensus among farmers on what to grow in each season
6. Research to determine water requirement for each soil type
7. Knowledge of benefits of crop rotation and alternate/ multiple cropping which consume less water
8. Encourage 'farmers to farmers' dialogue to bring the findings of Puducherry farmers to TN farmers and vice versa
9. Instill accountability and responsibility at all levels
10. Transmission of change in behaviour should begin at Individual to Collective to Community and finally at Societal level
11. Sensitisation should also be realised by exemplary models which illustrates best practices
12. Make use of modern social networks (Facebook etc.) for disseminating information

Bahour Lake

7.0 Energy

The situation of energy resources in the PVAC region has in the recent years shown signs of stress. The region's over-dependence on non-renewable sources, rising power purchase costs, increasing under recoveries, loss in the regional green cover, and increased transport energy consumption have become critical trend, which unless immediately rectified could spiral out of control and lead to electricity price shocks and increase in greenhouse gas emissions (GHG). This has resulted in rising inequalities in terms of resource allocation (increasing disparities between the rich and poor, urban and rural areas); environmental impacts (pollution, climate change, global warming); and stress on the existing socio- economic and ecological fabric of the region (consumption behaviour). The growing prominence of renewable energy sources (solar, wind, biofuels) has paved the path for research into alternative technologies as the preferred development path for future energy planning.

With rapid urbanization and lifestyle changes for the urban rich resulting in a situation of over-consumption, the equation between the supply and demand of the energy remains unbalanced. Demand management of energy is necessary to ensure that the users are more energy efficient in terms of their behaviour towards purchase and consumption. A pilot survey was conducted as part of the regional planning process to assess the consumer and vendor behavioural patterns. (Refer side box) Providing high priority of energy provision in rural areas and creating energy smart rural communities that have 24x7 access to electricity is another emerging concept that needs further research related to its applicability within the PVAC region.

The Power Grid Corporation of India Limited (PGCIL) has signed a Memorandum of Understanding with the Puducherry Electricity Department to implement the first Smart Grid Pilot Project in the country. "Smart Grids focus on establishment of a two way flow of information between supplier and user to

Community Perceptions

Power Supply and Consumption Behaviour
- Frequent Power Outages in the Tamil Nadu districts in comparison to its neighbouring Puducherry region

Transportation and Energy
- Public transportation is expensive and unsafe in comparison to private vehicles
- Inaccessible or non-existent public transportation in certain areas

Indifference to high power tariffs/ Unsustainable tariff Structure
- Energy consumption patterns are unlikely to be changed if the power tariffs increase
- High power tariff in the Tamil Nadu region in comparison to the Puducherry region

Lack of awareness
- Unaware about the solar cooking devices, electric scooters and other energy efficient alternatives
- The cost of purchase rather is important than the cost of operation of an electric appliance. Pollution and energy consumption are not important factors while buying or using an energy device.
- Unaware about the energy star rating of the appliances

increase the efficiency and quality by optimizing grid operation, use and infrastructure; integrating large scale intermittent generation; information and communication technology; active distribution networks; and new market places, users and energy efficiency." Rural Smart Grids is a broad concept that covers the entire electricity supply chain and is characterised by the use of technologies to intelligently integrate the generation, transmission and consumption of electricity with considerations beyond technology. The concept aims to optimize generation of power by solar and bio energy combination. Its operation, integrate and improve the reliability and efficiency of electricity supply by considering socio-economic structure and regional perceptions. (http://www.adicet.com/WARES2011/Materials/Sanjay%20Kumar_%20WARES2011.pdf)

Utilization of land resources, development patterns and energy consumption are interrelated. For example, the electricity consumers or rate payers in Puducherry are subdivided into two large categories, Low tension (LT) and High Tension (HT) consumers. The LT consumers are made up of 5 sub categories, namely Domestic, Commercial, Agricultural, Street lighting, and Industrial. The HT consumers are subdivided into HT I, HT II and HT II. We find that the largest numbers of consumers are in the domestic sector. They comprise 73% of the total number of ratepayers in the Union Territory followed by Street lighting (13%) and Commercial (11%). Each of these consumer sections has a certain amount of annual electricity consumption. It is important that we look how much electricity each category of consumers is using annually. This will help us identify the largest users of electricity because any action to increase the systemic efficiency will have to target these consumer groups.

Transport, Land Use and Energy

Increasing dependence on automobiles as the primary mode of travel combined with the public transportation crisis and low-density development patterns in the region continue to exert pressure on the existing region's energy resources. Contemporary energy planning trends emphasize the need for designing compact communities connected with efficient public transportation systems to reduce the carbon footprint, urban heat island effects, fuel consumption, and overall energy consumption at the local and regional levels.

From the energy survey conducted in the region, it was observed that if the fuel cost doubles a staggering 45% people will look for fuel efficient vehicles and 27% people will switch to public transport. Some will walk more (10%) and cycle more. However, not many will switch to smaller vehicles (3%), or move closer to work or share a ride if the fuel cost doubles.

Built Environment

The region is still lagging behind in incorporating energy efficient building regulations in local bye-laws or adopting green building standards such as Leadership for Energy and Environmental Design (LEED) and TERI Griha. Further research on developing tools and strategies at the local level along with implementing pilot projects are needed to increase awareness and adherence of sustainable development building practices in the region. Retrofitting existing municipal buildings and ensuring that all new public buildings are designed "green" from the conception of the project will give the local governments a chance to lead by example the benefits of using better technologies and design elements in building design.

Green Roofs of City Hall in Chicago, Illinois, U.S.A
Image Credit: TonyTheTiger, http://en.wikipedia.org/wiki/File:20080708_Chicago_City_Hall_Green_Roof.JPG#filelinks

Energy Pricing

Energy efficiency cannot be implemented unless there is a tariff rationalisation. Low electricity price leads to wastage. Therefore there needs to be a tariff rationalisation. There must be tariff rationalization where the LT industries and domestic consumer's tariff structures are created so as to ensure that the total cost of power delivered to each consumer category is recovered. While the domestic consumption is 24% of the total energy sold by the PED, it accounts for only 10% of the total revenue. Domestic Consumers have traditionally been charged less than the average power purchase cost of the PED. Similarly the HT industry which consumed around 41% of the total energy sold accounts for more than 54% of the total revenue.

In the case of domestic consumers there is a strong case to ensure that consumers who are economically disadvantaged are provided electricity at lower tariffs. To do this while ensuring that the sector pays the cost of electricity delivered, the local agencies must ensure subsidies within the sector instead of across sectors. The rich domestic consumers must subsidise the cost for economically under-privileged consumers. A fixed slab system can be adopted. In this system as soon as a consumer moves to a higher consumer slab their total consumption is billed at the higher slab rate. This will ensure not only a greater equity in the system but will also ensure that consumers become more energy efficient in their behaviour of purchase and consumption.

Community Awareness

In general, there seems to be low awareness about energy efficient practices/ appliances across the region. There is low awareness about energy star rating appliances, solar cooking devices and electric vehicles. There is a need to ensure that a market transformation occurs so that more and more 5 star appliances are introduced and sold in the market

The need for drafting a regional energy policy framework was reiterated during the workshops conducted as part of the planning process. The framework should look at equitable energy access and distributed generation as well as promote energy efficiency and conservation. The respective electricity departments and renewable energy developments agencies of the two states will then automatically find synergies while attempting to meet the plan objectives.

While the strategies discussed in this section are applicable across the region, the data collected for this study was limited to Puducherry District. Appendix B contains the detailed report of Puducherry's power supply and preliminary strategies to increase efficiency in the sector.

Goals

- Promote long term renewable energy plans at the regional level
- Ensure responsible consumption and encourage energy efficiency
- Ensuring tariff rationalization and reducing sectoral cross subsidies
- Bringing market transformation for energy efficiency appliances
- Achieve energy efficiency in building construction
- Promote the use of energy efficient modes of transport
- Introduce regional level advocacy and awareness programmes on energy efficient practices

Preliminary Recommendations

Policy and Enforcement
1. Work with the government of Puducherry and Tamil Nadu to create tariff rationalization across the region
    - Tariff rationalization needs to be created so as to ensure recovery of the total cost of power delivered to each consumer category.
    - Ensure subsidies within the sector instead of across sectors.
    - Introduce cross subsidies to better serve the marginalised communities

2. Prepare a long term regional plan to generate renewable energy
    - Explore possibilities of collaboration between the Tamil Nadu and Puducherry region, to aid the latter meet its Renewable Energy obligation through wind and biomass generation sourced from the outlying areas of Tamil Nadu.
    - Create decentralized power generation through bio mass. Install mini grids at the tail end of the grid for out flung villages around Cuddalore and Viluppuram.

- Procure biomass from energy plantations as well as farm residue, which would in turn generate income in the Puducherry, Cuddalore, Viluppuram and Auroville regions.
- Prosume: Introduce Solar roof top PV feed in tariff to increase and encourage individual production of electricity across the region
- Promote roof top renting for the installation of solar panels
- Conduct a detailed resource and consumption mapping of the region. This should culminate in a detailed 5 year plan with annual targets with detailed monitoring and evaluating procedures to ensure that objectives are being met and to suggest course correction in case of failure to meet targets.

3. Reduce energy consumption in agricultural use
    - Subsidize agricultural output instead of the input; the basic facilities like the electricity and water should not be subsidized for agricultural consumption
    - Reduce pump size with energy efficient E pump sets (Head, delivery)

4. Encourage the use of appliance and products with energy efficiency ratings through government procurements
    - Tenders for government procurement for appliances could be 5 star rated appliances and evaluations could be based on life cycle costs and payback of these appliances. Large scale purchase orders will mutually benefit all the areas as the bargaining power will substantially increase. The regular procurement of energy efficient appliances will also mean that dealers and stockists will stock more and more of efficient five star appliances

Physical Interventions

1. Promote Energy Efficiency Practices
    - Replace incandescent lamps with Compact fluorescent lamps (Domestic)
    - Replace old T8 tubes with new T5 Tube lights (Domestic)
    - Ensure all new ceiling fans sold are energy efficient
    - Introduce Energy Efficiency activities that have life cycle costs lower than average power purchase costs
    - Conduct energy audits of govt buildings
    - Smart load reduction

2. Achieve Energy Efficiency in buildings
   - Adopt traditional architecture which responds to the local climatological conditions. This incorporates day lighting and passive cooling in buildings.
   - Reduce the total embodied energy of a building
   - Incorporate green roofs in building design
3. Minimize waste from the buildings: Reduce, recycle and reuse at each building level
   - Incorporate EE principles in new building construction
   - Retrofit existing buildings
4. Strive to implement energy efficienct transportation practices
   - Encourage non-motorized vehicles, public transportation and electric vehicles
   - Dedicated lanes for high capacity carrying vehicles
   - Dedicated parking/ priority parking for energy efficient vehicles/ car pools

Advocacy and Community Awareness
1. Create awareness programmes on energy efficiency though electronic and print media
2. Introduce awards for Energy Efficiency appliances/ products to encourage the retailers to sell and use these products
3. Create advocacy for renewable energy production

Solar Cities Programme, India
The Ministry of New and Renewable Energy (MNRE), Govt. of India has sanctioned the Solar Cities programme under their 11th Five Year Plan with an objective to help Urban Local Bodies guide their cities towards becoming "Solar Cities".

The Solar City aims at minimum 10% reduction in projected demand of conventional energy at the end of five years, through a combination of enhancing supply from renewable energy sources in the city and energy efficiency measures. The basic aim is to motivate the local Governments for adopting renewable energy technologies and energy efficiency measures. In a Solar City all types of renewable energy based projects like solar, wind, biomass, small hydro, waste to energy etc. may be installed alongwith possible energy efficiency measures depending on the need and resource availability in the city.

The Solar City programme aims to:
- To enable and empower Urban Local Governments to address energy challenges at City - level.
- To provide a framework and support to prepare a Master Plan including assessment of current energy situation, future demand and action plans.
- To build capacity in the Urban Local Bodies and create awareness among all sections of civil society.
- To involve various stakeholders in the planning process.
- To oversee the implementation of sustainable energy options through public - private partnerships.

(Source: http://www.mnre.gov.in/schemes/decentralized-systems/solar-cities/; Sustainable Urban Energy: A Sourcebook for Asia UN HABITAT, 2011)

Eco-Districts

The eco-district is a self-sustaining unit, which is a part of a larger system like a city or a town. This concept attempts to bridge the social, cultural and economic barriers in the community by emphasizing on the concept of community owned and shared spaces. The elements within the district are identified and constructed according to the needs of its people. Also, the eco-district applies sustainable design principles at the neighbourhood level, making it energy efficient in the long-term.

An Eco-district embodies the following :
Ecological Aspect:
•	Efficient use of water and energy
•	Reduced ecological footprint
•	Reduced carbon emissions
•	Interactive built and open spaces
•	Effective Solid and Waste Water
•	Management
Economical Aspect:
•	Community owned business
•	Employment generation within
•	the district through the businesses
•	within the district
Social Aspect:
•	Shared Community spaces
•	Mix of Uses and Amenities
•	Community involvement in the
•	planning, construction and maintenance of the spaces
Extracted from http://en.wikipedia.org/wiki/Ecodistrict

Kronsberg eco-district of Hannover, Germany, Image credit: Jeb Brugmann,
Accessed online at: http://www.asla.org/ContentDetail.aspx?id=28358

PVAC Region Energy Survey

Consumers and vendors in the four development hubs in the bio-region were interviewed across. The objective of this exercise is to carry out a consumer and vendor (of electrical appliance) survey in the region to:

- Assess energy usage pattern in relation to domestic electrical appliances, cooking and mobility
- Create awareness among the respondents about energy efficiency and challenges with energy production and consumption
- Seek out likely future behaviour in various scenarios with cost and availability of energy.
- And through this
- Discover trends in behaviour relating to energy consuming products and energy consumption
- Contribute to a sustainable energy policy framework

A total of 278 consumers and 23 vendors have been surveyed in the bio-region for this exercise. Appendix A contains detailed results of the survey.

Survey Assumptions
As the local community was apprehensive about disclosing information about their income, the income group assessment was made during the time of the survey, based on observation of the ownership of vehicles/ home/ appliance, locality of the respondent among others.

Observations: Consumer Survey

Electricity

Trends
- A significant number of respondents surveyed (45%) claim that their behaviour will not change if the price of electricity went up. The figure rises to 70% in the high income segment.
- The survey suggests that 8% of the users will continue to buy an incandescent lamp in the future. Around 40% would buy a tube light. Their future behaviour relating to CFL is unclear. The response to question 45 suggests more than 50% will chose a CFL in the future. However, the response to question 44c seems to indicate only a small number (7%) will switch to CFL if electricity prices went up.
- Only 20% of the fan users will look for energy efficient fans if electricity prices went up. And 13% of the users will look for an energy efficient fridge if electricity prices went up.
- Less than 10% will look for energy efficient TV if electricity prices went up.
- However, 25% of AC users may use it less if electricity prices go up.

Key Findings
- Electricity consumption and bills are dependent on income groups
- 45% people across different income groups do not foresee any reduction in their consumption if there electricity prices went up
- Incandescent lamps are still being used. Increase in consumption/ use for CFL is not significant despite obvious advantages. No awareness and provision for disposing used CFL exists in the region.
- Poor house design results in more light and fan usage in homes
- The major contributing factor to domestic load at present includes lights, fans, fridge and TV. This will change as more products are being offered in the market and the affordability improves with rise in per capita income.
- Similarly, only 5% respondents currently have an inverter backup system. This will grow with rise in per capita income and power outages

Cooking
Trends
If the LPG prices doubles from its current price, 30% of the households surveyed would switch to electric stoves, whereas 65% would switch to Biomass. Most low income households intend to switch to Biomass.

Key findings
- Most households use LPG for cooking. Most of them will switch to biomass if the price of LPG doubled. One third of them will switch to electric cooking.
- On average, Pondicherry households consume more kWhs in comparison to the Tamil Nadu households
- LPG users are spending around Rs 300 to 500 per month on cooking fuel where as biomass users tend to spend less than Rs 200.
- Only one third of biomass users are using smokeless stoves for cooking.
- Convenience and cooking time matter in cooking fuel selection more than cost and fuel and fuel availability.
- Lack of awareness seems to be the key factor in poor adoption of solar cookers.

Transportation

Trends

If the fuel cost doubles, a staggering 45% people will look for fuel efficient vehicles and 27% people will switch to public transport. Some will walk more (10%) and cycle more. However, not many will switch to smaller vehicles (3%), or move closer to work or share a ride if the fuel cost doubles.

Key findings

- Most people use public transport but not daily. It is not a popular mode of commute to go to work. Cost and safety are key barriers in its usage.
- People belonging to the low income segment walk and cycle more to work than the people belonging to the high income segment.
- Most people (60%) use motorcycles to commute to work. .People in the low income segment are beginning to use it to commute to work too with more than 25% penetration.
- The roads and parking spots are overflowing with cars when the car ownership is only restricted to 13% of the total respondents
- More than 44% people use cars less than once a week. This is ideal for car sharing.
- Electric scooters have not caught on in the region.

Observations: Vendor Survey

- Incandescent lights are used for lighting in all of the vendor's shops. The vendors appear to prefer Tube lights over CFL for lighting in their shops.
- 56% of the vendors interviewed experience over 4 hours of power cuts in a day. Only one among these vendors is located in Pondicherry. The shops in TN seem to experience a minimum of 2 hours of power cuts in a day. In comparison, the Pondicherry shops seem to experience power cuts only a couple of times in a week.
- The product selection, by the vendors, is largely based on the cost and quality of the product and the profit it generates. Energy consumption of the products sold is not one of the top priorities of the vendor.

8.0 Implementation Programme

The success of the Puducherry-Viluppuram-Auroville-Cuddalore (PVAC) Regional Plan ultimately rests on the coordinated efforts of the various agencies and stakeholders serving the region. Through this regional planning process, INTACH and PondyCAN have successfully initiated a dialogue between key stakeholders that have a significant impact on shaping the region's future growth. Some of these stakeholders include:

- Local, State and Central Government- Government of Puducherry, Tamil Nadu Ministry of Urban Development, Town and Country Planning Organization (TCPO), Cuddalore and Viluppuram District Collectorates, Auroville Town Development Council, including the various government departments
- Non-governmental agencies (NGOs) and Area institutions- French Institute of Puducherry, FERAL, Dhan Foundation, Centre for Ecology & Rural Development, Pitchandikulam Bio-Resource Center.
- Private Sector- Confederation of Indian Industries (CII), developers, infrastructure providers
- Residents, civic society residents, and farmers

In order to implement the various projects, policies, and ideas generated as part of this process, it will be critical to utilize the synergies created by this regional planning effort to continue with an ongoing programme that strengthens the role of these organizations in providing a better quality of life for the people residing in the region.

The work of various agencies in the region needs to be integrated in order to achieve the PVAC Regional Plan objective of more balanced regional development. This chapter outlines the anticipated organizational framework and recommended implemented functions intended to serve as a guideline for the various individuals and organizations involved in turning this vision into reality.

The development of a shared regional vision is a critical part of the planning process, but our work does not end here. This theme addresses the need for increased effectiveness of governments in the region and beyond, which is important to meet residents' needs regarding accountability and transparency. The main objectives of this suggested implementation programme include:
• Integrate State and Local Planning Practices
• Capacity Building
• Improve Access to Information
• Pursue Coordinated Investments

Way Forward- Next Steps

Successful implementation hinges upon close cooperation and coordination between private groups, NGOs and public agencies requiring strong and determined leadership. While leadership is a highly intangible quality, it is the single most important factor for successful implementation of any master planning effort. This leadership must come from both the public and private sectors. Because the proposed regional planning framework encompasses the State of Tamil Nadu and the Union Territory of Puducherry, the establishment of a clear driving force at the Central and State Government levels to bring those involved together will be pivotal in the success of this effort.

Several priorities were identified in the four stakeholder workshops conducted during the course of the initial phases of the regional planning process. Various speakers explained the rationale in the preparation of a Regional Plan and how this would benefit both Puducherry and the adjoining districts of Cuddalore and Viluppuram in Tamil Nadu. The initial hesitation and apprehension that this was an exercise designed to benefit only Puducherry was allayed by presenting how development would flow into the less developed districts of Tamil Nadu once a holistic development plan was prepared.
Specifically, the following preliminary recommendations were suggested.

Define the "Planning Region"

Regional Planning researchers and practitioners acknowledge that delineating a planning region is a complex task primarily because of the diverse range of interests and factors involved in selecting the boundaries. Regions have been defined on several criteria: eco-system based or bio-regions, economic, administrative, physical or activity regions.

For the purposes of this study, the region had been defined based on the basis of several rudimentary criteria. A 40 kilometer radius around Puducherry city was identified taking into consideration the administrative boundaries, natural features (specifically the water bodies and topography), and presence of major growth centers (population and employment linkages).

However, during the stakeholder workshops several participants expressed the need to expand the area to encompass the entire districts of Cuddalore and Viluppuram as the defined "planning region" for subsequent planning efforts. It is recommended that a delineation exercise be conducted based on collection of technical data and scientific analysis regarding the region's water resources to identify the watershed based bio-regions within this larger area.

Governmental Support

A regional plan for Puducherry and surrounding districts of Cuddalore and Viluppuram could evolve into a new paradigm for development in the country. Since it involves the cooperation of two State governments the Union Territory of Puducherry and the State of Tamil Nadu, it will be important to gather support from the governmental officials and elected members at the Central, State, district levels. The District Collectors of Cuddalore and Viluppuram have agreed in principle to initiate the regional planning concept in their respective districts and were instrumental in organizing two successful workshops in Cuddalore and Viluppuram regions. Representatives from the Department of Town and Country Planning in Chennai also attended the workshops.

The Government of Puducherry has already officially endorsed this Regional Planning effort. It was determined during various consultations with the Cuddalore and Viluppuram officials that a formal approval from the Government of Tamil Nadu should be obtained for the effective preparation of the Regional Plan. This would enable the Collectors of Puducherry, Cuddalore and Viluppuram to meet officially and propose the roadmap for this initiative. Additionally, it was recommended that

the Ministry of Urban Development, Government of India in New Delhi, should be requested once again to discuss the potential of developing a Model Inter-State Regional Plan with the Tamil Nadu Government.

Establish Working Groups

Once the necessary approvals from the two State Governments are obtained and appointed officials are on-board, a steering group and sub-working groups should be formed. For successful realization of the collaborative planning model and to continue the dialogue at the state levels, a Steering Group made of the following players should be constituted- secretaries of Urban Development and Town and Country Planning from both states, District Collectors, and representatives from Auroville Town Development Council, PondyCAN, and INTACH.

Furthermore, sub-working groups with civil society should be constituted on the lines of the Working Groups constituted for the NCR Plan-2021 to provide regular input during the preparation of the Regional Plan. The sub-groups may include:
1. Land Use and Rural Development
2. Policy Zones and Demographic Analysis
3. Physical Infrastructure
4. Social Infrastructure including Heritage and Tourism
5. Environment and Disaster Management
6. Institutional Framework
7. Economic and Fiscal Policy

Statutory Support

To ensure the successful implementation of the PVAC Regional Plan and to ensure the commitment of the governmental agencies at various levels, it is necessary that appropriate statutory provisions relating to the planning and regulatory powers of the regional and local authorities are in place. The 1985 Enactment of the National Capital Region Planning Board Act by the Union Parliament, with the concurrence of the participating States of Haryana, Rajasthan and Uttar Pradesh, resulted in the constitution of the NCR Planning Board. Taking inspiration from the reasonable success around Delhi, a similar structure should be explored for the PVAC Region.

Under current provision, the 74th Constitution Amendment stipulates that District Development Plans need to be prepared for all constituent districts of the Inter-State Region. However, none of the districts in the region have formulated any of these plans. Furthermore, the integration of the District Development Plans into regional plans has to be further

researched. The PVAC Regional Plan provides a unique opportunity to search for a new model for integrated regional planning in India.

The new Draft National Water Policy 2012 also emphasises that "Integrated Water Resources Management (IWRM) taking river basin/ sub-basin as a unit, should be the main principle for planning, development and management of water resources. The departments / organisations at Centre/State Governments levels should be restructured and made multi-disciplinary accordingly.

Create a Regional Planning Technical Cell

It would be imperative that a Regional Planning Cell be created for coordinating and monitoring the implementation of the plan on an ongoing basis. The primary role of this cell should be to provide technical research support to the Steering Board, Working Group, or the PVAC Regional Planning Board. Considering Auroville's unique status and role in the region, it is recommended that this option be explored further in collaboration with the Auroville Town Development Council, local governments with support from TCPO in Delhi.

Strengthen Partnerships

As part of the implementation programme, it is recommended that INTACH and PondyCAN continue working with various local, regional, and state level organizations to strengthen the networks established as part of this first phase planning process. This also includes forging key urban- rural partnerships which recognise that urban and rural areas are inter-dependent, and developing strategic alliances with private sector entities to ensure that future development patterns are sustainable in nature.

Initiate Phase 2 of the Regional Planning Process

In order to build upon the relationships built during this phase of the regional planning process, INTACH and PondyCAN should continue with the efforts to initiate the second phase of the process. The above mentioned organizations have already submitted a research proposal to the Town and Country Planning Department, Ministry of Urban Development, Government of India, and this should be augmented by creating a grant stacking strategy that identifies further funding opportunities. A second proposal would be made to the Collector of Cuddalore to strengthen co-operation between the two districts of

Cuddalore and Viluppuram in the preparation of a development plan of these areas.

During this phase, the regional planning framework will be further developed to formulate regional planning guidelines as well as preparing sub-region functional plans at regional, district, and city/village levels that are sensitive to existing infrastructure carrying capacities. The following are the 8 sub-plans proposed as part of the proposed Regional Plan proposal:

- Agriculture and bio-diversity conservation sub-plan
- Land-uses (with GIS mapping) and provision for disaster
- management sub-plan
- Demography sub-plan
- Socio-economic development sub-plan
- Sub Plan relating to Water, Irrigation & Drainage (W.I.D) combined
- with Sanitation, Sewerage, Effluent & Solid Waste Management
- (S.S.E&SWM)
- Multi-modal transportation sub-plan
- Energy and climate change management sub-plan and Sustainable
- Habitat Mission
- SMEs, informal sector and skills development sub-plan

Integration with Local Plans, Policies and Programmes

During the workshops the need for updating the local master plans was emphasized. The regional plan should be informed by relevant local plans and strategies, while at the same time, government departments and agencies should establish mechanisms to ensure that local policies are consistent with the regional vision.

Identify Joint Pilot Projects

To sustain the momentum generated by this regional planning initiative, it will be critical to identify catalyst joint projects between the different districts that demonstrate a commitment to creating sustainable communities across the region. Transportation networks including roadways, rail service, public transportation, airways, and waterways serve as prime opportunities for promoting projects at a regional scale as they typically fall under the purview of the Central Government (National Highways Authority of India and the Indian Railways). One such example identified during the workshops was to provide better rail connectivity between the major growth centers in the region, including frequent rail service between Cuddalore town, Viluppuram town, and Puducherry.

Ongoing Community Participation, Outreach and Advocacy

A key outcome of this phase of the PVAC Regional Plan was the community outreach and participatory planning approach adopted. The involved organizations should work with area residents, government agencies, private entities and institutions to establish channels of communication that foster support for an integrated sustainable planning effort and facilitate programme implementation.

Stakeholders, including civil society, should provide information concerning all aspects of the regional plan throughout the process using venues such as newsletters, radio, television, newspapers, websites, as well as presentations to neighbourhood and civic organization meetings to generate public support. An outreach working group with representatives of key interests, including government departments and state agencies, NGOs, the private sector, and other relevant entities should be put in place by the proposed Regional Planning Steering Committee.

Community surveys related to the various themes (transportation, water, energy) that were initiated as part of this phase should be continued on an ongoing basis. Conducting surveys in collaboration with local residents, especially youth, will help create awareness about the importance of participation in planning decisions as well as provide local employment opportunities.

Regional GIS Clearinghouse and Data Sharing Policy

Geographic Information System technology was utilized to collect important data related to the region's physical, administrative, natural, and economic features. However, there are several organizations- both governmental and non-governmental- within the region that have over the years compiled data that is currently inaccessible to all users. As part of the regional planning efforts, it is very important to ensure that a coordinated networked data sharing policy is established at the regional level. The intent is to facilitate planning and management of the region's data resources specifically GIS, that improves access to information that is affordable and in an easily usable format. Creating a GIS Clearinghouse with well-defined data policies, in collaboration with the local governmental departments, should be the first step towards achieving this objective.

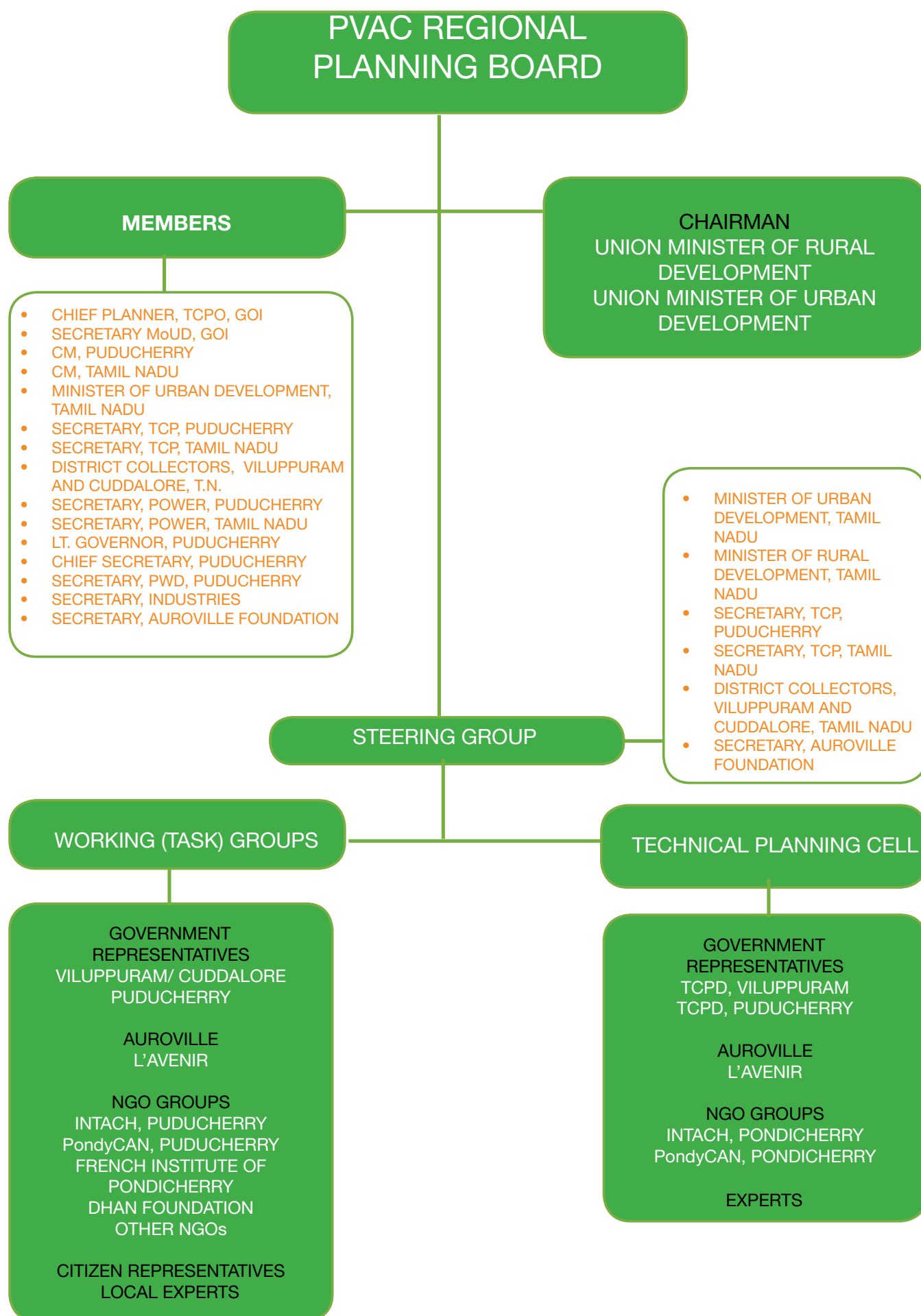# Identify Funding Sources and Mobilization of Resources

Government and international aid grants have long been a source of funding for research projects. Developing a consolidated grant stacking strategy for the various components of an integrated sustainable regional plan will assist in ensuring that the process is carried forward as an ongoing programme. Collaborating with the various non-profit agencies and area institutions to jointly apply for grants could be used as a strategy to ensure that integrated planning goals are incorporated into several projects in the region.

The most important element required for achieving success of a Plan is the availability of the resources. In the case of NCR, funds for development activities in the NCR are available mainly from four sources:

*   NCRPB assisted projects, the Board provides loan up to 75% of the
*   cost of the project.
*   State Government projects are implemented by various
*   development authorities, local bodies, housing boards, industrial
*   development corporations etc.
*   Projects funded by Central Ministries such as Railways,
*   Communications and Information
*   Technology, Shipping, Road Transport and Highways etc. and
*   Private sector investment in infrastructure.

The funds available with the Board are from the following sources:

*   Grant from the Ministry of Urban Development
*   Contribution from Delhi Government
*   Market borrowing (Taxable and Tax-free bonds)
*   Internal accruals (Interest income)

PVAC REGIONAL PLANNING BOARD

MEMBERS

- CHIEF PLANNER, TCPO, GOI
- SECRETARY MoUD, GOI
- CM, PUDUCHERRY
- CM, TAMIL NADU
- MINISTER OF URBAN DEVELOPMENT, TAMIL NADU
- SECRETARY, TCP, PUDUCHERRY
- SECRETARY, TCP, TAMIL NADU
- DISTRICT COLLECTORS, VILUPPURAM AND CUDDALORE, T.N.
- SECRETARY, POWER, PUDUCHERRY
- SECRETARY, POWER, TAMIL NADU
- LT. GOVERNOR, PUDUCHERRY
- CHIEF SECRETARY, PUDUCHERRY
- SECRETARY, PWD, PUDUCHERRY
- SECRETARY, INDUSTRIES
- SECRETARY, AUROVILLE FOUNDATION

CHAIRMAN
UNION MINISTER OF RURAL DEVELOPMENT
UNION MINISTER OF URBAN DEVELOPMENT

- MINISTER OF URBAN DEVELOPMENT, TAMIL NADU
- MINISTER OF RURAL DEVELOPMENT, TAMIL NADU
- SECRETARY, TCP, PUDUCHERRY
- SECRETARY, TCP, TAMIL NADU
- DISTRICT COLLECTORS, VILUPPURAM AND CUDDALORE, TAMIL NADU
- SECRETARY, AUROVILLE FOUNDATION

STEERING GROUP

WORKING (TASK) GROUPS

GOVERNMENT REPRESENTATIVES
VILUPPURAM/ CUDDALORE
PUDUCHERRY

AUROVILLE
L'AVENIR

NGO GROUPS
INTACH, PUDUCHERRY
PondyCAN, PUDUCHERRY
FRENCH INSTITUTE OF PONDICHERRY
DHAN FOUNDATION
OTHER NGOs

CITIZEN REPRESENTATIVES
LOCAL EXPERTS

TECHNICAL PLANNING CELL

GOVERNMENT REPRESENTATIVES
TCPD, VILUPPURAM
TCPD, PUDUCHERRY

AUROVILLE
L'AVENIR

NGO GROUPS
INTACH, PONDICHERRY
PondyCAN, PONDICHERRY

EXPERTS

Case Study: National Capital Region, Delhi

The National Capital Region (NCR) area is 33,578 sq kms. and comprises of:
- National Capital Territory of Delhi (NCT-Delhi)
- Haryana Sub-region comprising of eight districts namely, Faridabad, Gurgaon, Rohtak, Sonepat, Rewari, Jhajjar, Mewat and Panipat
- Rajasthan Sub-region comprises of Alwar district
- Uttar Pradesh Sub-region comprising of five districts namely, Meerut, Ghaziabad, Gautam Buddha Nagar, Bulandshahr and Baghpat

The Plan aims to promote growth and balanced development of the whole region through providing economic base in the identified major settlements (Metro Centres/Regional Centres) for absorbing economic development impulse of Delhi, efficient transport network, development of physical infrastructure, rational land use pattern, improved environment and quality of life.
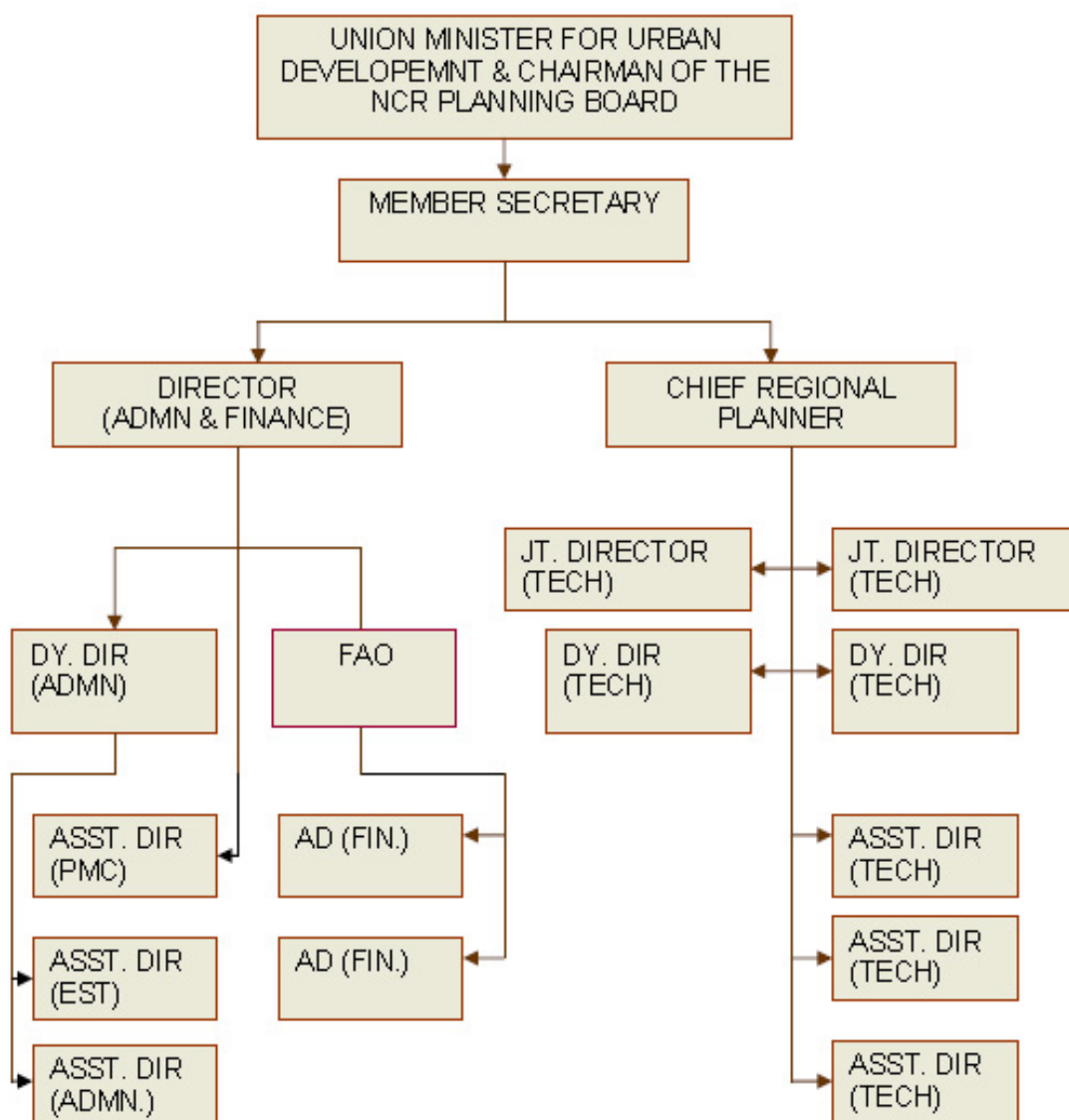
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