

Water Management Challenges to Sustainability of Agriculture in Pondichery

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Abstract

While water holds the key for food production and agriculture perhaps is the major consumer of fresh water, sustainability of agricultural development greatly depends upon timely reliable and sufficient supply of water for cultivation. Contradictorily, evidences from various studies indicate a steady decline in the availability of fresh water for agriculture not only due to the competing demands for multiple uses of water, but also due to environmental pollution and water resource despoliation.

In the backdrop of ongoing urbanization coupled with increasing water scarcity in Pondicherry, this paper investigates into the question of sustainability of agricultural development in this region. Locating the enquiry into the management of surface and groundwater resources, this paper attempts to delineate the impediments, issues and implications in water resource management for sustainability of agriculture in Pondicherry.

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INTRODUCTION

Agriculture and irrigation sectors have always been a prime focus world over for reforms because of their importance in world economy and rural livelihood of 41% of world's total labor. Although securing water for both productive and domestic uses is critical in achieving food security and improved rural livelihoods in most parts of the world, one third of the world's population is currently experiencing some kind of physical or economic water scarcity. Competing demand for water from different sectors, including industry, urban domestic use, tourism, power generation, etc. poses challenges to rural people to access this vital resource for productive, consumptive and social uses. In water-scarce regions and countries, inequity in access to water resources is increasing because of competition for limited resources, and this particularly affects poor rural people, especially women.

In the backdrop of ongoing urbanization coupled with increasing water scarcity in Pondicherry, this paper attempts to investigate into the question of sustainability of agricultural development in this region. Locating the enquiry into the management of surface and groundwater resources, this paper attempts to delineate the impediments, issues and implications in water resource management for sustainability of agriculture in Pondicherry.

WATER AND SUSTAINABLE DEVELOPMENT

Sustainable Development Goals (SDG-6), 2017 has given importance to clean water and sanitation for the efficient use of water and sustainable withdrawals and supply of fresh water and to have integrated water resources management and also to protect and restore water related ecosystems including mountains, forests, wetlands, rivers, aquifers and lakes. International cooperation and capacity- building support in water harvesting, desalination, water efficiency, waste water treatment, recycling and reuse technologies of water is also given adequate importance by SDGs. SDGs also focus on the participation of local communities in improving water and sanitation management.

In India, water is not only becoming increasingly scarce in many regions, and requires judicious management but also country's surface irrigation systems are deteriorating. Of all the uses of water in India, irrigation is estimated to be a major consumer. Figures indicate (Source: Indiastat.com) that annual requirement of water for irrigation in India will go up from 541 BCM (85% of the total annual water requirement) from the 2000 levels to 910 BCM by 2025 at the current levels of efficiency (20-50%). Major problems facing Indian irrigation sector include: a) declining investment on maintenance; b) low levels of system efficiency; c) poor financial working; and, d) low quality, reliability, and system-wide equity. Further,

there is a competing demand for water from other sectors. In the light of this scenario, our ability to address future water scarcity problems and conflicts over the use of water would depend heavily on how we manage irrigation sector (Kumar, 2007).

WATER MANAGEMENT CHALLENGES IN PONDICHERRY

Pondicherry with the density of 3232 sq.km as per 2011 census witnessing an increasing population growth of 29.23% has registered increased growth in urban areas 1990s to 69.16% in 2011 and decrease in rural area to 30.84% in 2011 signifying steady decline of agriculture corresponding to Liberalization, Privatization & Globalization. It has witnessed a massive growth of factories which set the stage for urban development. This growth ensured increased water utility in industry and urban without replenishing it. Water in Pondicherry is been undervalued and over used without regard to the current cost and availability and also with no regard to future requirements. Excessive use of groundwater, improper maintenance and functionality of irrigation systems, unsystematized drinking water, improper disposals of waste into water without recycling leads to water scarcity not only in future but is being experienced in the present as well. Total annual availability of water for all uses is 200mcm and annual per capita of water is 200 cubic meter per person. The water required for various purposes like agriculture, industry challenges and for domestic is estimated as 150mcm, 20mcm and 33mcm respectively, totally amounting to 203mcm. This evidently shows the scarcity of water resources in Pondicherry area. Ground water depletion is the major issue as mentioned earlier by excessive extraction of ground water and development of urban centres with buildings and concrete infrastructures has lowered the level of ground water availability to 35-50 ms, which was previously 15-30 m. the urban settings has not given the space for the ground water to get recharged because of the void vegetation cover and unseen wetlands on the surface of the soil. Tanks and canals are also not properly maintained so that it can arrest the runoff water within it.

Sea water intrusion is the common problem found in Pondicherry region. Even if the ground water is received through long dug tube wells or dug wells, the water may tend to be saline in nature because of the seepage of salt water. The reason is being attributed as over extraction of ground water. Nearly 10-15 villages in Pondicherry have saline ground water which cannot be used for drinking purposes. And water to those places is being served by the water tankers by the commune heads. Salt water intrusion can be seen up to 5-7 km, so ground water can be extracted only after the above said area.

Industrial pollution is another way of depleting water resource that is found in Pondicherry area. The industrial settings found in Kirumambakkam, Mettupalayam,

Sedarapet areas are highly polluted by dumping of solid waste into the water and land. Solid wastes, untreated water, chemicals from industries have been directed to water without proper management. There can also be seen an upward mobility of chemicals and its constituents from the industries to the water sources and leaving it in poor and ill quality, unfit for consumption. High consumption of water by industries and factories and also for power stations has decreased the use of water for irrigation purpose or any other purposes. Increase in population has resulted in mass consumption of water for domestic uses resulting in scarcity.

30% of municipal wastes are thrown into water. There is no proper drainage system in Pondicherry and the wastes reach the water untreated. Urban waterways, tanks, ponds are polluted with industrial excretion and this has made an irrigation canal to become a main sewage. All these issues have made the water an economic good which is undervalued by water charge of Rs.50/ cubic meter for domestic use and Rs.1.50/cubic meter for commercial and institutional use, whereas the cost of supplying water being at Rs.5/ cubic meter.

CHALLENGES TO SUSTAINABILITY OF AGRICULTURAL DEVELOPMENT IN PONDICHERRY

With North-east monsoon as the major source of rainfall amounting to 1200mm, Gingee and Pennaiyar are the major rivers in the Puducherry region. Gingee River traverses diagonally from North-West to Southeast with Pambaiyar tributary, while Pennaiyar River forms the southern border of Puducherry region with Malattar and Kuduvaaiyar spill channels. River water is conveyed through feeder canals.

Groundwater and surface irrigation being the sources of irrigation, well and tank irrigation are the most important form of irrigation in the territory. The total extent of fresh water in the union is estimated at 1347 ha. And the major water bodies are Usteri and Bahur tank which alone cover 8.30 ha. Recharging and replenishing of groundwater takes place only through the availability of surface water, and tanks are the only possible surface water irrigation in Pondicherry to have control over the runoff water and to save the rain water for future and to check river flow through organized dams. Irrigation for agriculture is done through surface water resources whereas water for domestic and commercial and industrial activities is fed by ground water resources. Rain water in Pondicherry reaches sea without tapping and utilization. North- west region of Pondicherry, known as Redhills or Gorimedu has very good ground water level saved naturally through pebble conglomeration under the surface soil. Presently, it is found that there is 35mm³ of surface water and 150 mm of groundwater which is 20% less than the requirement.

And since the ground water recharge depends on the surface water supply,

the total recharge is estimated at 164 mm³ arising out of rainfall, irrigated fields, rivers and canals, and from tanks, ponds and lakes. I.V.K. Reddy (Hydro- Geology & Agriculture Extension) estimated the utilizable groundwater resources at 85% of the gross recharge potential at 151 mm³. A gradual decline in groundwater level is visible which shows that its draft to meet the agricultural, domestic and industrial demands exceeds the gross recharge potential of the resources. Initially, Puducherry was highly dependent on groundwater resources which can be seen in the following table:

Table No: 1 Area under different irrigation sources in hectares

	2006-07	2007-08	2008-2010	2009-10	2010-11	2011-12
CANALS	6472	6170	5707	5755	4558	5761
TANKS	-	-	-	-	-	-
TUBEWELLS	11222	10896	10443	10187	10164	9563
NET IRRIGATED AREA	17694	17066	16150	15942	14722	15324

(Source: Directorate of Economics and Statistics, Puducherry)

Ground water being the main source of irrigation in the Union Territory, excessive extraction of ground water results not only in the declining ground water table, but also causes sea water intrusion in the East-cost.

Table No: 2 Groundwater potential (in mm³)

CONSUMTION	POTENTIAL
AGRICULTURE	116
DRINKING	18.5413
INDUSTRY	5.4750
TOTAL	140.0163

(Source: Directorate of Economics & Statistics, Puducherry)

Groundwater level went lower to 150 to 250 feet, even to 350 feet in some places from 25 to 50 feet. This was due to groundwater exploitation by percolation of sea water leading to saline ground water, emission of industrial wastes and effluents, licensed chemical industries, biomedical wastes, village and urban liquid wastes, not recycled solid wastes, etc. Ground water level dropping was seen as result of lack of surface water irrigation, mismanagement of surface water bodies, neglect of runoff and also over use or over extraction of the resource.

There are 84 tanks been identified in Pondicherry region and out of 84, 54 are system tanks and 25 are non- system tanks. Each tank irrigation system consists of a catchment area, a tank and a command area. Only 40 tanks out of 84 can be seen

with proper tank maintenance and *ayacut*, non- *ayacut* areas. Usteri is the biggest irrigating tank in the Pondicherry region receiving water from River Gingee through Suttukanni channel has total *ayacut* area of 1538 ha and has lost one third of its area. Bahour commune and its tanks are affected by salt water intrusion. The tanks that are affected are Kirumambakkam, Pinachchikuppam, Bahour Sitheri, Manapattu, Utchimedu, Adingapattu, Kudiyirippupalayam, Kuruvinathan and Cherry Sluice of Bahour Tank. Canal irrigation is also a common way of irrigation found in Puducherry state but it is widely seen in Karaikal, 25% of irrigated land through canal irrigation is from Cauvery River.

RETROGATION OF IRRIGATED AGRICULTURE IN PONDICHERRY

Among the working population of 237953 males and 77617 females, cultivators and agricultural laborers account for only 9393 and 51908 respectively, but over 70% of the people depend directly or indirectly on agriculture for their livelihood. Because of the low income from agriculture, more than 30% of the people are living below the poverty line. Since most people depend on agriculture for their living, the income from the land has to be substantially increased to solve the problems of poverty in the Territory. There seems to be no collective effort among the people to take to intensive farming practices to achieve maximum, or even optimum, returns from the land holdings, utilizing the available resources of irrigation water.

Table No: 3 Classification of Area under agriculture in hectares

	2008-09	2009-10	2010-11
Total area according to village papers	48651	48651	48651
Land put to non-agricultural uses	18283	18466	18547
Other fallow lands	2454	2526	2369
Net area sown	19205	18734	18565
Total cropped area	32768	31910	31437

(Source: Directorate of Economics & Statistics, Puducherry)

GSDP contribution by primary sector came down to 2.59% from 15.15% because of more recent development of industrial activities in the suburbs of Pondicherry town in Mettupalayam, Thattanchavady, Sedarapattu, Kirumambakkam and Thirubuvanai areas and there is migration of labour to the urban area, which is creating the problems of various kinds as mushrooming of slums, inadequate basic amenities of shelter, protected drinking water, public health, sanitation, etc leading to

urban population explosion. While a few enlightened farmers, especially those governed by the Pondicherry Sri Aurobindo Ashram are engaged in producing a high value crops, eggs and milk products, such activities seem to be exceptional rather than general among the farmers. World Food Summit, 1996 has defined food security as a situation in which all people at all times, have access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life. Thus the importance given to agriculture is not a blind activity but a real need which is attainable through proper management and governance.

The main soil types found in the area are red ferralitic, black clay and coastal alluvial soil which helps in maintaining soil fertility and enhance soil nutrients and to arrest the water runoff from the land. Water management is the major area to be noted to understand and to take relative steps regarding agriculture. Irrigation, especially surface (tank) irrigation, is the main way through which agriculture takes place apart from rain water and ground water source.

Paddy is the main crop in the three seasons in the *ayacut* areas (command wet area of irrigation tank), especially Bahour and Nettapakkam communes are real paddy producers. Rice- fallow pulses are used during water scarce seasons to improve the soil fertility. Sugarcane holds the second place which is the year round crop. The major non- *ayacut* (command dry area of irrigation tank) crops are tapioca and groundnut. Industries and residential areas are invading the agricultural land both in *ayacut* as well as in non- *ayacut*. Bahour is the rice bowl of Puducherry located in the wet land region and irrigate about 4775 acre in Pondicherry region receiving water from Pennaiyar River through Sornavur Anaicut. But pulses are cultivated in many tank areas in Bahour because of the salt water intrusion.

Nettapakkam commune has the productive soil and water quality is good with not much salinity. Korkadu is the only tank providing water for irrigation and it goes for year round paddy crop as clay soil is not suited for any other crops. And some other water demanding crops like sugarcane and banana with groundnuts and cotton. Ironically, Industrial invasions have resulted in water pollution in the fields. Villianur commune grows paddy with moderate cropping intensity and practices like crop rotation, intercropping and crop diversification is also followed in this area. Salinity of ground water and fast growing industry in this region puts agriculture into further deterioration. The northern part of Villianur has been largely industrialized and *ayacut* and non- *ayacut* of Sederapattu sitheri are totally allotted for an infrastructure development project, industry.

Mannadipet commune is an area with a wide variety of soils and crops. Crop rotation and intercropping are widely in practice and farmers believe it to be

advantageous in this region. But in the North- Eastern part of the commune, farmers prefer only paddy and sugarcane because of the availability of only clayey soil. Water scarcity is the problem in several areas of this commune because of the presence of bed rock on 60 feet depth under the surface of the soil. Another problem in this region is the ions in the water and on the top of the clay is the presence of high soluble iron levels.

Common property resources such as fish, Palmira, grass, firewood, wooden construction materials are some of the benefits of the people from the irrigation tank that people can get apart from the agricultural produces.

MODERNIZATION OF TANK IRRIGATION IN PONDICHERRY

There are 84 tanks been identified in Pondicherry region and out of 84, 54 are system tanks and 25 are non- system tanks. Each tank irrigation system consists of a catchment area, a tank and a command area. Only 40 tanks out of 84 can be seen with proper tank maintenance and *ayacut*, non- *ayacut* areas. Usteri is the biggest irrigating tank in the Pondicherry region receiving water from River Gingee through Suttukanni channel has total *ayacut* area of 1538 ha and has lost one third of its area. Bahour commune and its tanks are affected by salt water intrusion. The tanks that are affected are Kirumambakkam, Pinachchikuppam, Bahour Sitheri, Manapattu, Utchimedu, Adingapattu, Kudiyirippupalayam, Kuruvinathan and Cherry Sluice of Bahour Tank.

Government bureaucracy operating and maintaining irrigation system is found to have been less capable of assuring predictable, stable and adequate supply of water across the system with equity and reliability to all users. As reported by Chamber (1988) this is because, government agencies deliver water to field first and to farmer needs next, while many farmers are supplied with large quantity of water than required many more are denied of their share of water. Tang (1992) has found that such poor performance of large-scale irrigation systems in India as in other countries of the world have been largely due to bureaucratic governance In irrigation

Conventional bureaucratic administration had perceived farmers as unorganized or poorly organized individual farm operators. Thereby, the irrigation systems were designed and administered by bureaucrats who placed the farmers at the receiving end of irrigation project, as beneficiaries. More over farmers were portrayed to be inefficient in the use of water, unpredictable in their behavior or uncooperative with the irrigation agency. Therefore, the institutional difficulties posing problems in irrigation development were attributed to farmers. This resulted in lack of farmer participation leading to unsatisfactory water distribution and ineffective system management, which in turn culminated in less benefit than estimated despite

huge investments in irrigation development.

Against this backdrop, Tank modernization is envisaged as the strategy to enhance the performance of water institutions through the rehabilitation or the rejuvenation of the tank system after the worse cycle through which it has passed through. The decline of tank system has made people realize the importance of tank for irrigation, domestic and various other purposes directly and indirectly. Rejuvenation of tank system doesn't mean the complete changeover of the system or creating a new way of system but attaining the old prosperous way through modernizing certain aspects of the old system and bringing back the old back into play. Tank modernization looks into the historical antecedents of the tank system, it examines the reasons for decline in the traditional tank system and the relationship between the society and the tank system both in terms of roles assigned and the sustainability of system, the multiple uses (usufructs) and identify the major beneficiaries of the tank and the conditions that are necessary for the success of environmental- friendly and sustainable development of the tank system. It also examines the prospects of rehabilitation of tanks and its potential linkage with other sources of irrigation, especially ground water irrigation. Various approaches had been made to improve the tank system and rehabilitate it. One such approach is seeking the external fund for rehabilitation purpose and to entrust the power of management and maintenance in the hands of beneficiaries of the water through creation of water users associations (tank associations in Pondicherry). 84 tanks of Pondicherry were taken into account for the purpose of modernization by Public Works Department (PWD) and the program was named as "Tank Rehabilitation Project in Puducherry" (TRPP). This project was funded by European Union in 1999 and 81% (Rs. 28,13,0000) of the fund was provided by EU and 13% (Rs. 4,40,0000) was provided by the State government and the remaining Rs. 2,20,0000 (6%) was contributed by farmers. The main aim of this project was to have farmers' direct role and participation in the tank system, not just in maintaining but also in controlling. Similarly, European Union funded many other tank rehabilitation projects throughout the country and took serious step in modernizing tanks at various levels.

Tank modernization in Pondicherry was implemented through the tank rehabilitation project and was carried for five years by European Commission and later was taken by Puducherry government. Massive rehabilitation drive was with the participatory approach involving tank associations which was locally called as *eri sangam* and carried on various methods and techniques to maintain the tank which they were using for their own consumption. This approach mainly involves the direct users of the water into the system management. Apart from government

PWD and European Commission, many NGOs took active part in organizing the people, bringing awareness to the people and provide necessary training required for the tank rehabilitation through community organization and mobilizing the members. As a result, tanks are digitized by the government to enable the management of the tank system in Pondicherry with the scanned images of Government of India, data of tanks, other water bodies, rivers, feeder channels, major roads, minor roads, village roads, railway lines, settlements, commune boundaries and various other data was digitized and recorded for future purposes and for better management and operation. The tanks which were previously under the administration of the local community in various names doing similar kinds of functions, deteriorated over a period of time, and now modernization of tank aims to bring the power back to the local community i.e., village community in the administration and authoritative decision making over the tank issues. The farmer's participation (users of the tank) was given more importance and it was affected through creation of various associations like tank associations, sluice committees, channel (canal) committee and it also had bank accounts and common fund provided by government or other organizations and commonly held people's money. It was all used jointly for the benefits that has to be driven from the tank and for the users of the tank system of irrigation.

CONCLUSIONS

Sustainable agricultural growth and production necessitate timely, reliable and adequate irrigation. A global panorama of evidences and issues indicate that climate adaption including heat waves, melting snowpack, protracted droughts, increased wildfires, lowered reservoirs, rising sea levels, sinking aquifers, flash floods and desiccating soils and all are mainly due to water crisis. Virtual water flows towards capital and climate change falls heaviest on the poor. Water decisions set priorities about equity, value, gender, poverty, hunger, disease, energy, efficiency and rights. These issues transcend the local dynamics of people, place, demographics or time, to become universal. Any local waste, loss or abuse of fresh water anywhere diminishes all globally. Leaching of nutrients and pesticides, illegal and unregulated water extraction and drainage, flooding, contamination of ground and surface water by use of manure and chemical fertilizers, industrial effluents or by saline content will reduce the quality and quantity of the water available not only for agricultural use but also for the drinking purposes. Overgrazing, erosion of vegetations, loss of soil and silting of rivers will also result in poor availability of water for agriculture.

The tank irrigation institutions are identified as possibly accessible irrigation source among the other sources of irrigation and it is the largest reservoir that is found in the surface level for easy reach of the people. The tank has been in practice

since people started living in settlements and there are evidences today which act as proof for this. Pondicherry too has very good tank system which was reliable by many as the best source of irrigation until 1990s. After 2000, it started declining and its importance was realized by people through various awareness programs, the system got rejuvenated with modern techniques and modernization process was carried out with the help of government and other funding agencies and NGOs. The tank modernization tried replacing the traditional system of tanks but did not reach to its optimum utilization or it was not completely reestablished which would benefit the maximum. Appropriate strategies are needed to build institutions to evolve coordination between government bureaucracy and farmers to enhance and sustain the performance of tank irrigation in Pondicherry.

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