

A description of Coonoor region based on a Social-Ecological System perspective

1. Introduction

Coonoor, the second most popular tourist destination in the Nilgiris has been facing a water crisis over the last few years. This was particularly heightened in 2012-13 when it faced two successive years of poor monsoon. Keystone is exploring whether a Payment for Ecosystem Services model could be developed for the Coonoor region to address this crisis. As a basis for such an exploration, it was decided that it is imperative to develop an understanding of the region using a Social-Ecological System (SES) perspective. A description of the area of interest based on some components of the framework provided by the Resilience Alliance¹ follows. This is a work in progress. The figure below depicts the general conceptual model of a Social-Ecological System.

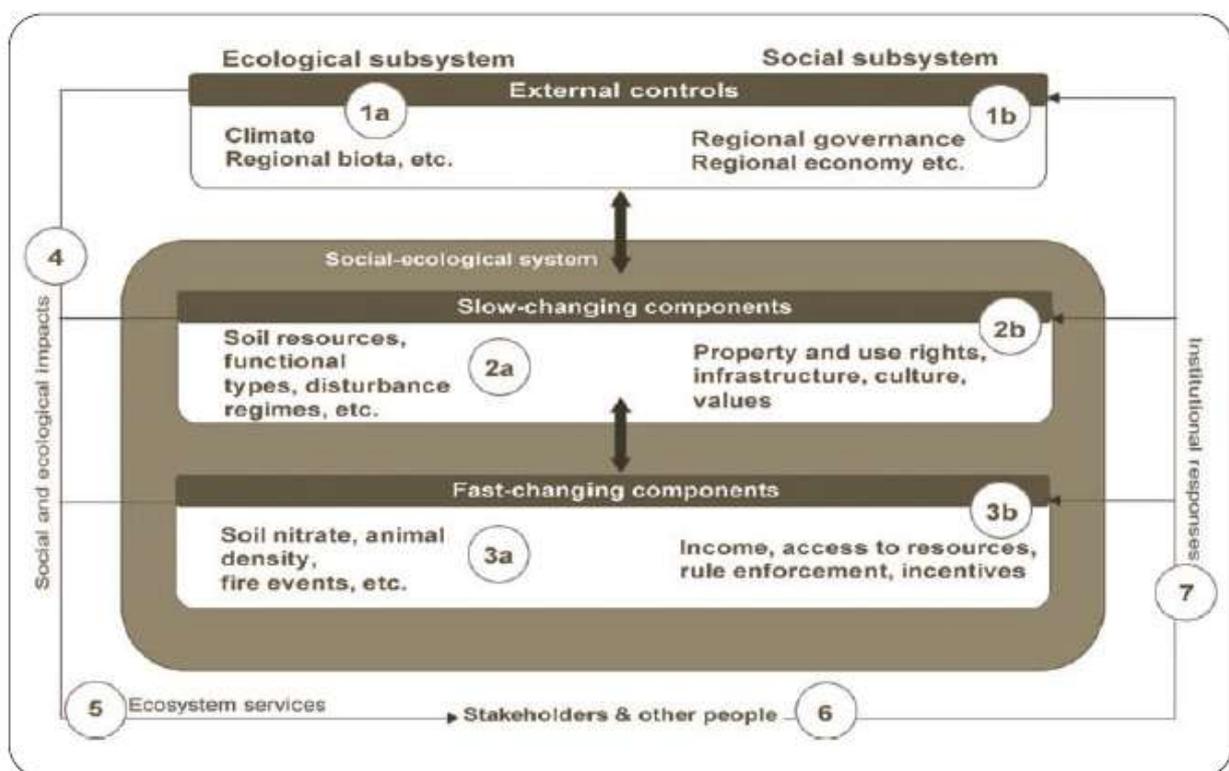


Figure 1: The General Conceptual Model of a Social-Ecological System

2. Defining the focal system

The area of interest for the SES profiling is centred on Coonoor town. Given that the interest is in the water supply to the town, the sources of water to the town and their catchment areas together make up the boundaries of the focal system. This results in an area of approximately 111 km. However, given the paucity of secondary data for areas that do not align with administrative units, we will use data of the Nilgiris district as well as of

¹ Resilience Alliance. 2010. *Assessing resilience in social-ecological systems: Workbook for practitioners. Version 2.0.*

Coonor taluk to describe the focal system. A map of the boundaries of the focal system is given below,

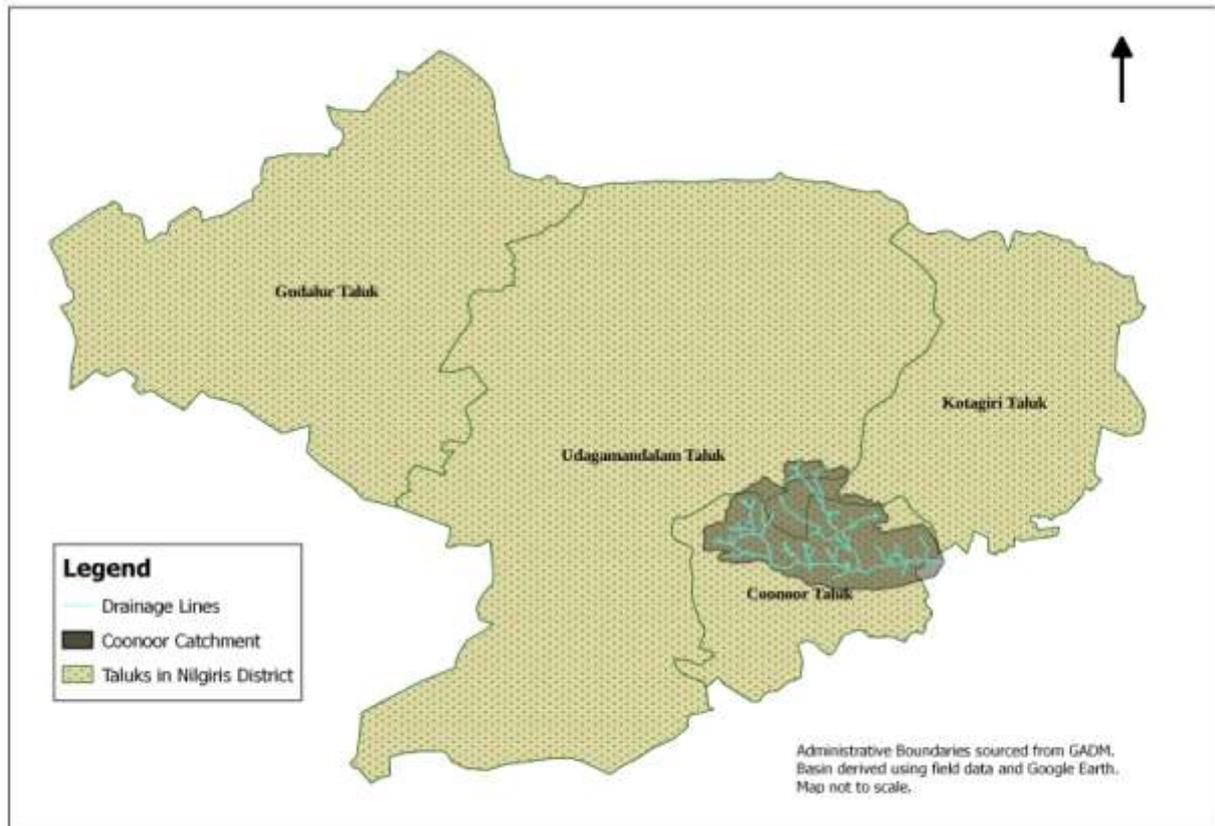


Figure 2: Focal system boundary overlaid on administrative units

Coonor is located at 11.35⁰N, 76.82⁰E in the Nilgiris district at an altitude of approximately 1850 m AMSL. It has a geographical area of 15.05 sq km. Coonor became a Municipality in 1866, making it one of the oldest in the state. It has 30 wards, which are also electoral wards.

Coonor town had a population of 45,494 as per the Census 2011, with 23,387 females and 22,107 males. The Sex Ratio is therefore 1058, while that for the state of Tamil Nadu is 996. There are 12,704 persons belonging to the Scheduled Castes and 106 to the Scheduled Tribes. The literacy percentage was 85% with female literacy being 82 % and male literacy being 88 %. Coonor had 12,384 households. Of a total of 17,421 workers, 50 are cultivators, 152 main agricultural labourers, 266 work in household industries, 15,790 other workers, 1,163 marginal workers, 6 marginal cultivators, 66 marginal agricultural labourers, 31 marginal workers in household industries and 1,060 other marginal workers². Tea and tourism are the two main economic drivers in the town.

The population reduced from 50,196 in 2001, possibly due to migration to the plains in search of employment. However, there is a floating population of about 3,000-5,000 people which can hit a peak of 15,000 per day during the tourist season. In addition to this, a

² www.censusindia.gov.in/pca/SearchDetails.aspx?Id=688917

tourist population of approximately 2.5 million people visit Coonoor annually. The area is also dotted with second homes for the wealthy from outside the district who visit occasionally. Some of these also double up as guest houses for tourists.

The land use of the area has been derived from visual interpretation of Google Earth Imagery from 2012 followed by field verification³. The resulting land use map is given below.

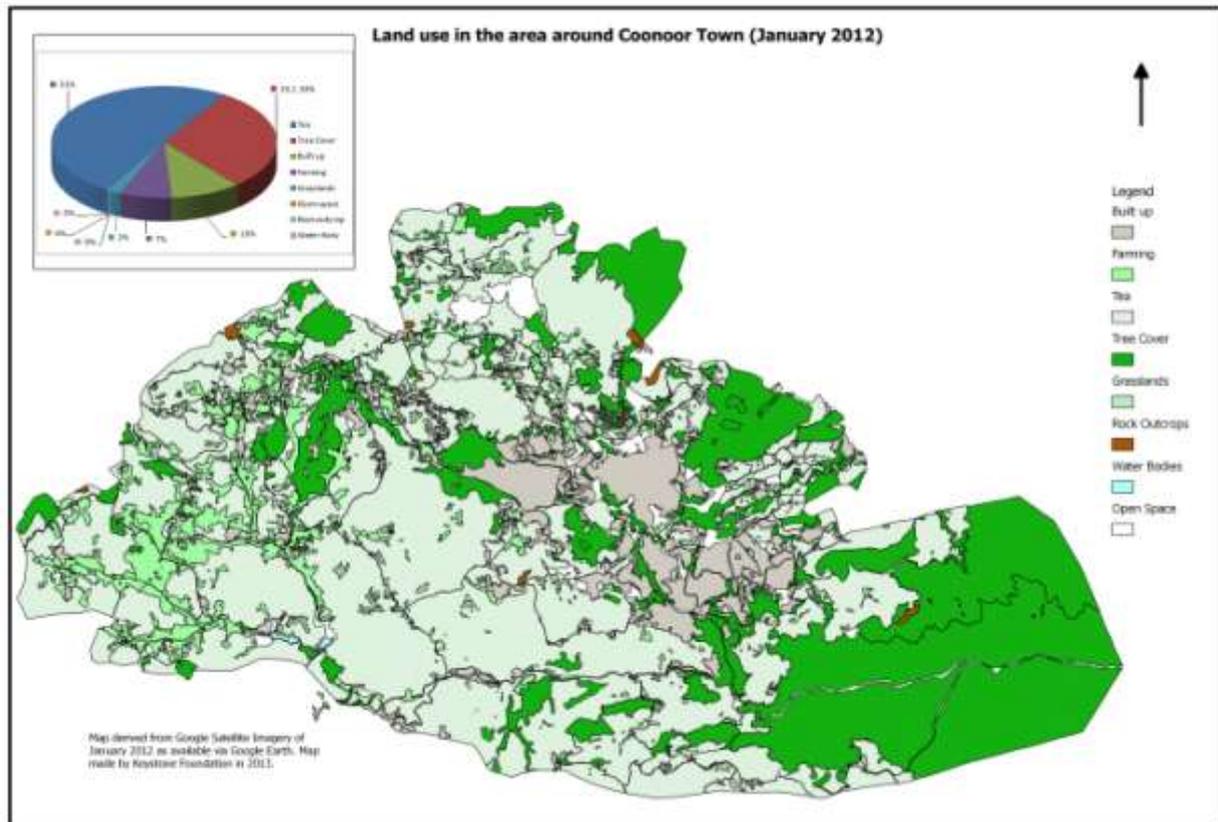


Figure 3: Land use of the focal area in 2012

³ Keystone Foundation. Building a mathematical model of the water resources in the Coonoor Region. 2013. <http://www.nilgiriswaterportal.in>

The land use data thus derived has been provided in the table below.

Table 2: Land use in Coonoor Region

Category	Area (sq km)	%
Tea	56.4	50.7
Tree Cover	33.2	29.8
Built up	11.2	10.1
Farming	8.3	7.4
Grasslands	1.9	1.7
Open space	0.0	0.0
Rock outcrop	0.2	0.2
Water Body	0.1	0.1
Total	111.3	100.0

It is evident that Tea and tree cover (mostly exotic plantations) account for more than 80 % of the area. Built up area is also significant at 10.1%. Farming is another growing land use choice.

2.1 The Main Issue

The main issue of concern is the water scarcity affecting the residents of the town. According to the Municipality, 90 LPD is being supplied during the monsoon season and 43 LPD once in five days during summer. There are widespread distribution problems, with all localities not being able to get adequate water during the summer season. In low rainfall years, when the dams are dry and water flows in streams are reduced the situation is much worse. During the summer of 2013, water supply in the town had become once a month, leaving the people to fend for themselves.

It is evident that the Municipality has been unable to provide sufficient water to everyone in the summer months. The centralised supply by the Municipality has led to a dependence on this infrastructure rather than development of decentralised systems that are managed locally. Thus while the town was reeling under severe water crisis, neighbouring villages that had spring based water sources did not face any scarcity. In the face of successive years of monsoon failure even the springs may reduce to a trickle in the summer.

As mentioned earlier, the number of tourists coming to Coonoor is very high, in the order of 2.5 million per year. This puts tremendous pressure on the water and sanitation infrastructure of the town. Open defecation is not uncommon and where toilets are used, often the waste leaches into the groundwater due to the septic tanks not being sealed. This further degrades the water quality. Disposal of waste directly into the streams is a common phenomenon across the Nilgiris, and in Coonoor this has resulted in the perennial river flowing through the town being unfit for human use.

The water supply to the town is heavily dependent on the rainfall. The figure below depicts the annual rainfall for the period Jan 1935 to Dec 2013.

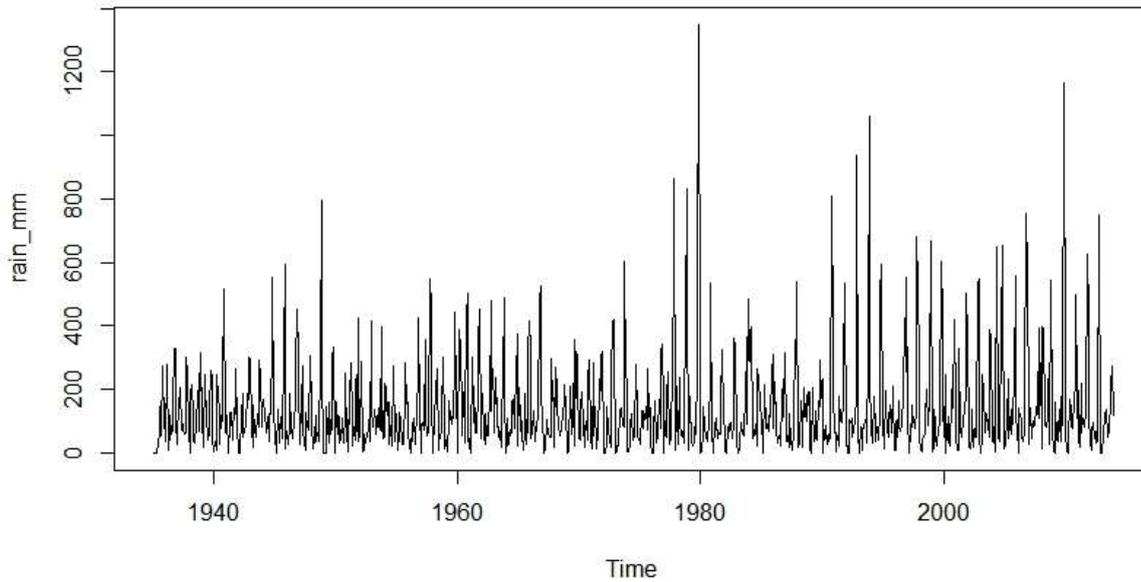


Figure 4: Annual Rainfall from UPASI, Coonoor

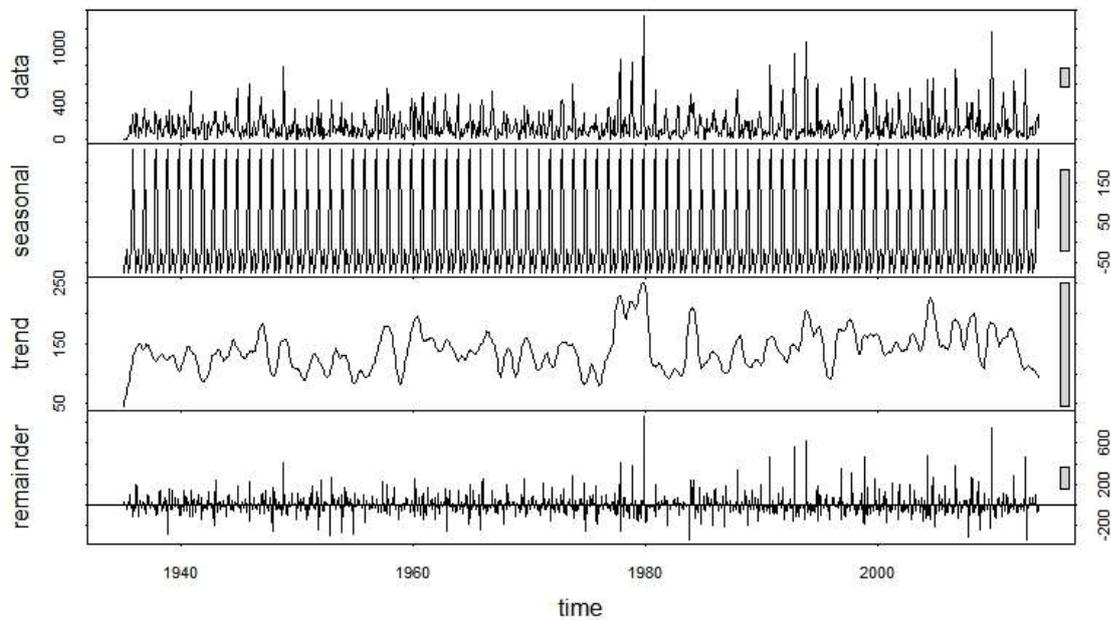


Figure 5: Output of ts function in R for the monthly rainfall data

The above output shows that the seasonality component is not very strong although there seems to be a regular pattern in it. The trend component is even less significant. The remainder seems to explain a lot of the variation in the rainfall data (It is significant). We can conclude that the rainfall pattern in the region has always been uncertain and variable.

The streams and springs provide the water supply during the non-monsoon season. Increasingly wells are being developed to tap groundwater. Whether through tapping the

base flows in streams or through wells, the city is increasingly depending on groundwater for meeting its needs. However a good understanding of the underlying aquifers is missing.

Worksheet 1.1: Summary of main issues of concern

Issues	Main Issue(s) of concern for the assessment	Valued attributes of the system
Water Scarcity for people in Coonoor Town	Municipality is unable to supply sufficient water	Stream flows
	Centralised water supply system for the town	Springs
	Increasing demand for water – from tourism and local use	Wells
	River water unfit for human use due to pollution	Aquifers
	Erratic Rainfall	

2.2 Key Components of the SES

Considering the larger region including the village and town panchayats upstream of the town we find a diverse set of stakeholders. These are listed in the worksheet table below.

Worksheet 1.2

Natural Resource Uses	Stakeholders
Direct Uses	Inside focal system
Cooking	Residents
Drinking	Industries, Associations
Washing	Farms- Vegetables, Tea, Mushroom
Farming	Estates - tea, coffee
Processing	TWAD, Municipality, Electricity Board, Forest Dept, Gram Panchayat, Town Panchayat, District Administration
Cleaning	CSWCRTI & other
Sanitation	NGOs, Charities
Gardening	CBOs
	Wellington Cantonment Board
	Tankers, Filtered water sellers
Indirect Uses	Outside focal system
Sewage Disposal	Tourists
Electricity	Government departments at state level
Recreation	Downstream Community- Farmers, households
	Virtual water- Vegetable, tea, flowers
	Buyer, consumer

There are a diverse set of stakeholders with varied interests and often competing

objectives. While the stakeholders inside the system are directly impacted themselves, those outside the system have a significant influence on the state of the water resources within the focal system.

2.3 Resilience to what? Disturbances, Disruptions & Uncertainty

The region faces multiple disturbances at present and some more in the future. These are analysed in the table given below.

Worksheet 1.3

Disturbance (past or present)	Pulse or press	Frequency of occurrences	Time for recovery between occurrences	Components most affected (e.g. soil, markets)	Magnitude of impact (minor to severe)	Any change in past years or decades? (none, less frequent, more intense, etc.)
Conversion of Farms to Built up area	Press	Ongoing	Infinity	Soil infiltration, Vegetation, Biodiversity, Wildlife Movement	Difficult to quantify. Urbanisation rate data is not available.	Increase
Rainfall Failure	Pulse	Once in five years	(1-2yrs)	Water run off, Infiltration, base flows	Moderate to severe	Scarcity increase, Demand increase
High Rainfall	Pulse	Once in five years	(1-2yrs)	Soil Cover loss, Urban Area-Flood	Get data from CSWCRTI	Increase
Land use change(both grasslands and tea)	Press (Historic)	Ongoing	??	Biodiversity, vegetation, water flow	High, Get data	Slowed Down, Policy Change
Future disturbances						
Climate Change	Press	-	?	Water	High	Increase
Tourism	Press	-	?	Biodiversity, water	Moderate	Increase
Population	Press	-	?	Vegetation Cover		Increase

2.4 Expanding the System – Multiple Space and Time Scales

The Indian Easements Act (1882) confers on the owner of the land, the right to collect and dispose, within his own limits, all water under the land which does not pass in a defined channel. This enables the owner full control of the water beneath his property and he is free to withdraw and use it as he feels appropriate. However, this has led to a situation where a resourceful farmer can dig deeper tube-wells and pump large quantities of water

and thereby deprive nearby land owners from their legitimate rights. This has also resulted in mining of ground water in many places⁴.

On the other hand, the expectation of people that the government will provide water has led to a lack of alternative water supply systems. A few people who have the land and resources to dig private wells have their own private sources of water. For the vast majority, this is not an option. Even the Municipality is looking at the water sources from an extractive mindset rather than conservation.

Land use change is one of the biggest contributors to the water crisis. Tea and exotic plantations allow much less water to infiltrate into the soil than natural forests and grasslands. This in turn would impact extent of dry season flows. The Ralliah dam, whose 300 acre catchment is largely covered with exotic plantations, has perhaps suffered due to less infiltration leading to lesser groundwater recharge. This could have resulted in lesser dry season flows from springs into the dam. The unpredictability of rainfall further compounds this complex scenario.

At a smaller scale, individual habitations, as well as colonies within the town, dump their waste into the river and pollute the only large, perennial and abundant source of water within the town. Wetlands are diverted for 'development' and valleys and stream porambokes are encroached for vegetable and tea cultivation.

Worksheet 1.4

Large-scale systems	Entitlement to water based on land ownership; expectation that government has to provide water; Mix of communities - heterogeneity - lack of traditions around water conservation. Extractive mindset rather than conservation.	Land use is the primary determinant of water resources; Tea - 51%, exotic tree plantations - 30% and built up - 10% are major categories. All of them affect the infiltration of water and negatively impact dry season flows. Rainfall is quite unpredictable without clear trends over the years.
Focal System		
Smaller-scale systems	Within the city - Streams used as sewage drains In the villages in the catchment – situation is the same. Sewage into streams or wetlands.	Stream areas are encroached and cultivated intensively

3. Institutions

The focal area is home to various institutions such as government agencies, market association, Cantonment Board, Academic institutions, NGOs, Community based organisations etc. The rural areas have large number of settlements of Badagas who are culturally cohesive and have a tradition of water conservation. There are also an equal number of settlements of repatriates from Sri Lanka and other settlers from the plains.

⁴ <http://www.nih.ernet.in/rbis/rights.htm>

These groups are also politically active.

The Municipality and Village and town panchayats are other major entities in the water resources arena. The Panchayats are the elected institutions, although the power resides with the concerned line departments. The TWAD Board implements water supply schemes and hands them over to village panchayats for operation and maintenance.

4. Way Forward

Given the competing interests of various stakeholders in the focal system, the historic and ongoing land use changes and the natural uncertainties in rainfall, the water crisis is inevitable. Traditional solutions for addressing such a problem have thus far not made an impact beyond making incremental improvements. E.g. Desilting Ralliah dam. The need of the hour is to examine the fundamental basis of the water sources, i.e. the aquifers which feed the base flows to the town and intervene in them meaningfully to enhance the quantity and quality of water available to the town.