

# A Questionnaire-based Survey on Groundwater Characterization

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## ABSTRACT

The sustainable groundwater management in a coastal watershed of Adappa must consider appropriate control measures of the socio-economic needs. Hence, there is a need for a better knowledge and understanding of the socio-economic variables influencing the groundwater. Therefore, in this study the variability of socio economic responses to groundwater and the problems of engaging large numbers of individual users are highlighted. The socio-economic survey is conducted with a questionnaire-based survey among the people of the study area with random sampling, wherein the participants of the survey are expected to express their feedback freely upon the grievances they had faced with respect to the insufficient availability of the groundwater and its quality of potability and irrigation. The percentage frequency analysis is performed using the SPSS software in order to have a clear understanding of the demands of the local aids. Descriptive statistics and one-way ANOVA are the statistical analysis procedure which is adopted in this analysis. In order not to lose the significance of any important factor, each aspect is dealt separately while doing the descriptive statistics and the one-way ANOVA. This analysis will help to assist decision makers to better assess the socio-economic needs and undertake proactive measures to protect the coastal watershed and have to recognize the value of problems and promote a change of government officers' attitude towards local people through training programs and incentives.

*Key words:* Groundwater, Coastal watershed, Socio-economic Study, SPSS Software, One way ANOVA, etc.

## Introduction

The quality and availability of drinking water has a great pressure on the physical condition and psychology of the residents. Groundwater has proved the most reliable resource for meeting rural water demand in India (MacDonald and Davies, 2000). India is the largest user of groundwater in the world (CGWB, 2014). Over 85% of rural domestic water, around 48% of urban domestic water, and 60–70% of agriculture water are groundwater dependent (CGWB (2006, 2011 and 2014)). This has resulted in

the overexploitation and acute depletion of the resource in many parts of the country. Some of these complexities in resource characteristics are important to understand before we begin to analyze the different dimensions of participation in India's groundwater management. In conclusion, the contribution of local people in improvement activities and in the conservation and management of natural resources seems to be currently at the stage of passive or, at best, consultative participation (Helene *et al.*, 2004). In order to deal with the severely rising groundwater problems in rural India, decision-mak-

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ers have to recognize the value of participation and promote a change of government officers' attitude towards local people through training programs and incentives. Considering the aforesaid factors, in this study the characterization of groundwater based on socio-economic response is carried out and also offered some relevant recommendations for groundwater management of the study area.

**Objectives of the Study**

The objectives of this research are:

- To study the Socio-economic responses with reference to the availability of groundwater resources.
- To arrive the suggestions and recommendations of the sustainable Groundwater management in the coastal watershed.

**Study Area**

The Adappa watershed (4B1A2b) being the study area is a coastal watershed in the Cauvery river basin and the river Adappa is a sub-tributary of the river Cauvery, confluence with the Bay of Bengal. It lies between latitudes 10°16'N and 10°44'N and the longitudes 79°30'E and 79°52'E, covering a geographical area of 698 sq.km. The watershed falls in parts of delta districts of Nagappatinam and Thiruvarur of Tamilnadu state covering seven

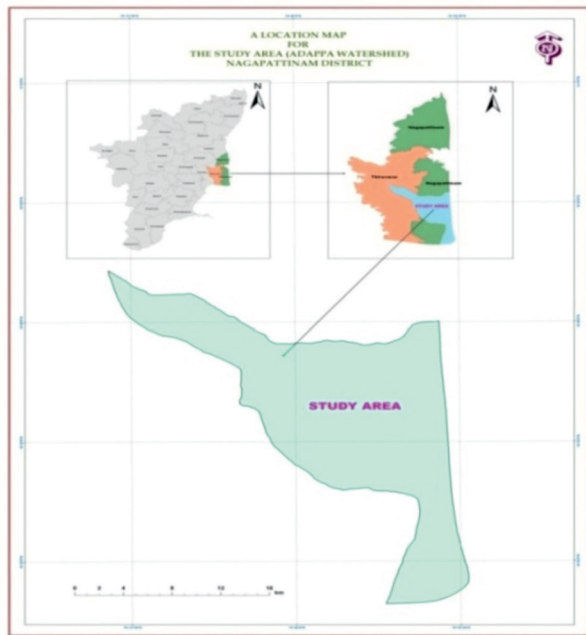


Fig. 1. Index map of Study area

taluks and nine blocks, having the main sources of irrigation accounting to groundwater, streams, tanks, and wells, wherein groundwater plays a major role for both irrigation as well as domestic purposes. The Index map of the study area is presented in Fig.1.

**Methodology**

A survey questionnaire is prepared based on quantity and quality aspect of groundwater resources. A

**QUESTIONNAIRE SURVEY FOR SUSTAINABLE GROUNDWATER MANAGEMENT**

**QUESTIONNAIRE**

**Dr. K. EZHISAIVALLABI**  
Assistant Professor

**Dr. S. POONGOTHAI**  
Professor

My name is **Dr. K. EZHISAIVALLABI**, this questionnaire survey seeks to explore the socio-economic features of groundwater availability, quantity and quality and the opinions of people with an aim to identify potential social impacts. Your contribution will help us to assess the social impacts and develop mitigation measures

**Respondent profile Name:**

Sl. No	Questionnaire	
1. Gender	<input type="checkbox"/> Male	<input type="checkbox"/> Female
2. Age	<input type="checkbox"/> < 40	<input type="checkbox"/> > 40
3. Educational Status	<input type="checkbox"/> Literate	<input type="checkbox"/> Illiterate
4. Experience in Agriculture (in years)	<input type="checkbox"/> 1 - 5	<input type="checkbox"/> 6 - 10
	<input type="checkbox"/> 11 - 15	<input type="checkbox"/> Above 15
5. Annual Income	<input type="checkbox"/> Less than 1 Lakh	<input type="checkbox"/> More than 1 Lakh
	<input type="checkbox"/> More than 5 Lakh	<input type="checkbox"/> More than 10 Lakh
6. What are the sources of domestic water?	<input type="checkbox"/> Surface water	<input type="checkbox"/> Groundwater
7. What are the sources of surface water?	<input type="checkbox"/> River	<input type="checkbox"/> Pond
	<input type="checkbox"/> Tank	<input type="checkbox"/> Well
8. Depth of bore wells	<input type="checkbox"/> Shallow wells	<input type="checkbox"/> Deep wells
9. What is the irrigation method adopted?	<input type="checkbox"/> Surface	<input type="checkbox"/> Furrow
	<input type="checkbox"/> Basin	<input type="checkbox"/> Drip
19. Is there fluctuation in water table?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
20. Status of farm	<input type="checkbox"/> Own	<input type="checkbox"/> Rented
	<input type="checkbox"/> Fallow	
21. Do you cultivate multi cropping	<input type="checkbox"/> Yes	<input type="checkbox"/> No
22. Is their any industry near by your farm	<input type="checkbox"/> Yes	<input type="checkbox"/> No
23. Do you get required amount of water at correct time	<input type="checkbox"/> Yes	<input type="checkbox"/> No
24. The reason for the decrease the level of groundwater	<input type="checkbox"/> Public Water Supply	<input type="checkbox"/> Agriculture
	<input type="checkbox"/> Others	
25. The reason for the decrease the level of surface water	<input type="checkbox"/> Rise of Groundwater Table	<input type="checkbox"/> Removal of Surface water

Fig. 2. Questionnaire survey of the Socio-Economic Assessment

total of 67 questionnaires are supplied to the respondents directly through hardcopy. The types of respondents involved in this questionnaire survey are farmers and villagers. The questionnaire is supplied to among the respondents in the study area of Adappa watershed. Analyses of data are perceived based on their feedback. The consolidation of questionnaires under this current topic of the socio-economic assessment of the study area is presented in Fig. 2.

**Analysis of Data**

Statistical analysis is the most powerful tool for making appropriate decisions in the interpretation of such data and hence it is adopted as the method of analysis in this research. The SPSS, the most known adopted software is used for the analysis. Descriptive statistics and one-way ANOVA are the statistical analysis procedure which is adopted in the analysis. In order not to lose the significance of any important factor, each aspect is dealt separately while doing the descriptive statistics and the one-way ANOVA.

**Results and Discussion**

The questionnaire survey is to produce a review on availability, quantity and quality aspect of ground-water resources and water resource allocation techniques for agricultural development in coastal regions of Adappa sub watershed through socio-economic survey.

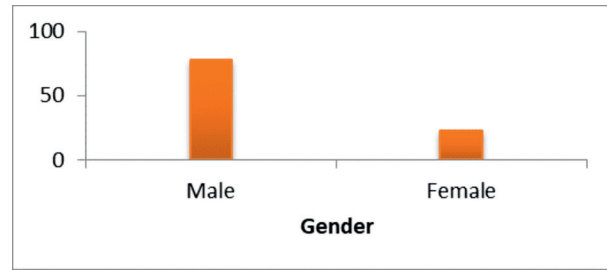
**Frequency analysis**

The frequency test on socio-economic aspect questionnaire survey revealed that the responses of the respondent on Gender, Age, Education, Agriculture Experience, Annual Income, Domestic Water Sources, Surface water sources, Bore well type, Irrigation Method Adopted, Agriculture Dependents, Subsurface Source, Pump Used for Subsurface, Period of Well, Quality of Water, Well Dependency, Alternate Source of Well, Farm Size, Water Table Fluctuation, Farm Status, Multi Cropping, Near by Industry, Do You Get Required Amount of Water at Right Time, sources of decreasing Groundwater Quantity and sources of decreasing Surface Water. For example the frequency tests on the response of 77.6% male and 22.4% female respondents (Table1 and Figure3) reveals the respondents aged more than 40 are of 65.7% and less than 49 is 34.3% with

the maximum literacy of 61.2% and 28.4% involved in this survey. The respondents have an experience in agriculture over 6 – 15 years (Table 2 and Fig. 4).

**Table 1.** Frequency Analysis on Gender

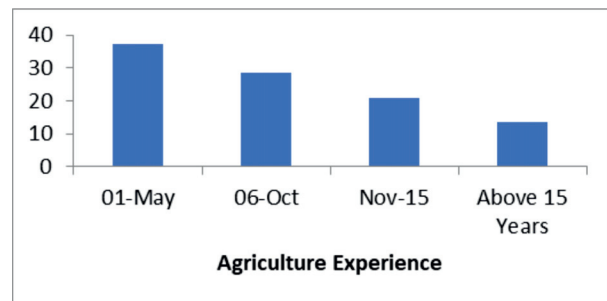
Gender	Frequency	Percent	Valid Percent	Cumulative Percent
Male	52	77.6	77.6	77.6
Female	15	22.4	22.4	100.0
Total	67	100.0	100.0	



**Fig. 3.** Male and Female response in Percentage

**Table 2.** Frequency Analysis on Agriculture Experience

Agriculture Experience	Frequency	Percent	Valid Percent	Cumulative Percent
1-5	25	37.3	37.3	37.3
6-10	19	28.4	28.4	65.7
11-15	14	20.9	20.9	86.6
Above 15	9	13.4	13.4	100.0
Years				
Total	67	100.0	100.0	



**Fig. 4.** Agriculture Experience in Percentage

**Descriptive Statistics**

The means of the respondents for each factor is calculated. Also, the standard deviation of the mean is calculated for each factor. The factor, for which the mean value of the response is more than 2.0, is treated as an important factor from the respondent's point of view. The criterion for selecting the mean value, for more than 2.0, are the contribution of the

factors that affects the quality and quantity of groundwater resources which have to be monitored very carefully. It's higher value indicates the criticality of the factor affecting the quality and quantity of groundwater resources. The reports on descriptive statistics are presented in Fig.5. The descriptive analysis is clearly showed the following factors are affect the groundwater quality and quantity of the study area. The factors are Agriculture experience, Annual income, Surface water sources, Existing irrigation methods, Dependency of Agriculture, Period of well, Quality of water, Alternate source of well, Farm size and status and Source of groundwater depletion. Therefore, adoption of incorporating the alternate source, techniques and new methods in the study area is the only way to improve the quality and quantity of the study area.

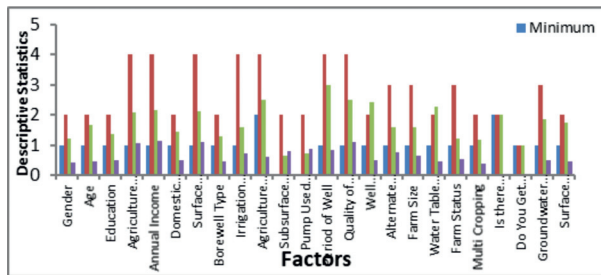


Fig. 5. Descriptive analysis of the Socio-economic Studies in the Study Area

**One Way ANOVA**

The one way ANOVA is done between the responses of the respondents to compare their means of responses for each of their product test factor. This test is conducted to identify the factor which differs in their perception of the importance of the factor. One way ANOVA, for 2 different pairs are presented in Tables from 3 to 4

**Table 3.** One Way ANOVA PAIR 1: Agriculture Experience Vs Reason for Decrease in Groundwater quantity

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	6.626	2	3.313	3.135	.050
Within Groups	67.643	64	1.057		
Total	74.269	66			

From Table 3, it is inferred that the F-ratio is 3.135 with the corresponding Significance value is (p-

value) 0.050. Therefore, F-ratio is significant, which implies the fact that a significant difference exists between the respondent's agricultural experience and their opinion about the reason for the decrease in groundwater quantity

**Table 4.** One Way ANOVA PAIR 2: Agriculture Experience Vs Quality of Groundwater

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.109	3	.370	3.318	.812
Within Groups	73.159	63	1.161		
Total	74.269	66			

From Table 4, it is inferred that the F-ratio is 3.318 with the corresponding Significance value (p-value) of 0.812. Therefore, the F-ratio is significant, which indicates that there is a significant difference between the respondent's agricultural experience and the opinion on the quality of groundwater.

**Summary**

The impact of quality and quantity of groundwater resources poses a greater concern for socio-economic problems. This study inferred that, less knowledge of the farmer about irrigation, drying up the wells by over -exploitation of the aquifers and the fluctuation in water table led to the decoupling of groundwater. The sea water intrusion near the coastal areas affects the groundwater quality of the study area. The review of questionnaire survey presents a framework and suitable techniques that can be employed to analyze the issues and make the rationale for the agricultural use of water in an explicit and transparent manner. Further, the study confirms the point that the socio-economic parameters are influential on sustainable groundwater management. It can be concluded that appropriate management of available water quantity will increase the level of satisfaction.

**Conclusion**

From the Questionnaire survey, it is inferred that the sea water intrusion near the coastal areas affects the groundwater quality and led to the variation of quality. The increase in demand and over-exploitation of the groundwater leads to the water level fluctuation.

tuation and the quantity of fresh water get decreased day by day by abandoned wells and seawater intrusion. The results from this study point that the respondents require appropriate management and conservation practices to increase the groundwater potential. Organizing the awareness program for farmers and villagers of the study area about the importance of surface water and groundwater scenario and its utilization, is recommended for sustainable groundwater management and development of the study area.

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