Sustainable strategies for water quality management in Krishnagiri district of Tamilnadu (India)

Article · January 2013

DOI: 10.6088/ijaser.020300002

1 author:

Balasubramanian Paramasivan
National Institute of Technology Rourkela
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Research article ISSN 2277 – 9442

Sustainable strategies for water quality management in Krishnagiri district of Tamilnadu (India)

Balasubramanian, P
Center for Energy & Environmental Science and Technology,
National Institute of Technology Tiruchirappalli, Trichy – 620 015
doi: 10.6088/ijaser.020300002

Abstract: Deterioration of drinking water quality in rural regions is a worldwide threat and considered to be one of the significant limitations in promoting sustainable development. As water quality problems become more severe and extensive throughout the world, community-level monitoring of water quality and sanitary surveillance has turned out to be inevitable and indispensable since they are the largest stakeholders and end receivers. Yet, lot of interventions needed to be overcome. Several capacity building workshops were organized for all stakeholders in Krishnagiri district of Tamilnadu (India) with an aim to promote the use of drinking water in an efficient and equitable manner consistent with the social, economic, and environmental needs of present and future generations. The programme is based on following main goals: to raise awareness among rural habitations about the impacts of fluoride in drinking water, to promote the wise, efficient use of water and to protect and enhance the quality of the water by continual monitoring using field testing kits. This programme depicted that community water quality monitoring is a low cost approach which is reliable and sustainable since being the largest stakeholders, the local community can become themselves as watch dogs for their water bodies in their vicinity.

Keywords: Community Participation, Environmental Awareness, Environmental Conservation, Environmental Education, Water quality, Drinking water.

1. Introduction

Without ensuring ample supply of safe potable water, one nation could not expect the better healthiness of their citizens since the relationship among water; hygiene and sanitation are an inseparable one. Yet, government agencies from developing countries and the international communities could not accomplish an invariable task of providing safe potable water and access to improved sanitation which remains a core challenge for accomplishing Millennium Development Goals (MDGs). For instance, based on the world bank data the status of key indicators of MDG7 were shown in Fig. 1. (i.e) the access to an improved water source and sanitation facilities in rural and urban populations of India in the last two decades. Despite rising interest in economically sustainable approaches to create awareness among rural habitations; relatively little research has been done on bridging the gap between scientists and policy makers. This is one of the most imperative interventions in environmental education at a scalable level. Availability of potable water supply is one of the most important socio economic factors contributing to nation's wealth. As economies of developing countries continue to grow, it is expected that the demand to gain access potable piped water from citizens will rise significantly. Since the ecological degradation were realised in the last decades and raised as a serious issue in international arena, environmental education and public awareness have been viewed as vital step of addressing these emergent problems. As far as environmental education is concerned, it is not at all a new concept to learn; rather forgotten knowledge has to be revitalized since most of the human knowledge is derived from nature.

Hydrofluorosis is a major public health concern in India due to consumption of excess fluoride through drinking water, affecting 62 million people, including 6 million children in 18 of the 33 constituent states including union territories. Tamil Nadu is one of the southern states having 10 of the 29 districts affected with fluorosis. (Susheela, 1999; Harikumar et al., 2007).

*Corresponding author (e-mail: biobala@gmail.com)
Received on October May, 2013; Accepted on May, 2013; Published on June, 2013

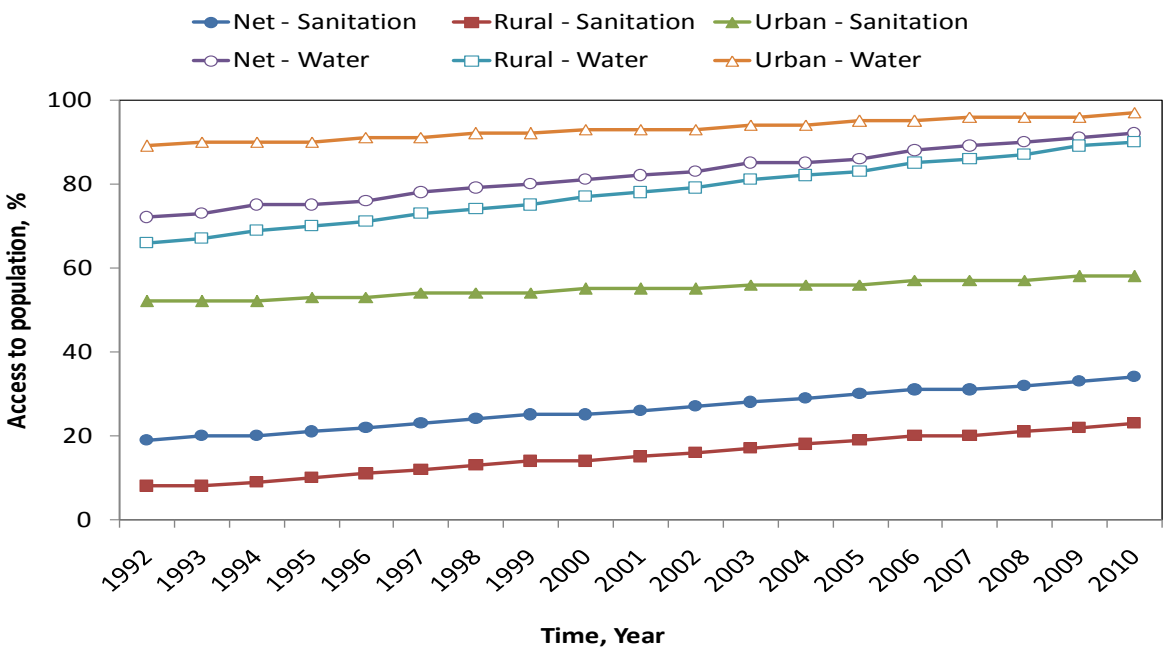

Figure 1: Improvement in access to water and sanitation sectors of rural and urban populations of India

Out of these, Krishnagiri district is worst affected district in Tamilnadu. Access to safe drinking water in Krishnagiri district is limited by contamination of surface water by greenish color, malodor (fishy smell) along with pathogenic microbes and groundwater with excessive fluoride concentration. The World Health Organization and Indian Council of Medical Research described the drinking water quality guideline value for fluoride is 1.5 mg/l (WHO, 1984; ICMR, 1975).

The objectives of the paper were (1) To initiate the community based efforts needed for improving the sustainability issues in both quantity and quality of water and (2) To build a team of volunteers at local (village) level to shoulder the responsibility of water quality management as an ongoing activity at regional (block) level. Overall, we aimed to impart technical skills on various practical aspects of water quality monitoring and management and to promote the surveillance of drinking water quality by using water quality test kits.

2. Materials and methods

2.1 Description about the study area

Krishnagiri district (Latitude: N12^0 09'to 12^0 54'; Longitude E77^0 27'to 78^0 41') is located in the north western part of the state Tamilnadu (Fig. 2) with spanning area of 5169 Sq. Km. The district constitutes 10 administrative divisions of 5 taluks and 10 blocks with 337 villages. The total number of habitations is 4403 and out of these, only 158 habitations are partially covered with piped water supply of 10 to 39 liter per capita per day (LPCD), while the rest are fully covered with the prescribed water supply above 40 LPCD as by the Government of India. These communities are made up of peoples of various ethnic and religious backgrounds most of who are engaged in farming and smallscale businesses, while others are civil/public servants. As a part of this programme, the capacity building workshops were organized in Krishnagiri block in first year followed by Bargur, Kaveripattinam, Thally and Veppanapalli in subsequent years.

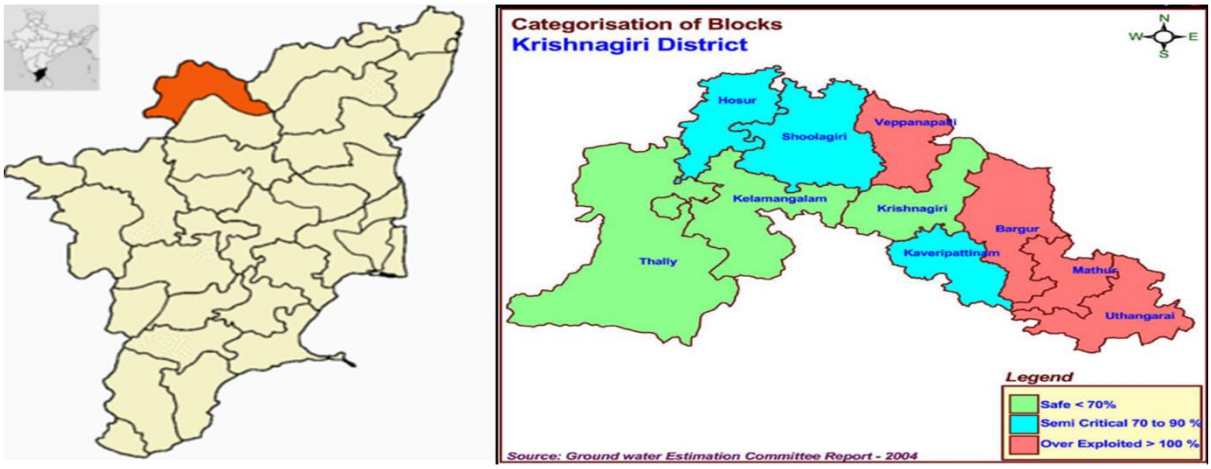

Figure 2: Location of Krishnagiri district in Tamilnadu of India where the study was organised

2.2 Methodology adopted in this study

Before initiating the environmental education programme in the Krishnagiri district, plan of actions were developed as shown in Fig. 3. A comprehensive, portable, water quality assessment toolkit was developed at Indian Institute of Technology Madras (IITM) and validated with the actual standard methods outlined by APHA, 1998. Following laboratory development, drinking water quality evaluations were done in Krishnagiri district. These water quality test kits have been tested extensively in all the villages of five blocks in Krishnagiri district under the sponsorship of UNICEF to the Panchayat raj and Block development department of the Government of Tamilnadu. The kit consists of user's manual in both Tamil (native) and English languages. The manual describes the procedures for water quality testing using the kit. Step by step details about the preparation of the reagents were also provided. With this disseminated information the volunteers can either make new field testing kits or utilized for refilling purposes. Water quality tests that detect Hydrogen Sulfide (H_2S) producing bacteria were utilized to check the presence of total coliforms in drinking water.

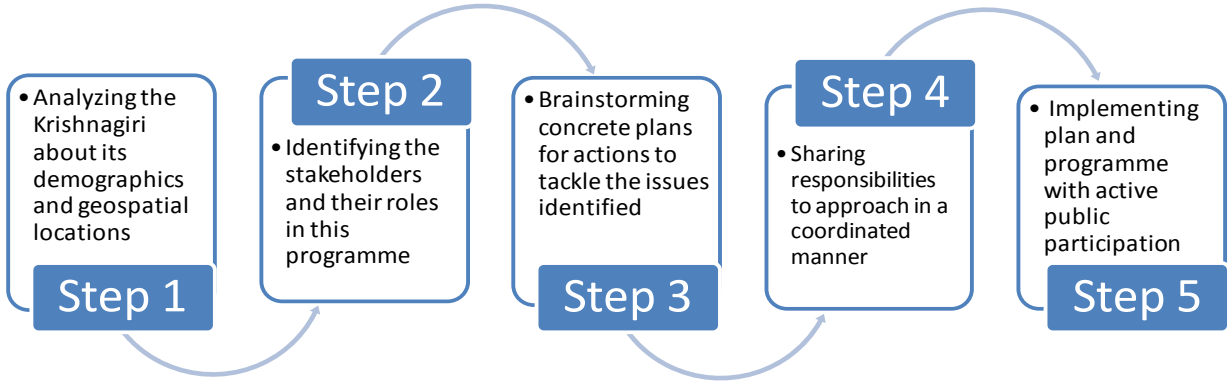

Figure 3: Evolving a plan of action before initiating the environmental education programme

Several capacity building training programs have been conducted and hands on training were given to the various stakeholders. In specific, participants (three volunteers from each panchayat) were trained how to use water quality test kits for the analysis of various key water quality parameters for analysing their drinking water quality atleast a month. Volunteers were provided with the registering note book to mark their results every month and disseminate the same to various stakeholders through panchayat level convergence committee (PLCC) meeting. The overall methodology adopted in the study is shown in Fig. 4.

In the short-term, the activities carried out as part of the programme were outlined in a nutshell as follows:

- Performing baseline survey about the extent of water quality problems by analysis of drinking water quality in pre and post monsoon seasons
- Raising public awareness by organising community level training workshops, facilitation of multi-stakeholder dialogues, gathering and dissemination of information through broadcasting short movies demanding the necessity of water quality
- Building the team of volunteers at local (village) level and imparting sound technical knowledge by giving hands on training to test the quality of water using field testing kits, demonstration of water collection, storage and treatment techniques, exchange of good practices, demonstration of defluoridation methods that can be suited at household levels and further scaled as pilot projects.
- Ensuring village volunteers about their water quality analysis including periodic documentation with mid-term correction and dissemination of results to Panchayat and public through PLCC meeting to sensitize the public about the extent of fluoride contamination in drinking water and the need of defluoridated water and demand of continual monitoring of water quality in Krishnagiri district
- Building capacities through education and technical assistance to enable communities play their roles in the process of partnerships and participation of various stakeholders to decision making at regional level

The long-term objectives, which are still ongoing, include: raising public awareness of water and sanitation issues, including hygienic and environmental issues; influencing decision-making at local, national and international level; and promoting drinking water quality.

3. Discussion

Before endeavoring this environmental education programme in Krishnagiri district, the baseline survey was conducted in aim to comprehend the extent of water quality in general and flouride contamination in specific. The alternative water are often equipped by either providing fluoride free water from nearby surface water source named Hogennakal water falls (Cauvery River) by pumping through pipelines or installation of defluoridation plants at water sources, and/or at domestic level. Yet, the teachings learned from their socio-economic, cultural and environmental state of affairs build us ease to evolve an idea of action that suits the stakeholders. The alternatives not solely need high capital investments however additionally significant expenditure on operation and maintenance, high level of supervision and operation by trained and skilled persons. The feedback from the first batch of block volunteers was interpreted to enhance the evolved plan of action for subsequent blocks and to upgrade the academic materials and methods if deemed. This strategy of reviewing the method analysis periodically and feed into the process was mandatory to achieve high performances in a sustainable

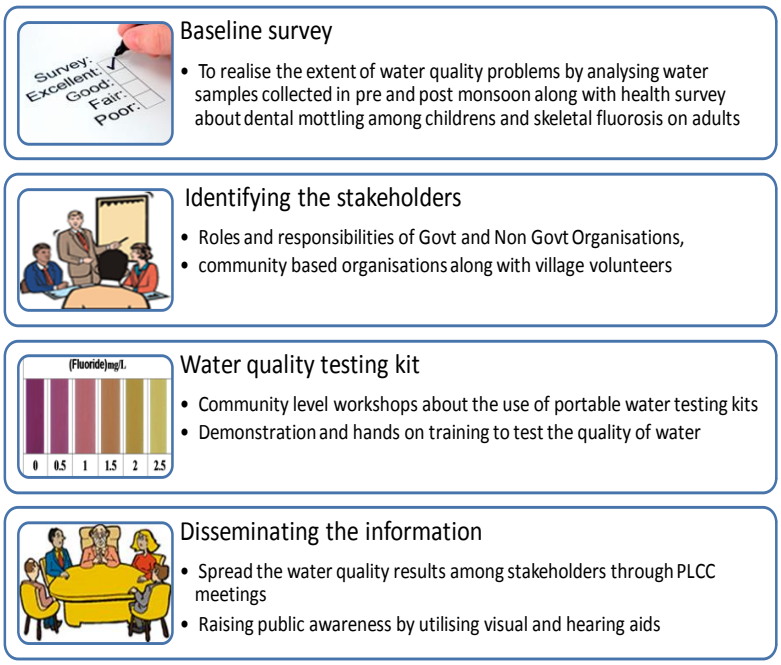

Figure 4: Overall methodology adopted in this study

manner.

The field testing kits were developed once the subsequent criteria were taken in consideration: light-weight weight, will rise up to rough 'travel' and still offer fairly correct results, may well be used anywhere and by anyone who will read and follow the prescribed instructions correctly. The volunteer communicators were advised to test their water quality in public areas such as schools, temples, panchayat offices, community halls and water distribution areas for the possible stimulation of interest to public. Following this, house-to-house campaign using posters, pamphlets, activity booklets along with panchayat level telecasting of short documentary movies, slide shows demanding the necessitate of potable water enhanced the promotion of awareness among the communities. It's been found that use of this kit for continuous monitoring of quality of drinking water has improved the general public health conditions considerably. The observations from this study are outlined as follows:

- There is a strong demand for increasing awareness and for improving water quality through better handling. Though most of the communities are connected to a piped water supply despite adequate centralized treatment, they have risk of diarrheal diseases compared with communities relying on other non-piped sources (such as dams, lakes and wells). This dictates that the institutional stakeholders should focus on good practices to enhance the quality of drinking water at the household level. Screening results comparing source and household contaminant levels consistently indicate microbial recontamination during water transport, storage or handling.
- Demand for alternative defluoridated water is promising since the communities are aware of overcoming water quality interventions to aceive high health benefits. Yet, they are not ready to commit to pay monthly fees for a alternative piped water system that works throughout the year. Through substantial amount of awareness through visual and hearing aids about the practicability, the community started demanding for the piped system and ready to pay the bills monthly. Now they realised that households with a piped system will pay less per month for water and can achieve greater satisfaction with the service over available alternatives.
- Boiling was not widely practiced irrespective of the awareness and so the boiling water as an effective household water quality intervention due to limited willingness in compromising taste and so the advocation of chlorination at household level was familiar there.
- Ecological sanitation (EcoSan) is a technology that may be appropriate, where the water scarcity is a significant threat; unlikely of networked sewerage due to unfavored terrain conditions; huge demand of natural fertilizer for widespreading agricultural activities. Market-based approaches may create the opportunity for sustainable scale-up of sanitation in this region.
- Routine handwashing with soap at critical times is rarely practiced in low income communities where it is most needed for their better health. Implications for handwashing and hygiene promotion strategies among stakeholders were demonstrated and sensitize the community by promoting world hand washing day among school children.

Reasons for accomplishments

We strongly emphasized that more focus should be on

a) Operation and practical sustainability

After the successful completion of programme and follow up actions by all the core players for a year, the whole plan was handover to villagers and panchayat leaders, who will take the responsibility of ensuring water quality in the subsequent years. Success is mostly about helping the right people (from village presidents to villagers) to do the right things.

b) An integrated management plan

The key reason for this convenient result is the best interactive link between all of its core players. In most cases, the most important core player like end user is problematic and often neglected while answering specific research questions and this widens the gap as transformation of research to policy. For instance, in this case the network were developed between core players such as *researchers* (IIT Madras, Sri Ramachandra Medical College), *funding agencies* (UNICEF India), *practitioners* (engineers, public health workers) and the *end users* (consumers, the general public) as shown in Fig.5.

c) Motivation of block coordinators and volunteers

The community was involved in the testing of water in all the panchayats. This facilitated the increase in awareness on the problem of fluoride contamination to an extent and building local capacity so that routine testing could be carried forward by the community itself using the testing kits available with the panchayat. High level of awareness towards the fluorosis and the health benefits gained by the users while advocating boiling water before use it for drinking purposes and using toilets, hand washing at household level is reflected in discussions during the follow up actions. The spread of awareness through motivation of block coordinators and volunteers was shown in Fig. 6.

Figure 5: Integrated planning of various stakeholders to improve water quality management in Krishnagiri district, India

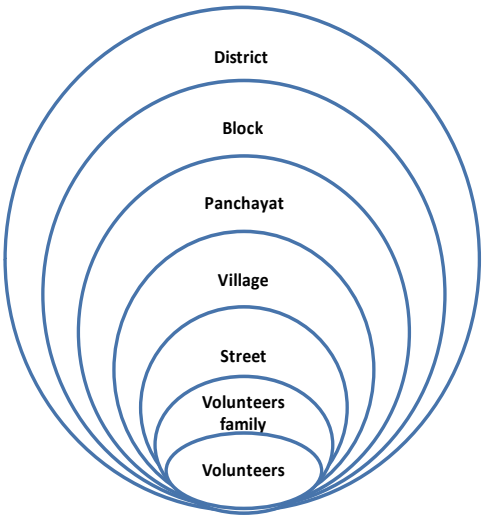

Figure 6: Igniting awareness through the trained volunteers about water quality issues

d) Addressing all dimensions of sustainability

The biggest challenge for community water quality monitoring programme is to have effective and analytical monitoring of environmental indicators. Hence, various target groups were identified and plan of actions were developed to address the specific target groups. The sustainable strategy that utilised for ensuring water quality protection and improvement in Krishnagiri district is shown in Fig.7.

Thus, various feasible options needs to be focused for providing fluoride-free water to Krishnagiri district are listed as follows:

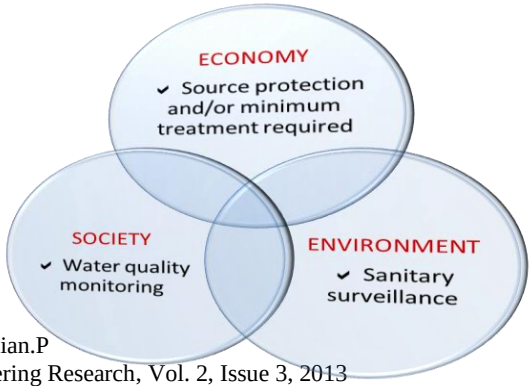

Figure 7: Sustainable strategy utilized for water supply quality protection and improvement in Krishnagiri district, India

- Meeting the water requirements for drinking and cooking purposes by promoting the rooftop rainwater harvesting at all possible levels.
- Establishing the proper structured networks of groundwater recharge structures to dilute the fluoride in aquifers.
- Promoting the utilisation of household activated alumina filters – It is important to note that the mere distribution of household fluoride filters has failed miserably earlier mainly because the villagers did not know how to reactivate the alumina filter or who to approach for maintenance. Thus, a strong back up support is essential to make it a successful low cost technology in accessing Fluoride-free drinking water on a sustainable basis. (with facilities for reactivating the filter material) for those who have constraints in harvesting rainwater
- Community-managed defluoridation units with adequate technical support for management from various stakeholders
- Creation of awareness on fluorosis and promoting the judicious use of calcium rich diet to reduce the ill effects of fluorosis

On the good side, the project was already initiated and executing by TWAD board with funding from Japan Bank for International Cooperation (JBIC) using Tamilnadu's share of Cauvery river water and about to finish within a year.

4. Conclusions

Improvements in rural water supply and sanitation provision is central to the achievement of MDGs7 and demands a multi-sectoral approach. The interim results suggest that the programme initiated a transformational change in the way block water supply and sanitation infrastructure is formed, using a community-led approach to ensure that services are capable and sustainable. It is widely accredited to address the problem sustainably, one should involve the affected community directly while planning, developing and implementing the strategy. Close collaboration of government along with the community is indispensable right from the project planning till implementation.

Through susbstantial improvements in raising awareness, communities started realising the actual cause of fluorosis disease and have acquired the importance of defluoridated water. At block level, active participation of community elected representatives, local school teachers, revenue officials, para-medical staff were warranted due to the community level convergence meeting organised by volunteers every month. At regional level, close cooperation between UNICEF, State public health departments, TWAD boards and local authorities were observed in the programme. From the last five years experience, it has been felt that due to the pipelined project of Hogenakkal integrated fluorosis mitigation drinking water project, treatment at household level was less preferred. Though the implementation of regional water supply schemes from safe surface water sources are favored, the need of environmental educations to the end user is highly demanded. To achieve sustainability, one have to remind the Confucius quote of "*If you plan for one year plant rice, if you plan for ten years plant trees and if you plan for hundred years educate people*".

5. Acknowledgement

The author is thankful to UNICEF India for supporting this ongoing programme and to Government of Tamilnadu and Sriramachandra Medical College, Chennai (India) for guidance in the programme. I place our great indebtness to our technical team, Dr. R. Elangovan and Dr. J. Senthilnathan, in preparing and validating the field testing kits. In addition, my sincere thanks to Mr. Kumaran and Mr. S. Soundhar, all project staffs, village volunteers, block coordinators and all who support this noble cause.

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