ASSESSMENT OF WATER SOURCES AND IMPACT OF CLIMATE CHANGE ON RURAL WATER SUPPLY.

Abstract: With the increased human activities, settlements, urbanization and industrialization, there are many challenges faced by water sources in Sri Lanka in terms of the quality and availability of the required quantity. Moreover, the fast rate of climate change experienced within the last five to six decades is posing a significant challenge that further aggravates these situations. The objectives of this study are to explore the types of water sources used in rural water supply and the impacts of climate change. The study design consisted of a literature review, stakeholder consultation, field observations, transect walks to the water sources and structured interviews with Community-Based Organizations (CBOs). The Development Officers of the Department of National Community Water Supply have been trained in data collection tools, administering questionnaires and conducting interviews. They completed the CBO-level interviews using semi-structured questionnaires. Stakeholder consultative workshops were held for the validation and interpretation of the findings. According to the results, the most dominant source is dug wells fitted with motorized pump arrangements (40%). 31% of the samples of the rural water supply schemes use springs as the water source while 8% of the samples use boreholes fitted with a motorized pump. 14% of the sample represent surface water sources which consist of streams and lakes. In addition, 1% of water schemes in the sample receive treated water as a bulk supply from the NWSDB. 74 % of CBOs mentioned that the water supply is affected by Climate change. Out of this, 77% was impacted by drought while 15%, 4% and 3% of the sample were impacted by flood, landslides and saltwater intrusion accordingly. These results showed that the issue of drought is widespread across the country while floods are mainly in low-lying areas, saltwater intrusion occurs in a small part of the coastal area and landslide issues occur mainly in hilly areas. Even though many 71% of water schemes use groundwater and are impacted by drought, CBOs hardly include climate-resilient interventions to mitigate groundwater depletion.

Keywords: Community-Based Organizations; Climate Change; Water Sources ; Groundwater

1. Introduction

The baseline assessment of the existing situation of rural water supply systems managed by communities was initiated under UNICEF funding to identify gaps and interventions required to improve sustainability while ensuring climate resilience. The assessment of water sources and challenges and risks for the water source management were main elements of this assessment. The collection of baseline information supported to prioritize Water Safety Plan (WSP) implementation and

necessary interventions to secure water sources.

2. Literature Review

It is estimated that 12% of the population is covered with rural water supply systems managed by Community Based Organisations (CBOs) and local authorities. According to the Department of National Community Water Supply, approximately 11% of the population of the country is served through these water schemes managed by CBOs, at present. NWSDB Corporate Plan and Business Plan prepared for the year 2020-2025 predicts that the coverage target is to increase the coverage from increased from 12% to 13.1% by the year 2050. According to the Department of National Community Water Supply (DNCWS), the number of rural water supply schemes managed by the CBOs within the country, is at 4627.

Climate variability and change strongly influence activities across the country and it significantly impact on rural water supply. According to the climate data available in the country, studies of the climate science community and predictions have been made for the climate future. On average, the temperature recorded since 1961-1990 was noticed to be increased by increasing temperature trend by 0.16˚C per decade; with the highest increase of minimum temperature around 2.0˚C at Nuwara Eliya. There is a noticeable decreasing trend in rainfall pattern in most parts of the island with the exception of the north and east. Mean annual precipitation decreased by 144 mm (7%) compared to the period 1931-1960. The consequence of these changes in the climate are extreme climatic events, mainly drought and extreme flood conditions. Furthermore, Saltwater intrusion is also increasing along the coastal belt of Sri Lanka. All these climatic events impact on water supply systems managed by CBOs.

3. Methodology

3.1 Sample Selection

The study consisted of a literature review of climate vulnerability aspects in the rural water supply sector in Srilanka. To ensure an adequate representative sample, from the total number of 4627 CBOs managing rural water supply systems a sample size of 20% was selected which was rounded off to 900 CBOs. The number of CBOs to be selected from each district for this sample was computed by providing 25% weightage for the number of CBOs in the district from the total while 75% weightage on the Rural Water Supply (RWS) beneficiary population in the district from the total RWS beneficiaries covered as mentioned below. Each CBO for this sample in the district were selected randomly by using computer generated algorithm.

3.2 Field Survey

The field survey was carried out by Development Officers (DOs) of the DNCWS. They were trained to administer the questionnaires and use Participatory Rapid Appraisal (PRA) tools for the field level data collection. Nearly 100 newly recruited Development Officers, were trained under the assistance

of UNICEF and Monitoring & Evaluation unit of the DNSWS. The data collectors at the field level were supervised by the respective officers in charge and the overall management of the data collection was carried out by the M&E division of the DNCWS under the direct guidance of the Director General.

3.3 Data Analysis and Validation

A mobile Application was developed to feed and analyze the field data. This has been linked to the online dash boards to make graphical presentations. The data have been updated after the field data was captured and uploaded through Mobile Application. However, during the data validation, it was found that data in only 704 CBOs could be considered for data analysis. Since the sample size is still 15.2% from the total no of the CBOs, it was decided that the sample is still a valid representation of the population.

4. Findings

4.1 Type of Catchments of **Rural Water Supply Systems and Identified Issues**

According to the field survey results, 23% of the catchment areas have been impacted by human intrusion and settlements. Such catchments displayed poor catchment characteristics and they were subjected to contaminations by unsafe excreta discharges, solid waste dumps and industry discharges. into the catchment area. On the other hand, the level of soil erosion was very high in some water source catchment areas due to the high rain fall. Out of the total, 38% of catchments were reserved, where the catchments were mainly government land either belonging to the Department of Forest Conservation, Department of Wildlife Conservation, or Land reform commission. Catchments belonging to these entities were strictly protected. However, retention capacity of some replanted land belonging to Land reform commission is not favorable for retaining water where the baseflow is limited during the dry period. The balance of 39% of RWSS represent –mixed catchments consisting of reserved areas and inhabitant lands.

4.2 Influence of Climate Change on Water Sources

74.23% of the Rural Water Supply systems managed by the Community based organisations (CBO)s mentioned RWSS were impacted by climate change. Most of the CBOs, 77%, of the sample, mentioned that RWSS impacted by drought and 15% was impacted by floods. Further, 4% and 3% of the CBOs mentioned that RWSS were impacted by landslides and saltwater intrusion accordingly. These hazards resulted water scarcity, contamination of drinking water and exacerbation of the spread of disease. Impacts of climate change and variability were evident in many RWSS and the increase of frequency and intensity of floods and droughts pose a challenge to RWSS. In the Sri Lankan context, the most sensitive

catchment is often a hilly and forested area. The physical extent of a catchment consists of surface vegetation and components of ecosystem and the ground water aquifers underneath. The extent of which the catchment area is demarcated has a critical role in water safety as well as water security.

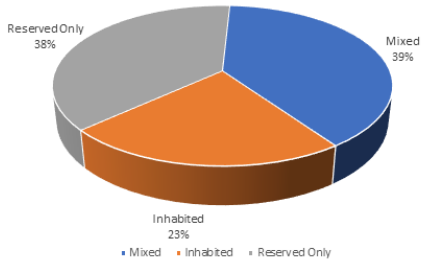

Figure 01: Type of Catchments

4.3 Land Ownership of the water Source Catchments Areas

The major challenge for the protection of the catchment areas is the land ownership. The 38% of the catchments of RWSS belongs to the Government while 17% of catchments are owned by plantation companies. These lands were leased out to Regional Plantation Companies for developing and management of plantations. 32% of the catchments belonged to the private sector. In private lands, tree species such as Eucalyptus and Pines which has high transpiration have been planted these trees do not allow undergrowth for better water recharge and retention

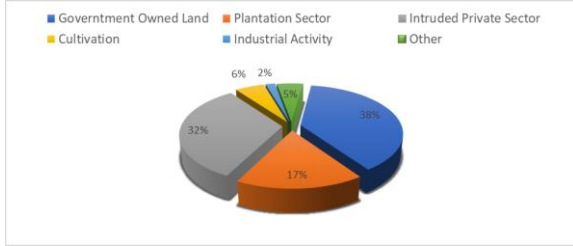

Figure 2: Land Ownership as Indicated during the Survey

Figure 3: Palm Cultivation carried out by some Plantation Companies undermines Catchment objectives

4.4 Water Quality Changes due to Climate Induced Events

Changes in water quality was identified as a significant challenge 29% of the CBOs. This was mainly due to high turbidity and suspended solids caused by floods and landslides. During a drought period, water quality altered due to the presence of algae in surface water resources since they were stagnant mainly in Lakes, Irrigation Tanks and Ponds. In water sources of coastal areas, water quality changed due to the saltwater intrusion. In coastal areas salinity might increase due to depletion of freshwater lenses in sub water /groundwater sources and surface

sources as well. Apart from the taste, corrosion might prevail where GI pipes are used .

A spring occurs in the earth surface where groundwater emerges naturally. The water source of most springs is rainfall that seeps into the ground uphill from the spring outlet. While springs may seem like an ideal water supply, they need to be selected with care, developed properly, tested, and monitored periodically for contamination especially during rainy seasons. Proper spring development helps to collect the flowing water and protect it from surface contamination.
Usually, intakes constructed in streams frequently requires the construction of small diversion dams. In this manner, provisions can always be made for a sufficient depth of water above the intake pipe, for the settling of suspended matter, thereby reducing the turbidity of the water, and for keeping floating leaves and other debris from obstructing the intake structure. As a result of climate change, many streams are now experiencing heavy silt loads during rainy season with very high precipitation events and very low flows during dry season due to very low retention capabilities in the catchment. Therefore, it is essential that the intake has to be designed to cater to this variability improving it's resilience during floods as well as dry weather.

Figure 4: A Weir Intake used in a Rural Water Supply System

4.5 Impacts of Droughts in Rural Water Supply Systems

The most common impact due to drought exposure is reduction of water yield and complete drying up incase of severe drought situation. Moreover, the situation gets worsened with the increased demand for water consumption due to heat waves. When there are multiple users from the same water source the increased competing demands between domestic and irrigation users from the current water sources complicate the matters further. In some situations, this might develop to a serious water crisis induced by climate issues between two different user groups. The changes in temperature and rainfall resulted the reduced inflows to water storage, reduced recharge rate of ground water, increased risk of algal blooms and reduced stream flows in major catchments. Low flows and reduced water levels tend to increase the concentration of pollutants and nutrients and cause longer term poorer water quality. Pollutant concentrations increase when conditions are drier. Increased water temperatures in the water

supply system may lead to increased microbiological activity and increased health risks to consumers. Drought impacted on water sources through ground water depletion, less precipitation and lowering water table in peak dry period which often leads to inactive most of the shallow water tables and needs ponding during abstraction of water. This also increased dependence on potentially less safe alternative water sources and limit people to use of safe water for hygienic practices. As a result, risks for diarrhoeal, dysentery increases.

5. Conclusions

The findings showed that the issue of drought is widespread across the country while floods are mainly in low-lying areas, saltwater intrusion occurs in a small part of the coastal area and landslide issues occur mainly in hilly areas. Even though many RWSS are impacted by climate induced events, CBOs hardly include climate-resilient interventions to mitigate effects and adapt to those disasters. eason situation. groundwater depletion. Water conservation and Demand management measures need to be implemented with incentives. Implementation of Rainwater Harvesting programme to supplement the water supply of all the customers is recommended as a practical way of improving the service level. It is recommended that DNCWS coordinate with the NBRO and the Disaster Management Centre on early warning systems and coordinate with the relevant CBOS before such catastrophic events takes place for the preparedness. Further necessary legal and institutional provisions and measures needs to be taken to avoid land fragmentation, and promote sustainable land management practices which improves water retention throughout the year and increase the water quality.

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