



INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
PhD-17 SHORT ABSTRACT OF THESIS

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Thesis Title: DEVELOPMENT OF VULNERABILITY INDEX OF GROUND WATER BASED RURAL DRINKING WATER SUPPLY SYSTEM

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SHORT ABSTRACT

Water is an integral component of all living organisms. Around 70% of the earth is covered with water but only 1% is usable for human consumption. Drinking water is the water which is safe to drink as to use for food preparation without risk of health problems. In urban areas in India, generally drinking water is supplied through surface and groundwater-based water supply schemes. But, for rural areas, it mainly comes from groundwater. Groundwater plays a crucial role in the country in increasing food and agricultural production, providing drinking water and facilitating industrial development. Due to rapid urbanization of developing country like India, the quantity as well as quality of ground water is affected due to excessive withdrawal of groundwater and waste disposal. According to WHO report, about 80% of the diseases in human beings are caused by lack of pure drinking water. So, it is the need of the hour to monitor quality of groundwater regularly to avoid ways and means to protect it. Moreover, the groundwater has been depleted in many parts of the country due to unplanned and over exploitation of groundwater. So, it is utmost important to have proper planning and management of this precise resource. Otherwise, a majority of the people of an area may face decline of agricultural productivity and deficiency of drinking water, which lead to wide spread socio-economic stresses. So, the primary factors responsible for vulnerability of groundwater-based drinking water supply systems are the water quality of the supplied water and ground water fluctuations. Moreover, vulnerability is also related to social factors such as age, literacy, economic status, asset value, and accessibility to drinking water sources. As such, the study considers the water quality, groundwater fluctuations along with the social factors to provide a composite social vulnerability index of groundwater-based drinking water supply systems. The district wise water quality data for the state of Assam, India has been collected from Assam Public Health Engineering Department, Government of Assam. The WQI values evaluated for all census districts using the 2011 census can be broadly categorized as either good or poor. The results show that out of 27 districts in Assam, 10 districts supply poor quality water, while 17 districts supply good quality water. The primary contaminants responsible for poor water quality are Iron and, in some areas, Magnese. The presence of arsenic and fluoride in certain districts necessitates advanced treatment methods such as reverse osmosis. The groundwater level data for the period of 2016-2022 are taken from the Groundwater monitoring wells of CGWB.

Linear regression is applied using GRACE data and IMD rainfall as inputs, with groundwater level as the output, to establish a relationship that is then used to estimate groundwater levels. Time-series analysis from 2002 onward reveals a general trend of ground water depletion across all districts indicating a long-term increase in drinking water vulnerability. Socio-economic factors influencing drinking water vulnerability such as age, literacy, income, asset ownership, and water accessibility are calculated from the 2011 census of India data. Dibrugarh district has found the highest number of accessible water sources, while Dima Hasao has the lowest. Goalpara district has the highest proportion of children aged 0-6 years and the lowest literacy rate, making it highly vulnerable. Kamrup metropolitan district has the lowest proportion of young children and the highest literacy rate, reducing its vulnerability. On the other hand, Kamrup district scores highest in asset and economic factors, while Dhubri district has the lowest asset factor and Karbi Anglong has the lowest economic factor. The weight for the parameters is obtained as per the opinion survey conducted among the experts. The results of the composite vulnerability index calculations show that four districts have high vulnerability value, one district is in medium vulnerability range and the other districts are in a very low to low vulnerability level. The high value of vulnerability level in the districts are mainly due to high value of age factor and low value of asset factor, literacy factor, and economic factor.

