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Freshwater Security of Sub-Saharan Africa

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Freshwater resources are an essential input for basic drinking water supply, agricultural production, socio-economic development and ecosystem sustainability. Existing and projected freshwater shortages in the sub-Saharan African region make the region one of the most water stressed. Improving access to freshwater in this region requires a diagnosis of the underlying cause(s) of these shortages. This study presents a conceptual approach seeking to identify the underlying cause(s) of freshwater shortages in the sub-Saharan Africa region. The analysis focuses on five key integrated freshwater security categories: structural deficit, pollution, population, water storage and development of infrastructure with associated indicators used to quantify water security. Starting from the premise that water scarcity is a complex, cross-sectoral phenomenon, the attempt is made to develop a system-oriented and integrated approach. The application of this conceptual approach to the sub-Saharan African region revealed that, all of the 49 countries in this region experience at least some form of vulnerability. Pollution vulnerability is the most dominating, with all sub-Saharan African countries having high to very high vulnerability rating in this category. In this regard, vulnerability refers to the lack of infrastructure, governance, policies and protection measures. Four countries had high to very high vulnerability rating in all the five freshwater vulnerability categories considered in this study. Djibouti is the most vulnerable country having very high ratings in all four categories while eight other countries follow closely each having high vulnerability rating in three vulnerability categories. The most significant and dominant pressure source contributing to an increase in vulnerability rating within the five categories considered in this study was identified. The widespread chaotic distribution of infrastructure in most sub-Saharan African countries contributes significantly to freshwater pollution. Nearly two-thirds of the countries assessed in this study lack rural-urban development plans and public environmental policies aimed at protecting surface watercourses and areas of significant groundwater resources. The countries dominated by population vulnerability are characterized high urban population and incommensurate development of the necessary infrastructure to counter centralized demand. Nearly two-thirds of the countries assessed lack sufficient reservoir storage capacities for storing 30 pc. of their annual total renewable freshwater flow. While Zimbabwe, Zambia and Ghana each have reservoir storage capacity per capita above 5400 cm countries like Benin, Niger, Congo Republic, Democratic Republic of Congo and several other sub-Saharan countries have reservoir storage capacities per capita less than 5 cm. Groundwater storage as a potential natural reservoir was considered as a complementary category. For the infrastructure development vulnerability category, infrastructure maintenance and repair were identified as the most dominant pressure source contributing significantly to the rating of this vulnerability category. The freshwater assessment approach developed in this study integrates five key human and physical factors including pollution which is rarely considered. The dominance of pollution vulnerability in the sub-Saharan African region emphasizes the need for more comprehensive pollution assessments in freshwater vulnerability analyses. Based on this analysis measures and investments to improve freshwater security can be defined and implemented for Sub-Saharah Africa.