# Hydrological Drought Analysis: Occurrence, Severity, Risks

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Persistent incidences of drought, in Ethiopia, in most cases, have resulted in famine and ravaged subsidiary economic activities. Beyond its short-term effects, such as the loss of human life, livestock and wildlife, lie long-term social and environmental impacts. Rising water demands for municipalities and agriculture coupled with increased threat of global warming requires a better understanding of drought characteristics and sustainable use of water resources. River systems are most stressed in low flow periods and thus, an understanding of drought conditions in time and space is fundamental to a wide range of water management problems.

The overall objective of this study is to develop an appropriate decision support tool in water resources planning and management under water scarce scenarios of especially ungauged catchments in the study area and statistically model hydrological drought variables under investigation. The study aims to identify, predict and clearly indicate the extent and severity of drought occurrences and understand the generics of low flow in selected basins in Southern Ethiopia. It will primarily focus on investigating the magnitude, frequency, spatial extent, and seasonality of drought behaviour, and associated risks and implications of drought incidents. Such studies are particularly important in connection with the design and operation of reservoirs, diversion of streams for irrigation, hydropower and drinking water and in all activities related to water quality.

The study will focus on two water scarce river basins, Wabi Shebele and the Rift Valley lakes basin, in Southern Ethiopia. The identification and prediction of droughts are achieved through analyses of time series of drought variables such as rainfall, stream flow, ground water levels, and soil moisture data, on a variety of time scales using a number of methods. Using the notion of runs, on the basis of constant or variable threshold levels, allows one to analyse the probabilistic structure of drought durations (run length) and severities (run sum). Discrete auto regressive and moving average (DARMA) processes are used to model the variability of wet and dry years. Using the Kaplan-Meir technique it is possible to estimate future drought length given past length and time of year of occurrence (seasonality) with certain level of confidence. Among other emerging approaches for drought analysis are pattern recognition and artificial neural networks. Development of models of probabilistic phenomena, such as low flows, is often hindered by short record lengths or total absence of any record. Thus, regional characteristics of drought duration and deficit volume will be analysed. Drought risk area, by nature, is a result of interrelated parameters concerned. It is envisaged to model the drought risk area with a set of themes using remotely sensed data and GIS. A user-friendly interface will be proposed to allow users to easily acquire low-flow information for any ungauged basin in the study area. This study is expected to contribute to the FRIEND-NILE project which has also a research interest in low flow and drought analysis.