DROUGHT MONITORING AND MITIGATION BASED ON CLIMATE CHANGE IN SOUTHERN AND SOUTHEASTERN ETHIOPIA

THESIS

Submitted for Partial Fulfillment of Requirements of Graduate School for Master Program in Environmental Science

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DECLARATION

I hereby declare that:

1. The enclosed manuscript of Master Thesis entitled: '**Drought monitoring and mitigation based on climate change in southern and south-eastern Ethiopia**' has been independently developed and authored by myself. I further declare that I have not used any sources without declaration in the text using the referred sources and support. Any thought from thoughts or literal quotations are clearly marked within the text and in list of cited sources accordingly. If elements of plagiarism proven to be evident in the manuscript, I accept the sanctions, both to the thesis and my Master's degree, as stated by legislation in effect.
2. Partial or entire publication of the content of this thesis in scientific journal or forums shall include as authors, the team of supervisors and Graduate School of Universitas Sebelas Maret as its institution. By violating the provision of this publication, I agree for the required academic sanctions to be enforced.

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ABSTRACT

Ethiopia is highly vulnerable to the impact of climate change like drought due to its low adaptive capacity, a higher dependence on rain-fed agriculture, and poor drought mitigation measures. The aims of this research were to analyses the long-term climatic trends, to monitor drought characteristics, to assess people's perceptions of drought and its mitigation measures, and to recommend better drought mitigation strategies in southern and south-eastern Ethiopia. This research is mixed method research. The southern and south-eastern of Ethiopia were purposely selected based on a frequent occurrence of drought. Primary data were collected via mailing of a questionnaire to 19 key informants. Monthly data (1980-2017) were obtained from National Meteorological Agency (NMA) of Ethiopia. Mann-Kendall (MK) Test coupled with Sen's Slope Estimator and linear regression were used to analyse the trend of climatic data whereas Standardized Precipitation Evapotranspiration Index (SPEI) was used to analysis drought characteristics. SPEI of 1-, 3- and 6-month timescales were calculated to understand drought frequency, duration and severity. SWOT analysis was conducted to analysis the strengths, weaknesses, opportunities, and threats of drought mitigation measures, and to formulate feasible mitigation strategy while quantitative strategic planning matrix (QSPM) was performed for comparing feasible alternative strategy. The result showed that annual rainfall trend had non-significant decrease at all station except at Gode. The trends of maximum and minimum annual temperature were insignificantly increasing. The calculated SPEI revealed drought is more frequent and severe from time to time in the study area. The most frequent, severe and prolonged droughts occurred during1999-2017 compared to 1980-1999. The most severe drought happened in 2016 with peak negative SPEI-3 value −4.4 in Moyale. The longest duration of drought was recorded in Kebry Dehar station in 2011, which stayed for 12 continuous months. SPEI of 1-, 3- and 6-month value indicated that drought characteristics are changed when timescale is changed. Deforestation and climate change were the highly responded as the major causes drought followed by poor land and water management while El-Nino was the minor causes. Food insecurity and scarcity, malnutrition, health problem, unemployment, migration, school dropout, hopelessness, stress, conflicts, and lack of shelter were identified impacts of drought on society. Economic impacts such as reduction of income, increment of food price, reduction of milk, crop failures, loss of livestock, shortage of energy sources, and recreational area problem were reported. Rising temperature, forest degradation, pasture degradation, scarcity of surface water, groundwater decline, and soil erosion were the identified environmental impacts of drought in this area. The mostly adopted drought mitigation measure in this area is emergency water and food supply followed by internal migration from drought area, which is reactive approach of drought mitigations. Total weighted score of internal factor and external factor evaluation were 2.38 and 2.39, respectively, and this indicates that drought mitigation measures are weak and the advantages of existing opportunities were not well used to minimize effects of threats. There were ten feasible alternative drought management strategies formulated. These ten strategies grouped in to four strategies and analysed using QSPM. The result of QSPM showed that the sum total of attractiveness score (STAS) of strategy 1, 2, 3, and 4 are 4.68, 4.65, 5.29, and 5.42, respectively. This indicated that strategy 4 is the most attractive followed by strategy 3, 1, and 2, respectively. Therefore, the ten drought management strategies formulated and listed according to their attractiveness are highly recommended in order to minimize causes and risks related to drought.

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List of Acronyms

EFEM	External Factors Evaluation Matrix
FDRE	Federal Democratic Republic of Ethiopia
GHG	Greenhouse Gases
IFEM	Internal Factors Evaluation Matrix
IPCC	Intergovernmental Panel on Climate Change
LDC	Least Developed Countries
MK	Mann-Kendall
MOA	Ministry of Agriculture
NMA	National Meteorology Station
PDSI	Palmer Drought Severity Index
PET	Potential Evapotranspiration
QSPM	Quantitative Strategic Planning Matrix
SPEI	Standardized Precipitation Evapotranspiration Index
SPI	Standardized Precipitation Index
SWOT	Strength, Weakness, Opportunity, and Threat
tho	Thornthwaite
UNEP	United Nations Environment Programme
WMO	World Meteorological Organization