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List of Acronyms

CHIRPS	Climate Hazard Group Infrared Precipitation with Station
CSA	Central Statistics Agency
DEM	Digital Elevation Model
DN	Digital Number
ERDAS	Earth Resource Data Analysis System
EWS	Early Warning System
FAO	Food and Agricultural Organization
FEWS NET	Family Early Warning System
GIS	Geographical Information System
GPS	Global Positioning System
IPCC	Intergovernmental Panel on Climate Change
LULC	Land Use/Land Cover
MCE	Multi Criteria Evaluation
NDVI	Normalized Difference Vegetation Index
NGO	Non-Governmental Organization
NMA	National Meteorological Agency
OAMD	Office of Agriculture of Meket District
PROBA-V	Project On-Board Automation Vegetation
SPI	Standard precipitation Index
SPOT	Satellite Pour l'Observation de la Terre
SPRITS	Software for Processing and Interpreting Remote Sensing Images Time Series
USGS	United States Geological Survey
VITO	Vlaamse Instelling voor Technologish Onderzoek
WMO	World Meteorological Organization

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Abstract

Remote Sensing and GIS-Based Modeling and Delineation of Vulnerability to Food Insecurity: The Case of Meket District, Northwest Ethiopia

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Food insecurity is a matter of both limited food availability and restricted access to food. Food availability is the availability of sufficient quantities of food of appropriate quality, supplied through domestic production or imports. The main objective of this study was to investigate vulnerability to food insecurity using Remote Sensing and GIS techniques in Meket District of Northwest Ethiopia. The necessary data used for the study were satellite images, meteorological data and other ancillary data. Drought, land degradation and socio-economic maps were generated by considering them as the major factors determining vulnerability to food insecurity in the study area. For drought detection, NDVI anomaly and SPI were generated from SPOT-Vegetation and PROVA-V dekadal NDVI images for the 10 study years (2008–2017). The land degradation vulnerability of the study area was modelled using Land Degradation Assessment Model. This model considers topographic, vegetation, soil, rainfall and human factors. In addition, socio-economic susceptibility of the community was also assessed and mapped. Then, these three determinant factors were weighted and overlaid to produce a model of vulnerability to food insecurity and further to delineate vulnerable areas. Firstly, a comprehensive map was produced that indicates agricultural drought risk prone areas of the study area by combining the frequency maps of the NDVI anomaly and SPI indices and confirmed drought pattern. This map shows that no, slight, moderate, severe and very severe drought risk areas constitute 2.5, 11.3, 34.87, 42.9 and 8.43%, respectively, of the total area of Meket District. The result map was validated using ground truth data such as crop production and experts in the Office of Agriculture of Meket District. Secondly, the land degradation vulnerability for 12.48, 28.78, 22.43, 26.42 and 9.89% of Meket District falls under very high, high, medium, low and very low vulnerability classes, respectively. Thirdly, the percentage areas categorized as very severely, severely, moderately, slightly and not susceptible classes were 7.25, 36.72, 33.24, 12.02 and 10.78% of the total area of Meket District, respectively. Finally, the result of vulnerability to food insecurity reveals that 23.26, 44.26 and 17.09% of the district were identified as moderately, severely and very severely vulnerable areas to food insecurity. Only 1.79 and 13.60% were found to be no and slightly vulnerable areas to food insecurity, respectively. Thus, the result could be used as a guide for concerned government and non-government organizations for taking actions on adaptive strategies of food insecurity in the study area. Spatially, most of northern, central and eastern parts of the district were found to be categorized into the severe and very severe food insecurity vulnerability classes.

Key words: Food insecurity, Drought, NDVI, SPI, Land degradation, Socio-economy