

Impact of Short-Term Drought on Vegetation Health Condition in the Kingdom of Saudi Arabia Using Space Data

Authors : E. Ghoneim, C. Narron, I. Iqbal, I. Hassan, E. Hammam

Abstract : The scarcity of water is becoming a more prominent threat, especially in areas that are already arid in nature. Although the Kingdom of Saudi Arabia (KSA) is an arid country, its southwestern region offers a high variety of botanical landscapes, many of which are wooded forests, while the eastern and northern regions offer large areas of groundwater irrigated farmlands. At present, some parts of KSA, including forests and farmlands, have witnessed protracted and severe drought due to change in rainfall pattern as a result of global climate change. Such prolonged drought that last for several consecutive years is expected to cause deterioration of forested and pastured lands as well as cause crop failure in the KSA (e.g., wheat yield). An analysis to determine vegetation drought vulnerability and severity during the growing season (September-April) over a fourteen year period (2000-2014) in KSA was conducted using MODIS Terra imagery. The Vegetation Condition Index (VCI), derived from the Normalized Difference Vegetation Index (NDVI), and the Temperature Condition Index (TCI), derived from the Land Surface Temperature (LST) data was extracted from MODIS Terra Images. The VCI and TCI were then combined to compute the Vegetation Health Index (VHI). The VHI revealed the overall vegetation health for the area under investigation. A preliminary outcome of the modeled VHI over KSA, using averaged monthly vegetation data over a 14-year period, revealed that the vegetation health condition is deteriorating over time in both naturally vegetated areas and irrigated farmlands. The derived drought map for KSA indicates that both extreme and severe drought occurrences have considerably increased over the same study period. Moreover, based on the cumulative average of drought frequency in each governorate of KSA it was determined that Makkah and Jizan governorates to the east and southwest, witness the most frequency of extreme drought, whereas Tabuk to the northwest, exhibits the less extreme drought frequency. Areas where drought is extreme or severe would most likely have negative influences on agriculture, ecosystems, tourism, and even human welfare. With the drought risk map the kingdom could make informed land management decisions including were to continue with agricultural endeavors and protect forested areas and even where to develop new settlements.

Keywords : drought, vegetation health condition, TCI, Saudi Arabia