

## Yield Loss Estimation Using Multiple Drought Severity Indices

**Authors :** Sara Tokhi Arab, Rozo Noguchi, Tofeal Ahamed

**Abstract :** Drought is a natural disaster that occurs in a region due to a lack of precipitation and high temperatures over a continuous period or in a single season as a consequence of climate change. Precipitation deficits and prolonged high temperatures mostly affect the agricultural sector, water resources, socioeconomics, and the environment. Consequently, it causes agricultural product loss, food shortage, famines, migration, and natural resources degradation in a region. Agriculture is the first sector affected by drought. Therefore, it is important to develop an agricultural drought risk and loss assessment to mitigate the drought impact in the agriculture sector. In this context, the main purpose of this study was to assess yield loss using composite drought indices in the drought-affected vineyards. In this study, the CDI was developed for the years 2016 to 2020 by comprising five indices: the vegetation condition index (VCI), temperature condition index (TCI), deviation of NDVI from the long-term mean (NDVI DEV), normalized difference moisture index (NDMI) and precipitation condition index (PCI). Moreover, the quantitative principal component analysis (PCA) approach was used to assign a weight for each input parameter, and then the weights of all the indices were combined into one composite drought index. Finally, Bayesian regularized artificial neural networks (BRANNs) were used to evaluate the yield variation in each affected vineyard. The composite drought index result indicated the moderate to severe droughts were observed across the Kabul Province during 2016 and 2018. Moreover, the results showed that there was no vineyard in extreme drought conditions. Therefore, we only considered the severe and moderated condition. According to the BRANNs results  $R=0.87$  and  $R=0.94$  in severe drought conditions for the years of 2016 and 2018 and the  $R=0.85$  and  $R=0.91$  in moderate drought conditions for the years of 2016 and 2018, respectively. In the Kabul Province within the two years drought periods, there was a significant deficit in the vineyards. According to the findings, 2018 had the highest rate of loss almost -7 ton/ha. However, in 2016 the loss rates were about - 1.2 ton/ha. This research will support stakeholders to identify drought affect vineyards and support farmers during severe drought.

**Keywords :** grapes, composite drought index, yield loss, satellite remote sensing

**Conference Title :** ICGISRSA 2021 : International Conference on GIS and Remote Sensing for Agriculture

**Conference Location :** San Francisco, United States

**Conference Dates :** November 01-02, 2021