NORTH DAKOTAVIEW 2023- 2024 ACTIVITIES

Water Balance and Assessment of Agricultural Drought and Crop Yield in North Dakota from 2000-2023 Using Landsat Data

• With a global rise in surface temperature, there has been an increase in the amount of precipitation that falls in extreme events, and North Dakota, a central agricultural region of the US, is witnessing this rainfall intensification

• The objective of the work was to develop and evaluate a combined drought index for North Dakota using high-resolution data to understand better agricultural drought and water resource stress at the state level from 2000 -2024.

• We estimated the main components of the water balance and linked them with information on vegetation growth and drought in North Dakota.

• For the analysis, we estimated monthly precipitation, evapotranspiration, water balance, and vegetable and drought Indices.

• Landsat Imagery was used to estimate the Vegetation Health Index (VHI) and Moisture Soil Index (MSI). We used Landsat 5, 7, and 8.

• The water balance was calculated using precipitation data from PRISM and Evapotranspiration data from TERRACLIMATE.

• We used the USDA NASS Cropland Data Layers for yearly land cover land use information.

•The VHI and water balance results reveal that the study area experienced the most severe drought in 2002, 2003, 2004, 2006, 2007, 2008, 2012, 2017, and 2021.

•This underscores the intricate interplay of moisture and thermal stress in drought development, directly linked to and influenced by rainfall.

•Crop development during drought depends more on moisture than temperature since precipitation reduces thermal stress. These droughts disrupt agricultural assets like crops, livestock, and timber.

•The seasonal VHI anomaly showed a strong correlation with the seasonal rainfall anomaly in June, July, and August, which are also the significant crop growth seasons in the region.
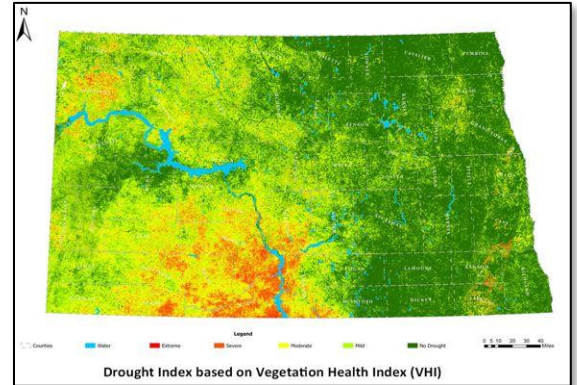
2006 extreme drought year showing drought index based on vegetation health index (VHI)

The 2021 extreme drought event year shows precipitation per land-use class and evapotranspiration per landcover class.

Corn and barley production and harvest for some corn belt states and how the production was affected during the extreme drought years
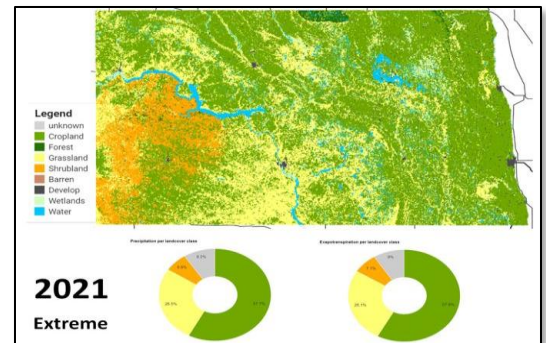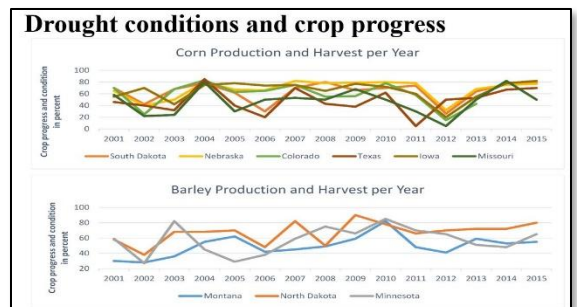
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BENEFITS TO NORTH DAKOTA

- NDView provided scholarships for three graduate students and one undergraduate student at the University of North Dakota to conduct research and train in remote sensing-related areas. Students used the funds to attend conferences and training seminars and purchase research equipment. The funds were also used to supplement tuition for the undergraduate student.
- NDView hired two graduate research assistants to perform the analysis on drought monitoring from 2000 – 2024 and develop a story map and a web-based North Dakota drought monitoring app.
- NDView provided training in streams and watersheds to more than 100 middle and high school students using an augmented reality sand table at the River Watch Forum in Grand Forks, ND.
- NDView helped support research and education in remote sensing in the state by purchasing equipment and supplies.
- These links can be used to access the comprehensive project through a story map and the North Dakota drought monitoring app.

Geography Graduate students and faculty during the Minnesota GIS/LIS Consortium meeting (October 4-6,2023)

Area students on the augmented reality sand table during the UND gathering for Great Northern Regional Robotics event. (3/7/24)

NORTH DAKOTAVIEW CONSORTIUM MEMBERSHIP

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