COLORADOVIEW
REMOTE SENSING ACTIVITIES
2014 - 2015

ColoradoView

AMERICA VIEW

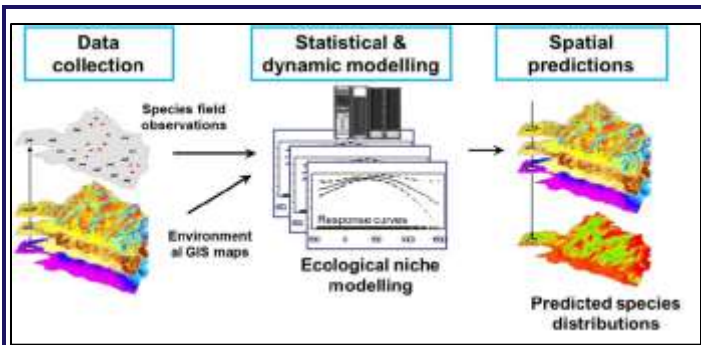## Using Remote Sensing Data in Invasive Species Modeling and Prediction

Figure 1. Remote sensing data are used as inputs to the MaxEnt software to predict invasive species distributions

Invasive plants are a pervasive and often times serious threat to ecosystem services, with economic impacts on agriculture, biodiversity, and threatened and endangered species. Resource managers, conservationists, and agriculturalists all need improved tools for understanding, predicting, managing, and mitigating potential impacts of invasive plant species, which requires models of present and future distributions and abundances of such species. Remote sensing data can be used to improve invasive species models.

In 2015 ColoradoView used remote sensing and GIS data as input layers for to predict the distribution of wheat stem sawfly, an invasive species distribution that causes damage to winter wheat. Data from the MODIS satellite were used, particularly Normalized Difference Vegetation Index (NDVI), which is a measure of greenness of vegetation, and Enhanced Vegetation Index (EVI) which is an improvement of NDVI that is more sensitive to densely vegetated areas as well as having a better correction for atmospheric haze. This imagery was combined with additional environmental data and presence data for the wheat stem sawfly. These data layers were used as inputs to MaxEnt, software that produces a model of the species range. The model successfully predicted the potential range for wheat stem sawfly, and MODIS data improved model predictive ability. The project was carried out by student interns under the direction of Dr. Sunil Kumar. The Colorado Geospatial Centroid at CSU provided facilities, guidance, and educational opportunities for the interns.

USING REMOTE SENSING DATA TO MAP UVB RADIATION OVER THE USA

The USDA established the UV-B Monitoring and Research Program (UVMRP) at Colorado State University to monitor UV-B levels across the United States. High-energy ultraviolet solar radiation (UV-B) can significantly damage plants, crops, animals, and ecosystems, alone or in combination with other environmental stress factors such as temperature and moisture. UV-B radiation is the principle cause of sunburn and skin cancer.

In 2015 ColoradoView developed an approach to improve maps of UV-B radiation that are derived from data from the UVMRP. A statistical model of the UV-B skin damage index was constructed based upon the incidence of UV-B radiation in the wavebands that cause skin damage. Data from the Ozone Monitoring Instrument (OMI) on the NASA Aura satellite were fit to data from the UVMRP using co-kriging. The model was then used to extrapolate over the USA. The best fit statistical model for the UV skin damage index data from the UVMRP included OMI-based ozone column thickness, elevation, UV-B in 2 bands, cloud fraction, and cloud thickness.
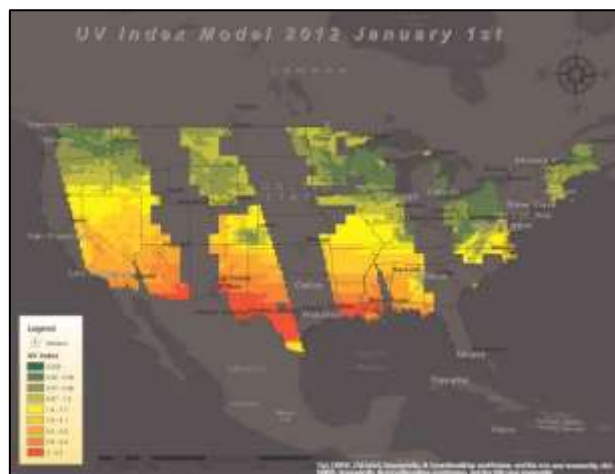

Figure 2. A map of UV skin damage index for a single day, developing using data from the ozone monitoring instrument (OMI) on the Aura satellite, and data from the UV-B Monitoring and Research Program at CSU

BENEFITS TO COLORADO

- ColoradoView (CV) is working with researchers who are experts on predicting the potential distributions of harmful invasive species in Colorado. Distribution models are improved through the use of remote sensing data.
- CV is working with the UV-B Monitoring and Research Program to use remote sensing data to produce improved maps of UV-B radiation. For Colorado, the improved maps will be combined with crop cover maps to estimate UV-B impacts on agriculture.
- CV is working with USDA and USGS, carrying out research using remote sensing data to map and assess the distribution and productivity of Colorado's grazing lands. In Colorado, grass/pasture lands is a widespread land cover used both by domestic livestock and wildlife (see Figure 3).
- CV provides opportunities for students at Colorado State University to learn how to use remote sensing in research on agriculture and natural resources in Colorado.
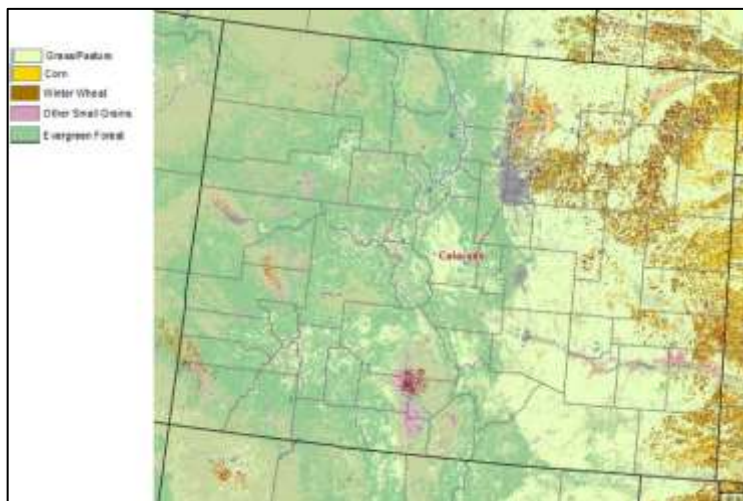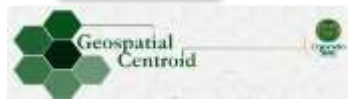

Figure 3. Colorado vegetation and crop cover map (CROPSCAPE) for Colorado, developed by the USDA using Landsat data. Note the extent of winter wheat, grass pasture (grazing land), and corn.

COLORADOVIEW CONSORTIUM MEMBERSHIP

ColoradoView works to foster communication with partners and consortia members who are current or potential end users of Landsat and other remote sensing data. These currently include educators and researchers at Colorado State University: the UV-B Monitoring and Research Program, the Natural Resource Ecology Laboratory, and the Colorado Geospatial Centroid. Our USGS partners carry out research on grazing lands and invasive species in the western USA. Our USDA partners carry out research on grazing lands in Colorado and Wyoming. The ColoradoView consortium also includes the USGS Northern Central Climate Science Center and the National Institute of Invasive Species Science.

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