ColoradoView Remote Sensing Activities 2015 - 2016

Modeling Invasive Species Distribution

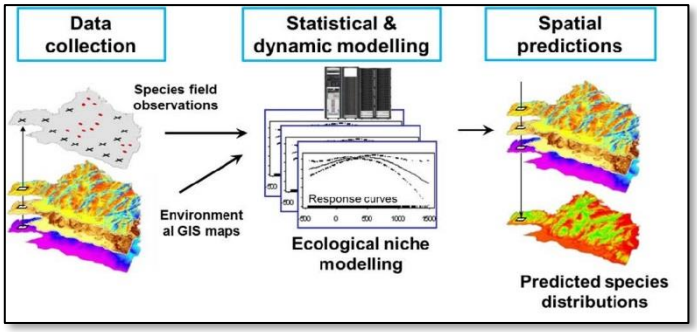

Figure 1. Remote sensing data are used as inputs to the MaxEnt software to predict invasive species distributions

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 2016 ColoradoView used remote sensing and GIS data as input layers to predict the distribution of invasive toadflax species. Data from the MODIS satellite were used, particularly several vegetation indices and phenology data that indicated the status of plant growth and development under water stress. This information was combined with additional climate, soil, topography, human footprint, and presence data for the toadflax species. These data layers were used as inputs to MaxEnt, a software that utilizes the maximum entropy method to produce a model of the species distribution. The model successfully predicted the potential range for three toadflax species, with remote sensing data improving model predictive ability. The toadflax distribution maps can benefit society by raising awareness of the potential risk of hybrid toadflax spread. These results may enable land managers to better plan and control the dispersal of the species. The project was carried out by student interns under the direction of Dr. Sunil Kumar. The Colorado Geospatial Centroid at Colorado State University provided facilities, guidance, and educational opportunities for the interns.

Ground UltraViolet-B Radiation Distribution

The USDA established the UV-B Monitoring and Research Program (UVMRP) at Colorado State University to monitor ground solar UltraViolet-B (UV-B) radiation across the United States. High-energy UV-B radiation, alone or in combination with other environmental stress factors such as temperature and moisture, can significantly damage plants, crops, animals, and ecosystems. Strong solar UV-B radiation also causes photodegradation of dead plant matter in ecosystems and increases the CO_2 in the atmosphere. In addition, UV-B radiation is the principal cause of sunburn and skin cancer.

In 2016 ColoradoView developed an approach to provide daily spatial UV-B radiation distribution in Colorado. In Colorado, ground level UV-B radiance is directly measured at only three stations operated by the USDA UV-B Monitoring and Research Program (UVBMRP). These station measurements represent the surrounding region to a limited extent, depending on time and atmosphere conditions. It is not feasible to add expensive ground stations to increase the spatial coverage of UV-B measurements. Instead, the relationship was modeled between the ground UV-B measurements and corresponding satellite-derived UV-B radiation for each 1×1 degree area across the state. The Ozone Monitoring Instrument (OMI) on the Aura platform measures top of atmosphere UV-B and variables that affect transmission through the atmosphere such as cloud optical thickness and total column ozone. The UVBMRP data are combined with the OMI-based estimates to generate daily UV-B radiance maps for Colorado, as well as the coterminous US.

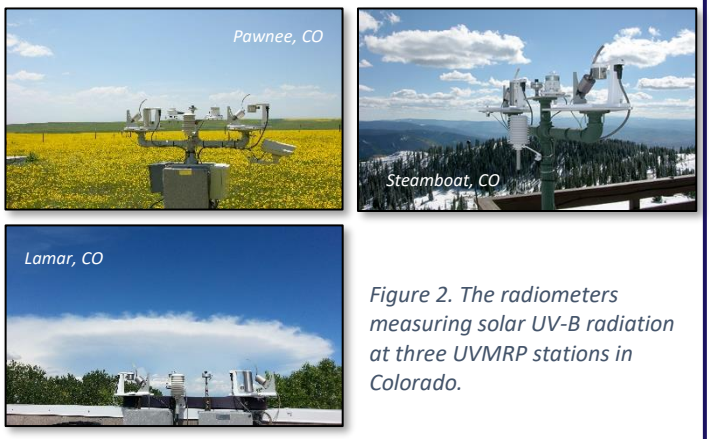

Figure 2. The radiometers measuring solar UV-B radiation at three UVMRP stations in Colorado.

ColoradoView is a member of the AmericaView Consortium, a nationally coordinated network of academic, agency, non-profit, and industry partners and cooperators that share the vision of promoting and supporting the use of remote sensing data and technology within each state.

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Benefits to Colorado

- ColoradoView (CV) worked 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 worked 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 and The Nature Conservancy investigated the response of grassland health to sustainable management alterations on Colorado grazing lands (Figure 3). The proposed approach has the potential to be replicated in a much larger range in order to determine the scale of grassland health and to monitor conversion of grasslands to bare ground.
- CV provided opportunities for students at Colorado State University to learn how to use remote sensing in research on agriculture and natural resources in Colorado.

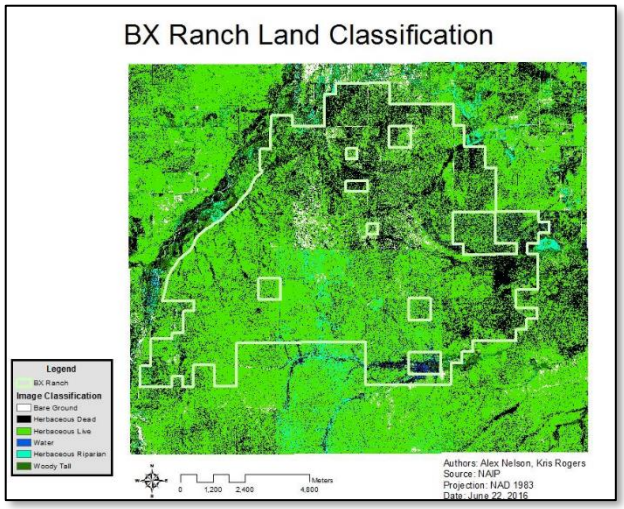

Figure 3. Classification of vegetation health on BX Ranch and the neighboring State Land Board using USDA 2015 NAIP imagery

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. This currently includes educators and researchers at Colorado State University: the USDA 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 North Central Climate Science Center, The Nature Conservancy, and the National Institute of Invasive Species Science.

Federal consortium members identified above do not receive funding from AmericaView.

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Major funding for the AmericaView Consortium is provided by the U.S. Geological Survey through Grant Number G14AP00002.