NASAfacts

Improving Shrub and Grass Fuel Maps using Remotely Sensed Data to Support Fire Risk Assessments

Shrub and grassland ecosystems in the western United States are very prone to fire events, but available data for assessing fire risk in these areas are inadequate. The condition of shrub and grasslands tends to be very difficult to characterize, in part because these sytems exhibit a high degree of intra- and inter-annual variability in fuel characteristics. Simply put, we need to develop better understanding of the conditions that lead to wildland fire in shrub and grasslands. This necessitates higher level understanding of the dynamics of these systems. Such information is of special importance to projects such as LANDFIRE, which has the goal of providing fire managers with nationally consistent and detailed spatial information about vegetation and fuel structure.

Figure 1. Example of a western US sagebrush ecosystem with invasive grasses (cheatgrass). The amount of herbaceous vegetation increases susceptibility to fires in these western systems.

Through the support of the NASA Applied Sciences Program, we embarked on a project to ascertain better fuel characterizations in western US shrub and grassland ecosystems. Our primary objectives of the project include the following: 1) Improve upon shrub and grassland mapping for fire applications; 2) Develop intra-seasonal (e.g. seasonal) fuel data sets in shrub and grassland areas using a combination of Landsat and MODIS data; and 3) Develop an approach whereby we can assess likely fuel risk before the main fire season occurs, thus providing the fire management community with fuel data sets representing near current conditions at the start of the growing season that will help in their decision making process.

While our long-term goals are to include the entire western United States, we focused our activities on the Great Basin. This area has been the site of many large and frequent shrub and grassland fires. The shrubland areas are dominated by sagebrush (Artemisia spp), as well as herbaceous species (Figure 1). Some of the areas also have substantial amounts of cheatgrass (Bromus tectorum), an invasive species that is very flammable during summer months. Since its establishment, cheatgrass has increased fires in the region, and thus has altered regional fire regimes (Figure 2).

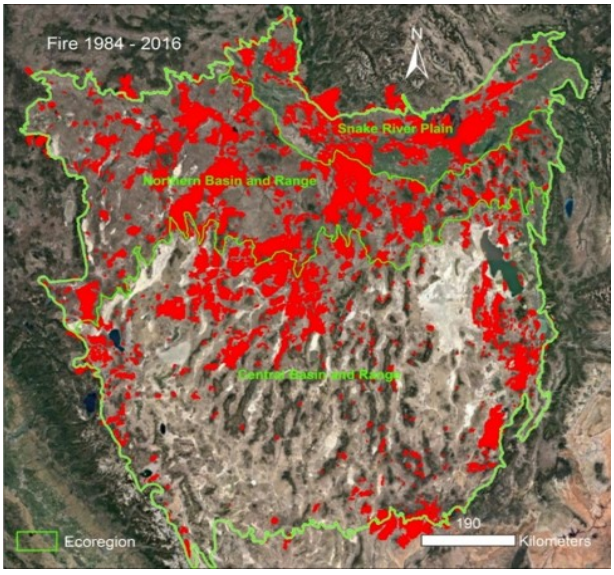

Figure 2. Areas that burned between 1984 and 2016 in the Great Basin, based on Monitoring Trends in Burn Severity (MTBS) data developed from Landsat Thematic Mapper time series data.

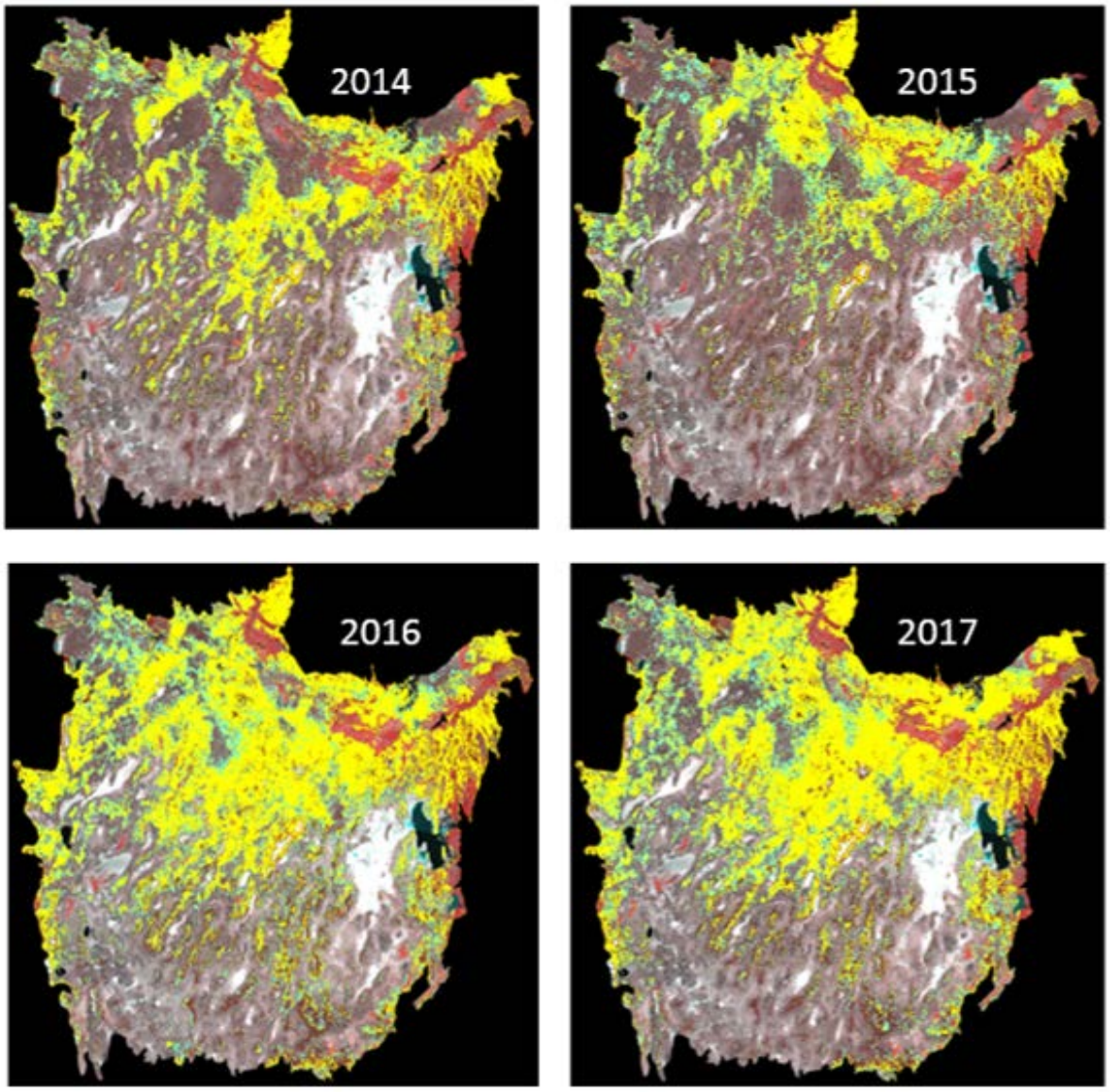

Figure 3. Patterns of shrub and grassland May NDVI for years 2014 through 2017. Yellow indicates areas of high shrub/grass NDVI, and aqua indicates areas of medium-high shrub/grass NDVI.

We used the combination of Landsat, MODIS and field data in this project, and from this information we generated data sets representing May, June, July and August conditions from 2000 through 2017. The resolution of the products is 30 meters, which provides the fire community with geospatial data at appropriate resolution for fire applications. Through analysis of historical MTBS data (Figure 2) and monthly imagery, we determined that wildland fire was more prevalent in areas that had high Normalized Vegetation Difference Index values in spring and comparatively low summer values. Yellow areas in the images in Figure 3 indicate where shrub and grass fires are most likely to occur later during the year.

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