An automated approach to identify burned areas in Landsat imagery

Todd Hawbaker[a*], Susan Stitt[a], Yen-Ju Beal[a], Gail Schmidt[b], Jeff Falgout[c], Carol Mladinich[a], Nicole Brunner[a], Megan Caldwell[a], Robert Bosshart[a], Josh Takacs[a], and Jodi Riegle[a]

[a] U.S. Geological Survey, Geosciences and Environmental Change Science Center, Lakewood, CO (tjhawbaker, susan_stitt, ygbeal, csmladinich, nbrunner, mcaldwell, rbosshart, jdtakacs, and jlriegle@usgs.gov)
[b] U.S. Geological Survey, Earth Resources Observation Science (EROS) Center, Sioux Falls, SD (gschmidt@usgs.gov)
[c] U.S. Geological Survey, Core Science Analytics, Synthesis, and Libraries, Lakewood, CO (jfalgout@usgs.gov)

PECORA 19, Nov. 17-20, 2014, Denver, CO

KEY WORDS: Wildfire, Climate, Landsat

ABSTRACT:

The U.S. Geological Survey is developing Essential Climate Variables (ECVs) following guidelines established through the Global Climate Observing System. These represent specific geophysical and biophysical properties of the land surface, including burned area. We present the Burned Area ECV (BAECV) algorithm which implements generalized boosted regression models to generate burn probabilities and thresholds the probabilities using a region-growing procedure. We used the Monitoring Trends in Burn Severity (MTBS) data, evenly split into training and validation data by year, to parameterize the algorithm and evaluate the results. Separate algorithms were developed using 29 Landsat path/rows distributed across 5 regions of the conterminous United States: East, eastern Great Plains, western Great Plains, Arid West, and Mountainous West. BAECV products were generated using Landsat TM, ETM+, and OLI imagery from 1984 to the present and include burn probabilities and burned area masks for each Landsat scene and annual composites. Evaluating the accuracy of our results is complicated because it is difficult to discern what areas did not burn with certainty using existing fire databases, which are often incomplete. However, results based on the MTBS validation data showed that 76% of the MTBS burn perimeters were found by the BAECV algorithm and most of the unidentified perimeters were in the East and eastern Great Plains regions. For the perimeters our algorithm did find, the correlation between the BAECV area burned and the MTBS burn perimeter area was 98%. Visual examination of the BAECV products demonstrated that they included burned areas not present in existing fire databases, such as MTBS, the MODIS active fire product, and the federal fire occurrence database. Thus, the BAECV algorithm and its forthcoming products will augment existing fire data sources by providing new information about previously unrecorded burned areas for use in studies examining disturbance patterns, their drivers, and impacts.