Climate Impacts on Wildfire Burn Severity: What it means for Fire and Land Managers

By Crystal A. Kolden

Recent research efforts indicate that wildfire will increase in Alaska under projected climate change. While predicting area burned is important, it doesn't tell the whole story of how wildfires impact the landscape. A recent USGS research project set out to determine how wildfire severity has changed over the last 25 years, and whether burn severity increases or decreases in association with temperature and precipitation. To measure burn severity, we used dNBR, a sometimes controversial index that is derived from satellite data. It is important to understand that dNBR does not measure soil carbon consumption, nor does it measure immediate post-fire conditions. dNBR is a measure of how much vegetation has been removed from a site by the fire, and since the post-fire image is taken a year after the fire, it will also measure how much vegetation has grown back since the fire.

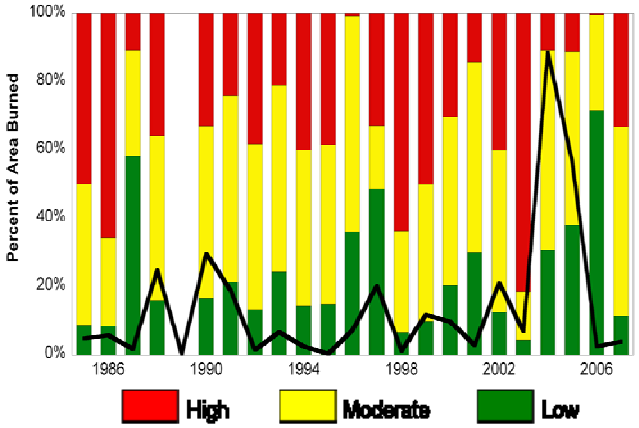

Figure 1. Percent of area burned in each severity class for each year in study for a random subset of 100 fires. Black line represents the total area burned for that year (axis not shown).

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Our results show that:

- There is no significant trend in burn severity from 1985 – 2007
- Larger fires tend to burn less severely than smaller fires
- More severe fires burned during cold and wet years, not warm and dry ones
- Less severe, but much larger, fires burned during years when the onset of late summer rains was delayed (i.e., 2004)

These findings are surprising until you determine what is burning during warmer (and larger) versus colder (smaller) fire seasons.

During cold years, smaller fires burn predominantly in black and white spruce stands. Live fuels such as shrubs and grasses are too moist, so the fire consumes the driest fuel available: the thick organic soil carpeting the understory of mature spruce stands. By the following summer, little has grown back, and a high dNBR value is assigned to indicate a high severity fire impact.

During warm years, however, live fuels such as shrubs and grasses are dry enough to burn. Because of their higher fuel moisture content, the burned area is less "scorched" and regrowth can occur shortly after the fire, resulting in a low severity fire impact in the dNBR imagery.

With future warming, fires will likely be larger, but will also likely burn more deciduous and herbaceous live fuels. This is critical during suppression or prescribed fire operations when deciduous stands or recent burns are used as fire breaks; in the future, those fire breaks are less likely to hold, and may burn up themselves.

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