How Available Burn Days Differ Using the Lavdas Dispersion Index Instead of Category Day

Bill Jackson
Margit Bucher
North Carolina Prescribed Fire Council
Ad Hoc Technical Committee

Air Resource Management
The North Carolina Smoke Management Program has been established to protect the health and safety of people that may be downwind of smoke from prescribed fires. To accomplish this goal, recommendations are made on the amount of fuel that can consumed within a 25 square mile area (air shed). The amount of fuel consumption varies by Burn Category. There are five Burn Categories and it is computed by multiplying the mixing height (feet) times the transport wind speed (miles per hour). Each day is classified into a Burn Category based upon the range of values from the product.
The amount of fuel consumption that can occur within an air shed depends on the several factor including the Burn Category and the distance downwind to the nearest smoke sensitive area (SSA).
The Lavdas Atmospheric Dispersion Index (AD) is reported daily by the National Weather Service fire weather forecasts for North Carolina. The Lavdas ADI has one important difference when compared to the Burn Category. The difference is the Lavdas ADI includes the Turner stability class when computing the index. Smoke dispersal is enhanced with an unstable atmosphere. The unstable atmosphere occurs when sunlight heats Earth’s surface and the warm air rises and the cooler air higher in the atmosphere moves towards the ground.

Our analysis focused on comparing how many days (stratified by NWS forecast areas and season) were in each of the Lavdas Atmospheric Dispersion Index (ADI) categories, and the Burn (or ventilation index) Categories currently used by the North Carolina Smoke Management Program.
Approach

- Corey Davis (NC State Univ. Climate Office) wrote a script to extract NWS fire weather forecast (archived) data.
- Files produced for each of the seven forecast areas. Years: 2009-2014.
- For each day, there was files for the morning, afternoon, and any updated forecasts. Total GSP = 7266 files.
- If available, up to 63 forecasted variables.

Air Resource Management
Approach

• Bill Jackson (USFS) wrote a program to process each of NWS fire weather forecast (archived) data.

• One Excel file produced for each of the seven forecast areas containing “Todays” results.

• The file contains the date, season, transport wind speed, mixing height, ventilation index, ADI value, and ADI category.
• For each NWS forecast area is a histogram of the annual, spring, summer, fall and winter results. Frequency for the entire 6 year period.

Example output found in the Excel files
• Burn Category 1 days had the largest range in ADI categories.
• Most frequent is Fair – a day that may have atmospheric stagnations if low wind speed.

Air Resource Management
This table shows how we placed the Lavdas ADI categories within the five Burn Categories. We divided the ADI “Fair” category into two categories at an ADI value of 30. Some southern states allow prescribed fires when the ADI is above 30. The right hand column has a description of the ADI, including what actions a burner should take or how the smoke and fire may behave.

<table>
<thead>
<tr>
<th>Burn Category</th>
<th>Lavdas Atmospheric Dispersion Index Category</th>
<th>Description of Atmospheric Dispersion Index Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Very Poor, Poor, Generally Poor, or Fair with ADI &lt;=30</td>
<td>Do not burn if the Atmospheric Dispersion Index is the sole criteria</td>
</tr>
<tr>
<td>2</td>
<td>Fair and ADI &gt;30</td>
<td>A day that may have atmospheric stagnations if low wind speed. Any residual smoke likely to result in problems if surface wind speed is &lt; 3 mph.</td>
</tr>
<tr>
<td>3</td>
<td>Generally Good</td>
<td>Typically has good afternoon dispersion of smoke</td>
</tr>
<tr>
<td>4</td>
<td>Good</td>
<td>Typically has good burning weather conditions</td>
</tr>
<tr>
<td>5</td>
<td>Very Good</td>
<td>May indirectly indicate hazardous burning conditions</td>
</tr>
</tbody>
</table>

Air Resource Management
Our results were similar among most NWS forecast offices. This table shows the spring (March – May) results for the Greenville-Spartanburg NWS forecast area. Using the ADI may allow for an increase in the tonnage of fuels or acres treated with prescribed fires. For example, we paired a day classified as a Burn Category 4 with an ADI category of Good. During the six years, there were 121 days classified as a Burn Category 1, whereas the ADI was Good. The NC SMP recommends if a smoke sensitive area is 5 to 10 miles downwind, then on a Burn Category 1 and 4 day, no more than 100 and 2880 tons of fuel consumption, respectively, is allowed in an air shed. If other fire parameters (such as fuel moisture, wind, relative humidity, and etc.) were in prescription during the six years, then there was a possibility that treatment of more fuels could have occurred on an additional 1846 days by using the ADI.
What Next?

• Write a report on the findings.
• Make data available for download and additional analysis.
• Dialogue among cooperators if Lavdas Atmospheric Dispersion Index should replace the Burn Day.
• If yes, then estimate the tons of fuel consumption for downwind distances to smoke sensitive areas and time of day.
• Evaluate before adopting into smoke management program.