

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

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# Current Approach

- Determine the burn category



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 be 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.

# Current Approach

- Determine maximum fuel consumption

Burn Category	1*	2	2	2	2	3	3	3	3	4	4	4	4	5	5	5	5
Burn Type	Under story	Open	Under story	Open	Under story	Open	Under story	Open	Under story	Open	Under story	Open	Under story	Open	Under story	Open	Under story
Night time Smoke Dispersion	Any	Poor to Very Poor	Poor to Very Poor	Good to Fair	Good to Fair	Poor to Very Poor	Poor to Very Poor	Good to Fair	Good to Fair	Poor to Very Poor	Poor to Very Poor	Good to Fair	Good to Fair	Poor to Very Poor	Poor to Very Poor	Good to Fair	Good to Fair
Time of Burn	Day Only	Day Only	Day Only	Day or Night	Day or Night	Day only	Day Only	Day or Night	Day or Night	Day Only	Day Only	Day or Night	Day or Night	Day Only	Day Only	Day or Night	Day or Night
Distance to SSA (mi.)																	
0<S	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1<S	50	360	720	720	1080	450	800	900	1350	720	1440	1440	2160	900	1800	1800	2700
5<S	100	720	1440	1440	2160	900	1800	1800	2700	1400	2880	2880	4320	1800	3600	3600	5400
10<S	150	1080	2160	2160	3024	1350	2700	2700	4150	2160	4320	4320	6480	2700	5400	5400	8100
20<S	150	1200	2400	2400	3600	1600	3200	3200	4800	2500	5000	5000	7500	3000	6000	6000	9000
30+	200	1440	2880	2880	4320	1800	3600	3600	5400	2880	5760	5760	8640	3600	7200	7200	10800

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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).

## Lavdas Atmospheric Dispersion Index

- All NWS forecasts have an estimate for ADI or Dispersion classifieds as “early”



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.



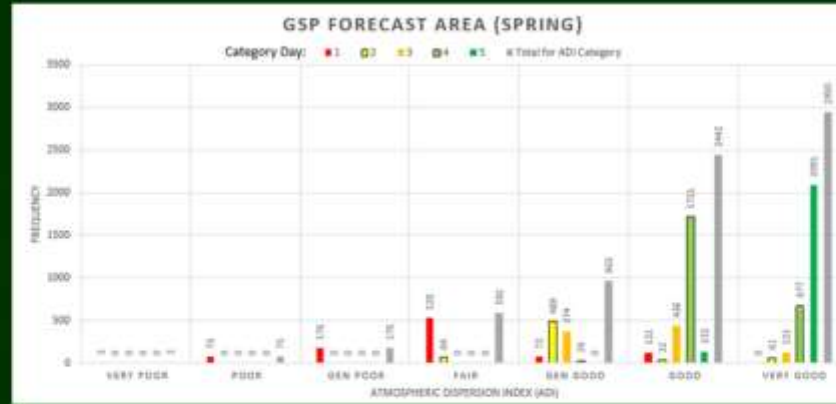
# Approach

- 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.

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# Results

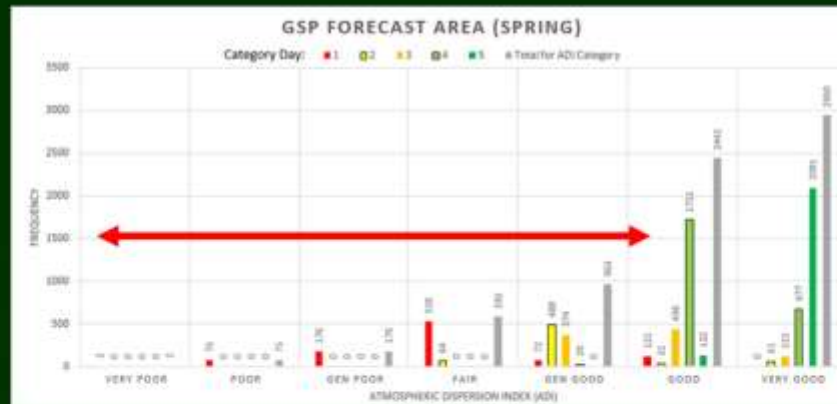


- For each NWS forecast area is a histogram of the annual, spring, summer, fall and winter results. Frequency for the entire 6 year period.

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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.

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# Categories

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

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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.

# GSP Results (Spring)

- During the 6 years, there may have been 1848 days in the spring (March – May) when more acres could have been treated.

Burn Category	Landscape Atmospheric Dispersion Index (ADI)					Total Days	Possibly Missed Opportunity	Over Estimate	
	Very Poor, Poor, Generally Poor, or Fair with ADI <=30	Fair and ADI >30	Generally Good	Good	Very Good				
1	448	332	72	121		973	525		
2		64	489	32	61	646	582		
3			374	436	121	931	557		
4			28	1721	182	1931	182	28	
5				132	2091	2223		132	
						<b>Total</b>	6704	1846	160

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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.

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<http://www.ncprescribedfirecouncil.org/>

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*The mission of the North Carolina Prescribed Fire Council is to foster cooperation among all parties in North Carolina with an interest or stake in prescribed fire.*


#### PURPOSE AND CHARGE

The North Carolina Prescribed Fire Council brings together natural resource professionals, public and private land managers, and others who support the use of prescribed fire in an organization to:

- Provide public education about the benefits of prescribed fire.
- Advocate for the ability to use prescribed fire as a land management tool now and in the future.
- Increase expertise in prescribed fire by sharing technical and biological information.
- Promote safety, training, and research in the art and science of prescribed fire.
- Review prescribed fire practices, regulations, and policies and suggest improvements.
- Promote best management practices that minimize smoke and air quality impacts from prescribed fire.



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